T. C.
BAHÇEŞEHİR UNIVERSITY

THE EFFECTS OF PROJECT BASED LEARNING APPROACH IN PEDAGOGICAL AGENT ASSISTED LEARNING ENVIRONMENT ON STUDENTS' ACHIEVEMENTS AND ATTITUDES IN HUMAN COMPUTER INTERACTION COURSE

M.S. Thesis

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ABSTRACT

THE EFFECTS OF PROJECT BASED LEARNING APPROACH IN PEDAGOGICAL AGENT ASSISTED LEARNING ENVIRONMENT TO STUDENTS' ACHIEVEMENTS AND ATTITUDES IN HUMAN COMPUTER INTERACTION COURSE

Karaca, Efsun

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The purpose of this study is to specify the effects of pedagogical agent assisted project based learning approach on students' achievements and attitudes in Human-Computer Interaction course. Research is done on a group consisting of 46 Software Engineering students taking HCI course from Bahçeşehir University in spring semester of the 2009-2010 academic years.

In this research, to test the perception of course content, chapter assessment tests were applied to students as pre-test and post-test. Students that take the HCI course with pedagogical assisted project based learning approach separated into 11 groups consisting of 2-6 students to work on different subjects.

In order to determine the students' achievements in and attitudes towards the activities of pedagogical agent assisted project based learning approach, 'Project-Based Learning Attitude Scale, 'Pedagogical Agent Satisfaction Survey and 'Perception of Course Content Attitude Scale' developed by the researcher were applied to each group. Perception of Course Content Attitude Scale was applied twice in order to compare the students' attitudes towards the HCI course which project-based learning approach was applied; and pre-test and post-test results of the questionnaire have examined. Furthermore, chapter review tests were applied twice as pre-test and post-test before and after the pedagogical agent assisted learning in web medium.

In the statistical analysis of the data, t-tests, ANOVA and correlation coefficient was used. The statistical analyses were done on SPSS 17.0. The significance of the data was tested at the significance level of .05.

As a result, according to the answers given to the surveys and final project grades, it is found that pedagogical agent assisted project based learning approach affects students' achievements and attitudes in human computer interaction course in a good way.

Keywords: Project Based Learning, Pedagogical Agent Assisted Learning Environment, Human-Computer Interaction, E-Learning

ÖZET

PEDAGOJİK AJAN DESTEKLİ ORTAMDA PROJE TABANLI ÖĞRENME YAKLAŞIMININ İNSAN VE BİLGİSAYAR ETKİLEŞİMİ DERSİ BAŞARISINA VE ÖĞRENCİ TUTUMUNA ETKİSİ

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Bu çalışma, pedagojik ajan destekli ortamda insan-bilgisayar etkileşimi (HCI) dersinde proje tabanlı öğrenme yaklaşımının öğrencilerin derse yönelik tutumlarını ve ders başarılarını araştırma amacıyla yapılmıştır. Araştırmanın örneklemini 2009–2010 öğretim yılı güz döneminde Bahçeşehir Üniversitesi'nde HCI dersini alan toplam 46 öğrenci oluşturmaktadır.

Bu araştırmada, ders içeriğinin algılanmasını test edebilmek için, ünite testleri ön test ve son test olarak uygulanmıştır. Pedagojik ajan destekli ortamda proje tabanlı öğrenme yaklaşımının online olarak uygulandığı öğrenciler, her biri seçilen farklı bir temel proje başlık konusu üzerinde çalışmak üzere, 2-6 kişilik gruplara ayrılmışlardır.

Her gruba, pedagojik ajan destekli proje tabanlı öğrenme yaklaşımında öğrencilerin başarı ve tutumlarını belirlemek açısından; 'Proje Tabanlı Öğrenme Tutum Anketi', 'Ders İçeriği Algılama ve Tutum Anketi' ve 'Pedagojik Ajan Memnuniyet Anketi' uygulanmıştır. Öğrencilerin insan-bilgisayar etkileşimi (HCI) dersi içeriğini algılamaya yönelik tutum anketine ve proje tabanlı öğrenme anketine verdiği yanıtlar ile pedagojik ajan destekli proje tabanlı öğrenme yaklaşımının uygulandığı dersin başarısını karşılaştırabilmek için, ön-test ve son-test anket sonuçları incelenmiştir.

Bu araştırmada, verilerin analizinde, istatistiki işlemlerden, eşli gruplar t testi, bağımsız gruplar t testi, ANOVA ve korelasyon katsayısı kullanılmıştır. İstatistiki işlemler SPSS 17.0 programında analiz edilmiştir. Elde edilen verilerin anlamlı olup olmadıkları .05 anlamsallık düzeyinde test edilmiştir.

Sonuç olarak, uygulanan anketlere verilen cevaplara ve öğrencilerin proje final notlarına bakıldığında, proje tabanlı öğrenme yaklaşımının öğrencilerin pedagojik ajan destekli ortamda öğrendikleri HCI dersindeki başarı ve tutumlarını olumlu yönde etkilediği görülmüştür.

Anahtar Kelimeler: Proje Tabanlı Öğrenme, Pedagojik Ajan Destekli Öğrenme Ortamı, İnsan-Bilgisayar Etkileşimi, E-Öğrenme

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LIST OF ABBREVIATIONS

Analysis of Variance	**:**	**ANOVA**
Computer Assisted Instruction	**:**	**CAI**
Computer Assisted Project Based Teaching	**:**	**CA-PBT**
Human Computer Interaction	**:**	**HCI**
International Organization for Standardization	**:**	**ISO**
Logical Thinking Group Test	**:**	**LTGT**
Mean of Squares	**:**	**Mean Sq.**
Microsoft	**:**	**MS**
Pedagogical Agent Satisfaction Survey	**:**	**PASS**
Perception of Course Content Attitude Scale	**:**	**PCCAS**
Project Based Learning Attitude Scale	**:**	**PBLAS**
Project Based Learning	**:**	**PBL**
Project Based Teaching	**:**	**PBT**
Science Course Attitude Scale	**:**	**SCAS**
Software Engineering	**:**	**SE**
Standard Deviation	**:**	**Std. Dev.**
Statistical Package for the Social Sciences	**:**	**SPSS**
Sum of Squares	**:**	**Sum Sq.**
Türkiye Bilimsel ve Teknolojik Araştırma Kurumu	**:**	**TÜBİTAK**

LIST OF SYMBOLS

Correlation Coefficient	**:**	**r**
Density Function	**:**	**df**
Difference of X Values	**:**	**ΔX**
f-Value in Analysis of Variance	**:**	**F**
Number	**:**	**#**
Sample Mean	**:**	**X**
Sample Size (Variable Quantity)	**:**	**N**
Seconds	**:**	**s**
Statistical Significance	**:**	**P**
t-Value in t-Test	**:**	**t**

1. INTRODUCTION

In problem definition, significance and the purpose of the study, research questions, limitations and term definitions are introduced in this section.

1.1 PROBLEM DEFINITION

Education is an ongoing fact from birth to death. It is the whole social process that become effective on individuals to reach their social standards, beliefs and life styles. It is the whole process in which individuals develop their skills, attitudes and other behavioral patterns that have values in the society they live in.

The aim in the Turkish education is to pass on to a student-based system. The syllabus in a student-based system is arranged specifically for each student according to their potentials and interests. A specific educational program is arranged and inspected for each student considering their personalities, skills and demands. Besides, attention of today's students is expected to increase; and students are expected to be more successful as they take courses in the fields they are interested in.

The use of technology in classes enables technology to be more effective and ease the tasks of teachers and students. Programs having same content are perfectly transferred, thanks to the use of technology, in education and technology, within this context; it helps the provision of equality. Furthermore, a limitless library is made available with the use of technology in education and teachers become more competent.

One of the methods that is developed as an alternative to traditional instruction methods and that enable students direct involvement in educational process is project-based instruction. Projects prepared by students are in the centre of project-based instruction method. Projects, draft or draft development means; imagination and planning. Projects are individual or group studies of students for the solution of a problem regarding acquisition of a concept of a skill (Kubinova et al. 1998).

Projects enable students to gain academic research skills and to learn through experience (Raghavan et al. 2001). Moreover, projects give opportunities to students to

use alternative approaches regarding their individual differences, different learning styles, intelligences, skills or interests (Saracaloğlu et al. 2006). Project-based learning (PBL) is an approach, requiring disciplined studies, in which students, taking responsibility as individuals or as group, conduct their own studies based on their own interests and skills regarding real life problems; in which teachers guide students and facilitate their students' studies and which consists of different approaches providing real outputs and presentations (Demirhan 2002, pp.21).

In PBL, students complete their projects with a presentation by working together on an actual topic or a problem from different disciplines (McGrath 2002, Wolk 2001). There is not a specific course session to apply on this approach. Students may work on their projects whenever and wherever they like (Saracaloğlu et al. 2006).

Besides these improvements, significant advances in information and communication technology lead to inevitable use of technological sources in schools and classes. The use of technology in instructional environments provides various learning possibilities to students; it improves the awareness and motivation of students and makes them the center of the instruction (İşman et al. 2002). Parallel to technological advances, computers have begun to be used with the purpose of developing materials like visualization and analogues and, as a result, the term Computer Assisted Instruction has come about. The use of activities like direct presentation of course contents in classes from computers, repetition of pre-learned knowledge with other methods, problem-solving and various exercises is called Computer Assisted Instruction (CAI) (Özmen 2004, Yalın 2002).

As a result of the literature research, the view that intended aims are accomplished through the involvement of computer technology in the project-based instruction process has come about (Jackson & Songer 2000, Greenbowe et al. 1998, Cole et al. 2002, McGrath 2002, Wolk 2001, Bernhardt 1999, Frank & Barzilai 2004, Melograno 2006). As a conclusion, the use of computer technology in educational process affects learning in a positive way (Bernhardt 1999).

1.2 RESEARCH QUESTION

In software engineering, how does the project based learning approach in a pedagogical agent assisted learning environment affects the students' achievements and attitudes in human computer interaction course in theoretical and practical applications?

1.2.1 Sub-Research Questions

a. Is there a significant difference between genders in students' attitudes towards project based learning approach?

b. Is there a significant difference between students in different groups in students' attitudes towards project based learning approach?

c. Are students' attitudes towards project based learning approach and final project grades directly proportional?

d. Is there a significant difference between genders in students' attitudes towards pedagogical agent assisted learning environment?

e. Is there a significant difference between students in different groups in students' attitudes towards pedagogical agent assisted learning environment?

f. Is there a significant difference between genders in students' attitudes towards perception of course content?

g. Is there a significant difference between students in different groups in students' attitudes towards perception of course content?

h. Are students' attitudes towards perception of course content and final project grades directly proportional?

i. Is there a significant difference between pre-test and post-test results in students' attitudes towards perception of course contents?

j. Is there a significant difference between pre-test and post-test results in students' chapter review assessments?

1.3 THE SIGNIFICANCE AND THE PURPOSE OF THE STUDY

The study is significant in providing a model for practitioners, such as instructional designers and instructors, who design online PBL courses in Software Engineering (SE) Department. As mentioned already, many of PBL approaching cases focus on Science

& Mathematics fields. Thus there are not enough researches on online PBL approaches in software engineering field. The purpose of this study is to specify the contributions of developing computer assisted project to the teaching process in HCI course.

Within the scope of this study, collecting data related to practicability of PBL approach in pedagogical agent assisted HCI course is aimed. In parallel with this, making an observation in a classroom in which PBL approach in pedagogical agent assisted learning environment is implemented and receiving opinions of students is aimed.

1.4 LIMITATIONS

This research is limited with the findings:

a. from 2010-2011 academic year spring semester,

b. from students who study Software Engineering in Bahçeşehir University,

c. from students who take the course 'Human Computer Interaction'.

1.5 DEFINITION OF TERMS

Project-Based Learning Approach: It is a student-centered learning approach which requires cooperation, provides students with academic research skills, and gives opportunity to study in individual and cooperative instructional mediums and in which both outputs and processes are assessed together.

Traditional Instruction Model: It is a teacher-centered instructional approach in which information level is important, students are generally passive and learn what is taught to them by teachers, roles of students and teachers are strictly determined, assignments, exams and students' behavior in class are assessed.

Computer Assisted Learning Approach: An approach that requires students to research, to acquire new information, to develop new skills in activities and to use computer technology and multimedia items in these activities.

Pedagogical Agent: Plays a role as a tutor or teacher and communicates and collaborates with students in the facilitation of subject contents to produce meaningful learning on the students' part (Atkinson 2002, Baylor & Kim 2004, Clark & Mayer 2003, Craig et al. 2002, Moreno et al. 2001, Wang et al. 2005).

Pedagogical Agent Assisted Learning Environment: An educational method which uses computers as interactive teaching devices. Computers adapt the presentation of educational material according to students' weaknesses, as indicated by their responses to questions.

2. LITERATURE REVIEW

Project based learning approach and computer assisted instruction are introduced in this section. Also, relevant researches done in different fields within the scope of project based learning approach are ordered.

2.1 DEFINITION OF PROJECT BASED LEARNING

Projects, drafts or draft development means imagination and planning. The solution of problems regarding acquisition of concepts or skills in education field is independent individual or group studies of students (Saracaloğlu et al. 2006). Projects underlie the center of project-based instruction method. Projects provide students with academic research skills and learning through living (Raghavan et al. 2001).

PBL is an instructional model that guides students to deal with compelling problems and, as a result, to produce original outputs. Projects prepared in order to create more effective learning opportunities in classes may vary in subject and content and may be separated into different classes. Furthermore, these projects also have descriptive features. Projects come about with the compelling problems that cannot be solved by rote-learning and they enable students to play different roles as; problem solver, decision maker, researcher, document author, etc. Projects serve certain important instructional goals; they are excluded from "real" curriculum.

PBL is an instructional and a learning method that is developed in modern countries against the instruction of curriculum as small, independent piles. This model is focused on primary concepts and principles of one or more fields and comprises goals of more than one course if possible in a course scenario. In this model, students generally do activities like critical thinking, problem-solving, creativity, access to information, processing, re-blending, questioning and negotiation in problem-solving oriented course scenarios and allocate time for both individual and group studies.

PBL consists of three main concepts to illustrate the expected educational system. One of these concepts is learning that is highly essential in drawing the attention to learners instead of instructors. Another one is the concept of project that which means imagining

and planning. This concept refers to the project designing of the education, i.e. guiding perception and, it puts emphasis on relative learning for a certain goal rather than solitary learning. It deals with projects as a background component rather than a goal and, as a result, it emphasizes process of learning instead of outputs and provides an original pattern to learning to the intended extent.

PBL approach is generally used in mathematics and science classes up until now. According to Shearer and Quinn (1996), the interests of students in mathematics and science classes may be improved by forming a creative class environment and enables students;

a. To improve their self confidence,
b. To form relations between real life and mathematics & science concepts,
c. To understand the importance of mathematics and science,
d. To switch among different disciplines by being aware of the relations between them (mathematics and science) as a result of understanding the fact that knowledge does not belong to a single discipline,
e. To improve problem-solving skills in mathematics and science,
f. To find opportunities to study in learning environments based on individual and group studies.

2.2 PROJECT BASED LEARNING PROCESS

In the preparation of the project, topics to be studied are determined in accordance with the student's interests and demands, a conceptual network including required studies related to the topics is prepared by brain storming and the student begins to study on the specific field (Hamurcu 2003). Accordingly, the process should be well-prepared appropriately to project development stages.

Table 2.1 : The Comparison of Project-Based Learning and Traditional Instructional Model

Traditional Instructional Model	Project-Based Learning Model
Definition of problems, solutions and designs are important.	Draft is prepared with students. There is not a single solution; more than one solution may be found out in the process.
Contents are important and a lot of time is devoted to content preparation.	Thorough understanding rather than content is important. An extensive data is obtained on a topic.
Knowledge level is in the foreground.	To comprehend principles, general concepts and views are in the forefront.
Teachers have strong authority in class.	A teacher model that learns, researches and inquires with students.
Teachers know all answers; there is only one answer or solution that is expected from students.	Students do research to find out answers; teachers cannot limit answers. Answers vary together with researches conducted.
Students are individuals who learn what their instructors teach. Students are generally passive in class.	Participative class environment; students are the ones who do activities.
There is a simple classroom environment: a teacher and twenty-twenty five students.	Integrated organization; teachers and students learn together.
To focus on a single discipline is dominant.	Interactions between disciplines are dominant.
Outputs are important.	Outputs and process are both important.
Standardization is important.	The actual indicators of skills are real life feedbacks.
There is assessment by teachers.	There are mutual decisions as a result of solution-oriented studies.
In long term goals; individuals who are successful in exams.	In long term goals; independent and problem-solver individuals who learn throughout their lives.

Source: Erdem, M. ve Akkoyunlu, B. (2002).

2.3 STAGES OF PROJECT BASED LEARNING APPROACH

Some of the stages of PBL approach in project development process are:

a. Deciding the project topic
b. Preparing timing and process schema
c. Preparing project stages
d. Determination of assessment criteria and benchmarks
e. Taking the first step of the project
f. Description and provision of learning sources
g. Planning and use of project process
h. Assessment of the project

Some of the stages that should be taking into consideration in PBL are (Moursund 1999):

a. Content of the project
b. Goals of the project
c. Preliminary information and skills of the student
d. Project group
e. Timing of the project
f. Sources and materials

Accordingly, the stages of PBL approach can be summarized with the following items (Moursund 1999, Erdem & Akkoyunlu 2002, pp.2-11):

a. Determination of the goals
b. Determination of the study or the topic to be dealt with
c. Formation of the groups

d. Determination of the features and presentation style of the conclusion report
e. Development of the study program
f. Determination of the check points
g. Determination of assessment criteria and efficiency levels
h. Collection of the data
i. Putting data in order and preparing reports
j. Presentation of the project

These are the six rules that should be applied by teachers in the process of PBL (Korkmaz & Kaptan 2001):

a. Decision on the project topic
b. Formation of the schedule
c. Planning the activities
d. Preparing the assessment plan
e. Initiate the project with students
f. Completing the project and contribution to the representation of the outputs

These are the points that should be taken into consideration by students during the planning and application of PBL approach (Korkmaz & Kaptan 2001):

a. Boundaries of the research
b. Responsibilities as individuals and as group members
c. Research process
d. Revision of applicability of the plans
e. Preference of new and original topics instead of imitating the old ones

These are the points to be taken into consideration in choosing the project during the planning and application of PBL approach (Korkmaz & Kaptan 2001):

a. The project should cover desired activities and should not include useless studies,
b. The time allocated to the preparation of the project should be sufficient,
c. The project should be related to the topic covered and skills to be gained should be described clearly,
d. The benefit from the project should worth the investment made for instruments, tools and sources,
e. Opportunities should be given to the students to solve problems through activities,
f. The project should give students the opportunity to taste creativity, responsibility and success,
g. The project should be appropriate to be examined in real life conditions,
h. The project should encourage students to think, examine and research.

These are the planning factors to be taken into account while preparing the project (Korkmaz 2002):

a. Program: Preparation of the study program that illustrates the studies and the time allocated to these studies
b. Division of Labor: Determination of each student's responsibility
c. Budget: Pre-determination of the money to be spent for studies of the group
d. Research Plan: The list of instruments, tools and sources to be used for data collection; preparation of the plan involving required activities to describe the research, and division of labor in studies to be done.
e. Materials: Determination and preparation of instruments, tools and check lists required for the research

f. Publication List: Preparation of the list of medias like photographs, newspapers, videos, radio, TV, etc. to be used in the research

g. Others: Consideration of problems that may occur during the process and solutions to these problems

2.4 ADVANTAGES AND DISADVANTAGES OF PROJECT BASED LEARNING APPROACH

Below are the advantages of PBL approach: (Ustunel 2011)

Project studies;

a. Promote students with a life-long learning opportunity.

b. Enable students to satisfy their curiosity through different aspects of the research field.

c. Enable students to obtain first-hand information in related topics with their projects.

d. Enable students to think, study and success independently and individually.

e. Help students to gain critical thinking abilities.

f. Enable students to develop problem-solving techniques and to learn stages of scientific methods.

g. Contributes to students' self-esteem.

h. Enable students to develop their creativity.

i. Enable students to gain scientific study habits.

j. Develop students' questioning, planning, inspection and research skills.

k. Increase students' motivation and help them to have new and different interests because students play an important role in their own learning process.

l. Help students to understand 'the reasons' of some topics.

m. Enable students to experience success.

n. Enable students to decide independently.

o. Improve students' group studies and their participation in collaborative learning activities.

p. Enable students to use different features of their intelligences.

q. Enable students to gain various skills (e.g., living skills, cognitive skills, self-control skills, etc.).

r. Make students responsible for their own learning.

PBL approach has also some disadvantages. These are as follows:

a. It may increase teachers' responsibilities and workload,

b. The time allocated for learning may be longer.

c. Excessive deviation and distraction from the topic may be observed if the limits of research are not properly determined (Kaptan & Korkmaz 2002, pp.95).

d. It may be more costly.

e. Teachers may hesitate to give responsibility to their students because classroom conditions and students may not be well-equipped for PBL approach.

f. Expectations of parents may pose obstacles. Most parents are more interested in their children's grades than their knowledge and skills. They expect certain roles from teachers. Moreover, they may interfere the learning by helping their children excessively.

g. In most of the learning activities, parents and teachers feel the necessity to control the methods as they do not think students can take those responsibilities. Therefore, the validity and the credibility of PBL approach will be prevented (Demirhan 2002, pp.27).

2.5 ASSESSMENT PROCESS IN PROJECT BASED LEARNING

The most important point in assessment is not only the evaluation of outputs from activities but also the process of developing these outputs. Within this context,

assessment includes both outputs and process. The PBL model does not only include teachers' assessment of students but it also enable students to assess themselves. The assessments help students to answer questions like ‘‘What do I understand?" and ‘‘How do I do it?’’.

Assessment in PBL is not only about students’ comprehension of concepts and topics; it is also about development and documentation of students’ required skills in their lives out of classrooms and schools. Teachers may also assess learning skills based on cooperation, skills to solve complex problems, skills to make correct choices, skills to make effective presentations (Demirel 2005, pp. 238).

PBL method does not give results on papers like traditional methods. Output may be a real model, a tape record, a presentation or a hardcopy. Therefore, writing assignments (home works or term assignments), observations (observations of group activities and individual studies), presentations, informal discussions and questions, project drafts and final assignments may be included in assessment (Demirhan 2002). Accordingly, assessment is not done with on-paper tests in classes where PBL approach is applied. Universal assessment methods (portfolios) are mostly used to assess learning process (Meyer 1997, pp.501-521, Wolk 1994, pp.401-409, West 1992, pp.265, Turnbull 1999, pp.548-568).

Portfolio is described as the collection of developed studies of students in learning process with a purpose and in a way that they can think about their own studies (Paulson et al. 1991). Portfolio is the consistent and increasing collection of selected student studies with students and their peers’ participation for the assessment of the development process in a certain field (Simon & Forgette- Giroux 2000). Portfolios created by systematic collection of students’ studies give the opportunity to assess students as a whole as they provide visual and dynamic evidence for necessary fields about students' skills, strong sides, success and development (Baki & Birgin 2004). Portfolios, which are described as just ‘folders’ for many years, are collections that present students success and learning process today. In short, portfolios that are systematic and purposeful collection of student studies that tell about students’ development process. Portfolio assessment is the collection and assessment evidences

regarding learning status of students. These may include all documents like step by step performance development, photographs of study environments, video tape records and teachers' thoughts, attitudes or comments (Katz 1996).

2.6 DEFINITION OF COMPUTER ASSISTED PROJECT BASED TEACHING

There is no difference between Project-Based Teaching (PBT) and Computer Assisted Project-Based Teaching (CA-PBT) methods in terms of implementation and evaluation processes. The only slightest difference is that computer technology is more dominant in developing project in CA-PBT. CA-PBT is an approach that requires students do researches, obtain new information, become skillful in activities and use computer technology along with multimedia objects in those activities. In other words; CA-PBT is defined as "an approach in which the students obtain new information and skills required for planning and instructing the lesson in order to create a multimedia product".

In CA-PBT students learn meaningfully by trial-and-error process with the help of multimedia that they create on their own, rather than learning by using the multimedia created by others. For instance, all of the students from all ages can develop multimedia projects by using the programs like MS. PowerPoint, MS. Publisher and MS. Word, etc. Because students are both researcher and designer in their projects; they do not only use written sources but also they use creative pictures, videos, audio files and other multimedia objects as primary data source (Cole et al 2002). For example, students use means like computer assisted laboratory studies, graphic software and distance communication technologies in computer assisted projects. With this means students find an opportunity to present and share their ideas (Blumenfield et al 1994).

2.7 ADVANTAGES AND LIMITATIONS OF COMPUTER ASSISTED INSTRUCTION

Advantages of CAI are following (Uşun 2000, pp.57-58):

a. Computer keeps students active all the time because students are supposed to give answers to the questions posed by computer and think about the subject; to be able to proceed to the next step.

b. It provides a learning process speed that suits with the student's learning pace. Students won't have to compete with those whose learning pace is faster. Teachers won't have to slow down those who learn faster in order to wait for those who are coming behind or teachers won't have to place those who learn slower on one side and instruct according to those who learn faster.

c. With this method every student can find answers to the questions they asked related to the topic; students may not be asked questions because classrooms are crowded, time is limited and individual differenced. In CAI, students contact with the computer whenever they want to ask questions to get answers and repeat those however much they want.

d. Experiments that are dangerous and expensive to do in laboratory environments can be done easily with the simulation method. It also saves money and time.

e. With CAI, subjects can be taught in shorter time and systematically.

f. Students can study comfortable in an individual learning environment that belongs to them. They feel more comfortable in an environment in which they are alone with the computer and if the learning pace is suitable for them. So that permanence of learning is longer.

g. Teaching program can be prepared accordingly with the necessities of the students related to learning. Order of the teaching goals is determined by the student's learning behavior.

h. Because learning is divided into small units; success is earned by these units.

i. Although students study on their own, they can be observed and intervened by the teacher if necessary. Students are under control of the teacher also in CAI.

Teacher can help the students when they have problems in individual studies that they cannot handle on their own.

j. Physically or mentally disabled students can proceed according to their learning pace in specially designed CAI environment. Physically or mentally disabled students may learn relatively slower in terms of learning pace than other students. In CAI, computer helps them providing a learning environment in which the learning pace is suitable for them.

k. It gives the opportunity for the teacher to spend more time with the students and provide efficient studies by taking some of the responsibilities of the teacher like repeating the lesson, checking or assessing the assignments etc.

l. Computer assures that time is used efficiently. Students spend limited time doing efficient activities. Secondly, students are self-awarded for every activity they do. They may accelerate their learning by seeing their own products. Lastly, it may improve students' creativity skills (İşman 2000).

Limitations of CAI are following (Şahin & Yıldırım 1999):

a. It prevents students' socio-psychological developments. According to some experts, computer individualizes the teaching process and therefore, it reduces the communication between students and teacher. Students are alone with their computers and they do not communicate with their friends and it might lead to selfishness that rushes up the individualism.

b. It requires special tool and skills. First of all, to be able to use an education software it is a must to find the suitable tool. Access to this tool which is necessary for CAI, might be difficult or expensive for classrooms or schools. And continuous updates of software are extra expenditure.

c. It doesn't support the education program. Every material used in teaching should support the education program and help students achieve the goals and aims that are determined in program. This type of software and programs might be updated and improved all the time.

d. Its educational quality is poor. Besides the suitability of program, education software should be able to provide an efficient educational environment. However, because software is not prepared by educationalists, some problems might be faced time to time.

e. Some negative aspects might occur if usage of the computer is not designed efficiently. Firstly, social relations between students might not improve. Secondly, computers bought for high amount of money might be place on one side and isn't used, which leads to waste of money. Lastly, some studies or projects might not be applicable in other computers. Thus, same software should be used in all the computers belong to the schools.

2.8 PEDAGOGICAL AGENT ASSISTED LEARNING ENVIRONMENT

Agent technology is used in a variety of areas. The use of agent technology in instructional environment is increasing rapidly. Therefore, the term 'pedagogical agent' has begun to be used. Pedagogical agents can be described as the software tools that are promoting learning process in interaction with students and learning environments and that works in certain tasks.

The most comprehensive definition of pedagogical agent was made by Kızılkaya and Aşkar (2006). According to their definition based on the properties of pedagogical agents in the specified area, pedagogical agents;

a. Communicates by using any communication tool (audio, video, text, etc.).

b. Carries the human-like features with the aim of creating a social learning environment.

c. Gives feedback to learner if necessary.

d. Guides to students during the learning process.

e. Provides information to students about the subject.

f. Are computer simulated characters.

2.9 RECENT STUDIES OF PROJECT BASED LEARNING

Thesis and articles published in PBL topic are generally written in primary school science and mathematics classes. There are very few researches on pedagogical agent assisted PBL in software development field. In this part of the study, researches done in different fields within the scope of PBL are ordered.

2.9.1 Theses Done on Project-Based Learning

Burcu Örentürk, in her post-graduate thesis with the counseling of Asst. Prof. Dr. Zahide Yıldırım in 2003, examined elementary school students' learning experiences with project-based collaboration via Computer Assisted Communication Tools. The purpose of the study was to research on the effects of computer assisted communication tools upon the attitudes of 5th grade students towards computers, their prediction level regarding their learning experiences, their social perception of themselves and the relationship of these perceptions with predictions in collaboration-based environments. The sample consisted of 36 students from two private schools in Ankara and Niğde. The students were chosen using sample methods based on suitability and purpose. At the beginning of the study, students were given Computer Attitude Scale to measure their attitudes towards computer. Computer attitude, prediction and self-confidence scales were applied at the end of the study. Results indicated that students' attitudes towards computers didn't change till the end of the study and that their attitudes towards project-based collaborative learning with computer assisted communication tools were positive.

Makbule Yurtluk, in her post-graduate thesis with the counseling of Prof. Dr. Özcan Demirel in 2003, studied the effects of project-based approach on the attitudes of students which are learning mathematics. The study was conducted in Ankara Private Tevfik Fikret Primary School. Quantitative and qualitative research methods were used together in this study. The study of students was observed and recorded from the planning stage to the project completion stage. The views of teachers and students about the approach were recorded in forms and these views were analyzed with coding method by using quantitative research methods. 'Mathematics Attitude Scale' developed by Baykul consisting of 28 articles was used to determine whether the attitudes of students towards the courses changed or not. When the views of students on the study were examined, it was found out that the courses were more fun and more

effective, that there were connections with different course, that the sense of responsibility were developed and the point reached with the study created sense of success. According to teachers' views, the study could be effective for both students and teachers and that the study would be more effective if accompanied by academicians.

Aykut Çil, in his post-graduate thesis with the counseling of Ass. Prof. Dr. Emine Erdem in 2005, studied the effects of project-based and traditional instructions on the success of students of7th and 8th grade in chemistry classes. The population of the study consisted of 7th and 8th grade students from schools connected to Ministry of Education. The sample consisted of 91 students attending Şehit Ali Usta, Gazi Mustafa Kemal and Günsazak Primary Schools in Mihalıççık, Eskişehir. Three science teachers from these schools were involved in the study for their views on PBL approach. The study was conducted in fall semester 2003-2004. Pre-test and post-test experimental group and control group design were applied in the study. Experimental group and control group were chosen from the sample randomly. In experimental group, the topics were covered with PBL method; and in control group, the topics were covered with traditional method. The required data in the study were gathered with 7 scales and questionnaires. These were; 'Students' Views on the Science Courses Form I and II', 'Students' Views Questionnaire', 'Science Course Teacher Questionnaire', Attitude Scale for Science Course and two different 'Science Course Success Tests' for 7th and 8th grade. With the findings of this study, it was found out that PBL approach would be more useful in students' success in chemistry classes, in the development of self-esteem, in academic success, in cooperative and individual learning.

Esra Özdemir, in her post-graduate thesis with the counseling of Ass. Prof. Dr. Behiye Ubuz in 2006, studied the effects of PBL on the attitudes of students towards geometry and their success in geometry. The study was conducted with a group consisting 24 seventh grade students from Bilim Private Schools on the last five weeks of 2004-2005 academic year. The results of success tests and geometry attitude scales indicated that PBL increases the success in and attitudes towards geometry. According to students' views, teachers' answers to observation scales and researchers observations, the reasons of the fact that PBL improves students' success in and attitudes towards geometry were examined. Moreover, students, who underperform, easily lose attention but also have

good potential, began to focus and their enthusiasm increased. To give another chance to improve their own studies to students who are easily distracted and take every opportunity to disturb the class order.

Olcay Yılmaz, in her post-graduate thesis with the counseling of Ass. Prof. Dr. Abdulhekim Koçin and Ass. Prof. Dr. Tuğba Yanpar in 2006, studied the effects of PBL on the creativity and attitudes of students towards social sciences and their success in social sciences. Pre and post tests experimental design were used in the experimental study. The sample was composed of 7th grade students from İhsan Yılmaz Kardeşler Primary School in Ereğli, Zonguldak in spring semester of the 2005-2006 academic year. Two groups, the experimental and control groups were examined in the study and these groups were chosen randomly. In experimental group, the topics were covered with PBL method and in control group; the topics were covered with traditional method. The study, expect the pre and post tests, lasted three weeks. Success test, attitude scale and Torrance creativity test were used as a means of collecting data in the study. The quantitative data collected from data collection methods in order to check study hypotheses. Quantitative data were evaluated by using t-test for dependent and independent groups in SPSS statistics program. As a result of the quantitative analyses it was indicated that the success level of experimental group increased, their attitudes towards Social Sciences course were improved and their level of creativity were increased.

Duygu Çırak, in her post-graduate thesis with the counseling of Ass. Prof. Dr. Ece Sarıgül in 2006, studied the effects of ‘‘the benefits of PBL in foreign language teaching to children’’ on success levels on English courses. This study was also an opportunity to show that children do not forget what they learn by experience. This study was composed of 29 students, both experimental and control groups, in total. The topic was taught with doing projects in the experimental group; and was taught with traditional method in the control group. The instructional activities were directed by the researcher, Duygu Çırak. Both groups were evaluated with pre-test at the beginning of the activity and with post test at the end of the activity and the data were analyzed with t-test.

Ayşe Sert Çıbık, in her post-graduate thesis with the counseling of Ass. Prof. Dr. Nuri Emrahoğlu in 2006, studied the effects of PBL approach on 7th grade students' logical thinking abilities and their attitudes towards science courses. The study was conducted in 2005-2006 academic year on students from Private Yüksel Sarıkaya Primary School in Yenimahalle, Ankara. An experimental and a control group were formed in order to study the effects of PBL approach on logical thinking abilities and attitudes towards science classes. The experimental group received project-based instruction through a unit for 6 weeks and the control group was instructed in the traditional approach. Both groups were given ''Logical Thinking Group Test'' (LTGT) and ''Science Course Attitude Scale'' (SCAS) before and after the process as pre and post tests. The study was designed according to pre and post test experimental model. According to the finding of the study, there was not a different between the experimental group and the control group in terms of logical thinking abilities before the process; however, there is a significant difference after the process between the groups in favor of the experimental group.

Alper Başbay, in his doctoral thesis with the counseling of Ass. Prof. Dr. Özcan Demirel in 2006, studied the effects of PBL approach supported by layered curriculum on learning process. With this purpose, the study lasted one year within the scope of Social Sciences course in 5-B class in Private Tevfik Fikret Primary School dependent on interdisciplinary connections. The study was conducted in two stages; the activities in fall were done with cooperative PBL and the activities in spring were done with PBL focusing individual learning assignments supported by layered curriculum. Qualitative data collection methods were used in the study and the process was observed and teachers' views were taken into consideration. The data collected from observations and discussions were analyzed with thematic coding and examined. The findings of the study indicated that both PBL activities and PBL activities supported by the layered curriculum had positive effects on the learning process. Within this context, it was indicated that the cooperative studying skills in groups were improved and the layered curriculum contributed to the sense of responsibility.

Murat Tuncer, in his doctoral thesis published in 2007 with the counseling of Prof. Dr. Mehmet Taşpınar, studied the effect of PBL and traditional learning methods on student

success and opinions in electronic circuits class taken in virtual environment. For this study which was planned as experimental, two groups of 26 second grade students have been created. One of these groups was experimental group and the other one was control group. Research was done compatible with the pre-test and post-test and experimental-control group pattern. While experimental group took the "Electronic Circuits" course in virtual environment with PBL method, traditional method is applied to control group. In terms of post-test success results no relative differences have been found between experimental and control groups. It has been seen that there is no relative difference between experimental and control groups in terms of achievement results. It has been revealed that no relative difference is observed between experimental and control groups in term of resistance test result. Generally, no difference has been found between the opinions of experimental group before and after the application.

Gülçin Erdoğan, in her post-graduate thesis published in 2007 with the counseling of Assist. Prof. Dr. Özlem Koray, studies the effects of PBL on knowledge level, critical thinking abilities of pre-service teachers in teaching the global warming topic in environmental education class. Research is an experimental study and pre-test and post-test with control group experimental pattern is used. Totally 79 students attended the research with balanced experimental (n=39) and control (n=40) groups. In the study while PBL approach is used for experimental group, traditional approach is used for control group. In the result of quantitative and qualitative analysis it is found that PBL approach has positive effect on students' knowledge level and critical thinking abilities.

Muhsine Türker, in her post-graduate thesis published in 2007 with the counseling of Prof. Dr. Dilek Gözütok, studied the effect of Project Based Teaching (PBT) approach on speaking proficiency in foreign language usage. In the research which was done suitable with pre-test and post-test with control group research pattern, experimental group consisted of 10th grade students from Aydınlıkevler Foreign Language Intensive High School. While experimental group are taught with PBT method, control group taught with traditional method. With the aim of evaluating the students' speaking proficiency pre-test and post-test are applied and points they took are recorded to the scale. Obtained data have been analyzed in SPSS program. Students also attended the evaluation process. They evaluated their peers' presentations with the help of Student

Observation Form. So as to follow the process and observe the students' skills in group studies, groups are asked to fill the Group Self-Assessment Forms. In the light of these findings, it can be stated that instructing the foreign language classes with PBT approach increases students' speaking proficiency.

Demet Ekinci Işık, in her post-graduate thesis published in 2007 with the counseling of Assist. Prof. Dr. Hülya Hamurcu, studies the effect of PBL, which is a pattern that students exhibit their products by studying cooperatively, reaching the information by doing research and examination and creating a product at the end of the process, on critical thinking, academic success, attitude towards the social studies class and permanency level. This research is done with attendance of 48 primary school third grade students. Pattern of the study is specified as pre-test, post-test with control group semi-experimental pattern. At the end of the 9-week "Social Studies Education based on PBL" application, Torrance Creative Thinking Test Oral B Form and Social Studies Lesson Attitude Scale are applied to the students in experimental and control groups again. Obtained data have been analyzed and evaluated. Results of the research show that post-test results, permanency post-test results and attitude scale post-test results of the students in the group to which social studies education based on PBL is applied have increased in a relatively high degree when compared to the post-test results of the students in the control group. No difference is observed between the creativity test post-test results of the students in the group to which social studies education based on PBL are applied and post-test results of the students taking part in the control group. No significant relation between the post-test results of creativity test and academic success of the students taking part in experimental and control groups is attained.

Dinçer Dede, in his post-graduate thesis published in 2008 with the counseling of Dr. Yavuz Erdoğan, studies the effects of the computer assisted project based teaching and traditional project based teaching strategies on students' academic success in science and computer lesson and the results of portfolio evaluation. Research is done on a group consisting of 146 students including 4th and 7th grades in Istanbul Bahçelievler Org. Eşref Bitlis Primary School in 2006-2007 academic years. According to the teaching methods applied to the students; science class, computer class and product file development (portfolio) achievements are compared. Researchers benefited from three

evaluation form and three different test tools so as to collect data. As a result of the research it has been specified that students' academic success and creating product success differentiate in accordance with the teaching method. According to these results; it has been observed that academic success of the students who are taught with computer assisted project based teaching method is generally significantly higher than the students to whom traditional project based teaching method is applied. No significant effect of gender features on student's academic success and product file development (portfolio) success is attained.

Ayşegül Erdem, in her post-graduate thesis published in 2008 with the counseling of Assist. Prof. Dr. Özcan Erkan Akgün, does a research to test the effect of PBL approach in computer teaching on primary school seventh grade students' attitudes towards the computer class and computer class success. Research is done with pre-test, post-test with control group experimental pattern. One experimental and one control groups have been created to observe the effects of PBL approach on students' academic success and attitudes towards computer. Experimental and control groups of the research consist of two branches of seventh grade students. According to the data obtained as a result of the research, no significant difference has been observed between the experimental group students to whom PBL approach is applied and the control group students to whom traditional teaching method is applied in terms of academic success results before the experimental procedure. On the other hand, significant difference in favor of experimental group has been observed between the experimental group students to whom PBL approach is applied and the control group students to whom traditional teaching method is applied in terms of academic success results after the experimental procedure. Researchers come to the point that significant difference were not observed between neither pre-test attitude results of experimental and control group students nor attitude results after the experimental procedure.

Cemile Atik, in her post-graduate thesis published in 2009 with the counseling of Assist. Prof. Dr. Hilmi Demirkaya, studies the importance of PBL method that keeps student active and provides multi-directional communication in science and technology teaching. In this study researchers try to find an answer to the question "Does PBL approach affect the academic success of 7. grade students in science and technology

class positively when compared to traditional teaching method?". This research aimed to study the PBL approach which also took part in 2005 primary school program and present samples related to the implementations of the approach. This research has been conducted with a research group of 27 secondary school 7. grade students in 2007-2008 academic year. Experimental and control groups of the research consist of two different 7th grade classroom studying in Yeşilova county in Burdur. The topic named "Light" is taught to experimental group with PBL approach and traditional method is applied to control group. Achievement test and notion test are given to experimental and control groups. Data is analyzed as pre-test and post-test with Mann-Whitney U and Wilcoxon Signed Rank Test. According to the results obtained from the analysis, achievement test results of the group to which PBL approach is applied is higher than the results of the other group's achievement test. According to gender type, the achievement test results of the group to which PBL approach is applied show significant difference in favor of female students. No significant difference has been observed in the achievement test results of control group in terms of gender type. Although no significant difference has been observed between the notion test results of the experimental and control group students, rank average of experimental group is higher. As a result of this research it has been understood that PBL method affects academic success positively in science and technology.

Mustafa Kılıç, in his post-graduate thesis published in 2009 with the counseling of Prof. Dr. Petek Aşkar, designs an environment that is supportive for PBL and takes opinions of students and teachers concerning the environment. Firstly a web based environment that is supportive for PBL has been created. Improvements and developments have been applied to the environment parallel with the opinions of students and teachers. Last version of the web site has been broadcasted on www.bizimprojemiz.com . Later on, opinions of students and teachers who are using the environment have been taken. In this research, interview which is one of the methods of qualitative research has been used. Questions have been asked to eight primary school students and five teachers who are using the environment and the answers are recorded. Audio record have been analyzed and placed to proper themes. Taken opinions are studied under the topics like benefit, suitability and technical suggestions. Students whose opinions are taken has indicated that the environment is beneficial and thanks to the environment they can

announce their projects, take criticism, be approved and develop their projects much faster. The teachers have also indicated that the environment might help them in sample projects and project development process management in project based lessons.

Mesut Tabuk, in his doctoral thesis published in 2009 with the counseling of Assist. Prof. Dr. Ahmet Şükrü Özdemir, studies the effect of multiple intelligence approach in PBL applied in math class on students' math class success and attitudes towards the math class. Research is pre-test, post-test with control group pattern. Experimental application is done in two different primary schools in Fatih County in Istanbul city in second term of 2006-2007 academic years. Samples of this research are 144 6. grade students of these schools. Two experimental and control groups have been created in each school. While PBL is applied to experimental groups, traditional learning is applied to control groups. In experiment-1 group, projects are given parallel with the intelligence field in which students get the highest results; however, in experiment-2 group, they are given parallel with the intelligence field in which students get the lowest results. In the research, math achievement test, attitude test towards math and multiple intelligence specification inventories are used as data collection tool. As a result of the research, statistically no significant effect of multiple intelligence approach in PBL applied in math class on math class success and attitudes towards the math class has been observed.

Fatma Yıldız, in her post-graduate thesis published in 2009 with the counseling of Assist. Prof. Dr. Berna Çoker Koloğlu, studies the effect of project based teaching on vocabulary learning success of 6. grade students. In this study, vocabulary learning successes of sixth grade students in Kazım Dirik Primary School after PDT method and Traditional Method have been compared. The research has been conducted in Kazım Dirlik Primary School. 6-A classroom consisting of 24 students and 6-B classroom consisting of 24 students attended to the study. The research in which pre-test, post-test with control group pattern is used is quantitative and semi-experimental. Same vocabulary items are studied in both groups. Both groups are given test before and after the study. The test before the study is considered as pre-test and the test after the study is considered as post-test. After the 4-week application, significant difference has been observed when the test results of both groups are compared. And these findings have

revealed that project-based teaching has an important effect on students' vocabulary learning.

Gülden Doğay studied on the effects of PBL method in understanding ecology unit, in 2010, in her post-graduate thesis which she published with the counseling of Ass. Dr. Mehmet Yılmaz. The research was experimental and it was conducted with a private and a public high school students in Istanbul in the 1th term of the academic year 2006-2007.While a private high school in Istanbul applying the project method was determined as the experimental group, a public high school in Istanbul applying the classical method was determined as the control group. 30 students from each of the 10th grades in these schools were chosen through the random sample method. While ecology was studied in the control group through classical methods, in experimental group it was studied within the scope of the academic program prepared in accordance with Project Method. A pre test was applied to the students taking part in the study and both how much pre information they had about environment and whether their levels of attendance among the groups are equal or not were determined. Afterwards, biology teachers of the two groups discussed the subject of ecology according to the plans they made in parallel with their methods. After the subject was studied in both groups, the last test was applied. The comparison of the academic success of the students in both control and experimental groups was done with an independent t-test. Significant dissimilarities in favor of experimental group with respect to academic success were found out between the instructions given according to the Project Method and classical method.

Tuğba Taflı studied the effect of PBL approach about the subject 'Cell' in the 1st grade at high school , in 2010, in her post-graduate thesis which she published with the counseling of Prof. Dr. Ali Ateş .Pre test and post-test models from the experimental methods were applied in the study. The research on the 9th grade students studying at Dumlupınar High School in Selçuklu, Konya was completed in 6 weeks. Two corresponding classes were elected according to the results of the pre-test which was applied along with the opinions of teachers before the practice. The study was conducted on 74 students in total; 37 in the control group and 37 in the experimental group. As the data collection tool, personal information form was applied and the results

were analyzed with the program SPSS 11.0. Afterwards, a biology achievement test was applied on students. To control whether the groups' datum were in accordance with the normal distribution, in data analysis, normality test was applied, for standard deviation equalization F test was applied and lastly for arithmetic mean, standard deviation and the comparison of two independent groups t-test was applied. At the end of the research, in biology lesson between the successes of the experimental group students to whom PBL approach was applied and the control group students to whom the current curriculum was applied, a significant difference – which is in favor of the experimental group was found. The end result is that the PBL approach which is student-centered and which makes it possible for them to take an active role in the process was considerably effective in the teaching of biology lessons.

Hakan Polat, in his post-graduate thesis published in 2010 with the counseling of Assist. Prof. Dr. Bünyamin Atıcı, studied the management and observation information systems in PBL. Pre-test and post-test experimental group and control group design were applied in the study. 99 students were participated in the study in which experiment-1 (n=33), experiment-2 (n=33) and control (n=33) groups were equal. PBL approach was applied to each group. In the experiment-1 group, management and observation information system; in the experiment-2 group both management and observation information system and traditional method and in the control group only traditional method was applied. Success test and attitude scales were used in the study as means of data collection. In order to test study hypotheses, qualitative data were assessed using t-test and one-way analysis of variance for dependent and independent groups in SPSS statistics program. There was not a significant difference between the experiment-1, experiment-2 and control group in success pre-tests. There was a significant difference among three groups in success tests. In the comparison between binary groups, on the other hand, there was a significant difference between the experiment-2 and control groups in favor of the experiment-2 group. It was found out that the management and observation information system did not have an improving affect on the success of the experiment-1 group but in the experiment-2 group. The attitude scales applied to the experiment-1 and experiment-2 groups indicated positive improvement in the attitude. The experiment-2 group had significant difference in terms of attitude scale scores. The study indicated that the management and observation information systems had no affect

on student success and attitudes itself; but it had a positive effect when used with the traditional method.

2.9.2 Theses Done on Pedagogical Agent Assisted Learning Environment

Gonca Kızılkaya, in her post-graduate thesis with the counseling of Prof. Dr. Petek Aşkar in 2005, investigated the effect of educational software supported with pedagogical agent and gender on achievement. Research methodology is designed according to Posttest Control Group Model where as experimental group (n=69) received an educational software supported with pedagogical agent; control group (n=56) received an educational software without a pedagogical agent. The educational software was developed by the researcher on the unit 'Discovering Space' for grade 6 students. The data analysis showed that the experimental group performed significantly better than the control group which indicated that using pedagogical agent in educational software has a positive effect on the achievement. In addition girls performed better than boys.

Özkan Mısırlı, in his post-graduate thesis published in 2007 with the counseling of Doç Dr. Yasemin Koçak Usluel, studied the effect of web based pedagogical agents on students' achievement. In addition, students' opinion about web based learning environment was gathered. Pedagogical agent that used in this research has the role of expert as giving information. Moreover, the pedagogical agent realizes the interaction with student by using the real human voice. 42 7. grade students from a public primary education school participated to this study. 21 participants were randomly assigned to experiment group, and the other 21 to the control group. While the experiment group worked with web based learning environment supported with the pedagogical agent, the control group worked with web based learning environment without the pedagogical agent. It was concluded that both web based learning environment supported with the pedagogical agent and web based learning environment without the pedagogical agent have significant difference between pre-test and post-test scores. While there hasn't been any significant difference between the two groups in terms of pre-test and post-test scores, the students stated that the learning environment with the pedagogical agent was enjoyable.

Hasibe Sel, in her post-graduate thesis with the counseling of Asst. Prof. Dr. Nesrin Özdener in 2009, agent supported collaborative and competitive instructions are compared according to student's achievement. The effect of support of audience and rival performance on student's achievement is researched. Presenting information that will be helpful at designing agent supported collaborative and competitive instructions by fixing rival and assisted characters preferences of students, is also aimed. In this study, qualitative and quantitative research techniques are used together. At the survey model, character selecting software and drawings which shows student's dream of rival and assisted characters are used to fix characters preferences of 6-7-8th classes 181 students. At the experimental model, five different CAI are applied 6-7-8th classes 153 students randomly divided into four competitors and a collaborative group. To evaluate the data, Chi-Square test and ANCOVA are used. Results, the preferences of students have a significant difference according to student's gender, agent gender and agent's emotional facial expression. If the audience supports students, the group that competes with the unsuccessful rival is more successful, if the audience supports students' rival, the group that competes with the successful rival is more successful. Besides collaborative group is more successful than the competitive groups except the group that competes with the unsuccessful rival and the audience supports students.

Esad Esgin, in his post-graduate thesis with the counseling of Prof. Dr. Servet Bayram in 2010, studied the effects of pedagogical agents' different properties on academic achievement, usability and attitude. Aim of the research is to examine the effects of pedagogical agents' image and communication channel properties on students' academic achievement, attitude towards pedagogical agent and usability of pedagogical agent. In this study, 5x2 factorial design was used. Participants of the research were 188 students from 6th, 7th and 8th grades. Multimedia learning environment developed by the researcher was prepared to provide an environment to students learn by discovering enactively. Pedagogical agent was used to guide users and give feedback and motivation messages to learners. Data were collected by achievement test about the topic "Cell", attitude questionnaire, usability and student information survey. There were totally sixteen hypotheses which of six were accepted and others were rejected. According to the results of the study, there were no significant differences among groups by academic

achievement. Presence of pedagogical agent and narration effected students' attitude towards pedagogical agent and usability of pedagogical agent positively.

Ramazan Yılmaz, in his post-graduate thesis with the counseling of Asst. Prof. Dr. Ebru Kılıç Çakmak in 2010, studied the effect of different educational interface agents that are used in educational software on the 8th grade primary school students' achievement, attitude and learning permanency for the science and technology course. This research has been carried out to assess the effect of the educational interface agents used in educational software and having different features on achievement, attitude and learning retention of the 8th grade primary school students' towards the Science and Technology course. An experimental design including pretest - posttest - permanecy test control group was used in the study. 70 students from İstilli Primary School in Düzce province participated in the research in the first semester in 2009 - 2010 academic year. The experimental and the control groups were selected randomly. Educational software was prepared for the unit "Organisms and Life" as part of the eighth grade science and technology course. An "Achievement Test consisiting 15 Multiple Choice Questions" was used to evaluate the students' pretest, posttest performance and learning consistency, an "Attitude Scale Consisting 32 Questions" was used for data collection, and a "Semi Structured Student Interview Form" was used to get the the students' opinions in the experimental groups. The results of the study have shown that the students using the educational software with educational interface agents in the form of real human appearance were more successful than the students of the other experimental groups and the students of the control group in terms of achievement, attitude and learning consistency toward Science and Technology course. To support educational software with educational interface agent has a positive effect the on students' achievement; therefore, educational software that will be developed for eighth grade elementary school students should be supported by educational interface agents in the form of real human appearance.

2.9.3 Articles Published in Project Based Learning Topic

In their article published in 2006, Ebru Öztürk and Şükrü Ada did research on the reflection of PBL and portfolio evaluation approaches in social studies education to education and test status. Goal of this study is to observe the improvement in Social

Studies lesson with the usage of primary school 7th grade students' portfolios based on the PBL Approach and then specify the reflections of evaluation results to the learning process by evaluating the improved portfolios with Portfolio Evaluation approach which is an alternative evaluation approach. In the study which aims to reveal the Reflections of Portfolio (Student Improvement File) Usage and Portfolio Evaluation in PBL to the Learning Process; program development, education status of teaching-learning process and test status are focused. To sum up the results of the study; after the process an increase is observed in the positive attitude of student, teacher and parent towards the portfolio evaluation and PBL approach.

Ayşe Sert Çıbık, in her article published in 2009, studies the effect of PBL method on improvement of the attitudes of primary school seventh grade students towards science class. The research is done with the contribution of the 7th grade students in a private primary school in Yenimahalle district in Ankara city. There are 22 students in experiment group, and 22 students in control group. Science attitude scale is applied as pre-test and post-test in order to determine sub-problems of the study. After the study it has been observed that there are relatively big differences in the attitude of the experiment group towards the science class when compared to the attitude of the control group towards the science class. It is thought that it might be efficient to implement this approach in science classes to improve attitudes of the students toward science classes.

Melek Şahin Civelekoğlu and Şafak Öztürk, in their article published in 2010, evaluate the opinions of primary school 5th and 8th grade students and science and technology class teachers about the application of project studies which are applied in science and technology class. In the study 552 students and teacher are reached in total. According to the results of the questionnaires that are prepared as two different types and used as data collection tool both for students and teachers; it is determined that students more negative opinion about the PBL method than the teachers, they vary in gender and study room. Moreover the differences are observed in terms of the grade, number of siblings, education level of parents. As for teacher opinions, no differences are observed in terms of sub-problems.

In their article published in 2010, Bünyamin Atıcı and Hakan Polat study the effect of PBL approach in web design teaching on academic success and opinions of students. This study is done with the aim of determining the effect of PBL approach in web designing class on academic success and opinions of students. Samples of the study consist of 118 students including 2 graduate and 1 undergraduate programs who are taking web designing course in Fırat University in 2009-2010 fall semesters. In this research pre-test and post-test control group experimental design which is one of experimental researches is used. A scale consisting of eight items and taking opinions of the students about the improvement of knowledge and skills related to the lesson is applied to the experiment group which is exposed to PBL approach. Web designing class given to experiment group is done according to PBL approach for six weeks. Meanwhile control group took the class according to traditional teaching method. Results of the data analysis show that pre-test results are not much different; however, post-test results show that there is relatively big difference between the groups in favor of experiment group which is exposed to PBL approach.

Dilek Karahoca, Adem Karahoca and Hüseyin Uzunboylu, in their article published in 2011, investigates robotics education to support science and technology courses for primary school education in Private Evrim College in Istanbul. The research performed with 16 students between 10 and 15 years old and they are distributed in 4 groups. In the research, it will be seen that students can learn and apply their skills on designing circuits while they are discussing with classmates by the means of collaborative learning and project based learning. Also, students have been attended to the race in their schools. Furthermore the winner group is competed in a robotics competition which is held every year in Istanbul Technical University. Consequently, the findings and evaluations help to understand that robotics education to support students' life, moreover, affecting their science performance and relationships with friends in class positively.

3. METHODOLOGY

In this section, the research model, the research group, data collection tools and data analysis techniques are covered.

3.1 RESEARCH MODEL

The research was done in order to apply Project-Based Learning Approach in Pedagogical Agent Assisted HCI course and to determine students' views. A new approach is brought to the present system by extending the present traditional instructional model with project-based learning approach in pedagogical agent assisted learning environment. Action research was done in this research as, a problem in class was solved in cooperation with different groups and these researcher groups directly participated in the research.

As the research subject was new and it was applied to a small group, the purpose was to present all the studies from all aspects and, therefore, both qualitative and quantitative data were included.

The students were asked to design a website for online education on museum studies and to do the analyses in this research which is carried out as a part of HCI course. The students were separated into groups and each group carried out their studies on the module they determined.

Literature review technique was used in order to develop the theoretical infrastructure. The activities done in the research were shared on web; they were also examined in classroom environment and researcher students also participated in the classroom environment. Within this context, one-to-one discussion techniques were used in class environment in order to enable the students and teachers to express their views on the activities shared on web. In addition, Project Based Learning Approach Attitude Scale, Pedagogical Agent Based Satisfaction Survey and Course Content Perception Attitude Scale were applied in order to determine students' attitudes towards the HCI course.

3.2 STUDY GROUP

The research was done in Bahçeşehir University. The research was carried on with third grade undergraduate students taking HCI course in Faculty of Engineering, Software Engineering Department. All the activities done by students taking HCI course were examined.

As the purpose in the research was to find out the situations encountered in the application of Project-Based Learning Approach in Pedagogical Agent Assisted Learning Environment, no universal generalizations was concluded from the data collection. Therefore, there was not any attempt to determine universe and samples.

Determination has not been examined in a population and sampling; only one study group was included in the research. The study was done in the spring semester of 2010-2011 academic years on all students taking the HCI course. The participants consisted of 46 students, 13 females and 33 males, taking the HCI course in Software Engineering in Bahçeşehir University, Faculty of Engineering. The participants were separated into 11 groups, each consisting of 2-6 students. The research was done in these 11 groups and each group was given the opportunity to carry out their own studies. Gender distribution in each group is shown in Figure 3.1.

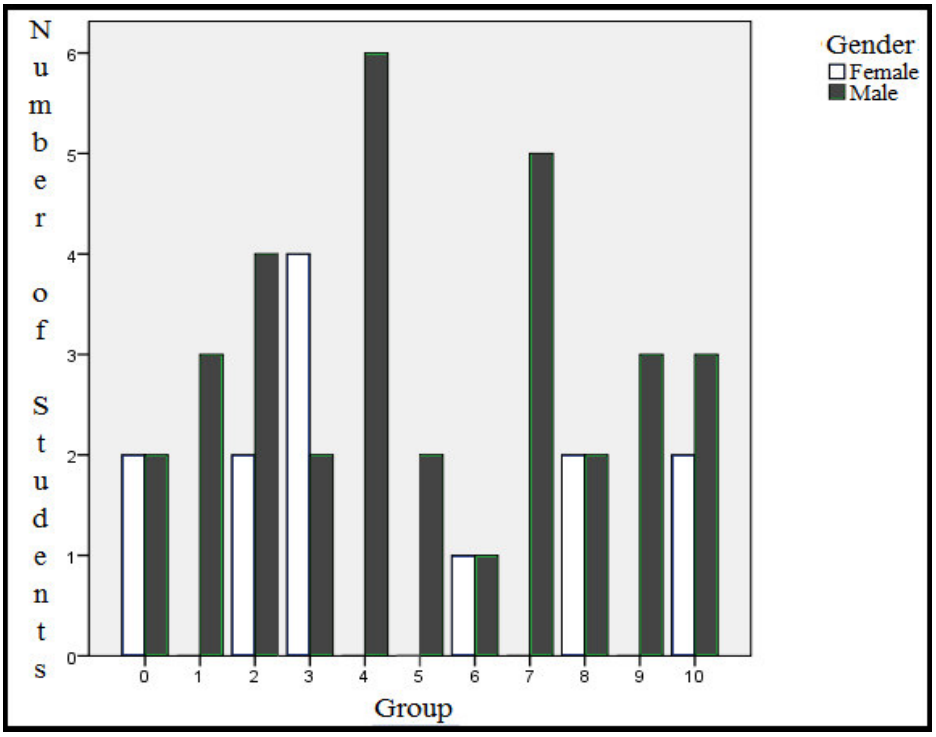

Figure 3.1 : Gender distributions in project groups

3.3 HOW IS THE PEDAGOGICAL AGENT ASSISTED PROJECT BASED LEARNING APPROACH ORGANIZED IN HCI CLASS?

In order to demonstrate how the pedagogical agent assisted Project-Based Learning Approach in is organized in HCI course, it was examined in four sections that are Planning, Performing the Activities, Assessment Process, Presentation and Reporting.

3.3.1 Planning

The curriculum to which the Project-Based Learning Approach in pedagogical agent assisted learning environment be applied is examined by the researcher. The chapter contents that were prepared to be shown in the curriculum were rearranged in web medium so that they could be taught visually by the pedagogical instructional agent (Figure 3.2).

Figure 3.2 : Pedagogical Instructional Agent Assisted Learning Environment

Agent technology is used in a variety of areas. The use of agent technology in instructional environment is increasing rapidly. Therefore, the term 'pedagogical agent' has begun to be used. Pedagogical agents can be described as the software tools that are promoting learning process in interaction with students and learning environments and that works in certain tasks. There are examples in which pedagogical agents are used in learning environments. ADELE (Johnson et al., 2003), PPP Persona (Andr'e et al., 1996) are examples of pedagogical agents (Serçe & Alpaslan, 2009).

The general template of the study was prepared by the researcher. Project Stages of Virtual Museum Studies Media Design and Virtual Museum Study Instruction:

a. The formation of the roles of users in the project according to their levels

b. Determining the needs in user levels in the project and doing the requirements analysis

c. The formation of task analysis and scenarios according to user levels

d. The formation of prototype design depending on the main tasks chosen in the project

e. The formation of state chart, activity and sequence diagrams from user data obtained on the paper mock-up,

f. The formation of financial analysis (the determination of financial requirements and expenses)

The groups are formed randomly without considering academic success and gender of students. Each group chose a different museology module according to their group members' mutual interests and skills.

The groups were given weekly activities beginning from the project starting date. The activities done were transferred into the web medium and were checked by teachers in order to resolve the problems. Necessary helps and arrangements were made.

3.3.2 Performing the Activities

In this section, the forming structures of group works' in process are examined.

Each group chose their project manager among themselves. Both teachers and project managers played important roles in planning and performing the activities phases.

Firstly, what kind of a project study will be carried out was explained and the groups were determined. 11 groups were created consisting of 2-6 students. The project stages were explained to each group and the groups were told to have project managers to provide the proper functioning of the project plan.

Each group chose a museology module according to their mutual interests and skills and adjusted the stages to these modules under the leadership of project managers (Table 3.1).

Table 3.1 : Project groups and chosen museology modules

Group	N	Online Museology Module
1	4	Searching Engine for Museum Resources
2	3	Online Museum Education
3	6	Online Ticket Reservation System
4	6	Online Museum Education and Personal Educational Activities
5	6	Online Museum Galleries and Resources
6	2	Online Museum Education
7	2	Online Museum Galleries and Resources
8	5	Online Ticket Reservation System
9	4	Searching Engine for Museum Resources
10	3	Online Museum Activities and Games
11	5	Online Museum Store

Each student was asked to examine the already existing examples of modules they had chosen and the museum websites in which these modules are used. Each group examined at least three websites related to their modules and did the requirement analysis and SWOT (strengths, weaknesses, opportunities, threads) analysis of the site they would design. They formed three user levels and determined the roles of the users during the requirement analysis. While determining the levels of users, they were allowed to separate users according to age, educational levels, disability level or completely different levels if they wanted.

First of all, task analysis was done in order to form the conceptual design of the web site they would create. Later on, the required modules are determined in order to create the physical design and then groups passed on to the storyboarding stage. The groups examined mock-up and paper prototype examples in order to form the draft of physical design of their own websites and then created their own prototypes.

After completing mock-up activities, the groups compared ISO 9241-11 usability metrics with mockup usability values. ISO 9241-11 usability metrics deals with the

extent to which a product can be used by specified users to achieve specified goals with effectiveness (Task completion by users), efficiency (task in time) and satisfaction (responded by user in term of experience) in a specified context of use (users, tasks, equipments & environments).

The groups formed the roles according to the user levels, completed requirement analysis and formed task analysis scenarios in conformity with the work flow. Each group formed the prototype of their own website, completed mock-up usability tests and formed state chart, activity and sequence diagrams for each module based on the user data obtained.

When all these stages were completed, each group completed their project by doing financial requirement determination analysis and expense analysis as the last stage.

Brief descriptions of group projects are listed below.

Group 1 : In this project; there are 3 user levels which are kids, teenagers and adults. All users can search museum artefacts and get detailed information about them. Additionally, users can make virtual tours to the exhibitions in the museum.

Group 2 : The aim of this project is to add a different perspective to the concept of museum and museology, to let them a permanent memories of objects they see in museums, to provide users to see and improve their capabilities in different subjects with not only visuals, but also with museum education. User levels are students, teachers and adults.

Group 3 : The aim of this project is to provide the use of virtual museums interactively by different user levels which are visitors, receptionist and manager. Users can buy their tickets online or make reservations for group tours for museum exhibitions.

Group 4 : This project provides visitors to access in a virtual museum environment according to their age, experience and knowledge, shows museum collections online and gives detailed information about the artefacts to visitors. User levels are separated into 3 groups; students and teachers, children and parents and finally adults.

Group 5 : This project grants users that non-complicated, easy to understand and wide archive online museum site. The feature that distinguishes this project from other virtual museum applications is to make the user spend time in an interactive environment. There are 3 user groups which are kids, teenagers and adults.

Group 6 : This project is based on a platform which has powerful education modules. This project supports each step of education in terms of prior knowledge, assessment and audio-visual items. K-12 students can find contents parallel to their education program in the museum site; can attend to online tests to measure their information. The user groups are visitors for educational purpose, researchers and regular visitors.

Group 7 : The aim of this project is creating an interactive virtual museology. The user groups differ among knowledge of art. They are “art for life”, “art for education” and “art for art”.

Group 8 : Levels of users are students, teachers and collectionists. Users can buy their tickets online or make reservations for group tours for museum exhibitions.

Group 9 : In this project; students, teachers and visitors are the user levels. All users can search museum artefacts and get detailed information about them. Additionally, users can make virtual tours to the exhibitions in the museum.

Group 10 : The main objective of this project is that, different levels of business users with a virtual museum environment can be sold to a museum to ensure the comfort of his/her home. User classification made according to the following criteria; age, education level, the system skills/experience and mental/physical barriers. According to the specified user groups, interfaces, virtual museum activities and game modules are created separately.

Group 11 : This group’s project is leading the beginning of online museums store in Turkey. The project is a virtual museum of the store, and be able to allow such a practice also used in shared data environment to ensure the privacy of membership are used. User groups are divided into three categories which are adult user group, young user group and children user group.

3.3.3 Assessment Process

While assessing the individual and group works in Project-Based Learning Approach, it is necessary to help students to improve their skills and guide them. All stages in the project were published in web medium as weekly activities and the activity results that groups shared on web medium were assessed by the teacher, researcher and all students in class environment in order to promote students development and to guide them. The defects of the groups and the flaws in the projects were fulfilled by the teacher in this process. Final project grades were given according to the groups' success in all project steps. Groups' range of success in all steps is given in Table 3.2.

Table 3.2 : Project achievements of each group according to the project steps

GROUPS / PROJECT STEPS	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11
The roles of users according to levels	H	H	H	H	H	H	H	H	H	H	H
Requirements analysis according to user levels	H	H	H	H	L	M	H	M	H	H	H
Task analysis and scenarios	M	H	H	H	H	M	H	H	H	H	H
Prototype design and storyboarding	H	M	H	H	H	H	H	H	M	H	H
State chart, activity and sequence diagrams	M	L	L	H	L	L	H	L	H	L	L
Financial analysis	L	M	M	H	L	L	H	L	M	H	L

H: High (71-100)
M: Medium (36-70)
L: Low (0-35)

The chapter presentations involving course contents were presented in classroom environment by the pedagogical agent and it supported by the teacher when necessary. In order to determine whether the lectures were useful or not, firstly the course evaluation tests were applied in web medium (pre-test) before the chapter presentations and the same tests were applied at the end of the pedagogical agent assisted lecture.

Moreover, three questionnaires in five level likert scale were given to students in order to determine the effects of Project-Based Learning Approach on students' attitudes.

3.3.4 Presentation and Reporting

The groups presented their studies in the classroom environment. The groups made the project presentations that they supported with posters on cardboards in the classroom environment where the HCI course instructor Dr. Dilek KARAHOCA, the researcher and other students are present. The presentations and project reports were prepared in compliance with the template of the TUBITAK Project Application Form.

Gains in Human Computer Interaction Course are:

I. Requirements Analysis
    a. Implementation of face-to-face interviews with users
    b. Prioritization of user requirements
    c. Reviewing similar projects and comparing similar requirement analysis approaches
II. Task Analysis
    a. Determination of main task and sub-tasks according to requirement analysis in user levels
    b. Creation of work flow diagrams
    c. Creation of storyboards

III. Prototyping
    a. Creation of mock-up designs
    b. Creation of interfaces according to mock-ups
    c. Testing of scenarios with the help of mock-up interface designs

IV. Usability Analysis
    a. Video recording of scenarios with mock-up interfaces
    b. Learning one video recording program (i.e. Camtasia)
    c. Implementation of usability tests (i.e. ISO 9241-11)
    d. Reorganizing the interfaces according to usability criteria

Project steps according to the template of TUBITAK Project Application Form are;

a. *Abstract and Keywords:* Project topic, summary and keywords are written in Turkish and English. In this part, the literature review should be given briefly and how the project steps would be carried on should be mentioned.

b. *Purpose:* The purpose of the project and retriecal on the desired solution should be written in clear.

c. *Subject and Scope:* The subject and the scope of the purposed project should be defined clearly; the relationship between the purpose should be mentioned.

d. *Literature Review:* National and international literature research should be done in the field related with the project topic. Not a raw list of literature, but it should be given a brief analysis of the literature.

e. *Original Value:* Research based on the hypothesis should be placed clearly and it should emphasized the original value clearly. How the proposed new technology or method will be a contribution to the literature should be described.

f. *Methodology:* Parameters which are selected to examine in accordance with the research design/approaches should be listed. The method applied and materials used should be clearly identified.

g. *Research Opportunities:* The infrastructure/equipment facilities used in project should be specified.

h. *Work Schedule:* Main work packages and their proposed timing should be given in a Work-Time Schedule.

i. *Success Criterias and Plan B:* Which actions to what extent was it performed specifies the project successful. What to do on what (Plan B) should be described in detailed.

j. *Budget and Justification:* General budget table prepared by TUBITAK should be filled.

3.4 DATA COLLECTION TOOLS

All the activities carried on pedagogical agent assisted HCI course within the research were observed by the researcher and the teacher; these observations were recorded into the researcher's journal.

In order to determine the students' achievements in and attitudes towards the activities of project based learning approach in pedagogical agent assisted learning environment, 'Project-Based Learning Attitude Scale, 'Pedagogical Agent Satisfaction Survey and 'Perception of Course Content Attitude Scale' developed by the researcher were applied. Five level likert scale is used in these questionnaires. Furthermore, chapter review tests were applied twice as pre-test and post-test before and after the pedagogical agent assisted learning in web medium.

To check the consistency of students' answers to attitude and satisfaction surveys, the questions are examined and it was found out that all the students gave answers consistent to the scale. All the surveys applied in the research created by the researcher and the teacher and these surveys can be found in the appendices.

3.4.1 Project Based Learning Attitude Scale

An attitude scale was developed in order to measure the students' attitudes towards project-based learning approach (Appendix-1). The survey applied to all groups was prepared using five level likert scale as base.

The data were examined and checked whether they were filled out in compliance with the rules before they were evaluated. In the analysis of the data, 5 point was given for 'Strongly Agree', 4 for 'Agree', 3 for 'Neither Agree Nor Disagree', 2 for 'Disagree' and 1 for 'Strongly Disagree'. The Project-based Learning Attitude Scale consisted of 50 questions and was applied on 46 students taking the HCI course.

The Cronbach Alpha reliability test was taken into consideration in order to determine the reliability of the measurement tool. The reliability parameter was found to be 0.945

(Table 3.3). The values showed that the reliability parameters are at an acceptable level for the scales used in social and educational sciences (Karasar 2004).

Table 3.3 : PBLAS - Reliability Statistics

Cronbach Alpha	# of Questions
.945	50

3.4.2 Pedagogical Agent Satisfaction Survey

An attitude scale was developed in order to measure the students' satisfactions towards pedagogical agent assisted learning (Appendix-2). The survey applied to all groups was prepared using five level likert scale as base.

The data were examined and checked whether they were filled out in compliance with the rules before they were evaluated. The Pedagogical Agent Satisfaction Survey consisted of 8 questions and was applied on 46 students taking the HCI course.

The Cronbach Alpha reliability test was taken into consideration in order to determine the reliability of the measurement tool. The reliability parameter was found to be 0.929 (Table 3.4). The values showed that the reliability parameters are at an acceptable level.

Table 3.4 : PASS – Reliability Statistics

Cronbach Alpha	# of Questions
.929	8

3.4.3 Perception of Course Content Attitude Scale

An attitude scale was developed in order to measure the students' attitudes towards perception of course content (Appendix-3). The survey applied to all groups was prepared using five level likert scale as base.

The data were examined and checked whether they were filled out in compliance with the rules before they were evaluated. The Perception of Course Content Attitude Scale consisted of 35 questions and was applied on 46 students taking the HCI course.

The Cronbach Alpha reliability test was taken into consideration in order to determine the reliability of the measurement tool. The reliability parameter was found to be 0.957 (Table 3.5). The values showed that the reliability parameters are at an acceptable level.

Table 3.5 : PCCAS – Reliability Statistics

Cronbach Alfa	# of Questions
.957	35

3.4.4 Chapter Review Tests

Multiple choice tests consisting of 10-20 questions on all chapters were prepared in order to determine to what extent students were able to understand course contents with pedagogical agent assisted learning in web medium.

The students were provided with the opportunity to solve the pre-tests covering each chapter and then to listen to pedagogical agent assisted chapter presentations. As pedagogical agent assisted chapter presentations were carried on in a classroom environment, the teacher was able to make the necessary explanations in time, preventing any distraction from the lecture. After pedagogical agent assisted chapter presentation, students were asked to re-answer chapter review tests. The difference in time spent on answering the questions and in test scores were observed.

3.5 DATA ANALYSIS

Observations were made thanks to the researcher's journal in order to determine how the activities in Project-based Learning Approach were designed. The data from the journal were used as support to the answers to the questions in the questionnaires and students' views. Thus, the views and behaviors of students are examined in terms of consistency.

In the statistical analysis of the data, in order to compare the pre-test and post-test success points, paired-samples t-test; to compare the attitudes and views of students, independent-samples t-test, to compare the attitudes and views of students when different groups are considered, one-way analysis of variance (ANOVA) was used.

Moreover, correlation coefficient was used in order to interpret the relationship between students' attitudes towards project-based learning and their success in HCI course projects. The statistical analyses were done on SPSS 17.0. The significance of the data was tested at the significance level of .05.

4. FINDINGS & RESULTS

The data from measurement tools used in order to determine the effects of project-based learning approach in pedagogical agent assisted learning environment were analyzed with statistical techniques in this section. The findings from the analyses were tabulated considering the sub-problems and comments were made based on the results from the data.

4.1 FINDINGS ON PROJECT BASED LEARNING APPROACH

- *Is there a significant difference between genders in students' attitudes towards project based learning approach?*

Table 4.1 : Independent samples t-test results of PBLAS according to the genders

Gender	N	X	Std. Dev.	df	t	p
Male	33	3.95818	.439100	44	1.537	.131
Female	13	4.16462	.319912			

According to Table 4.1, no significant difference between genders in students' views on project-based learning approach was observed (t_{44}=1.537, p>.05). Accordingly, we can also say that the relationship between gender and students' attitudes towards project-based learning is not statistically significant at the level of p<0.05.

- *Is there a significant difference between students in different groups in students' attitudes towards project based learning approach?*

Table 4.2 : ANOVA results according to students' attitudes in PBLAS from different groups

	Sum Sq.	df	Mean Sq.	F	P
Between Groups	1.691	10	.169	.970	.486
Within Groups	6.104	35	.174		
Total	7.795	45			

According to Table 4.2, no significant difference was observed in students' views on project-based learning approach when different groups were taken into consideration ($F_{10,35}$=.97, p>.05). We can say that the relationship between different groups and students' attitudes towards project-based learning is not statistically significant between 95% confidence interval.

Means and standard deviations of students' attitudes towards project-based learning approach according to the groups are shown in Table 4.3.

Table 4.3 : Means and standard deviations of students' attitudes in PBLAS according to the groups (ANOVA results)

Groups	N	X	Std. Dev.
Group 1	4	3.94000	.295296
Group 2	3	3.84000	.586174
Group 3	6	3.93667	.578193
Group 4	6	4.38000	.375020
Group 5	6	3.86000	.551507
Group 6	2	3.82000	.084853
Group 7	2	4.37000	.523259
Group 8	5	3.82000	.269444
Group 9	4	4.11000	.389701
Group 10	3	4.13333	.127017
Group 11	5	4.02000	.224054
Total	46	4.01652	.416212

- *Are students' attitudes towards project based learning approach and final project grades directly proportional?*

Table 4.4 : Correlation between students' attitudes towards PBL approach and course achievements

		Project Grade	Attitude Mean
Final Project Grade	Pearson's r	1	.440**
	P	-	.002
	N	46	46
Student's Attitudes Mean Towards Project Based Learning Approach	Pearson' r	.440**	1
	P	.002	-
	N	46	46

**Correlation is significant at the .01 level (2-tailed).

The final grades of the students were determined after the project presentations. The results of students' attitudes according to the project-based learning attitude scale and final project grades are compared in order to examine the relationship between students' attitudes towards project-based learning and success in the course.

When Table 4.4 is analyzed, it can be seen that there is a positive direct relationship in .01 significance level ($r=.440$, $p>.01$) between the attitude average of students towards project- based learning and final project grades. It can be said that students who receive instruction with project-based learning approach are pleased with the approach and their success improves with this approach.

4.2 FINDINGS ON PEDAGOGICAL AGENT ASSISTED LEARNING

- *Is there a significant difference between genders in students' attitudes towards pedagogical agent assisted learning environment?*

Table 4.5 : Independent samples t-test results of PASS according to the genders

Gender	N	X	Std. Dev.	df	t	P
Male	33	3.75	.797334	44	.321	.750
Female	13	3.82692	.519260			

According to Table 4.5, no significant difference between genders in students' views on pedagogical agent assisted learning environment was observed (t_{44}=.321, p>.05). Accordingly, we can also say that the relationship between gender and students' attitudes towards pedagogical agent assisted learning environment is not statistically significant at the level of p<0.05.

- *Is there a significant difference between students in different groups in students' attitudes towards pedagogical agent assisted learning environment?*

Table 4.6 : ANOVA results according to students' attitudes in PASS from different groups

	Sum Sq.	Std. Dev.	Mean Sq.	F	P
Between Groups	11.298	10	1.130	3.205	.005
Within Groups	12.337	35	.352		
Total	23.635	45			

According to Table 4.6, a significant difference was observed in students' views on pedagogical agent assisted learning environment when different groups were taken into consideration ($F_{10,35}$=3.205, p<.01). We can say that the relationship between different groups and students' attitudes towards pedagogical agent assisted learning environment is statistically significant between 99% confidence interval.

Means and standard deviations of students' attitudes towards pedagogical agent assisted learning environment according to the groups is shown in Table 4.7.

Table 4.7 : Means and standard deviations of students' attitudes in PASS according to groups (ANOVA results)

Groups	N	X	Std. Dev.
Group 1	4	3.78125	.187500
Group 2	3	4.83333	.288675
Group 3	6	4.00000	.176777
Group 4	6	3.72917	.229356
Group 5	6	2.68750	1.103262
Group 6	2	3.75000	.176777
Group 7	2	3.75000	.176777
Group 8	5	4.07500	.590286
Group 9	4	3.90625	.948546
Group 10	3	3.79167	.381881
Group 11	5	3.80000	.527376
Total	46	3.77174	.724715

4.3 FINDINGS ON COURSE CONTENT PERCEPTION ACHIEVEMENT AND STUDENTS' ATTITUDES

- *Is there a significant difference between genders in students' attitudes towards perception of course content?*

Table 4.8 : Independent samples t-test results of PCCAS according to the genders

Gender	N	X	Ss	df	t	P
Male	33	3.9718	.52454	44	1.210	.233
Female	13	4.1785	.51272			

According to Table 4.8, no significant difference between genders in students' attitudes on perception of course content was observed (t_{44}=1.210, p>.05). Accordingly, we can also say that the relationship between gender and students' attitudes towards perception of course content is not statistically significant at the level of p<0.05.

- *Is there a significant difference between students in different groups in students' attitudes towards perception of course content?*

Table 4.9 : Means and standard deviations of students' attitudes in PCCAS according to groups (ANOVA results)

Groups	N	X	Std. Dev.
Group 1	4	4.1625	.24784
Group 2	3	4.1200	.35539
Group 3	6	3.6083	.62535
Group 4	6	4.1917	.73366
Group 5	6	3.6817	.67701
Group 6	2	3.8850	.20506
Group 7	2	4.4550	.64347
Group 8	5	3.9220	.29003
Group 9	4	4.2925	.41194
Group 10	3	4.4200	.25239
Group 11	5	4.1540	.24327
Total	46	4.0302	.52403

Means and standard deviations of students' attitudes towards perception of course content according to the groups is shown in Table 4.9.

Table 4.10 : ANOVA results according to students' attitudes in PCCAS from different groups

	Sum Sq.	Std. Dev.	Mean Sq.	F	P
Between Groups	3.317	10	.332	1.284	.277
Within Groups	9.041	35	.258		
Total	9.690	45			

According to Table 4.10, no significant difference was observed in students' attitudes on perception of course content when different groups were taken into consideration

($F_{10,35}$=1.284, p>.05). We can say that the relationship between different groups and students' attitudes perception of course content is not statistically significant between 95% confidence interval.

- *Are students' attitudes towards perception of course content and final project grades directly proportional?*

Table 4.11 : Correlation between students' attitudes towards perception of course contents and course achievements

		Project	Mean Attitude
Final Project Grade	Pearson's r	1	.316*
	P	-	,032
	N	46	46
Student's Attitudes' Mean Towards Perception of Course Contents	Pearson's r	,316*	1
	P	,032	-
	N	46	46

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

The results of students' attitudes according to the perception of course content attitude scale and final project grades are compared in order to examine the relationship between students' attitudes towards perception of course content and success in the course.

When Table 4.11 is analyzed, it can be seen that there is a positive direct relationship in .05 significance level (r=.316, p>.05) between the attitude average of students towards the perception of course content and final project grades. It can be said that students who receive instruction with pedagogical agent assisted project-based learning approach are pleased with this approach and it improves their success.

- *Is there a significant difference between pre-test and post-test results in students' attitudes towards perception of course contents?*

Perception of course content attitude scale was applied to students as pre-test at the beginning of the semester in order to find out if students were aware of the course

contents which are about the project steps in human computer interaction course. The same survey was applied to students again after students have finished their projects and have learned the project topics. The purpose was to check to what extent the course contents of project based HCI course was effective.

Table 4.12 : Paired-samples t-test results according to the pre-test and post-test results for the course contents of project-based HCI course

	X	ΔX	N	Std. Dev.	df	t	P
Post-Test	4.2596	0.2294	46	.45116	45	2.518	.015
Pre-Test	4.0302		46	.52403			

The results of paired-samples t-tests results for the course contents of project-based HCI course are presented in Table 4.12 in order to determine whether there is a significant difference between the students' responses for pre-test and post-test results in perception of course content attitude scale. According to the data in the table, while the average grade of pre-tests was 4.03, the average grade of post-tests was 4.26; that is, there was an increase about 0.23 points between the tests.

According to these data, a significant difference between pre-test and post-test evaluations for perception of course content surveys was observed (t_{45}=2.518, p>.05). Therefore, we can say that the difference between pre and post test evaluations of perception of course content surveys is statistically meaningful between 95% confidence interval.

4.4 FINDINGS ON CHAPTER REVIEW TESTS

- *Is there a significant difference between pre-test and post-test results in students' chapter review assessments?*

Chapter review tests were applied to students as pre-tests before the chapters were covered in order to check the perception of course contents in web medium. The same tests were applied to students in the HCI course again after students covered chapter contents with pedagogical agent assisted online. The purpose was to check to what extent the pedagogical agent assisted instruction in web medium was effective.

Table 4.13 : Paired-samples t-test results according to the pre-test and post-test results of chapter review tests

	X	ΔX	N	Std. Dev.	df	t	P
Post-Test Grade	6.1739	1.13304	46	1.52300	45	5.187	.000
Pre-Test Grade	5.0409		46	1.51529			
Pre-Test Duration	529.021 s	124.994 s	46	203.110	45	3.821	.169
Post-Test Duration	404.027 s		46	140.497			

The results of paired-samples t-tests are presented in Table 4.13 in order to determine whether there is a significant difference between pre-test and post-test results. According to the data in the table, while the average grade of pre-tests was 5.04, the average grade of post-tests was 6.17; that is, there was an increase about 1.13 points between the tests. When we come to the differences in the test durations, we can say that while the average period of time in which students did pre-tests were 529 seconds, the average time period of the post-tests decreased to about 404 seconds.

According to these data, a significant difference between pre-test and post-test evaluations of chapter reviews was observed (t_{45}=5.187, p>.01). Therefore, we can say that the difference between pre and post test evaluations of chapter review tests is statistically meaningful between 99% confidence interval.

5. CONCLUSION

The conclusions drawn with the data obtained in the research and the recommendations put forward are included in this section.

5.1 RESULTS

The effects of Project-Based Learning approach in pedagogical agent assisted HCI course on students' views and academic success were examined. The conclusions obtained with the help of sub-problems are listed below:

a. There was no significant difference according to gender in the attitudes towards project-based learning approach of HCI students, to whom Project-Based Learning method in Pedagogical Agent Assisted Learning Environment was applied; however, female students' attitudes towards Project-Based Learning approach were a little higher than those of males.

b. There was no significant difference according to groups in the attitudes towards project-based learning approach of HCI students, to whom Pedagogical Agent Assisted Project-Based Learning method was applied.

   This conclusion may be related to the fact that the students was chosen randomly regardless of their academic levels, interests or genders.

c. There was a significant positive linear relationship between the attitudes towards project-based learning approach and their final project grades of HCI students, to whom Pedagogical Agent Assisted Project-Based Learning method was applied.

   It was observed that the students who were more successful in final projects had given more positive answers In Project-Based Learning approach questionnaire. According to this result, it can be said that students, to whom Project-Based Learning method in Pedagogical Agent Assisted Learning Environment was applied, are pleased with this approach; and the approach has positive effects on students' achievements.

d. There was no significant difference according to gender in the attitudes towards Pedagogical Agent Assisted Learning environment of HCI students, to whom Project-Based Learning method in Pedagogical Agent Assisted Learning Environment was applied; however, female students' attitudes towards Pedagogical Agent Assisted Learning Environment were a little higher than those of males.

e. Significant differences were observed according to groups in the attitudes towards Pedagogical Agent Assisted Learning approach of HCI students, to whom Pedagogical Agent Assisted Project-Based Learning Method was applied.

   This conclusion may be due to the fact that the Pedagogical Agent Satisfaction Survey was applied after the whole semester and during the semester students may have influenced each other's ideas in their own groups on Pedagogical Agent Assisted Learning Environment.

f. There was no significant difference according to gender in the attitudes towards Perception Of Course Contents of HCI students, to whom Project-Based Learning method in Pedagogical Agent Assisted Learning Environment was applied; however, female students' attitudes towards Perception Of Course Contents were a little higher than those of males.

g. There was no significant difference according to groups in the attitudes towards Perception Of Course Contents of HCI students, to whom Pedagogical Agent Assisted Project-Based Learning method was applied.

   This conclusion may be related to the fact that the students was chosen randomly regardless of their academic levels, interests or genders.

h. There was a significant positive linear relationship between the attitudes towards the perception of course contents and their final project grades of HCI students, to whom Pedagogical Agent Assisted Project-Based Learning method was applied

It was observed that the students who were more successful in final projects had given more positive answers in Perception Of Course Contents attitude questionnaire. According to this result, it can be said that students, to whom Project-Based Learning method in Pedagogical Agent Assisted Learning Environment was applied, are pleased with this approach; and the approach has positive effects on students' success.

i. Significant differences were found out in the pre-test and post-tests evaluations for the Perception Of Course Content survey results in HCI course which is taught with Pedagogical Agent Assisted Project-Based Learning approach.

   According to this result, it can be said that HCI course, in which Project-Based Learning Approach in Pedagogical Agent Assisted Learning Environment was applied, had positive effects on students' achievements and students' attitudes towards the perception of HCI course's contents; and student were pleased with the approach.

j. Significant differences were found out in the pre-test and post-tests evaluations of HCI students, to whom Pedagogical Agent Assisted Project-Based Learning method was applied.

   According to this result, it can be said that HCI course, in which project-based learning method in pedagogical agent assisted learning environment was applied, had positive effects on students' achievements; and student were pleased with the approach.

According to this research, it can be said that HCI course in which project-based learning method in pedagogical agent assisted learning environment was applied, has influence on students' attitudes towards the course and their academic success. That project-based learning approach covering human-computer interaction in software engineering field may be effective in reaching the goals when used in classroom environment with pedagogical agent assistance is under consideration.

5.2 RECOMMENDATIONS ON FUTURE RESEARCHES

1. This study was applied on a small sample group consisting 46 students. More meaningful results may be obtained with more crowded samples.

2. In this study, we used pre-existing pedagogical agents that are already used in different studies. New pedagogical agents may be designed and their appearances may be changed according to the students' ages, genders or level of education.

3. In next researches, it may be provided guidance applications by pedagogical agents and competencies of agents on project evaluation process may be developed.

4. In this study, not just pedagogical agents was used, but also student-teacher relationship has used when it is necessary. Pedagogical agents' emotional and cognitive skills may be developed as student-agent relationship in classroom environments (Sound, Light, Motion-Sensitive Pedagogical Agent Designs).

5. The effects of project-based learning approach on students' success and attitudes were examined in this study. Project-based learning approach may be also examined in terms of features like logical thinking, permanency, creativity, self-sufficiency, cognitive intelligence, etc.

6. The effects of project-based learning on HCI course was examined in this study; and the results promoted the use of project-based learning approach in pedagogical agent assisted learning environment. Within this context, similar studies may be applied in different disciplines and their results can be discussed.

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APPENDICES

APPENDIX A1 : Survey - Project Based Learning Attitude Scale

	QUESTIONS	1	2	3	4	5
1	The students participating in the project should be separated into groups equally and in a balanced way considering their academic success in previous years.					
2	The experiences of project members on design, risk, technology and expense should be taken into consideration in project topics to be chosen.					
3	The user profile to be served by the projects should be determined and these projects should be applicable.					
4	The project members should be informed beforehand about the fact that they should support the all stages of the project.					
5	The sub-tasks of each project member should be described.					
6	According to the main and sub-tasks, the exchange of tasks and the development should be taken into consideration in each stage of the project.					
7	Each member's task should be checked in certain periods and should be evaluated by the whole group.					
8	Checklists should be prepared for the evaluation process according to weekly project stage criteria.					
9	Each member should be able to criticize him/herself on his/her own task.					
10	Each member should be able to criticize other members of the group.					
11	Different project groups should be able to evaluate and criticize each other's works.					
12	The tasks of project members in each stage should not only be explained, but also should be given in written form.					
13	A plus point should be given for every critic that is both realistic and innovative.					
14	The individual roles of members should be described in each stage in project evaluations.					
15	A collective evaluation should be done as groups for each of the stages.					
16	Private discussion platforms should be created in order for group members to communicate with each other.					
17	Private discussion platforms should be created in order for project groups to do intergroup evaluations.					
18	The instructor should describe the tips and instructions regarding the topic in all stages of the project.					

	QUESTIONS	1	2	3	4	5
19	The instructor should describe the project requirements in the curriculum.					
20	There should be a social warning system for members who do not work systematically.					
21	Project members should in face-to-face communication with the instructor while the doing weekly tasks.					
22	As students will be under a lot of stress when they take responsibilities in different project groups, their success will also increase accordingly.					
23	The topics that project members are interested in should be determined beforehand.					
24	Individual assessment should be done after the intergroup assessment.					
25	There is no need to even out the number of successful and unsuccessful project members in every group.					
26	The emotional intimacy of project members according to the tasks to be done in the project should be taken into consideration.					
27	While arranging project groups, the tendency of project members to the project topics should be taken into consideration.					
28	While arranging project groups, the students to participate in the project should be separated into groups in a way that the mental effort should be at the highest level.					
29	The students should focus on topics suitable for new trends in sectoral service fields required.					
30	Project topics should be in connection with the real world.					
31	Project-based learning improves the sense of responsibility both individually and in groups.					
32	Project-based learning enables students to relate real world problem involving different disciplines to the collaborative learning projects they prepare.					
33	Project-based learning encourages students to do research and improves creativity.					
34	In project-based learning approach, learners should have rights to speak about project selection, in small groups or whole class discussions and in the determination of the topics they would like to do research on.					
35	Determination of the project plays an important role in the presentation of skills and development of a student and determination of his/her instructional goals.					
36	Project topics should be related to daily life so that students can learn what they learned and why they learned it.					

	QUESTIONS	1	2	3	4	5
37	Project groups should be organized with students and the groups should be in a heterogeneous structure in terms of students' skills.					
38	The assessment of performances on the project should not only be dependent on group reports and portfolios but also on intergroup discussions, observation of students' works and individual teacher-student meetings.					
39	Projects help students to gain practical experiences.					
40	Projects give the opportunity to make use of the knowledge, which is acquired in class, in daily life.					
41	Students gain self-confidence when they completed their projects with success.					
42	Projects improve students' motivation towards learning and enable students to develop new interests in the following projects.					
43	Projects allow students to be responsible for their own learning.					
44	Projects enable participation of students in group activities and cooperative learning activities.					
45	Projects suggest multiple ways for knowledge reflections and participations of students.					
46	Projects teach students to make the right choices on their own.					
47	If projects are carried out without the teachers' supervision, many problems may occur.					
48	If projects are carried out without the teachers' supervision, students may have difficulty in finding interesting topics to research on.					
49	Projects promote students' learning and improve the permanency of the knowledge.					
50	Projects improves students' attitude towards the course and their social skills like communication and entrepreneurship.					

5 : Strongly Agree

4 : Agree

3 : Neither Agree Nor Disagree

2 : Disagree

1 : Strongly Disagree

APPENDIX A2 : Survey - Pedagogical Agent Satisfaction Scale

	QUESTIONS	1	2	3	4	5
1	I think pedagogical agents facilitate the comprehension of the contents in classroom environment.					
2	I liked the instructional role of virtual pedagogical character.					
3	I think the virtual pedagogical character was effective in the comprehension of the contents.					
4	I liked the image of the virtual pedagogical character.					
5	I think the virtual pedagogical character made the learning more enjoyable.					
6	I was pleased with the instructional role of the virtual pedagogical character.					
7	I think the use of the virtual pedagogical character in class is effective.					
8	I think the use of the virtual pedagogical character together with the teacher is more effective.					

5 : Strongly Agree

4 : Agree

3 : Neither Agree Nor Disagree

2 : Disagree

1 : Strongly Disagree

APPENDIX A3 : Survey - Perception of Course Content Attitude Scale

	QUESTIONS	1	2	3	4	5
1	Project-based learning studies based on Human Computer Interaction may be improved in many areas.					
2	Usability requirements should be determined beforehand in project-based learning studies based on Human Computer Interaction.					
3	User needs should be taken into consideration in project-based learning studies based on Human Computer Interaction.					
4	Project-based learning studies based on Human Computer Interaction improves critical thinking ability.					
5	The project should be reliable, consistent, suitable to standards and applicable in every technological platform in project-based learning studies based on Human Computer Interaction.					
6	In the design of user-centered software, it is important to model tasks and technological systems to be used beforehand.					
7	It is important to determine users' needs in user-centered software design based on Human Computer Interaction.					
8	In each stage of user-centered software design, it is important to do the tasks step by step in terms of the effectiveness of the project.					
9	All users' needs may be taken into consideration and all needs may be met with a single project in user-centered software design.					
10	It is important to design the system as customizable by users in user-centered software design so that all user profiles' needs are properly met.					
11	User modeling is understandable in user-centered software design.					
12	In user-centered software design, the selection of user models that will meet the conditions is important in terms of project acceptance trial (user tests).					
13	User-centered software designs should always be available everywhere and for everybody.					
14	Work models play important roles in reaching goals in project-based learning studies based on Human Computer Interaction.					
15	User-centered software designs can be used in different technological platforms.					
16	It is important to create interface design suitable for the standard directions determined in user-centered software design based on Human Computer Interaction.					

	QUESTIONS	1	2	3	4	5
17	Font, type size, colors and visuals are important to attract users' attention in user-centered software design.					
18	Task analysis and modeling are understandable in project-based studies based on Human Computer Interaction.					
19	Data should be collected from real users; user requirements should be determined and task analysis should be done before passing onto the software stage in user-centered software design.					
20	To prepare a scenario draft with visuals is important in user-centered software design in terms of measuring the functionality, preparing the process and noticing and resolving possible problems.					
21	The interface should be well-designed to enable users to use the site effortlessly in user-centered software design.					
22	The determination of the requirements in the first place is important in terms of the process in Waterfall model, as in all design models based on Human Computer Interaction.					
23	It is important to analyze users and their worlds in user-centered software design.					
24	It is effective to evaluate ideas on the project with users in user-centered software design.					
25	It is important to check the system with potential users and to repeat this process in user-centered software design.					
26	It is important for users to participate in each stage of the project in user-centered software design.					
27	Task analyses facilitate designers' comprehension of the present system in project-based studies based on Human Computer Interaction.					
28	Different approaches may be used for task analyses in project-based studies based on Human Computer Interaction.					
29	Different approaches may be used for collecting data in project-based studies based on Human Computer Interaction.					
30	Task analyses are important in terms of determination of goals in user-centered software design.					
31	Requirement analyses are important in terms of determination of what the system should do in project in user-centered software design.					
32	Preparing scenario drafts with visuals is important as they enable designers to see and check the design beforehand in project in user-centered software design.					
33	Preparing prototypes of designs is important as it presents users something with low expense in project in user-centered software design.					

	QUESTIONS	1	2	3	4	5
34	The evaluation process is important as it constitutes tangible evidences of how the system is used in project in user-centered software design.					
35	The installation process is important as it enables testing, development and spreading of the system in project in user-centered software design.					

5 : Strongly Agree

4 : Agree

3 : Neither Agree Nor Disagree

2 : Disagree

1 : Strongly Disagree

APPENDIX B1 : Samples of Weekly Activities From Projects

a. The formation of the roles of users in the project according to their levels

Group 4:

Müzecilik Eğitimi

1. **Öğretmenler ve Öğrenciler**
    a. **Öğretmenler**
        i. İlköğretim Öğretmenleri
        ii. Lise Öğretmenleri
        iii. Üniversite Öğretmenleri
    b. **Öğrenciler**
        i. İlköğretim Öğrencileri
        ii. Lise Öğrencileri
        iii. Üniversite Öğrencileri
2. **Çocuklar ve Aileler**
    a. **Çocuklar**
    b. **Aileler**
3. **Yetişkinler**

Group 10:

Kullanıcı Grupları:

- Öğrenciler
    - Çocuklar (7-12 Yaş arası)
    - Gençler (12-18 Yaş arası)
    - Üniversite Öğrencileri
- Yetişkinler (25-.. Yaş)
- Eğitimciler
    - K-12 Öğretmenleri
    - Üniversite Öğretim Üyeleri
- Engelliler
    - Görme Engelliler
    - Duyma Engelliler

b. Determining the needs in user levels in the project and doing the requirements analysis

Group 4:

Gereklilik Analizi

1. **Öğretmenler ve Öğrenciler**
   a. **Öğretmenler**

Input:

i. Kendi departmanlarına yönelik somut bilimsel verilere ulaşmak ister.
ii. Öğrencilerine online öğretici aktivite sunmak ister.
iii. Öğrencilerine örnekler sunmak ister.
iv. Öğrencilerinin öğrenme yeteneklerinin gelişmesini ister.
v. Müzelerdeki ilgili etkinliklerden haberdar olmak ister.
vi. Sanal müzelere erişmek ister.
vii. Online müze rehber kataloglarını görmek ister.

Output:

i. Öğretmenlerin departmanlarına göre ayrı ayrı modüller sunulması.
ii. Öğretmenin talebine göre online öğretici aktivite sunulması.
iii. Öğretmenlere müze veri tabanı sunulması.
iv. Öğretmen ve okul yöneticilerinin müze eğitimi ve müze eğitiminde yeni teknolojilerden nasıl yararlanılabileceği ile ilgili hizmet içi programlara yer verilmeli.
v. Öğretmenlerin departmanlarına göre arama motorlarının oluşturulabilmesi için veritabanı oluşturulması.
vi. Her etkinliğin yeri, zamanı ve ücretin ilgili öğretmene bildirilmesi
vii. Sanal müze hizmeti sunulması.
viii. Online müze rehber kataloglarının sunulması.
ix. Müzelerin çocuk eğitimine yönelik bağımsız online programlar hazırlamaları, bu programları okul ve öğretmenlere duyurmaları. oluşturulabilmesi için veritabanı oluşturulması.
vi. Her etkinliğin yeri, zamanı ve ücretin ilgili öğretmene bildirilmesi
vii. Sanal müze hizmeti sunulması.
viii. Online müze rehber kataloglarının sunulması.
ix. Müzelerin çocuk eğitimine yönelik bağımsız online programlar

b. **Öğrenciler**

Input:

i. Kendi seviyesine yönelik somut bilimsel verilere (müze veri tabanı) ulaşmak ister.
ii. Müzelerdeki ilgili etkinliklerden haberdar olmak ister.
iii. Kendi seviyesine göre eğlenceli modüller ister.
iv. Sanal müzelere erişmek ister.
v. Online müze rehber kataloglarını görmek ister.

Output:

i. Öğrencilerin seviyelerine göre modüller sunulması
ii. Öğrencinin seviyelerine göre veritabanı oluşturup arama motoru sunulması.
iii. Öğrenciler için online öğretici aktivite sunulması.
iv. Öğrencilerin seviyesine göre kullanıcı arayüzünün tasarlanılması.
v. Sanal müze hizmeti sunulması.
vi. Online müze rehber kataloglarının sunulması.

2. **Çocuklar ve Aileler**

a. **Çocuklar**

Input:

i. Kendi seviyesine yönelik somut bilimsel verilere(müze veri tabanı) ulaşmak ister.
ii. Sesli ve görsel içerikle zenginleştirilmiş modül ister.
iii. Animasyonlu içerikler ister.
iv. Bilgileri oyunlarla öğrenmek ister.
v. Müzelerdeki ilgili etkinliklerden haberdar olmak ister.
vi. Kendi seviyesine göre eğlenceli modüller ister.
vii. Sanal müzelere erişmek ister.

Output:

i. Öğrencilerin seviyelerine göre modüller sunulması
ii. Müzelerin, çocuklara yönelik, ilgi çekici, eserlere odaklı, eğlenirken öğrenmeye yardımcı olan zenginleştirilmiş online programlar sunulması.
iii. Sesli ve görsel modüllerin sunulması.
iv. Sesli ve görsel modüllerin animasyonlarla güçlendirilmesi.
v. Oyunların tasarlanması.
vi. Öğrenciler için online öğretici aktivite sunulması.
vii. Öğrencilerin seviyesine göre kullanıcı arayüzünün tasarlanılması.
viii. Sanal müze hizmeti sunulması.
ix. Müzelerde sunulan eserlerden kendilerine özel müze alanlarının oluşturulması.
x. Görüntülenen eserin yanında ilgili eserlerinde listelenmesi.

b. **Aileler**

Input:

i. Çocuklar için anlaşılabilir multimedya rehberler ister.
ii. Müzelerdeki ilgili etkinliklerden haberdar olmak ister.
iii. Sanal müzelere erişmek ister.
iv. Ailelere özel etkinlikler ister.
v. Sesli ve görsel modüller ister.
vi. Online müze rehber kataloglarını görmek ister.

Output:

i. Aileye özel etkinlik takvimi sunulması.
ii. Sanal müze hizmeti sunulması.
iii. Multimedya rehber hizmeti sunulması.
iv. Online müze rehber kataloglarının sunulması.

3. **Yetişkenler**

Input:

i. Sanal müzelere erişmek ister.
ii. Online müze rehber kataloglarını görmek ister.
iii. Kendi seviyesine yönelik somut bilimsel verilere(müze veri tabanı) ulaşmak ister.

Output:

i. Sanal müze hizmeti sunulması.
ii. Müzedeki eserlerin dönemine ait daha ayrıntılı şekilde bilgilendirme online kursların yapılması ve böylece bu alanda kendini geliştirmek isteyen kişilere yardardımcı olunur.
iii. Yetişkinlere yönelik online müze hizmetlerinin artırılması ile müze gönüllülerinin oluşması ve sayılarının artması böylece de müzelerin geniş bir çevreye yayılması sağlanabilecektir.
iv. Online müze rehber kataloglarının sunulması.
v. Yetişkinlere göre müze veritabanından arama motoru oluşturulması.

Group 2:

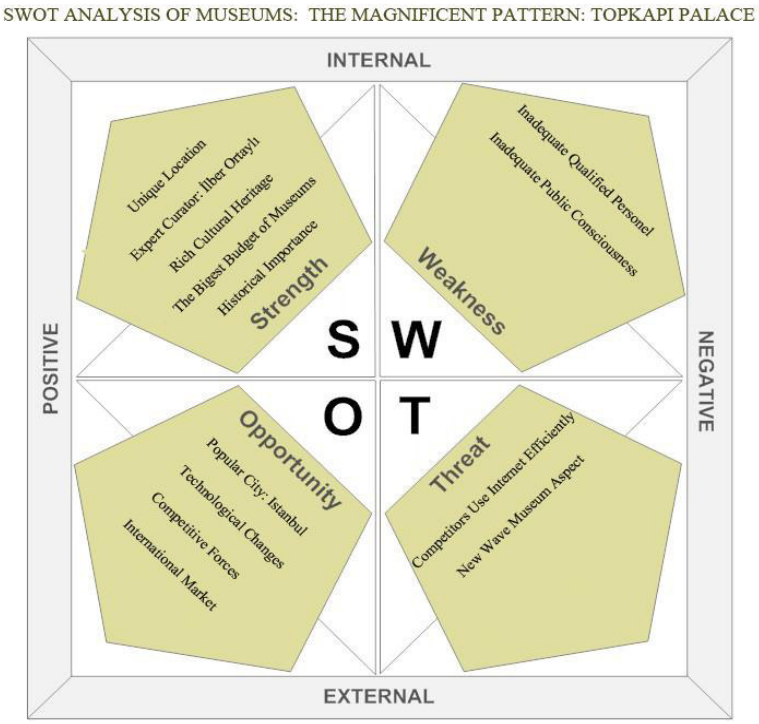

Figure B1.1 : An example of SWOT Analysis of Museums

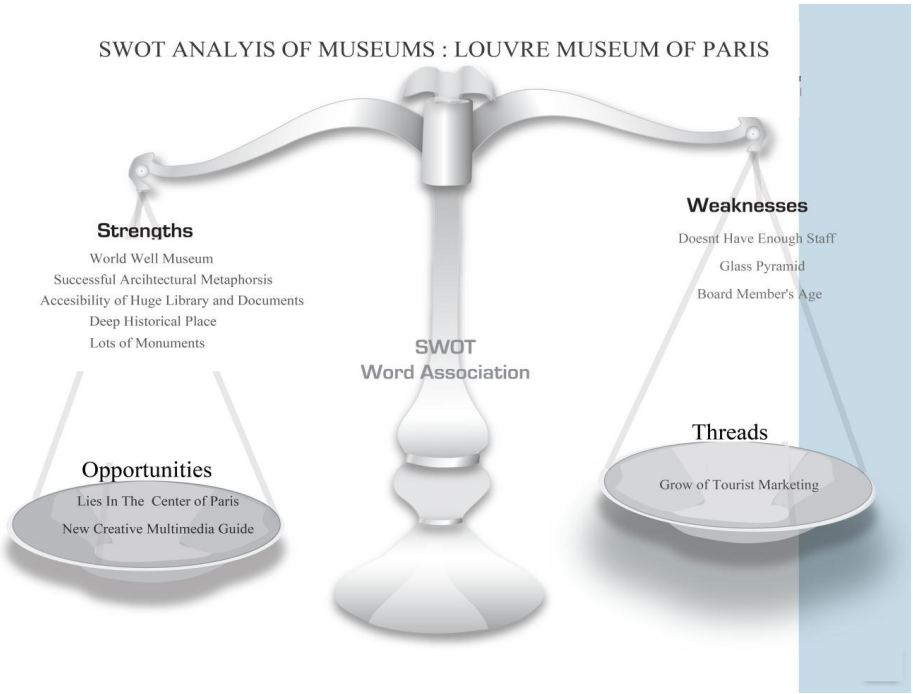

Figure B1.2 : An example of SWOT Analysis of Museums

c. The formation of task analysis and scenarios according to user levels

Group 7:

HİYERARŞİK TASK ANALİZLERİ

"Yaşam için sanat kullanıcı" profili :

1.Kullanıcı internet sayfasına giriş yapar.

a.Müzenin açılış ve kapanış saatleri ile hizmet verdiği günler kontrol edilir.

b.Müzenin fiziki olanaklarına bakılır

i.park yeri olanakları kontrol edilir.

ii.sinema olup olmadığı kontrol edilir.

iii.cafe/restoran olanakları kontrol edilir.

iv.engelli kişiler için duruma uygun olup olmadığını kontrol edilir.

v.hediyelik eşya satışı var mı kontrol edilir.

c.Sergiler hakkında bilgi alınır.

i.rehberli turlar hakkında bilgi alınır.

ii.halk turları hakkında bilgi alınır. (ücretsiz günler)

iii.güncel sergiler hakkında bilgi alınır.

-sergi ve sanatçı hakkında bilgi sahibi olunur.

2.Rezervasyon sistemine giriş yapar.

a.Online rezervasyon sisteminden bilet alınır

"Eğitim için sanat" kullanıcı profili :

1.Kullanıcı internet sayfasına giriş yapar.

a.Müzenin açılış ve kapanış saatleri ile hizmet verdiği günler kontrol edilir.

b.Müzenin fiziki olanaklarına bakılır

i.park yeri olanakları kontrol edilir.

ii.sinema olup olmadığı kontrol edilir.

iii.cafe/restoran olanakları kontrol edilir.

iv.engelli kişiler için duruma uygun olup olmadığını kontrol edilir.

v.hediyelik eşya satışı var mı kontrol edilir.

c.Sergiler hakkında bilgi alınır.

i.rehberli turlar hakkında bilgi alınır.

ii.halk turları hakkında bilgi alınır. (ücretsiz günler)

iii.güncel sergiler hakkında bilgi alınır.(sergi ve sanatçı hakkında bilgi sahibi olunur.)

2.Müzede bulunan eserler hakkında bilgi alır.

a.İnternet sitesinde bulunan eserler hakkında genel bilgi bulunduran katalog sistemden indirilir.

3.Ziyaretçi bilgi sayfasına giriş yapılır.

a.Grup turları hakkında bilgi alınır.

b.Rehberlik hizmetleri hakkında bilgi alınır.

4.Rezervasyon sistemine giriş yapılır.

a.Rehberlik hizmetinin uygun olup olmadığı kontrol edilir.

b.ilköğretim/Lise/Lisans öğrencileri için rehberlik hizmetinden yararlanmak üzere rezervasyon yaptırılır.

i.Yapılan rezervasyon üzerinden biletler satın alınır.

"Sanat için sanat" kullanıcı profili :

1.Kullanıcı internet sitesine giriş yapar.

2.Kullanıcı rezervasyon sistemine giriş yapar.

a.Online sergi için rezervasyon bölümüne giriş yapar.

b.Online sergi için tarih sorgusunda bulunur.

3.Online satışta yer almasını istediği parçaları sistemden seçip bilgileri girer.

(Sistem tarafından onaylandığı takdirde sergi parçaları sisteme girilir)

Group 5:

STORYBOARDING

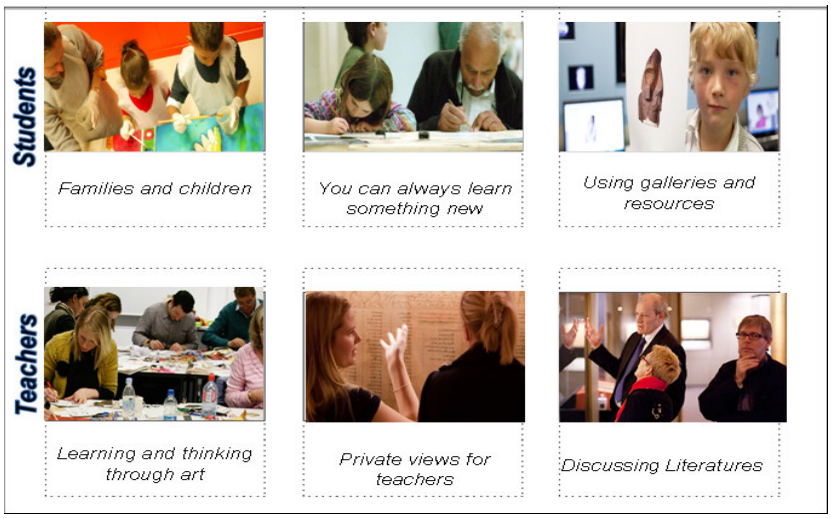

Figure B1.3 : A storyboarding example

d. The formation of prototype design depending on the main tasks chosen in the project

Group 4:

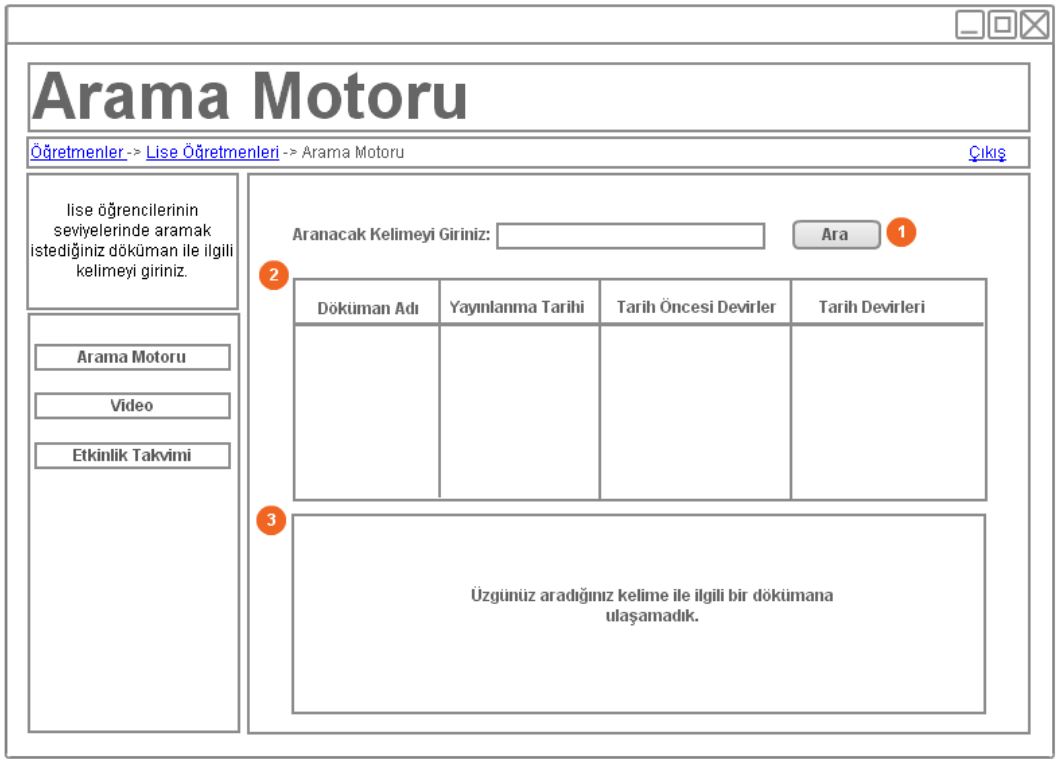

Figure B1.4 : A prototype design example

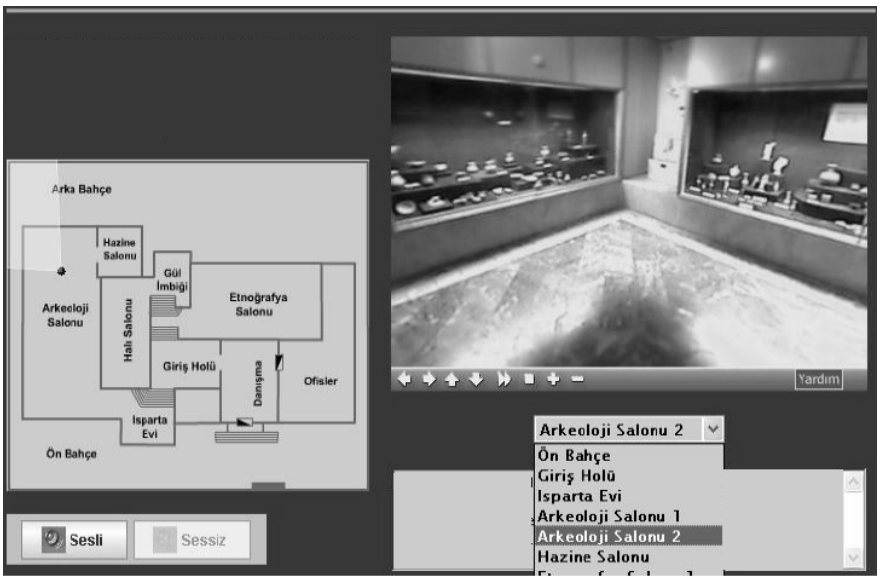

Figure B1.5 : A prototype design example

e. The formation of state chart, activity and sequence diagrams from user data obtained on the paper mock-up

Group 4:

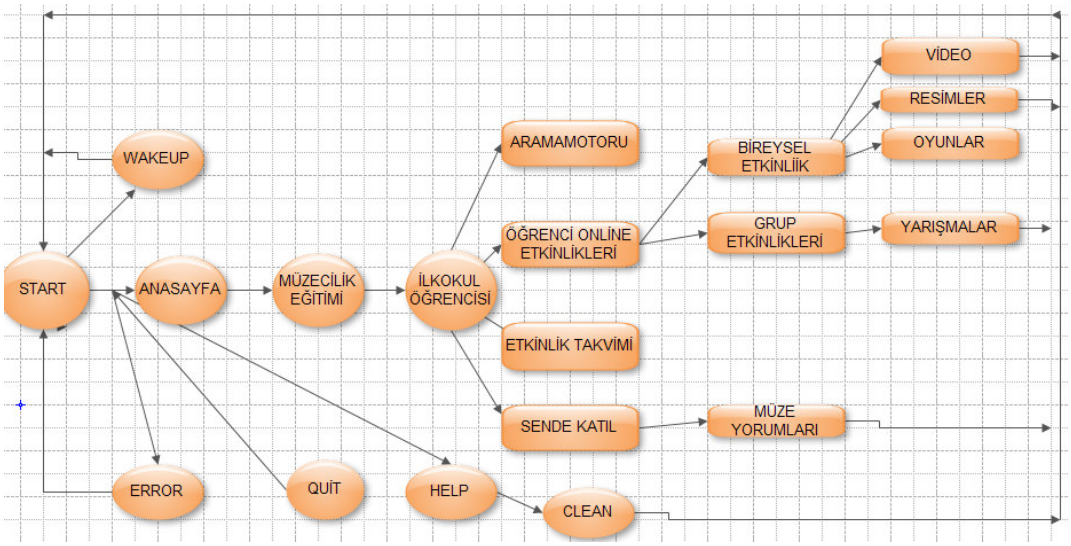

Figure B1.6 : A state chart example

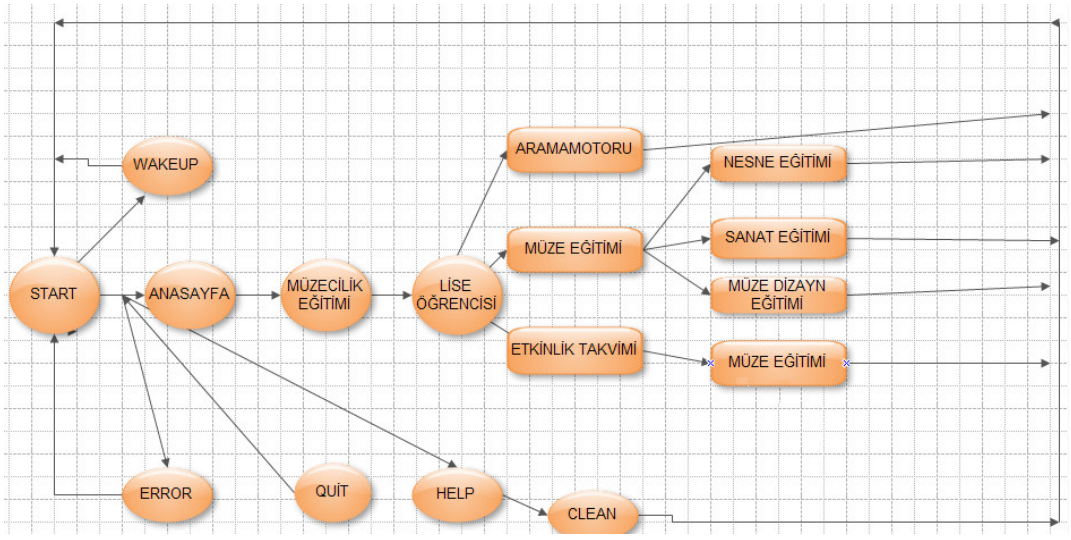

Figure B1.7 : A state chart example

f. The formation of financial analysis (the determination of financial requirements and expenses)

Group 2:

Table B1.1 : General budget table of TUBITAK Form (TL)

Katkı Kaynağı	Makine Teçhizat (06.1 + 06.3)	Sarf Malzemesi (03.2)	Hizmet Alımı (03.5 + 3.6)	Seyahat (03.3)	Bursiyer (05.4)	Yardımcı Personel (01.3)	Proje Teşvik İkramiyesi(*) (01.1)	Kurum Hissesi(*) (07.1)	TOPLAM
TÜBİTAK'tan Talep Edilen Katkı		10000	22000	3000	5000	10500			50500
Öneren Kuruluş Katkısı									
Destekleyen Diğer Kuruluş Katkısı (**)									
TOPLAM									

g. 9241-11 usability metrics

Table B1.2 : 9241 usability metrics for Anıtkabir Museum

Time to complete the task.	13:27
Percent of task complete	%100
Percent of task complete per unit time	%90
Ratio of successes to failures	%95
Time spent in errors	00:00
Percent or numbers of errors	%0
The number of commands used	24
Frequency of help and documantation use	1 times per user
Percent of favorable/unfavorable user comments	%40 / %60
Number of repetitions of failed commands	0
Number of runs of successes and of failars	5
Number of times interface misleads the user	0
Number of good and bad features recalled by users	20
Number of available commands nor invoked	2
Number of regressive behaviours	0
Number of users preferring your system	3
Number of time average, number of users need to work around a problem	0:18
Number of times th user is distrupted from a work task	0
Number of times user loses control of system	0
Number of times user expresses frustration of satisfaction	6

ANITKABİR MÜZESİ

Kullanıcı 1

- Ana sayfa – tablolar bölümü (24 sn) sürdü
- Tablolar bölümünün yüklenmesi (2 sn) sürdü
- Tablolar ortamında "Sakarya Büyük Taarruz Panoramaları" seçmesi (6 sn) sürdü
- Tablolar ortamında "Sakarya Büyük Taarruz Panoramaları" nın yüklenmesi (3 sn) sürdü
- Tablolar ortamında "Sakarya 2" bölümünü seçmesi seçmesi (5 sn) sürdü
- Tablolar ortamında "Sakarya 2" bölümünü seçmesi seçmesi (6 sn) sürdü
- Kategori açıklamasını okuması (17sn) sürdü
- Tablolar ortamında "Büyük Taarruz1" bölümünü seçmesi seçmesi (3 sn) sürdü
- Tablolar ortamında "Büyük Taarruz3" bölümünü seçmesi seçmesi (20 sn) sürdü
- Tablolar ortamında "Büyük Taarruz3" bölümünü incelemesi seçmesi (6 sn) sürdü

Mock Up Çalışmalarındaki Ortalama Erişim / Kullanım Süreleri

- Kayıt olma bölümünü bulma: 3,5 sn
- Kayıt olma işlemlerini bitirme süresi: 25 sn
- Oturum açma bölümünü bulma: 3,5 sn
- Site içi arama bölümünü bulma: 4,5 sn
- Kütüphane erişim sayfasını bulma: 3,5 sn
    - Katalog arama bölümünü bulma: 2 sn
    - Arama sonuçlarını bulabilme: 2 sn
- Ana menüye geri dönebilme: 3 sn
- 3D Müze ortamına erişme: 4,5 sn
- Alıştırma sayfasına erişme: 4,5 sn
- Oyun sayfasına erişme: 4 sn
- Animasyon sayfasına erişme: 4,5 sn
- Haftanın uzman konuğuna soru sor sayfasını bulabilme: 4,5 sn
    - Sorulmuş sorular bölümünü bulabilme: 2 sn
    - Haftanın uzman konuğu hakkında bilgi bölümünü bulabilme: 2 sn
    - Soru sorma bölümünü bulabilme: 2,5 sn
- Sanal Eğitim Metotlarını bulabilme: 6 sn

APPENDIX B2 : Pictures Taken During the Project Presentations

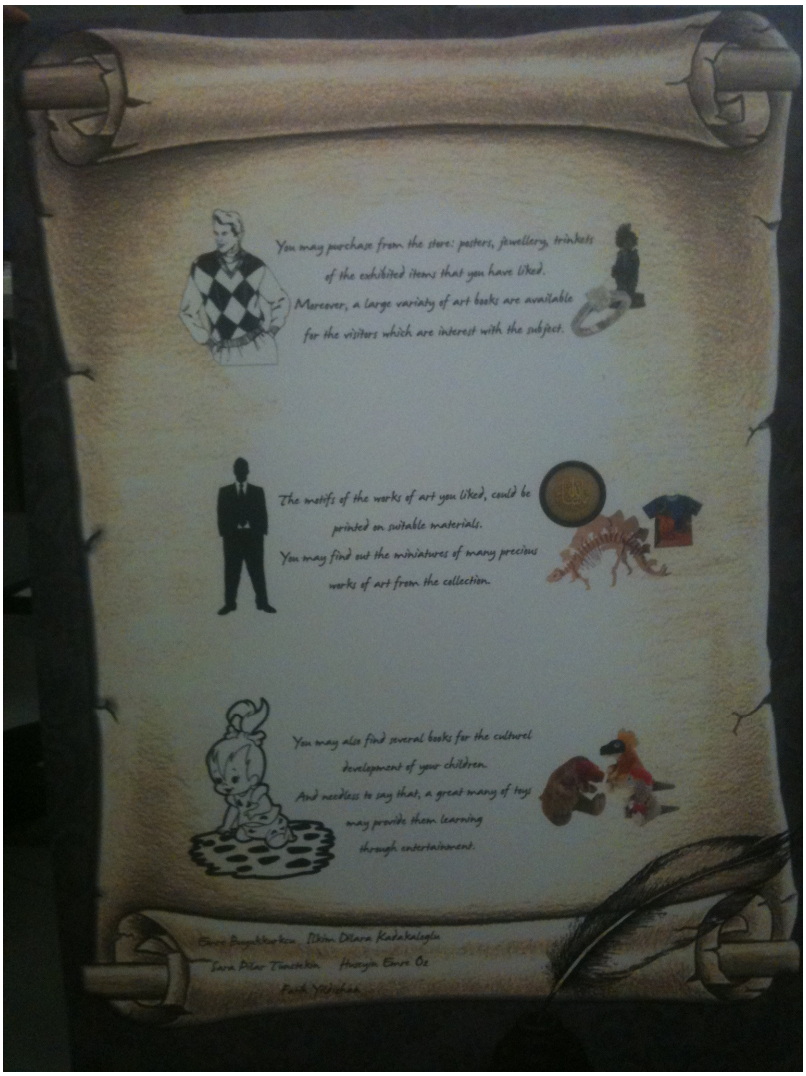

Figure B2.1 : A project poster example

Figure B2.2 : A project poster example

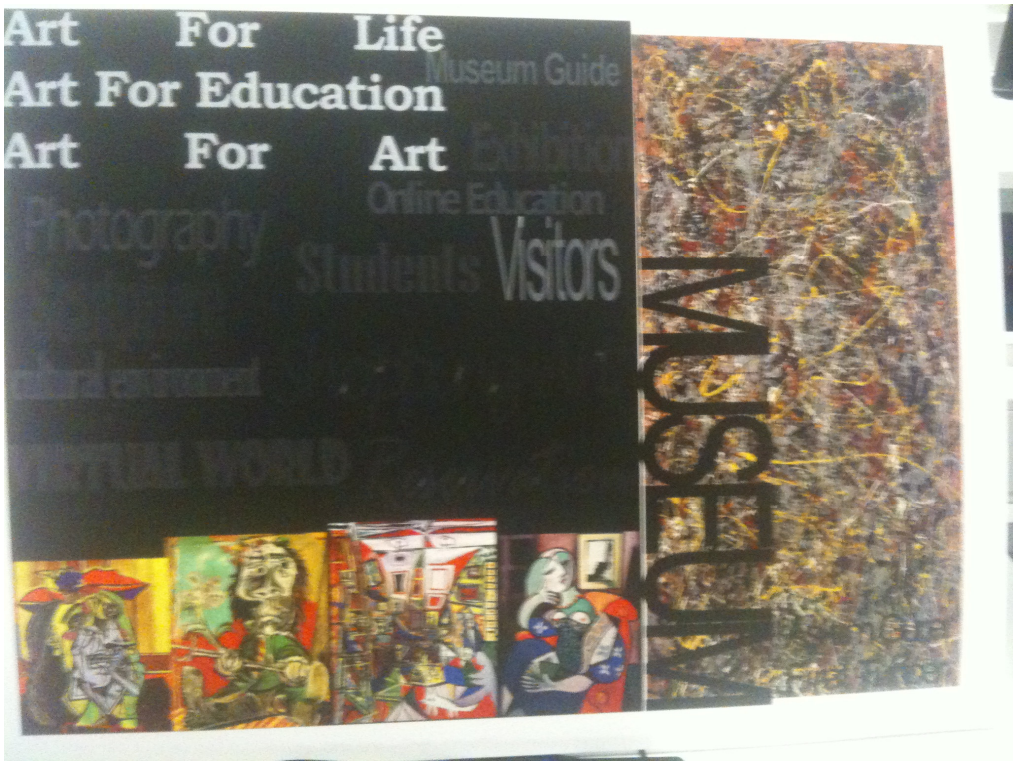

Figure B2.3 : A project poster example

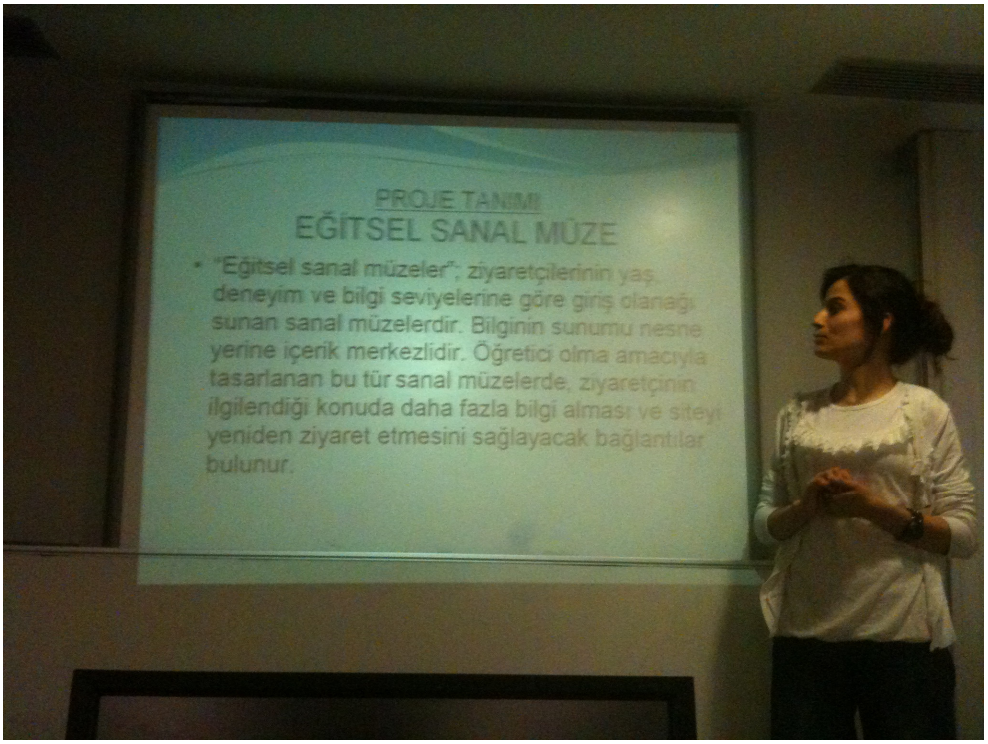

Figure B2.4 : A picture taken during the presentations

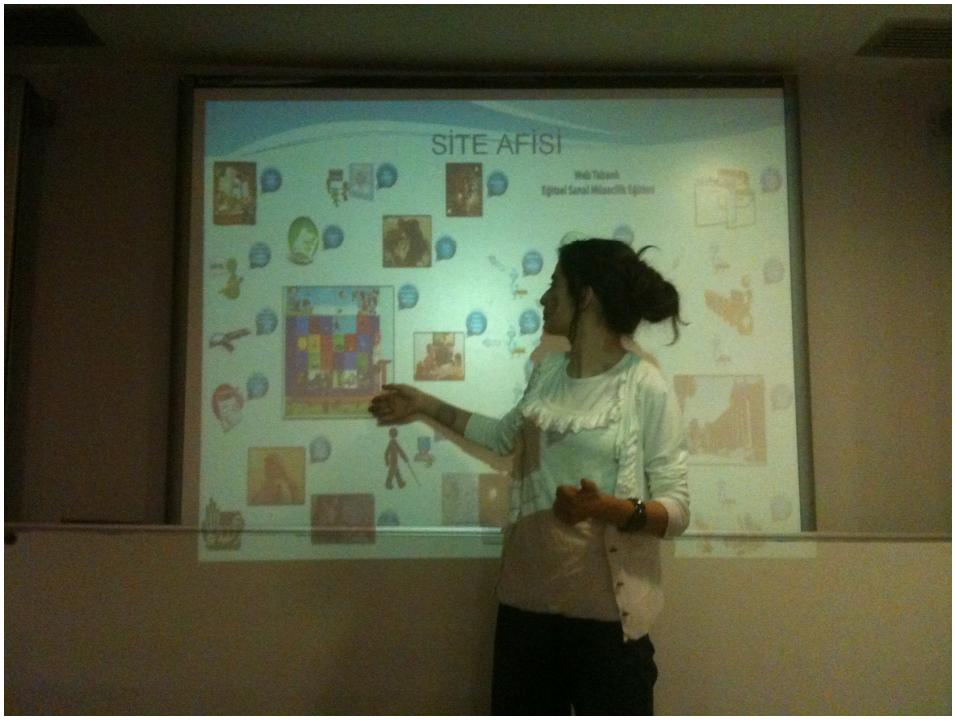

Figure B2.5 : A picture taken during the presentations

Figure B2.6 : A picture taken during the presentations

Figure B2.7 : A picture taken during the presentations

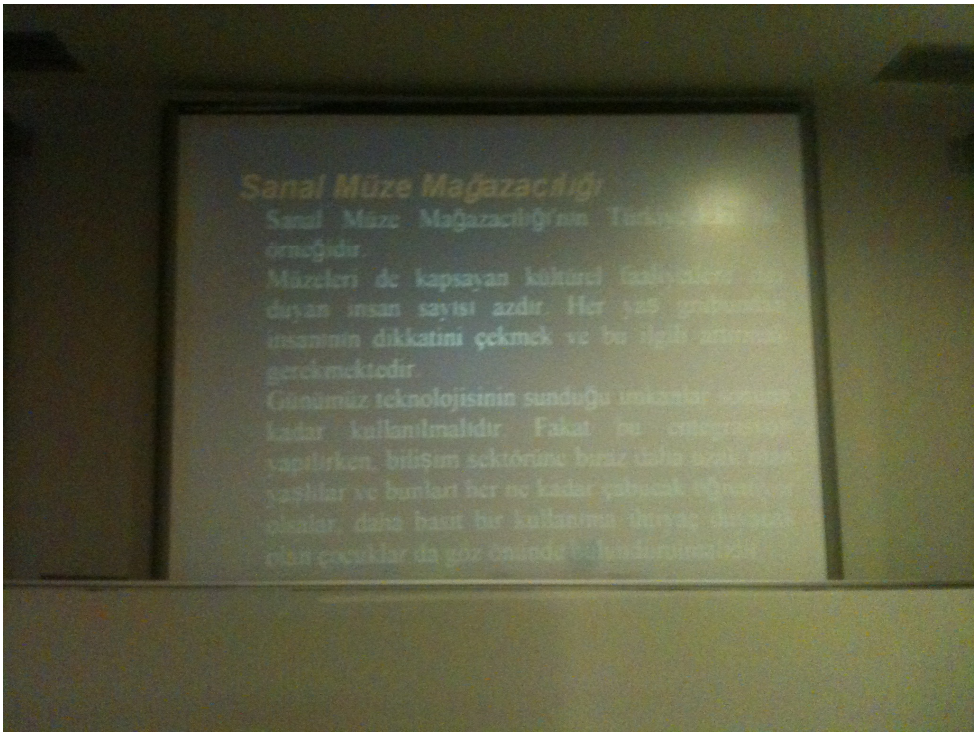

Figure B2.8 : A picture taken during the presentations

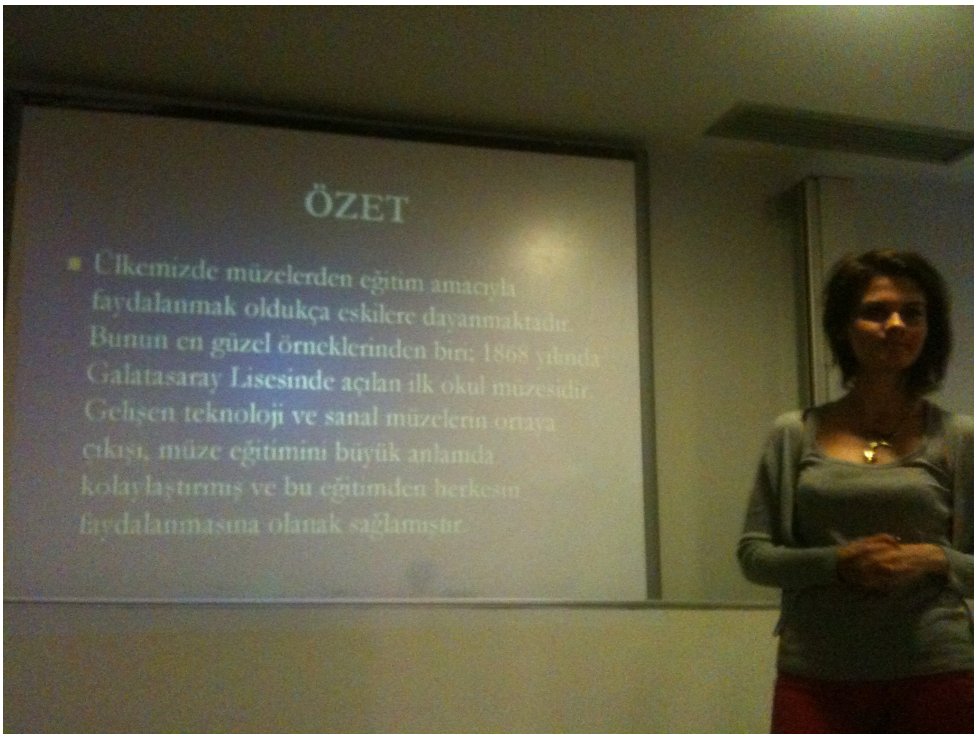

Figure B2.9 : A picture taken during the presentations

Figure B2.10 : A picture taken during the presentations

Figure B2.11 : A picture taken during the presentations

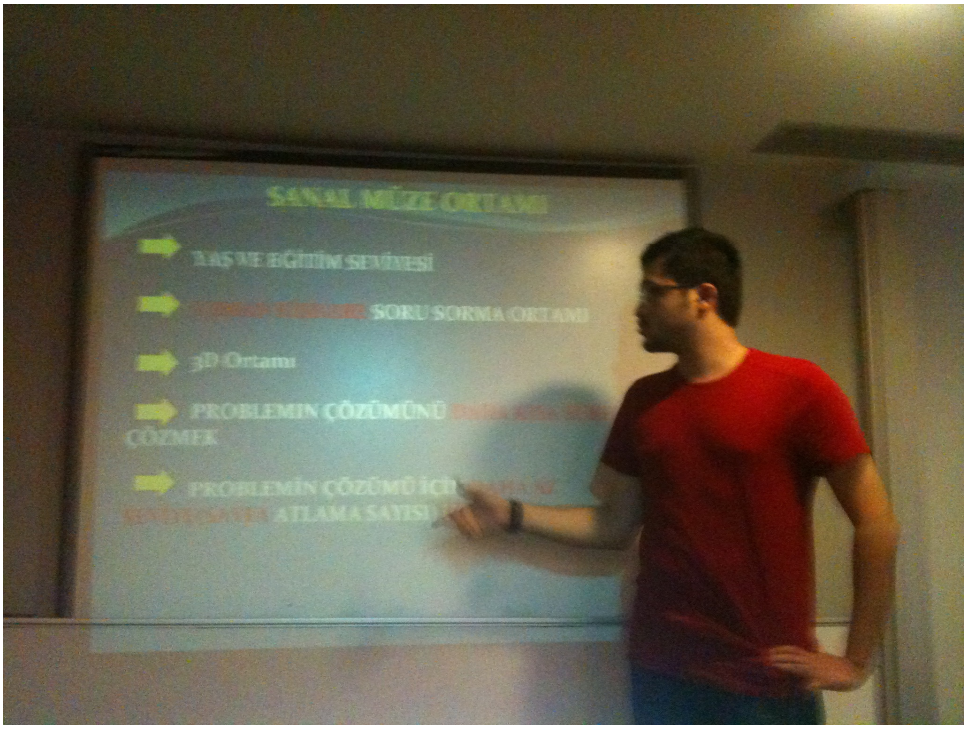

Figure B2.12 : A picture taken during the presentations

Figure B2.13 : A picture taken during the presentations

Figure B2.14 : A picture taken during the presentations

Figure B2.15 : A picture taken during the presentations

Figure B2.16 : A picture taken during the presentations

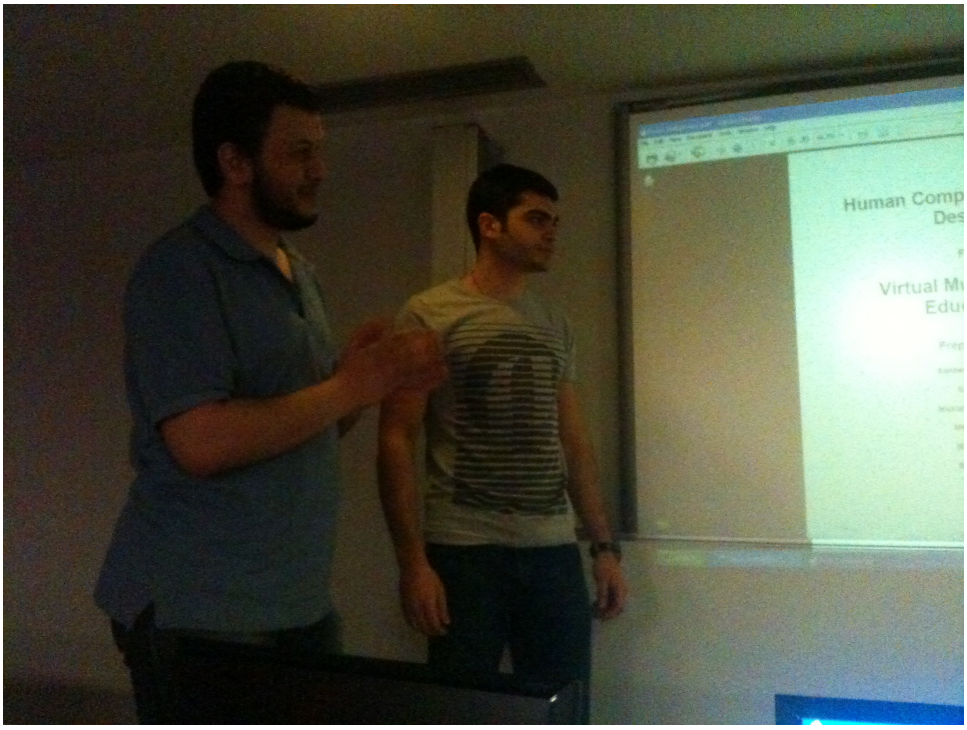

Figure B2.17 : A picture taken during the presentations

Figure B2.18 : A picture taken during the presentations

Figure B2.19 : A picture taken during the presentations

Figure B2.20 : A picture taken during the presentations

Figure B2.21 : A picture taken during the presentations

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