NEAR EAST UNIVERSITY
INSTITUTE OF EDUCATIONAL SCIENCE
DEPARTMENT OF COMPUTER EDUCATION AND
INSRTUCTIONAL TECHNOLOGY

Evaluation of Multimedia Based Project Materials of Teacher Candidates

MASTER THESIS

FEZİLE ÖZDAMLI

Nicosia
AUGUST, 2007

NEAR EAST UNIVERSITY
INSTITUTE OF EDUCATIONAL SCIENCE
DEPARTMENT OF COMPUTER EDUCATION AND
INSRTUCTIONAL TECHNOLOGY

Evaluation of Multimedia Based Project Materials of Teacher Candidates

MASTER THESIS

FEZİLE ÖZDAMLI

Supervisor: Assoc. Prof. Dr. Hüseyin UZUNBOYLU

Nicosia
AUGUST, 2007

ABSTRACT

Evaluation of Multimedia Based Project Materials of Teacher Candidates

ÖZDAMLI, Fezile
M.Sc., Computer Education and Instructional Technology
Supervisor : Assoc. Prof. Dr. Hüseyin Uzunboylu

August 2007, 130 pages

Evaluation is an important component of developing educational materials so the aim of this study is to evaluate teacher candidates' studies about instructional multimedia material in PBL according to their opinions in terms of the competencies it provides. This study was applied to a randomly selected sample of 202 students (102 females and 100 males) of various departments of Near East University and who got the course "Instructional Technologies and Materials Development" at the beginning of the 1st term of 2006-2007 academic year. The scale "Project Based Learning Checklist" has been translated to Turkish by using the back-translation method. As a result of statistical analyses, the reliability of the scale has been estimated to be .93 (Cronbach's Alpha), indicating satisfactory levels of international consistency. As data analysis techniques percentage, mean One Way Anova and t-test analysis were used. The study showed that the approximately 82.70% of the sample had improved instructional multimedia materials 3 or more times. At a glance result of this research suggest that teacher candidates mostly conform to preparation, organization, media-use, navigation tools use, appearance design and resource use operations' rules of improve instructional multimedia materials in Project Based Learning. These results are satisfactory for us.

Key words: Instructional multimedia material, Teacher Education, Project Based Learning.

ÖZ

ÖĞRETMEN ADAYLARININ GELİŞTİRMİŞ OLDUKLARI ÇOKLU ORTAM TABANLI PROJE MATERYALLERİNİN DEĞERLENDİRİLMESİ

ÖZDAMLI, Fezile
Yüksek Lisans, Bilgisayar ve Öğretim Teknolojileri Eğitimi
Tez Yöneticisi : Doç. Dr. Hüseyin Uzunboylu

Ağustos 2007, 130 sayfa

Eğitimde geleneksel yöntemden yeni yöntemlere geçiş vardır. Eğitimde kullanılan materyallerin önemi gün geçtikçe artmakta ve değerlendirilmeleri gerekmektedir. Bu çalışmanın amacı öğretmen adaylarının Proje Tabanlı Eğitimde geliştirdikleri eğitim materyallerini kendi görüşlerine göre değerlendirmektir. Bu çalışmaya 202 (102 kız – 100 erkek) öğretmen adayı katılmıştır. Çalışma grubunu 2006-2007 1. dönemde Eğitim Teknolojileri ve Materyal Tasarımı dersini alan öğrenciler oluşturmaktadır. Araştırmada "Project Based Learning Checklist" izin alınarak Türkçeye geri çevirme yöntemiyle çevrilmiştir. Çeviri işlemi yapıldıktan sonra yapılan güvenirlik testinde Cronbach Alpha .93 çıkmıştır. Veri analizinde yüzdelik, ortalama, tek yönlü varyans, ve t-testi kullanılmıştır. Araştırmanın sonuçlarına göre öğretmen adaylarnın %82,70'i üç veya daha fazla eğitim materyali geliştirmiştir. Diğer önemli bir bulguda öğretmen adayları Proje tabanlı eğitimde hazırlık, organizasyon, medya kullanımı, yönlendirme araçları kullanımı, görünüş dizaynı ve kaynak kullanımı kurallarına genel olarak uymaktadır. Bu sonuçlar tatmin edici derecededir.

Anahtar Kelimeler: Eğitimsel çoklu ortam materyali, Öğretmen eğitimi, Proje tabanlı eğitim.

ACKNOWLEDGEMENTS

First of all, I would like to thank my supervisor Assoc.Prof. Dr. Hüseyin Uzunboylu for his guidance and support with name been a keystone for my success in the program. Additional thanks to my committee members Assc. Dr. Mustafa Kurt and Dr. Nadire Çavuş for being a part of this process and seeing it through to the end.

Special thanks to Dr. Nadire Çavuş for encouraging me to enter the master program at Computer Education and Instructional Technologies and, for providing me with the opportunity to collect my data, and mentoring me.

I would also like to thank my supervisor, Aykan Sahir, for his tolerance, his continued support to me during this research.

In addition, I would also like to thank all teacher candidates who took part in the research.

Finally, I would like to thank my family, my friends and Mete Işık, who has always been very supportive of my goals.

TABLE OF CONTENTS

CHAPTER 4

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

ABBREVIATIONS

AED: Academy for Educational Development

CBT: Computer Based Training

CD-ROM: Compact Disc Read-Only Memory

CTGV: Cognition and Technology Group at Vanderbilt

CTR: Computer Technology Research

ELOB: Expeditionary Learning Outward Bound

EMU: Eastern Mediterranean University

ERIC: The Education Resources Information Center

GUI: Graphical User Interface

IEEE: The Institute of Electrical and Electronics Engineers, Inc

IT: Information Technology

M: Mean

Mb: Megabyte

MM: Multimedia

NAS: National Academy of Sciences

NEU: Near East University

p: Significance p-value (2-tailed).

PBL: Project Based Learning

SD: Standard Deviation

T.R.N.C: Turkish Republic of Northern Cyprus

UK: United Kingdom

US: United Stated

WWW: World Wide Web

CHAPTER 1

INTRODUCTION

In this section, the research problem, the purpose of the study, the significance of the study, limitations, and the commonly used terms are described.

1.1 The Problem

Education is the key to the new world (Russell, 1930). The literature related to education embraces various definitions. John Dewey (1958) theorized that learning should not only prepare one for life, but should also be an integral part of life itself. Emile Durkheim (1963) argued that the main function of education is the transmission of society's norms and values in three mains areas; 1. Social Solidarity: For example, the teaching of history provides social continuity. 2. Social Rules: At school, we learn to co-operate with strangers and to be self-disciplined. 3. Division of Labor: Education teaches individual skills necessary for future occupations. This is the most important function in advanced industrial society with its complex division of labor.

Education is a term often used to refer to formal education. However, the word's broader meaning covers a range of experiences, from formal learning to the building of understanding and knowledge through day-to-day experiences. Ultimately, all that we experience serves as a form of education.

It is widely accepted that the process of education is lifelong. Studies have shown that the child educated by the experiences is exposed to in the womb even before it is born. Individuals receive informal education from a variety of sources. Family members, peers, books and mass media have a strong influence on the informal education of the individual (Afro Global Alliance, 2007).

Learning can be defined as an experiential process resulting in a relatively sates, maturation, or innate response tendencies (Klein, 2002).

The old-school model of passively learning facts and reciting them out of context is no longer sufficient to prepare students to survive in today's world. Solving highly complex problems requires that students have both fundamental skills (reading, writing, and math) and digital age skills (teamwork, problem solving, research gathering, time management, information synthesizing, utilizing high-tech tools). With this combination of skills students, become directors and managers of their learning process are guided and mentored by a skilled teacher (George Lucas Educational Foundation, 2002).

Changing Learning Expectations and Related Educational Initiatives.

To support the need for changing learning expectations, the U. S. Department of Labor's Secretary's Commission on Achieving Necessary Skills (SCANS) (1991) recommended a set of skills needed by workers of the new century. The skills are which SCANS recommended:

(a) Reason;

(b) Think creatively;

(c) Make decisions;

(d) Solve problems;

(e) Work in teams;

(f) Work well with people of other cultures;

(g) Understand, monitor, correct, design, and improve systems;

(h) Select appropriate technology and apply it to specific tasks, and

(i) Direct their own personal and professional growth through lifelong learning (Wolff, 2001).

In 1996, the National Skills Standards Board (NSSB) was formed to determine national industry standards from which learners and employees would show competency in skill areas. One part of the vision of the NSSB was to encourage educational institutions to implement processes to ease the recording and acceptance of completed credits and assessment from one institution to another. A second part of the vision was to encourage educational institutions and business/industry partners to establish common competencies and common assessment tools. Another federal initiative sponsored by the U. S. Department of Labor, to address the changing needs of work, family, and community was The Workforce Investment Act of 1998. The Act recognized the need to provide necessary family and social service support systems for people while they developed their workforce skills. At the same time, other state and federal initiatives were established for identifying learning outcomes or expectations, for establishing new methods for assessment, and increasing accountability to legislators and taxpayers. According to the League for Innovation in the Community College (1999), the outcomes identified for 21st century learners included achievement of strong

(a) Communication skills;

(b) Computation skills that included the capability of reasoning, analyzing, and using numerical data;

(c) Community skills of citizenship, diversity and pluralism;

(c) Local, global, and environmental awareness;

(d) Critical thinking and problem solving skills;

(e) Information management skills;

(f) Interpersonal skills including teamwork, relationship management, conflict resolution, and workplace skills; and

(g) Personal skills that included management of change, learning to learn, and personal responsibility.

In summary, the impact of moving from the industrial age through the technology age to the knowledge age spanned the boundaries of work, family, and community. The skills needed to effectively fulfill the roles and responsibilities in the three areas were far different from those needed for the industrial age.

To fulfill the roles and responsibilities, youths and adults sought more active, relevant opportunities to learn the skills required to actively participate and contribute to their work, to their families, and to their communities. The new roles, responsibilities, and expectations of the learners indicate changing learning processes.

Changing Learning Processes. Dede (1993) described the changing learning processes that needed to prepare learners for the work place and in society. The different learning processes needed to change from "the more traditional classroom-based, discipline-focused, learning-by-listening approaches" to “just-in-time, life- and work-focused, and learning-while-doing approaches” that were linked to everyday situations. The changing learning expectations needed for transformation in work, family, and community roles and responsibilities required new, more active learning processes. According to Skolnikoff (1994) educational institutions needed to provide programs in which learners learned to think and become participants in the larger world. Collaborative, project-based learning teaches many of the above skills through the active process of designing, developing, and producing products in the forms of information, service, or goods. This learning process occurs through grouping learners into various sized groups depending upon what learning activity is taking place. Direct and guided instruction is often presented to larger groups of learners by a faculty member or teaching team. Exploration and discovery can occur with or without a faculty member and can happen individually, in small groups and teams, or within larger groups. Project work more often happens in teams and includes community and business members as resource people and advisors for the projects.

The traditional methods of using lectures and written assignments have been ineffective in educating students about being finally literate. Students have not been motivated to learn by these methods, and, as a result, have done poorly on assessments (Kell, 2006).

According to Fiske (1998), technology has the ability to incorporate the essential content of instruction, but also to move students to higher-order thinking and teach life-long learning skills.

Teaching methods abound- some sound, some not so sound. If you have been teaching for many years, you have no doubt seen several new ways of teaching come into vogue. Some have taken hold; many have faded away; a few have become infamous. Joyce, Weil, & Calhoun (2003) describe no fewer than 20 ways to teach. Like different health remedies, the proponents of these teaching methods clamor for attention, and each urges teachers to include it in their repertoire of teaching approaches (Simkins, Cole, Tavalin, & Means ,2002).

Information societies, people need to gain abilities beyond the fundamental skills like problem solving, collaborative working, learning how to think or being responsible or own learning. In this direction, learning-teaching process must be constructed according to these needs (Atmaca & Aslan, 2006).

Vygotsky’s sociocultural constructivism asserts that knowledge is constructed through interactions in the social world. It abandons the traditional views, introduces a new range of theoretical departures, and values shared as opposed to individualist value investments (Gergen, 1994). In addition to the above, it provides with learning environments in which group discussion or social negotiation, inquiry, reciprocal teaching, humanistic education, computers, and hypermedia are utilized (Woolfolk, 2001). Then, it is indispensable that the socio-cultural aspects exposed in the classroom interfere with learning and lead to a new knowledge construction on how to deal with forthcoming issues. Critical thinking, problem-solving, development of metacognitive skills, and information processing seem to be the aspects that play a crucial role in such conceptual change.

Project-based learning, deriving its theoretical underpinning from Dewey’s educational philosophy (1907) and constructivist epistemological belief, organizes learning around a project.

Project-based learning (PBL) is a model for classroom activity that shifts away from the classroom practices of short, isolated teacher-centered lessons and instead emphasizes learning activities that are long term, interdisciplinary, student-centered, and integrated with real world issues and practices. One immediate benefit of practicing project-based learning is the unique way that it can motivate students by engaging them in their own learning. Project-based learning provides opportunities for students to pursue their own interests and questions, make decisions about how they will find answers, and solve problems. In the classroom, Project-based learning provides many unique opportunities for teachers to build relationship with students. Share student work-which includes documentation of the learning process as well as the student’s final projects with other teachers, parents, mentors, and the business community who all have a stake in the students’ education (Office of education, 2001).

Project-based learning is curriculum fueled and standards based. Project-based learning addresses the required content standards. With project-based learning, the inquiry process starts with a guiding question and lends itself to collaborative projects that integrate various subjects within the curriculum. Questions asked direct students to encounter the major elements and principles of a discipline (George Lucas Educational Foundation, 2002).

Teachers need to know how to formulate guiding questions for students, help provide resources and community members who can relate the project to real-world issues and problems, encourage students to work productively in small groups and independently, and use appropriate assessment tools. In addition, staff meeting and project-planning time need to be allocate so teachers can share ideas and discuss problems. Teachers are much more enthusiastic about implementing new strategies when they have the backing of the administration (Railsback, 2002).

Many researchers (Beal, 1995; Liu, 1998) believe that, used project based multimedia learning; hypermedia development can help students construct knowledge, develop higher order thinking skills and, possibly, promote problem-solving skills.

Project-based learning is an old and respected educational method. The use of multimedia is a dynamic new form of communication. The merging of project-based learning and multimedia represents a powerful teaching strategy that we call “project-based multimedia learning.” Definition of PBML, it is best to start with some definitions. By project-based learning, we mean a teaching method in which students acquire new knowledge and skills in the course of designing, planning and producing some product or performance. By multimedia, we mean the integration of media objects such as text, graphics, video, animation, and sound to represent and convey information. Project- based multimedia learning is a method of teaching in which students acquire new knowledge and skills in the course of designing, planning, and producing a multimedia product (Simkins, Cole, Tavalin, & Means, 2002). Technology can play an important role in facilitating project-based learning by enhancing students’ interest and supporting information gathering and presentation (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palinscar, 1991).

Attention to the preparation of literacy teachers for use of computer technology in the classroom gained momentum in the early 1980’s. The major text books for use in the mid-and late 1980’s. The field of computer technology is notoriously fast-changing, and it might be expected that ideas and materials presented and discussed five to ten years ago might be outdated and in need of reconsideration. Major changes brought about in the middle 1990’s, which most dramatically affect literacy education, include following (Balajthy, 1996):

a) Decline interest in direct instructional software
b) Development and popularization of the “electronic book”
c) Increased memory capabilities of computers
d) Integrated multimedia packages based on CD-ROM and/or video disc technologies
e) Vastly increase availability of computers in homes.

Alkan (1997), argues that related to the use of new technologies in the field of education are required to determine how teachers can update themselves for the new developments in education especially in the preparation of educational tools and new teaching methods and processes. In parallel with the developments in the information technologies, the knowledge has now become unlimited in the global world. In addition, the changes in the social, cultural and economic fields, high speed, security, multi-user capabilities, and similar attributes have caused the computers to become an inseparable part of the everyday life. See figure 1.1. (Cavus, 2007).

* Educational
* Economic
* Cultural

EDUCATION TECHNOLOGY

* Education Technology
* Technic Education
* General Education

Figure 1.1: Relations of Education and Technology (Alkan,1997)

The literature related to the educational technology embraces various definitions of the concept of educational technology, which are sometimes difficult to associate with each other. Similarly, epistemological concerns lying based on definitions also vary. It is impossible to reach a proper and satisfactory definition through gathering all perception styles fostered within a century. Such efforts often disregard the conditions that foster each perception, and the uniqueness of these styles. It is crucial to have a certain internal consistency in such efforts towards unifying different perception styles, which have a philosophical unity in themselves.

Responses given to the question “what is educational technology” have changed significantly within time (Seels & Richey, 1994). A chronological review of these definitions is important in the sense of revealing the perception styles that are parallel to the understandings we have had at a certain point of time.

The literature review has shown that what was understood from the concept of educational technology until that time was mostly related to the concepts of tools, materials and messages. Many people who focused their studies on details of teaching-learning processes pointed out that there were many more things to be developed in education. This led to a more comprehensive interpretation as “the technology of education”, which was far beyond the concept of “technology in education”. This interpretation caused a shift in the focus to a system consisting of everything, which is supposed to be effective in learning and instruction, including hardware and software of educational technology (Percival & Ellington, 1988).

In recent periods, functions and methodology of educational technology have been changed by the constructivism, which is based on both cognitive psychology and interpretative philosophy. Constructivist educational paradigm has caused perceptions related to the educational technology to focus on learning, student, and learning environment. It may be claimed that this approach has led to a narrow-down in the scope of perceptions of educational technology, but also to a deepening and flexibility in applications. Educational technology is a field that develops rapidly. Within rapid development process, findings related to the issue of associating the field of educational technology with specific subject areas in international area can provide various perspectives to those who are performing their careers in the field of educational technology (Simsek, 2005).

The information technologies increase the versatility and value of project-based learning as a curriculum tool. Technology can help create a rich environment for individuals and teams to carry out in-depth projects that draw on multimedia and information resources from throughout the world. (Bielefeldt, Moursund, Underwood, 1997).

Students increase their knowledge and skill in making use of information technology to carry out the work in a project. A project may include a specific goal of students acquiring new knowledge and skills in information technology (Moursund, 1999).

As articulated by Brown, Collins, and Duguid (1989), skills and knowledge too often taught out of context, as ends in and of themselves. To overcome this, teachers are using multimedia to bring into the classroom real-life examples of situations that provide the contextual framework so important for learning. Brown (1989) calls this use of multimedia situated learning. Multimedia gives teachers instant access to thousands of slides, videos, sound tracks, and lesson plans. These materials can be call up instantly, either for classroom use or as a networked resource for student exploration, discovery, reflection, and cooperative learning. Among educational researchers, the capability to demonstrate vividly and convincingly the real-world applicability of knowledge has become known as anchored instruction (Cognition and Technology Group at Vanderbilt, 1990). Engaging students in hypermedia/multimedia design is one type of project-based learning which has shown some encouraging results in promoting higher order thinking skills (Liu & Pedersen, 1997).

Multimedia is highly effective. As research and publishing company Computer Technology Research (CTR) Corporation reports, people retain only 20% of what they see and 30% what they hear. However, they remember 50% of what they see and hear, and as much as 80% of what they see, hear and do simultaneously. That is why multimedia provides such a powerful tool for teaching and learning. According to the traditional definition of *instructional design* (Reigeluth, 1983; 1999), the teacher uses instructional methods and media that are best suited to bring about changes in students' knowledge and skills. Authoring tools such as *Movie Maker* and *Photo Story* free to purchasers of *Windows XP* (Microsoft Corporation, 2006) can be used to design your own multimedia in science, mathematics, music, language arts, social studies, and other subjects in the curriculum. The traditional definition however, excludes the student from the design process. Hannafin and Hill (2007) introduced the term *constructional design* to mean a learning environment that enables and supports a student by engaging them in design and invention tasks where knowledge-building tools are provided but concepts are not explicitly taught. Students take an active role in the design of their own educational materials (Mann, 2006).

As technology has progressed, speechmakers, teachers, and others who regularly present information to audiences have moved quickly from photographic slide projection to overhead projection, and to the current presentation medium of choice: Microsoft PowerPoint. Each of these technologies aids a presenter in displaying visual information, in an attempt to make the details of a presentation more understandable to the audience (Evnin, 2006). Multimedia software can be used in the Project Based Learning to create images, animations, sound clips, video, and interactive elements. There is wide spectrum of multimedia software products that range from simple to highly complex. These include programs such as PowerPoint, Authorware, Macromedia Capitative, QuickTime Pro, and Macromedia Flash. PowerPoint is one of the most widely used computer applications in the world. Over the years, Microsoft has conducted considerable research on how to improve the user interface (Hofstetter, 2001). With this program, users can prepare professional presentations easily. Users can use template easily. Users can select animations, photographs about their topics in archive (See *Appendix A).*

In an article from Milken Family Foundation (1999), is described that in the past few years the pre-service teacher education programs have made substantial progress in preparing future teachers in information technology. In a survey, titled "Information Technology in Teacher Education" asked faculty members about the extent to which future teachers were being exposed to technology in their classes, field experience and curriculum materials. The majority of faculty-members revealed that they do not, in fact, practice or model effective technology use in their classrooms. Zhang’s (2002) study showed that in multimedia classrooms and traditional classroom, female students and male students had positive general perceptions of multimedia classrooms.

1.2 The Purpose of the Study

The aim of this research was to evaluate the instructional multimedia materials that teacher candidates improved in Project Based Learning. More specifically, this study seeks to find answers for the following research questions:

1. What are personal characteristics of teacher candidates?
2. How often did teacher candidates benefit from “Preparation”, “Organization”, “Media-use”, “Navigation Tools”, “Appearance Design” and “Resource-use” operations of Project Based Learning when they are developing instructional multimedia materials?
3. Are there any significance differences between teacher candidates according to their genders, branches and number of projects?

In the summary, this study support that using the challenge of student-generated instructional multimedia materials that would teach “future” students about key theories, would encourage learners to think carefully about the design of their instructional multimedia material and to improve a more active level of learning with Project Based Learning.

1.3 Significance of the Study

Project Based Learning is becoming more important in today’s knowledge era. The teacher candidates are study dependable and creatively who study on Project Based Learning. Teacher candidates can create instructional multimedia materials for the future with Project Based Learning. In these, respect obtained data with this study, especially;

1. It is hoped that the result of this research will be a guide to instructors, researchers and teacher candidates who will improve instructional multimedia materials in Project Based Learning.
2. It is believed that teacher candidates’ scientific thinking and studying skills will be developed with these results.

3. It is believed that the results of this research will bring a new approach to creating instructional multimedia materials with Project Based Learning at the universities.

1.4 Limitations of this Study

This research has been carried out with the following limitations:

1. The research coverage is limited to the teacher candidates' appropriateness for creating instructional materials as multimedia on project based learning
2. The research is limited to the general survey model
3. The research is limited to the studies carried out at the Near East University, and with the students who enrolled in the course "Instructional Technologies and Materials Development" at the beginning of the 2006–2007 academic year
4. The research took part in the 2006- 2007 academic year.

1.5 Definition of Terms

Instructional Multimedia Materials: Instructional multimedia materials are programs that allow students to learn subjects, practice using subject already known and program can evaluate student' knowledge.

Prepare Process: Preparation activities before start to project.

Organization Process: The act of organizing project content or time of project process.

Media – Use: Materials which designer used for instructional multimedia material. Ex: animations, photos, music etc.

Navigation – Use: The means by which a user can click page to page on corse software.

Appearance Design: The means appearance design of project. How is project seen?

Resource – Use: How materials used in the project. Ex: ethically, accordance with copyright.

CHAPTER 2

REVIEW OF LITERATURE AND THEORETICAL FRAMEWORK

2.1 REVIEW OF LITERATURE

This section, examines the theoretical perspectives and researches related to a teaching and learning model popularly referred to as “Project-Based Learning” (PBL).

Recently, numerous research papers on project-based learning have published showing the benefits of this learning paradigm for learners and teacher as well. A growing body of academic research supports the use of Project Based Learning.

Lehrer, Erickson, and Connell conducted a study in which ninth-graders created hypermedia presentations on American history for other students. They found that students’ time on-task increased significantly over the course of successive design projects. In addition, the study showed that the design process helped students to internalize various design skills. Students reported increases in mental effort and involvement, interest, planning, collaboration and individualization. Supporting their findings, Beichner (1994) found in his study that junior high school students were highly motivated and often spent extra time when working on producing a multimedia program. Spoehr’s study (1994) showed that designing hypermedia programs could help students develop more complex knowledge representations and assist the development for their thinking skills.

A teacher in Washington State who has used project-based instruction in his math and science classes reports that many students who often struggle in most academic settings find meaning and justification for learning by working on projects (Nadelson, 2000). The teacher also notes that by facilitating learning of content knowledge as well as reasoning and problem-solving abilities, project-based instruction can help students prepare for state assessments and meet state standards.

In a study reported by Barron (Barron et al., 1998), learners worked for five weeks on a combination of problem-solving and project-based learning activities focused on teaching learners how basic principles of geometry relate to architecture and design. The problem solving component involved helping to design a playground in a simulated computer aided environment. The project-based component involved designing a playhouse that would built for a local community center. Following experience with the simulated problem, learners were asked to create two- and three-dimensional representations of a playhouse of their own design and then to explain features of each in a public presentation to an audience of experts.

Ching et al. (1998) investigated mixed teams of girls and boys (10-12 years old) during a three-months computer project, in which the students simultaneously learned new information and designed a relevant product (a multimedia encyclopaedia) reflecting their knowledge. The focus was not so much on programming as such, but on the status of girls in these mixed gender teams. From the students' perspective high-status activities were programming and graphic art, Internet research, leading a software demo and consulting (helping others). In the beginning of the project, "low-status" activities such as reporting on group progress and resolving interpersonal problems of the group were assumed by the girls. Boys started contributing on this level only when group meetings were introduced. While most boys worked on individual stations, calling one another for help, girls preferred to work collaboratively, giving programming advice by glancing over to another's screen. The most discouraging finding for Ching et al. was that the girls at the end of the project "had not expanded their planning repertoire to include more bottom-up strategies" and boys "developed a more flexible view than the girls of what it takes to plan and manage a project" (p. 75).

The Center for Children and Technology at the Education Development Center, Inc., monitored a two-year technology was used to support project-based learning, eighth graders in Union City, New Jersey, scored 27 percentage points higher than students from other urban and special needs school districts on statewide tests in reading, math, and writing achievement. The study also found a decrease in absenteeism and an increase in students transferring to the school. Four years earlier, the state had been considering a takeover because Union City failed in 40 of 52 indicators of school effectiveness.

A 1992 study of 700 students from 11 schools districts in Tennessee found that students doing projects using videotaped problems over a three-week period performed better in a number of academic areas later in the school year. The study, by the Cognition and Technology Group at Vanderbilt University, examined student competence in basic math, word problems, planning capabilities, attitudes, and teacher feedback. Students who had experience in the project work performed better in all categories.

A 1999 study by the Center for Research in Educational Policy at the University of Memphis and University of Tennessee at Knoxville found that students using the Co-nect program, which emphasizes project-based learning and technology, improved test scores in all subject areas over a two-year period on the Tennessee Value-Added Assessment System. The Co-nect schools outperformed control schools by 26 percent.

Since 1996, Rockman et al., an independent research firm in San Francisco, has studied the impact of widespread use of laptop technology on teaching and learning. The focus of the firm's multiyear studies has been on dozens of public and private K-12 schools participating in a pilot laptop program sponsored jointly by the Microsoft and Toshiba corporations. Through both observation and feedback from laptop-using teachers and students, researchers have documented a shift from lectures and other teacher-centered forms of delivery to lessons that are more collaborative and project-oriented. Teachers, researchers note, become facilitators in project-oriented classrooms, with students increasingly assuming the role of directors of their own learning. In a 1998 report, researchers note that three-fourths of the teachers who participated in a Rockman et al. survey reported that project-based instruction had increased since the introduction of the laptops in their classrooms. Among the many reported benefits of this project-based approach to learning are greater student engagement, improved analytic abilities, and a greater likelihood to apply high-order thinking skills. Laptop-using students also performed better on a Rockman et al.- administered writing examination. The research firm did not; identify significant differences in the standardized test scores of laptop-using students. Researchers offered two possible explanations for the lack of significant improvement in this area: 1.Standardized tests were not design to reflect the types of learning that laptops support 2. Because the students had been using their laptops for less than two years, it might have been too soon to see noticeable gains in areas that are covered by standardized tests (Staff, 2001).

At Montake Terrace High School in Mountlake Terrace, Washington, teams of students in a high school geometry class design a state-of-the-art high school for the year 2050. The students create a site plan, make simple architectural drawings of rooms and a physical model, draw up a budget, and write a narrative report. They present their work to real architects, who judge the project and “award” the contract.

At The Mott hall School in New York’s Harlem, a fifth-grade project on kites involves using creative writing skills in poems and stories with kite themes. While designing their own kites on the computer and then making them by hand, students learn about electromagnetism and principles of ratios and proportions. A casual remark by one student leads to an in-depth study of the role of kites in various cultural celebrations.

A survey of student teachers views, before and after the their projects, and an evaluation of the web sites created by them were conduced with a view to assessing their responses to the learning environment, its impact on them, as well as the challenges faced during web site creation. The result showed that the project-based learning approach has been motivational and effective regarding the acquisition of web site design and development skills. The participants demystified the process of educational web site creation and became more interested in self-confident about it, although they encountered certain difficulties in image processing, file management and design of navigational structures.

A study by Liu and Rutledge (1997) found that high school students showed a significant growth in their value intrinsic goals, and hypermedia, design helped them to acquire several critical design skills. Other studies have shown that seventh graders, both advanced and behaviorally/emotionally disordered, were motivate by creating multimedia projects

Liu & Pedersen (1997) found that engaging students in hypermedia authoring could enhance their motivation, and allowing students to be hypermedia designers could support the development of design knowledge and higher order thinking skills.

The skills mostly affected in this study included planning, presentation, reflection, collaboration, task distribution, and time management.

The statistical analyses indicated that students who were hypermedia designers had a significantly better understanding of planning and collaboration than the non-designer group, and valued these tasks above those of a more mechanical nature, a finding that supports other research Lehrer et al. (1994).

Liu & Hsiao's (2002) study showed that such an environment encourages the students to be independent learners, good problem solvers, and effective decision-makers. Engaging middle school students in being a multimedia designer can have positive impact on their cognitive strategy use and motivation.

Demirel's study (2005) showed that student groups shared knowledge and photos with other groups. Students used the computer technology while preparing the project but they did not use anything for presentation.

Montgomery's (2000) study showed that students who developed multimedia more successful than others did who used traditionally materials when study in project-based learning.

Liu & Hsiao (2002) found that such an environment encourages the students to be independent learners, good problem solvers, and effective decision-makers. Engaging middle school students in being a multimedia designer can have positive impact on their cognitive strategy use and motivation.

Spoehr's (1993) study showed that students developed more complex knowledge representations and various thinking skills through the design of hypermedia programs. Lehrer found similar results and his collogues [Lehrer, et al. 1994]. In their study, ninth-grade students used a program called HyperAuthor to develop hypermedia presentations about a topic in American history for their peers as an educational tool. As a result, students significantly increased their time on-task behavior and internalized some design skills over the course of their design projects. Liu and Rutledge (1997) worked with a group of at-risk high school students as they designed multimedia projects for a children's museum. The result showed that students significantly increased their interest and involvement throughout the project. Students steadily increased their time spent on the project and became more motivated in learning than the control group. Moreover, their self-efficacy enhanced and they obtained a more positive image about themselves. Many students reset their goals for the future-to work in multimedia design profession rather than working in fast food restaurants.

The studies on learner-as-hypermedia/multimedia-designers suggest the following: 1- such a learning environment can have a positive impact on students' motivation toward learning; 2- such an environment encourage creativity and enhances the development cognitive skills; and 3- high and middle school students learned design skills in addition to content and computer knowledge. While the preliminary finding in this are have shown some encouraging results, much is to be learned about designing and implementing such a learning environment effectively for different learners and curriculum needs (Liu & Pedersen, 1997).

Many experts are agreeing using multimedia in education is increased percentage of student's success. A student can adept lesson in classroom only 20-30 minutes. But with multimedia programs student can adept lesson 60 - 90 minutes.

In 1998 Colombia university researched on 150 students. Experts divided student's two groups. First group joined classroom lesson for 1 week, second group join multimedia program for 1 week. After one week, they entered an exam for these lessons. Moreover, results; first group have 50% success and second group have 75% success.

For military; U.S.A.F. trained pilots with simulations and pilots' skills increase 65% with these simulations.

As research and publishing company Computer Technology Research (CTR) Corporation reports, people retain only 20% of what they see and 30% what they hear. However, they remember 50% of what they see and hear, and as much as 80% of what they see, hear and do simultaneously. That is why multimedia provides such a powerful tool for teaching and learning.

Electronic publishing also affects the education industry. Schools are beginning to invest former textbook budgets in multimedia technology, for example, by equipping students with laptop computers to access course materials online(electronic-school.com 6/99), Multilit Web site). After studying hundreds of controlled experiments in which computers were used in college and high-school courses, elementary education, and adult high-school equivalency programs, Kulik (1985, 1986, 1991, and 1994) reports overall learning gains averaging more than a letter grade higher (effect size= .32), and significant reductions in the time required for students to learn (averaging 34% in college and 24% in adult education).

The benefits of multimedia well documented by Professor James Kulik (1985, 1986, 1991, and 1994) and his associates at the University of Michigan. During the past 20 years, Kulik has analyzed hundreds of controlled experiments on the effectiveness of computer-based learning. Although the term *multimedia* did not exist then, many of the studies used graphics, sound, and video in a manner now referred to as multimedia. Overall, the findings indicate that average learning time has been reduced significantly (sometimes by as much as 80%), and achievement levels are more than a standard deviation higher (a full letter grade in school) than when multimedia is not used.

The Kulik studies classified according to grade levels. The information Superhighway is linking universities, colleges, schools, and homes into a continuum that is helping to break down the distinctions between these grade levels. The internet is enabling students of all ages to collaborate on worldwide projects, share discoveries, and develop strategies for acquiring knowledge in a social context.

A teacher in Washington State who has used project-based instruction in his math and science classes reports that many students who often struggle in most academic settings find meaning and justification for learning by working on projects. The teacher also notes that by facilitating learning of content knowledge as well as reasoning and problem-solving abilities, project-based instruction can help students prepare for state assessments and meet state standards (Nadelson, 2000).

Gains in Student Achievement: Research conducted in Expeditionary Learning Schools and Co-nect Schools. Expeditionary Learning Outward Bound (ELOB) and Co-nect schools were part of the New American Schools Designs study and thus have participated in the most extensive evaluation research of any Project-Based Learning context. With respect to Expeditionary Learning schools, a report by the

New American Schools Development Corp (1997) summarizes some of the findings for the school years 1995 through 1997. These and subsequent findings are summarized in two publications of ELOB (1997; 1999). Overall, ELOB publications report that nine of ten schools that implemented Expeditionary Learning in 1993 demonstrated significant improvement in students' test scores on standardized tests of academic achievement. According to a study conducted by the RAND corporation (ELOB, 1999), Expeditionary Learning was the most successful program of the six New American School designs implemented in 1993, and EL schools have continued to deepen their implementation and improve year to year. The gains exhibited in academic achievement on the part of Expeditionary Learning schools are quite dramatic. In Dubuque, Iowa, three elementary schools implemented the EL program. After two years, two of these schools showed gains on the Iowa Test of Basic Skills from "well below average" to the district average; the third school showed a gain equivalent from "well below average" to "well above the district average." The magnitude of the 1995 to 1997 gains in reading for the three EL schools ranged from 15% in one school to over 90% in the other two schools, while the averages for other schools in the district remained unchanged. After four years of EL implementation, graduates from these three Dubuque EL schools scored "above the district average in almost every area." In Boston, eighth-grade students at an inner city, EL school exhibited the second highest scores in the district on the Stanford 9 Open Ended Reading Assessment, scoring behind the exclusive Boston Latin School (ELOB, 1999). An EL elementary school in this district ranked 11th in mathematics and 17th in reading out of 76 elementary schools on this same test, despite serving a population that is 59% Hispanic and 27% African American (ELOB, 1999). Similarly, in Portland, Maine, an EL middle school showed increases for the school year 1995-1996 in all six curriculum areas assessed with the Maine Educational Assessment battery, this in contrast to the previous school year (prior to the onset of EL) and the results of the state as a whole. Again, the improvement scores were of a magnitude three to ten times larger (a 59 point increase, on the average) than that of the state as a whole (average gain of 15 points). Moreover, these improvement scores occurred at a time when the percentage of limited English speaking students increased in this EL middle school from 6% to 22% (ELOB, 1999), and these gains did not level out but increased an average of 25 additional points the following year (ELOB, 1999). Similar dramatic gains reported for schools in Colorado, Decatur, Georgia, Cincinnati, Ohio, Memphis, Tennessee, and New York City. (ELOB, 1999). 10 As important as these gains in academic achievement have been for validating the EL model, an additional study of EL schools conducted by the Academy for Educational Development (AED) demonstrated some interesting additional effects of EL implementation (ELOB, 1999). Results from classroom observation, teacher interviews, and analyses of teacher reports in ten EL schools revealed that Expeditionary Learning schools influenced school climate and student motivation. According to this report, the Expeditionary Learning experience increased participating teachers' beliefs in their ability to teach students of different ability levels, conduct assessments, and use parents and outside experts in the classroom, as well as their confidence in themselves as teachers and learners. A companion report produced by the University of Colorado found that Expeditionary Learning in Colorado schools "consistently promoted structural changes such as block scheduling, increased partnership with the community, authentic assessment, teaming of teachers, and interdisciplinary project-based curriculum." (ELOB, 1999). Additionally, the AED report found attendance to be high in all EL schools, with an average attendance rate across all schools of over 90%. For example, according to this report, attendance at a participating elementary school in Cincinnati increased from 75% before the implementation of EL to over 95% after two years of EL. Additionally, the AED report found rates of retention, suspensions, and other indices of disciplinary problems to be unusually low in EL schools. Similar dramatic gains in academic achievement reported for Co-nect schools. Co-nect, like Expeditionary Learning, is a comprehensive, whole-school reform effort that places strong emphasis on project-based learning, interdisciplinary studies, and real-world applications of academic content and community service. Co-nect also characterized as having a central emphasis on technology (Becker, Wong, & Ravitz, 1999). A study conducted by University of Memphis researchers (Ross et al., 1999) compared Co-nect schools to control schools in Memphis on Tennessee's Value-Added Assessment System. According to this report, Co-nect schools gained almost 26% more than the control schools over the two-year period 1996-1998 and showed strong achievement gains in all subject matter areas. Comparable gains reported for Co-nect schools compared to district averages in a separate independent evaluation of Co-nect schools in Cincinnati for the period 1995-1999 (Cincinnati Public Schools, 1999). It should be note that the findings reported above drawn from ELOB and Co-nect publications, respectively. Even if these findings and interpretations are accurate, they undoubtedly selected for their salience and positive direction. It is quite possible that a full set of findings would reveal schools in which gain scores on standardized achievement tests were minimal or negative. In addition, even if the results selected by ELOB and Co-nect for display in their publications were representative of all schools in all years of the study, these results may be attributed, in part, to features of these programs other than Project-Based Learning (e.g., portfolios, flexible block scheduling for ELOB; technology in the case of Co-nect schools). Nevertheless, the magnitudes of the gains reported above are impressive for a number of reasons. First, that an instructional intervention of any kind was successful at boosting academic achievement is remarkable in its own right. For the most part, attempts to raise students' scores on standardized achievement tests have not met with great success. Second, there is no particular reason to expect that Expeditionary Learning or Co-nect would have an impact on standardized achievement tests, especially in reading and mathematics. That is, the learning expeditions that form the core of EL and the technology projects that are central to Co-nect do not target the basic skills tapped by standardized achievement tests, at least not directly. Typically, projects target content areas topics or technological operations. Skills of reading, writing, and computation are often involved in constructing project products, but these skills rarely introduced in the context of projects. Thus, in both of these instances, the reported effects of PBL-based programs on students' basic skills achievement may be the result of a generalized effect associated with the whole school reform effort or, perhaps, the motivational effect of project-based instruction may lead to increased student attendance, attention, and engagement during the (non-project) periods students spend learning basic skills. More research and more in-depth analyses of existing research would seem to be called for.

Gains in Students' Understanding of the Subject Matter: A Longitudinal Study of Two British Secondary Schools. One of the most powerful designs for conducting research on instructional practices involves comparing students' performance on some criterion measure before and after an experimental treatment, while at the same time being able to compare these gains to those of a comparison group that is similar to the experimental group in all respects except the nature of the treatment.

Only one study of Project-Based Learning effectiveness was found that incorporates this research design. Boaler (1997) describes a longitudinal study of mathematics instruction conducted in two British secondary schools. This study was also reported in Education Week (Boaler,1999) and in Boaler (1998a, 1998b). As mentioned, the study has several features that make it a significant study of Project-Based Learning effectiveness. Most important, the study employed a closely matched (though not randomly assigned) control population. In addition, the study included pre- and post measures, it was a longitudinal study that lasted for three years, thus allowing for multiple measures of growth, and the experimenter included a variety of instruments, throughout the study, to assess students' capabilities, achievement, and attitudes. The two schools were select for their differences with respect to traditional versus project-based methods of instruction. One of the schools (referred to here as "traditional") was characterize as incorporating a more teacher-directed, didactic format for instruction. Mathematics taught using whole class instruction, textbooks, tracking, and the frequent use of tests. At the second school (referred to here as "project-based"), students worked on open-ended projects and in heterogeneous groups. Teachers taught using a variety of methods with little use of textbooks or tests, and they allowed students to work on their own and to exercise a great deal of choice in doing their mathematics lessons. The use of open-ended projects and problems was maintain in the project-based school until January of the third year of the study at which time the school switched to more methods that are traditional in order to prepare students for a national examination. During the three-year period of the study, the author observed and interviewed students periodically. At the traditional school, students' responses to the textbook-based teaching were, according to Boaler, "consistent and fairly unanimous...the majority of students reported that they found (the) work boring and tedious." Moreover, "the students regard mathematics as a rule-bound subject and they thought that mathematical success rested on being able to remember and use rules." In contrast, students at the project-based school regarded mathematics as a "dynamic, flexible subject that involved exploration and thought." (Boaler,1997, p. 63).Results from mathematical assessments administered in each of the three years favored the students at the project-based school. Students at the project-based school performed as well as or better than students at the traditional school on items that required rote knowledge of mathematical concepts, and three times as many students at the project-based school as those in the traditional school attained the highest possible grade on the national examination. Overall, significantly more students at the project-based school passed the national examination administered in year three of the study than traditional school students. Students at the project-based school outperformed students at the traditional school on the conceptual questions as well as on a number of applied (conceptual) problems developed and administered by Boaler. According to the author, these results suggest that students at the two schools had developed a different kind of mathematics knowledge. These different forms of knowledge were also reflected in students' attitudes toward their knowledge. Not only were students at the traditional school unable to use their knowledge to solve problems, but according to Boaler, "Students taught with a more traditional, formal, didactic model developed an inert knowledge that they claimed was of no use to them in the real world." In contrast, "Students taught with a more progressive, open, project-based model developed more flexible and useful forms of knowledge and were able to use this knowledge in a range of settings." (Boaler,1998a).

A study reported by Penuel and Means (2000) incorporates real-world, student directed projects on the one hand and a combination of project-specific performance tasks and more general ability measures on the other. This study, which was conducted by SRI International, reports on a five-year evaluation of the Challenge 2000 Multimedia Project in California's Silicon Valley. Student participants worked on a variety of projects and then presented their work at regional Multimedia Fairs. In order to assess the effectiveness of these varied experiences, SRI staff gave students an additional project and observed how they went about completing it. Students in both project and comparison classrooms were asked to develop a brochure, targeted at school officials that would inform people about the problems faced by homeless students. Students who had taken part in the Multimedia Project outperformed comparison students on all three measures associated with the brochure task: content mastery, sensitivity to the audience, and coherent design (integrating multiple graphical and textual elements). In addition, results from the study demonstrated that gains in these skills were not achieved at the cost of growth in other areas. Students in the Multimedia Project made the same progress as did students in the comparison classes on standardized tests of basic skills.

Tretten and Zachariou (1995) conducted an assessment of Project-Based Learning in four elementary schools using teacher questionnaires, teacher interviews, and a survey of parents. Of interest in this study was the fact that the schools involved had only recently begun to experiment with Project-Based Learning and that all teachers, a total of 64 across the four schools, were surveyed. The average percentage of instructional time devoted to Project-Based Learning across al schools and teacher was 37%. According to teachers' self-reports, experience with Project-Based Learning activities had a variety of positive benefits for students including attitudes towards learning, work habits, problem-solving capabilities, and self esteem. In summary, Tretten and Zachariou state that:

"Students, working both individually and cooperatively, feel empowered when they use effective work habits and apply critical thinking to solve problems by finding or creating solutions in relevant projects. In this productive work, students learn and/or strengthen their work habits, their critical thinking skills, and their productivity. Throughout this process, students are learning new knowledge, skills and positive attitudes."

Other studies in which self-report data was used as a measure of project effectiveness include an examination of the effect of Project-Based Learning on third-, fifth-, and tenth-grade students identified as low in motivation (Bartscher, Gould, & Nutter, 1995). After taking part in project work, most of these students (82%) agreed that projects helped motivate them, and most (93%) indicated increased interest in the topics involved. This study also included an independent measure of project effectiveness, percentage of homework completion. However, the 7% increase in homework completion attributed to the project work is quite small and, given the lack of a control group in the study, difficult to interpret.

Rosenfeld and Rosenfeld (1998) were interested in investigating the learning styles of students who were characterized by their teachers as "pleasant surprises" (students who perform poorly in conventional classrooms, but who do well in PBL activities) and "disappointing surprises" (students who performed well in conventional classrooms, but who turned in poor projects or no projects at all). Eleven students from three eighth-grade science and technology courses were identified as "surprises" by their teachers. According to the performance of these students on the

4-MAT and LCI, two learning styles inventories, students characterized as "pleasant surprises" exhibited high scores on inventory scales for applied, discovery (as measured by the 4-MAT), technical, and/or confluent processing (as measured by the LCI), whereas students who were characterized as "disappointing surprises" scored high on the fact-oriented scale of the 4-MAT. The authors suggest that students who do poorly in traditional classrooms may have learning styles that are mismatched to the orientation toward the transmission of facts characteristic of these contexts. They suggest further that these students be exposed to PBL contexts where their learning styles constitute a better match.

Horan, Lavaroni and Beldon (1996) observed Project-Based Learning classrooms at two time periods during the year, once in the fall and once in the spring semester. At both occasions, they compared the behavior of high ability to low ability PBL students in-group problem-solving activities. Observers looked at five critical thinking behaviors (synthesizing, forecasting, producing, evaluating, and reflecting) and five social participation behaviors (working together, initiating, managing, inter-group awareness, and inter-group initiating). Results from the study are provocative, but difficult to assess. Overall, high-ability students engaged in the criterion social participation behaviors more than two and one-half times as frequently as low-ability students in the four classes observed and engaged in critical thinking behaviors almost 50% more frequently. The interesting finding, however, was that lower ability students demonstrated the greatest gain in critical thinking and social participation behaviors, an increase of 446% between the fall and spring observation, compared to an increase of 76% for the high-ability students.

Edelson, Gordon, and Pea (1999) report challenges associated with secondary students' ability to conduct systematic inquiry activities in high school science. One challenge is sustaining motivation for inquiry. Students often failed to participate or participated in a disengaged manner. Second, students were sometimes not able to access the technology necessary to conduct the investigation; i.e., they were not able to do the work. Third, students often lacked background knowledge necessary to make sense of the inquiry. Fourth, students were often unable to manage extended inquiry activities.

In a fifth-grade bilingual class at John Wesley, students engaged in a year-long project in which they developed multimedia descriptions of the lives of minority group members who had achieved prominence within the students' local community. The project motivated by the lack of curriculum materials focusing on Latino role models written at a level appropriate for students just transitioning to using English in the classroom. The project involved identifying local Latino, African-American, and Vietnamese leaders (including politicians, businesspersons, researchers, and educators), conducting and videotaping interviews, and composing written highlights from the interviews. Technology made it possible for students to aspire to producing, and making many copies of, multimedia materials with a quality of appearance that would tempt others to purchase them (*Technology and Education Reform, 1995).*

A City Building Project- Each year, students in this mixed-age (8 to 10) team-taught class spend a good part of their year on a project designing a city of the future for the urban area in which their school is located. Students divide into neighborhood groups that must work together to decide what will be built in their area of the city. Each child is responsible for an individual parcel within the neighborhood. Students also have membership in city commissions (e.g., Environment, Building and Safety), which may pass regulations that apply to all of the neighborhoods. In the case of a controversial issue (e.g., treatment of the infirm elderly), students may develop a survey and administer it to their classmates to determine public opinion. With one computer for every two students in the class, students are able to use technology when they feel it would support their assigned tasks. Students use word processing software in writing their city plans and descriptions. A drawing program (Canvas) is used when they need to design objects and buildings. HyperCard stacks and animations are used to illustrate the work of the various city commissions and neighborhood groups. Spreadsheet software is useful when it is time to calculate the effect of a decision under consideration on some variable (e.g., the effect of a building height limit on the number of residents that can be accommodated) and to graph survey responses. A portion of the city-building activities were videotaped and edited to produce QuickTime clips for a multimedia record of the project (*Technology and Education Reform, 1995).*

A Student-Run Manufacturing Company - Students in this middle school industrial arts class form companies and produce products such as wine racks, cabinets, or folding wooden stools for sale. Students elect company officials and divide into work teams to enact the various operations of a company. Many team activities supported by technology. For example, the Finance Team uses computer spreadsheets to find the lowest-cost materials and to create financial statements for the company. The Research Team uses drafting software in drawing up design plans. The Marketing Team uses the word processor in creating advertisements and product descriptions. A video camera used in creating commercials for the product; the commercials are then aired over the school's broadcast system. Most products require use of a computer-controlled lathe or mill. Final production is conducted assembly-line fashion, with the parts laid out in specific locations and some students acting out the parts of robotic arms to place the parts on the line. Products sold within the school community. Students buy and sell stock in the company, and after the products sold, stockholders get their share of the profits (*Technology and Education Reform, 1995).*

Over 70 percent of teacher training programs surveyed require students to take three or more credit hours of instruction with information technology (IT). And on average, pre-service teachers get an equivalent amount of IT built into their non-IT courses. However, despite the course requirements, most faculties did not feel that IT training was adequate or effectively modeled for the future-teachers they serve. "We want pre-service teachers to learn how to use information technology as a tool for helping their students learn." Survey researchers also asked about the field experiences of teachers — whether or not information technology was available in the K-12 classrooms, where pre-service teachers get their field training. They found that most of those classrooms have information technology available, but student teachers do not routinely use that technology during their field experience.

"The use of technology in everyday classroom and practicum experiences — seems to be more important than specific computer classes," says Talbot Bielefeldt, a researcher for the survey. "Specific technology training has a role, but only up to a point. The institutions that reported the highest levels of student technology skills and experience were not those with heavy computer course requirements, but those that made use of technology on a routine basis throughout the teacher training program." observes Bielefeldt. The findings in that report should be a wake-up call for higher education institutions and policymakers across the country — today’s students live in a global, knowledge-based age, and they deserve teachers whose practice embraces the best that technology can bring to learning.

Riley and Pace's (1997) investigation of the use of PowerPoint as a delivery tool for multimedia teaching aids found that: presentation time was reduced; concepts were ble to be communicated more effectively; and students were able to access computer- generated lecture notes on a server in their own time.

In a survey of Nonprofit Organizations and similar groups, Goodman (2006) found that 62% of presentations utilize slideware and that only 34% of respondents said they usually or always learn something from the average presentation. At the same time, 46% of presenters rated their visual aids as good-to-excellent, while only 19% of audiences found the same value in visuals (Goodman, 2006).

Issa, Cox & Killingsworth's (1999) studies provides a summary of the results from research on the effects of multimedia-based safety education conducted by the M. E. Rinker Sr. School of Building Construction at the University of Florida. The findings indicate multimedia-based, self-paced learning offers very distinct advantages over traditional, instructor-led classroom learning. Overall, both the high-school and university student groups involved in the study exhibited superior retention rates when learning from the multimedia-based materials. Higher scoring students in the classroom showed little difference in either media, while students who tended to score at the low end of the grading scale uniformly scored higher on multimedia-based materials. The reduced variation in student performance based on test scores in the CD-ROM instruction indicates the positive effects of multimedia-based instruction.

Learning also appeared to take less time when multimedia instruction was used. Kulik, Bangert, and Williams (1983) found one study that recorded an 88% savings in learning time with computerized instruction (90 minutes) versus classroom instruction (745 minutes) and another study that recorded a 39% savings in learning time (135 minutes for computerized instruction versus 220 minutes for classroom instruction). Kulik, Kulik, and Schwalb (1986) identified 13 studies in which students using computers mostly for tutoring learned in 71% less time than students in traditional classroom instruction. In a comparison involving eight studies, Kulik, Kulik, and Cohen (1980) found that computer-based instruction took about 2.25 hours per week while traditional classroom instruction took about 3.5 hours, a 36% savings in learning time.

2.2 THE PROJECT BASED LEARNING

Teaching methods abound- some sound, some not so sound. If you have been teaching for many years, you have no doubt seen several new ways of teaching come into vogue. Some have taken hold; many have faded away; a few have become infamous. In their book *Models of Teaching,* Bruce Joyce and Marsha Weil with Emily Calhoun (2000) describe no fewer than 20 ways to teach. Like different health remedies, these entire teaching methods clamor for your attention, and each urges you to include it in your teacher's medicine cabinet (Simkins, Cole, Tavalin, & Means, 2002).

Project-based learning, deriving its theoretical underpinning from Dewey's educational philosophy (1907) and constructivist epistemological belief, organizes learning around a project. Project-based learning (PBL) is a model for classroom activity that shifts away from the classroom practices of short, isolated teacher-centered lessons and instead emphasizes learning activities that are long term, interdisciplinary, student-centered, and integrated with real world issues and practices. One immediate benefit of practicing project-based learning is the unique way that it can motivate students by engaging them in their own learning. Project-based learning provides opportunities for students to pursue their own interests and questions, make decisions about how they will find answers, and solve problems. In the classroom, Project-based learning provides many unique opportunities for teachers to build relationship with students. Share student work-which includes documentation of the learning process as well as the student's final projects-can with other teachers, parents, mentors, and the business community who all have a stake in the students' education (http://www.pblmm.k12.ca.us, 2001).

Traditionally, project- based learning is a model of learning that organizes learning around projects. According to the definitions found in numerous research papers on Project-based learning, projects are complex task, based on challenging questions or problems, that involve students in design, problem solving, decision making or investigate activities; give students opportunity to work relatively autonomously, over extended periods of time; and culminate in realistic products or presentations (Jones, Ramussen & Moffitt, 1997). Project-based learning is curriculum fueled and standards based. Project-based learning addresses the required content standards. With project-based learning, the inquiry process starts with a guiding question and lends itself to collaborative projects that integrate various subjects within the curriculum. Questions asked that direct students to encounter the major elements and principles of a discipline (George Lucas Educational Foundation 2002).

According to Wikipedia **Project based learning**, or PBL, is a constructivist pedagogy that intends to bring about deep learning by allowing learners to use an inquiry-based approach to engage with issues and questions that are rich, real and relevant to their lives. This strategy is well served since the onset of the read/write Web. Teachers have ready made content easily available via the Web and the tools to allow for creative student directed creation of content related to the problems and questions contained in the project being studied. Sylvia Chard, who defines project learning as “an in-depth investigation of a real-world topic worthy of children’s attention and effort”.

Many researchers (Beal, 1995; Johnson, 1994; Liu, 1998) believe that, used in this context, hypermedia development can help students construct knowledge, develop higher order thinking skills and, possibly, promote problem-solving skills. Project-based learning (PBL) is not just an educational conference buzzword; it's a unique approach to learning that provides students with the opportunity to gain experience in sifting and sorting data, working collaboratively, and using critical-thinking skills, all to solve real-world problems (Microsoft Online, 2003). Project-based learning is an old and respected educational method. The use of multimedia is a dynamic new form of communication. The merging of project-based learning and multimedia represents a powerful teaching strategy that we call “project-based multimedia learning.” Defining Project-Based Multimedia Learning It’s best to start with some definitions. By project-based learning, we mean a teaching method in which students acquire new knowledge and skills in the course of designing, planning and producing some product or performance. By multimedia, we mean the integration of media objects such as text, graphics, video, animation, and sound to represent and convey information. Project- based multimedia learning is a method of teaching in which students acquire new knowledge and skills in the course of designing, planning, and producing a multimedia product (Simkins, Cole, Tavalin & Means, 2002).

Table 2.1: The basic differences between the traditional class environment and the project based class environment

The traditional class environment		**The Project-Based class environment**
Problems and solutions are described, there is only one solution.	Problem	There is more than one solution type. They can use more than one solution type.
To show the interest features a discipline.	The Subject Area	To dominate interaction between discipline, and collaboration differences discipline.
Standardization, to understand the concepts and basic elements, and use those solving problems.	Object	Solves complicated problems, investigates and using that information for solves problems. Study with collaboration. Constructs products of real world. In depth investigation.
The contents of the course includes only a few resources	Content	Content is not important very much in the project based classes, understanding is important in these classes.
Individual studies are important in these classes. Books and teachers notes are important. Final product is very important.	Process	Group studies, different resources, researches are basic elements of PBL. Product and process is important together. Process is important at least product.
Teachers take into consideration only the points of tests and final products for evaluation.	Evaluation	Teachers and students evaluate performance, products and process.
A simple class organization; One-teacher and 20-25 students.	Class Environment	A Complex class organization; Teachers are learning with their students.
Teachers explain and transfer the topics to the students.	The Role of Teacher	Teachers are guide and helps to students and to learning with students.

Students take notes and information from teachers.	The Role Of Learner	Students explore, find, use and learn the information.

The targets of PBL; solving of complex problem, studying with collaborative, gives differences solving ways for problems, create a product, be learner lifelong,

The information technologies increase the versatility and value of project-based learning as a curriculum tool. Technology can help create a rich environment for individuals and teams to carry out in-depth projects that draw on multimedia and information resources from throughout the world (Bielefeldt, Moursund, Underwood,1997).

The design project presents student with an authentic challenge and requires students to tap into their diverse intelligences, such as artistic, logical, linguistic and musical, and talents to accomplish the task. Students are engaged in a variety of activities from brainstorming gathering and researching information, writing, creating art works, to programming and evaluating. These activities resemble the practice employed in the multimedia industry (Liu, Jones, & Hemstreet, 1998). Project-based learning allows teachers to create tasks whose complexity and openness mimic problems in the real world. Students can see the interdisciplinary nature of these tasks and see that each task may have more than one solution. Students who have the freedom to choose different strategies and approaches may become more engaged in the learning process, and these students will be more likely to approach other problems with an open mind.

Learners have the added opportunity to identify related subtopics and explore them in a project-based scenario. Teaching with the project-based method enables students to work cooperatively with peers and mentors in a student-centered environment where learners are encouraged to explore various topics of interest.

In the study of Matejka, (2004) said that ICT and Project-based learning can be used closely together. Through the use of word processors, slide show presentations, and web authoring packages students can present the information they have found. Research tools such as e-mail, electronic mailing lists, forums, and other online applications facilitate communication and collaboration with the world outside the classroom. Additionally, hypermedia (web) or multimedia (CD-ROM) enables the student to discover museums, libraries and information to assist in their work. ICT can also assist in the publishing of student's work, to be viewed by a real audience (Solomon, 2003). Setting up links between students across the world can form communities of learners. Learning through hypermedia or multimedia and using authentic tasks requires learners to see the "relevance of the knowledge and skill to their lives, and the leverage it provides in problems they see as important" (Cunningham, 1991 cited by Carr & Jitendra, 2000).

Simulating real problems and real problem solving is one function of project-based learning. Students help choose their own projects and create learning opportunities based upon their individual interests and strengths. Projects assist students in succeeding within the classroom and beyond, because they allow learners to apply multiple intelligences in completing a project they can be proud of (http://www.4teachers.org, 2006)

2.2.1 Components of Project-Based Learning

Han & Bhattacharya (2002) explained in the key components of the Project-Based Learning. These features can be use in describing, assessing, and planning for projects. They are:

1. Learner-centered environment
2. Collaboration
3. Curricular content
4. Authentic tasks
5. Multiple expression modes
6. Emphasis on time management
7. Innovative assessment

Learner-centered environment: This component was designed to maximize student decision-making and initiative throughout the course of the project including topic selection to design, production, and presentation decisions. Projects should include adequate structure and feedback to help learners make thoughtful decisions and revisions. By documenting learners' decisions, revisions, and initiative, teachers (and learners) will capture valuable material for assessing student work and growth.

Collaboration: This component is intend to give learners opportunities to learn collaborative skills, such as group decision-making, interdependence, and integration of peer and mentor feedback, providing thoughtful feedback to peers, and working with others as student researchers.

Curricular content: Successful integration of content requires projects to be base on standards, to have clearly articulated goals, and to support and demonstrate content learning in both process and product.

Authentic tasks: This element can take on many forms, depending on the goal of the project. PBL may connect to the real world because it addresses real world issues that are relevant to learners' lives or communities. A project may be connecting to real professions using authentic methods, practices, and audiences. Communicating with the world outside the classroom, via the Internet or collaboration might also make real world connections with community members and mentors.

Multiple presentation modes: This component gives learners opportunities to effectively using various technologies as tools in the planning, development, or presentation of their projects. Though the technology can easily become the focus of a given project, the real strength of the multimedia component lies in its integration with the subject curriculum and its authentic use in the production process.

Time management: It builds on opportunities for learners to plan, revise and reflect on their learning. Though the period and scope of projects may vary widely, they should all include adequate time and materials to support meaningful doing and learning.

Innovative assessment: Just as learning is an ongoing process, assessment can be an ongoing process of documenting that learning. PBL requires varied and frequent assessment; including teacher assessment, peer assessment, self-assessment, and reflection. Assessment practices should also be inclusive and well understood by learners, allowing them opportunities to participate in the assessment process in ways not typically supported by more traditional teacher-centered lessons.

Generally, three phases can suggest in conducting Project-Based Learning: planning, creating and implementing, and the processing.

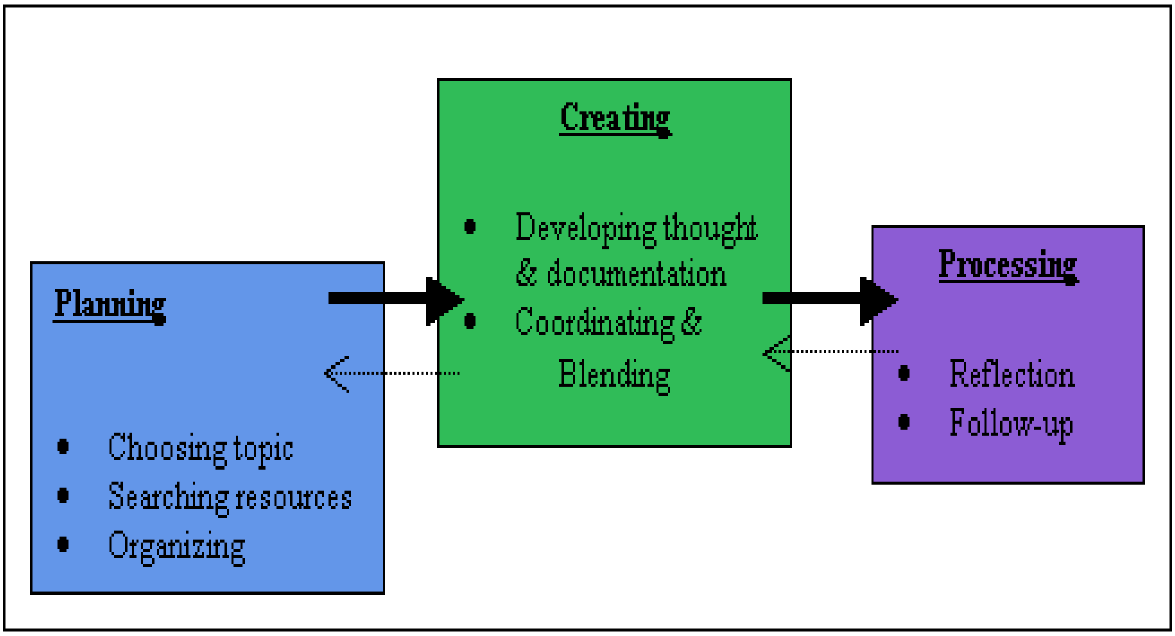

Figure 2.1: General framework of Project-Based Learning

Figure 2.1 represents the general framework of project-based learning. PBL can be dividing into three main processes. In the planning phase, the learner chooses the topic, searches for resources for needed information, and organizes the resources into a usable form. In the implementation or creation phase, the learner develops the project idea, combines the contributions of the group, and builds the project. In the processing phase, the project is shared with other groups, feedback is obtained, and then the groups reflect on the project. In the "planning" phase, the learner chooses the project, locates the required resources, and organizes the collaborative work. Through these activities, the learner identifies and represents a topic, gathers relevant information and generates a potential solution. The second phase is "creating", or implementing the project. This phase includes activities such as development and documentation, coordination and blend of member contributions, and presentation to class members. In this stage, learners expected to build a product that can be share with others. The activities for the third phase, "processing" the project, include reflection and follow-up on the projects. In this stage, the learners share their artifacts in a small group or with the entire class, obtain feedback, and reflect on the learning process and the project. Learners share each group's or individual's project and exchange feedback.

2.2.2 Project-Based Learning Working Styles

GLEF Staff (2001) explained that Project-based learning, as with all lessons, requires much preparation and planning. It begins with an idea and a “BIG question.” When designing the project and the BIG question that will launch the activities, it is essential that one remember that many content standards will be address. With these standards in mind, devise a plan that will integrate as many subjects as possible into the project. Have in mind what materials and resources will be accessible to the students to assist them. Next, students will need to be given assistance in managing their time – a definite life skill. Finally, have multiple means for assessing your students’ completion of the project. Did the students master the content? Were they able to apply their new knowledge and skills? Many educators involve their students in developing these rubrics.

“Project-based learning is focused on teaching by engaging students in investigation. Within this framework, students pursue solutions to nontrivial problems by asking and refining questions, debating ideas, making predictions, designing plans and/or experiments, collecting and analyzing data, drawing conclusions, communicating their ideas and findings to others, asking new questions, and creating artifacts (e.g., a model, a report, videotape, or computer program)” (p.370,Blumenfeld and colleagues, 1991)

2.2.3 Project-Based Learning: Instructional Strategies

The full benefits of projects cannot be achieve without considering the nature of the student's knowledge, the extent of teacher knowledge, and the complexity of the classroom setting. The following strategies can be implementing in the learning environment to promote a Project-Based Learning framework. Table 2.2 shows the general procedure and strategies for using Project-based learning, and includes both learner and instructor perspectives.

Table 2.2 Project-Based Learning: Procedure and Strategies

Planning	**Procedure and Strategies**	**Learner Perspective**	**Instructor Perspective**
1. Designing overall climate	- Create environments that will promote inquiry	- Allow sufficient time for project work. - Provide input for	- Understand project content to help learners -

	and challenge. - Make real-world connections	creation of questions, approaches and artifacts	Provide open-ended situation - Facilitate learning
2. Inquiry	- Choose topic - Locate resources - Organize collaboration	- Ask and refine questions - Formulate goals - Plan procedures - Debate ideas - Incorporate "Jigsaw" method	- Discover prior knowledge before the project begins - Provide structured set of inquiry steps for learners to follow
Creating	**Procedure and Strategies**	**Learner Perspective**	**Instructor Perspective**
1. Analyzing Data		- Make predictions - Design plans and/or experiments -Collect and analyze data	- Guide to analyze data -Incorporate a technical assistance model
2. Collaborating with others	- Communicate ideas and findings to others	- Possess skills needed to work with others and knowledge necessary to explore questions that arise	- Emphasize individual and group learning process -Provide norms for individual accountability
3. Developing thoughts & Documentation	- Create artifacts - Visualize and construct ideas	- Ask new questions - Draw conclusions	- Design activities - Provide resources -Give advice to learners as they progress in their projects
Processing	**Procedure and Strategies**	**Learner Perspective**	**Instructor Perspective**
1. Presenting Knowledge and Artifacts	Monitor what is known	Demonstrate the full range of one's competence	- Incorporate presentation opportunities involving external audiences - Require multiple criterion performances (e.g. collaboration, explanation, self-report)
2. Reflection &	- Assessment	- Understand the	- Create a

Follow-up	- Peer evaluation - Self-evaluation - Portfolio evaluation	teacher's method of evaluation -Create and agree on the norm of assessment initially -Reflect their own learning -Share and acquire multiple perspectives	classroom culture that supports frequent feedback and assessment -Find ways for learners to compare their work with others

2.2.4 Characteristics of Project-Based Learning

The Cincinnati bridge study mentioned above illustrates many of the characteristics of project-based learning activities:

- Students have some choice of topic as well as the nature the extent of content of the project. Students can shape their project to fit their own interests and abilities.
- The teacher acts as a facilitator, designing activities and providing resources and advice to students as they pursue their investigations. However, the students collect and analyze the information, make discoveries, and report their results.
- The context for the subject matter is larger than the immediate lesson.
- Students conduct research using multiple sources of information, such as books, online databases, videotapes, personal interviews (in-person or conducted via telecommunications), and their own experiments. Even if their projects are base on the same topic, different students may make use of considerably different sources of information.
- The project usually cuts across a number of disciplines. Students are expect to draw upon a broad range of knowledge and skills, and to “stretch” their knowledge and skills.
- The project extends over a significant period, usually from several class periods to an entire school year. Students plan for the effective use of their time and share resources such as computers, camcorders, and computer network access. One goal in project-based learning is for students to increase their skills in budgeting their time and other resources.
- The project involves the design and development of a product, presentation, or performance that can be use or view by others. Students may simply present the results of their projects in class as reports or posters. Other projects may extend

beyond the school boundaries in the form of broadcasts, publications, and public events.
- A team of people may work on project. The team may be an entire class, several classes, or even several remote sites.
- The instruction and facilitation guided by a broad range of teaching goals, and students may achieve additional goals as they explore complex topics from a variety of perspectives.

"Everybody is motivated by challenge and solving problems, and we don't make use of that in schools enough," says Bruce Alberts, distinguished cell biologist and president of the National Academy of Sciences (NAS). "Project-based learning gives everybody a chance to sort of mimic what scientist do, and that's exciting. And it's fun if it's done well."

Challenge 2000 (2000) explained characteristics of exemplary project-based learning with multimedia

- Anchored in core curriculum; multidisciplinary
- Involves students in sustained effort over time
- Involves student decision-making
- Collaborative
- Has a clear real-world connection
- Systematic assessment: both along the way and end product
- Takes advantage of multimedia as a communication tool

Examples of multimedia products

- Web page or site
- Hypermedia stack
- Computer presentation
- Computer generated movie
- Video program

5 Philosophical bases of Project Based Learning

Constructivism is a widely supported educational theory that rests on the idea that students create their own knowledge in the context of their own experiences

(Fosnot, 1996). Constructivism focuses on students being actively engaged in "doing", "rather than passively engaged in "receiving" knowledge. Project-based learning can be view as one approach to creating learning environments in which students construct personal knowledge.

Project based learning frequently includes teams of students engaged in cooperative learning and collaborative problem solving as they work to complete a project. Cooperative learning has been shown to be effective in improving academic and social skills; however, successful cooperative learning requires careful organization, and sometimes-explicit training in collaboration and communication (Johnson, 1986; Johnson & Johnson, 1989). Project-based learning provides an authentic environment in which teachers can facilitate students increasing their skills in cooperative learning and collaborative problem solving.

2.2.6 Teacher's Role in Project Based Learning

The teacher's role changes as well. The teacher is no longer the center of attention as the dispenser of information, but rather plays the role of facilitator, setting project goals and providing guidelines and resources, moving from student to student or group-to-group, providing suggestions and support for student activity. The majority of classroom time may be devoted to independent and collaborative projects. As students work on their technology-supported products, the teacher moves through the room, looking over shoulders, asking about the reasons for various design choices, and suggesting resources that might be used *(Technology and Education Reform, 1995).*

The teacher often acts a coach in guiding students through the process. Some necessary skills include (Martin & Baker, 2000):

- Analyzing tasks and skills needed to carry of the project
- Facilitating the process of analyzing project tasks, setting up the plan of action, and implementing and evaluating the project
- Determining how the project will contribute to the students' learning
- Facilitating decision-making, thinking, and problem-solving skills
- Facilitating students' demonstration of personal responsibility, self-esteem, and integrity

-Facilitating students' growth of interpersonal skills, such as working as teams, working with community members, and working with people who are of diverse backgrounds.

Teachers who make extensive use of cooperative learning and project-based work develop skills as intellectual "coaches" and undertake a new role as the activity designer and facilitator rather than the chief "doer" or center of attention. Their role is by no means a passive (Means & Olson, 1994).

Project-based work and cooperative learning approaches prompt this change in roles, whether technology is used or not. However, technology use is highly compatible with this new teacher role. Several teachers reported that technology led them to give their students more control after they witnessed what students were able to do with technology and how they were willing and able to take responsibility for teaching themselves and one another. Technology facilitates a change in the teacher's role also by making it easier to act as a diagnostician and coach for the cognitive aspects of task performance. Technology can help to make the students' thinking processes more visible to the teacher, something that does not happen when students simply turn in a completed assignment for checking and grading. As teachers observe their students working with computer applications, they can see the choices each student is making, stop and ask about the student's goals, and make suggestions for revisions or different strategies. It is easier also for the teacher to take momentary control of the computer to demonstrate what is mean.

Moreover, technology often puts teachers in the role of learner alongside their students. This is a big change from the traditional role of the teacher as the one with all the knowledge and right answers. Instead, students have given the chance to see their teachers struggle with the acquisition of a new set of skills. Teachers who were not threaten by this change in roles report that the experience sensitizes them to the learning process in unexpected ways, giving them new insights into their students as learners. Engaging in the process of exploring technology with their students further provides teachers with an opportunity to demonstrate aspects of problem solving and learning that rarely made visible in more product-oriented classrooms.

In addition to helping the teacher with technology, students also support the teacher by providing help to their peers. Students who are technology savvy are usually eager to share their knowledge with others. In our observations of technology-using classrooms, we saw numerous examples of students acting as peer coaches for each other, offering advice when a peer had trouble achieving a desired result with the software. Such advice giving was continual when students worked together in small groups, but was quite common also among students working individually on computers. Student coaching roles were generally not something that teachers had set up in any formal way; rather they emerged naturally as part of the parallel technology-based activity in the classroom (www.ed.gov).

2.2.7 Students' Role in Project Based Learning

Houghton Mifflin Company (1998) explained students' role in PBL: Students can be responsible for the creation of both the question and the activities, as well as the nature of the artifacts. Additionally, teachers or curriculum developers can create questions and activities.

Regardless of who generates it, the question cannot be so constrained that outcomes are predetermined, leaving students with little opportunity to develop their own approaches to investigating and answering the initial question.

Students' freedom to generate artifacts is critical, because it is through this process of generation that students construct their own knowledge. Because artifacts are concrete and explicit (e.g., a model, report, consequential task, videotape, or film) they can be shared and critiqued. This allows others to provide feedback, makes the activity authentic, and permits learners to reflect on and extend their knowledge and revise their artifacts.

Projects are decidedly different from conventional activities that are designed to help students learn information in the absence of a driving question. Such conventional activities might relate to each other and help students learn curricular content, but without the presence of a driving question, they do not hold the same promise that learning will occur, as do activities orchestrated in the service of an important intellectual purpose (Sizer, 1984). Supporters of project-based learning claim that as students investigate and seek resolutions to problems, they acquire an understanding of key principles and concepts (Blumenfeld et al.,1991). Project-based learning also places students in realistic, contextualized problem-solving environments (CTGV, 1992).

Projects can thus serve as bridges between phenomena in the classroom and real-life experiences. Questions and answers that arise in daily enterprise have given value and have proven open to systematic inquiry. Project-based education requires active engagement of students' effort over an extended period. Project-based learning also promotes links among subject matter disciplines and presents an expanded, rather than narrow, view of subject matter. Projects are adaptable to different types of learners and learning situations (Blumenfeld et al., 1991).

2.2.8 The Importance of Project Based Learning in the Classroom

Microsoft Office directors (2003) explained why use PBL: Project-based learning encourages students to think analytically and incorporate current technologies in their assignments. It also encourages students to use inquiry to understand the world around them and construct meaning from their own experiences. Project-based learning assignments also do the following:

The opportunities and freedom in project-based learning let students explore issues in more depth, satisfying their innate curiosity in a way that traditional learning does not. When students are interested in what they are doing, they are often capable of performing at higher levels. Traditional methods of teaching do not always address advanced thinking skills. As in the example of the traditional state report assignment, students often just rehash information that they have read or come across online. With project-based learning, students explore issues, solve problems, and collaborate with their peers. Many of the skills that students sharpen through project-based learning are exactly those that today's employers want.

Promote collaboration Students learn how to collaborate with their classmates, with students in other classrooms, or with students halfway around the world. They can also contact area experts by using e-mail, the Internet, and video conferencing. Teamwork and cooperation are keys to success in today's information-rich, highly technical work force. Project-based learning activities provide the framework for students to tap into their creativity while technology provides them with a means to develop solutions. Computers, the Internet, and programs like Microsoft Office Word 2003 or Microsoft Office PowerPoint 2003 can help students conduct research and produce their final products.

For students, benefits of project-based learning include:

- Increased attendance, growth in self-reliance, and improved attitudes toward learning (Thomas, 2000).

- Academic gains equal to or better than those generated by other models, with students involved in projects taking greater responsibility for their own learning than during more traditional classroom activities (Boaler, 1997; SRI, 2000).

- Opportunities to develop complex skills, such as higher-order thinking, problem-solving, collaborating, and communicating (SRI, 2000).

- Access to a broader range of learning opportunities in the classroom, providing a strategy for engaging culturally diverse learners (Railsback, 2002).

- Project based learning can provide students with the opportunity to work with emerging technologies and also gain important industrial experience (Gibson, O'Reilly & Hughes, 2002).

2.3 MULTIMEDIA AND INSTRUCTIONAL MULTIMEDIA MATERIALS

Multimedia can be define in a variety of ways, but in this study, the term “multimedia” refers to an instructional presentation made using primarily audio and images. Engaging students in hypermedia/multimedia design is one type of project-based learning which has shown some encouraging results in promoting higher order thinking skills (Liu & Pederson, 1997).

Beginning in 1990’s internet became most famous communication way all the world. Also most of firms started to advertise their products on the internet. They tried to use more colorful and animating catalogs and demo movies. However, there was a problem. Multimedia programmers were small amount. At this point many of universities open new department or new courses; multimedia designer. In these courses, students are learning how to use multimedia more effective and what can they do with multimedia. An obvious starting point is to examine what multimedia means to the public. This awareness has grown up since the late 1980s. In common, usage people will typically describe a multimedia experience as one involving pictures, sound, and video. They tend to think of it as a combination of stimuli such as this, often taking place in a specialized area (such as a 'multimedia experience' at a theme park or gallery). Individuals who use computers also commonly equate multimedia with CDs. In neither of these areas is interaction a key aspect of the term. People have tended to see themselves as recipients of a multimedia experience- passive observe of the time-based experiences that unfold before them.

Multimedia is the combination of a variety communication channels into a coordinated communicative experience for which an integrated cross-channel language interpretation does not exist (Cook, 2001). Tony Feldman who is the multimedia consultant explain

> *"Multimedia is the seamless integration of text, sounds, images of all kinds and control software within a single digital information environment. The definition applies to interactive media productions for distribution both online, such as Web pages, and offline, such as kiosks and CD-ROM."*

The word data has a dry sound, but as well as text and numbers, it includes pictures, animations, sounds and videos. The best example of a general-purpose data resource is the multimedia encyclopedia on a CD-ROM such as Encarta, but there are many CD-ROMs. Because of its large capacity (over 600 megabytes), a single CD-ROM makes the equivalent of many books available on one disk, through one program. This makes a huge amount of information available on a single computer. Having CD-ROMs on a network makes them available to many computers at once. More dramatically, much larger databases are available on-line at large remote computers. Furthermore, many computers in the internet- the worldwide network of computers – provide free information, creating the largest possible data resource (Bostock, 1995).

The typical design of multimedia is an array of representational forms (e.g., image, map, diagram, sound, video). Hypermedia is multimedia with substantive links between the various representational forms (Andrews & Tilton, 1993). Mayer (2000) provides a more specific definition, which is in line with the focus of the current study. He defines multimedia as the presentation of the learning material using both words and pictures. By words, he means that the material presented in verbal form, such as using spoken or printed text. By pictures, he means that the material presented in pictorial form, such as using illustrations, graphs, photos, or maps. Mao Neo and Ken T. K. Neo, faculty at Multimedia University in Malaysia, extend this definition (2001). They say that multimedia is “the combination of various digital media types, such as text, images, sound, and video, into an integrated multisensory interactive application or presentation to convey a message or information to an audience.”

Mayer (2002) suggests that knowledge of cognitive theory can inform multimedia design, based on three assumptions about how people learn from words and pictures:

• *The Dual Channel Assumption*: Human cognitive processing takes place along two distinct channels, the auditory-verbal channel (ears as input) and the visual-pictorial channel (eyes as input).

• *The Limited Capacity Assumption*: Working memory has a limited capacity for information and can easily become overloaded if too much material is presented at the same time.

• *The Active Processing Assumption*: Active processing within the auditory-verbal and the visual-pictorial channels leads to meaningful learning, and is more likely to occur if the working memory contains both types of representations.

A project in multimedia comprises a series of tasks that deliver a combination of media and have a computer component to integrate them. There are hardware-oriented multimedia projects where the aim might be to specify, introduce, and integrate a delivery platform, such as video conferencing with a tailored user front-end, into an organization. There are software development projects that combine media components into an application to run on a delivery platform. The delivery platform will be one that can support an interactive combination of video, graphics, animation, sound and text. This could include anything from the internet to interactive TV. Project management principles unite the disparate ways of working in interactive media development. (England, E. & Finney, A. 1999). Interaction is one of the most important components of any learning experience (Dewey, 1938).

In his book Hofstetter (2001) explained multimedia is the use of a computer to present and combine text, graphics, audio, and video with links and tools that let the user navigate, interact, create, and communicate as depicted in figure 2.2 this definition contains four components essential to multimedia. First, there must be a computer to coordinate what you see and hear, and interact with you. Second, there must be links that connect the information. Third, there must be navigational tools that let you traverse the web of connected information. Finally, because multimedia is not a spectator sport, there must be ways for you to gather, process, and communicate your own information and ideas. If one of these components is missing, you do not have multimedia. For example, if you have no computer to provide interactivity, you have mixed media, not multimedia. If there are no links to provide a sense of structure and dimension, you have a bookshelf, not multimedia. If there are no navigational tools to let you decide the course of action, you have a movie, not multimedia. If you cannot create and contribute your own ideas, you have a television, not multimedia.

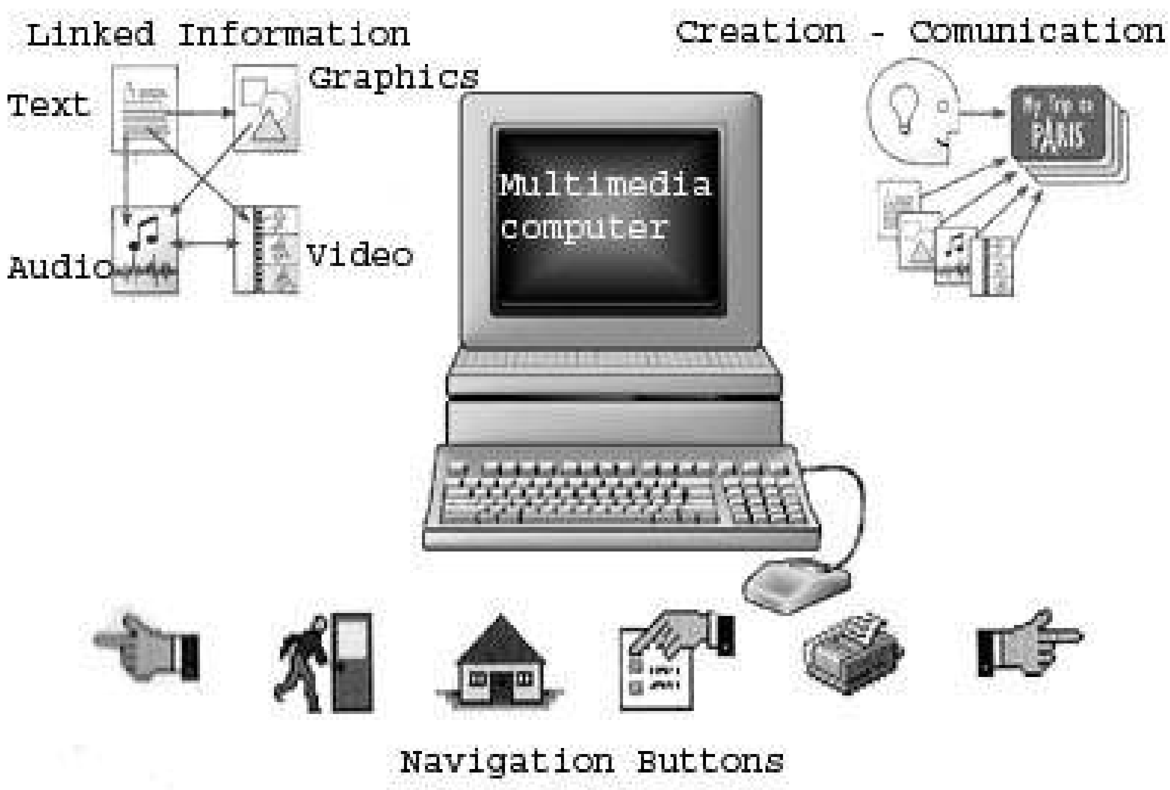

Figure 2.2: Multimedia is the use of a computer to present and combine text, graphics, audio, and video with links and tools that let the user navigate, interact, create, and communicate (Hofstetter, 2001).

Multimedia represents a qualitative technological and conceptual advance in information technology. Sound and moving images can convey vastly greater quantities of information than simple text and graphics will greatly change not only the way in which that information transmitted and used but also how it is structured and stored.

Schools are perhaps the neediest destination for multimedia. Many schools in the U.S. today are chronically under fund and are occasionally slow to adopt new technologies, but it is in the schools that the power of multimedia can be maximize for the greatest long-term benefit to all. Multimedia will provoke radical changes in the teaching process in the coming decades, particularly as smart students discover they can go beyond the limits of traditional teaching methods (Vaughan, 1994).

Most of us are by now familiar *with multimedia* as a way of presenting information. CD-ROM encyclopedias are a typical example. In this project, however, students do not learn simply by "using" *multimedia* produced by others. They learn by creating it themselves.

The development of such programs as HyperStudio, KidPix and Netscape Composer have made it possible for students of all ages to become the authors of *multimedia* content. As students design and research their *projects*, instead of gathering only written notes, they gather pictures, video clips, recordings and other media objects that will serve as the raw material for their final product. *With* PBL+MM, *multimedia* is a basic tool, not a glitzy add-on (Simkins, 1999).

There are seven components of the Project Based Learning using multimedia model projects except to:

- Be anchored in core curriculum; Multidisciplinary
- Involve student in sustained effort over time
- Involve student decision-making
- Be Collaborative

- Have a clear real-world connection
- Use systematic assessments: both along the way and end product.
- Take advantage of multimedia as a communicate tool (Penuel & Means, 1999).

Multimedia tools provide a rich environment for conducting PBL with students. A multimedia-based PBL lesson can easily include multiple goals. The following lists of goals extracted from Moursund (1999). The original list is much longer and is base on a survey of the literature in this field. A good IT-assisted PBL lesson is apt to include goals listed below;

1) **Expertise**. The project has a goal of students gaining increased knowledge and skill within a discipline or an interdisciplinary content area. Often students gain a high level of expertise within the specific area that they are studying.

2) **Research.** The project requires use of research skills and helps students to improve their research skills.

3) **Higher order thinking skills**. The project is challenging and has a focus on students improving their higher-order thinking skills.

4) **Information technology.** Students increase their knowledge and skill in making use of information technology to carry out the work in a project. A project may include a specific goal of students acquiring new knowledge and skills in information technology.

5) **Engagement.** Students are actively and appropriately engage in carrying out the work of the project; the students are intrinsically motivated.

6) **Community of scholars.** The entire class-student, teacher, teaching assistants, and volunteers-becomes a community of scholars, working together and learning from each other. Often this community of scholars expands to include parents, students from outside the class, and others.

A typical multimedia project might include:

- Project Manager;
- Software/program designers;

- High – level programmers;
- Low-level programmers;
- Hardware specialists;
- Interface designers;
- Text authors/Technical authors;
- Graphic designers;
- Photographers (still and video)
- Script writers;
- Video directors.

Each of these groups has different requirements for their working practice, and this must be allow for.

Users were not important in the early days of computing. Computers were very large and expensive machines, which ran programs that generated some sort of output. The people who worked with the computers specially trained, normally to work with one specific machine or one specific program. Things have changed since that time. Until the 1970s, it was still regard as quite acceptable for the computer to be extremely difficult to learn and for significant effort to be required on the part of the user. It began to become important to construct programs, which could actually be use by the public. This provided a major change in focus and emphasis in the design of software (Cook, 2001).

2.3.1 Important of Multimedia

Multimedia is fast emerging as a basic skill that will be as important to life in the twenty-first century as reading is now. In fact, multimedia is changing the nature of reading itself. Instead of limiting you to the linear presentation of text as printed in books, multimedia makes reading dynamic by giving words in multimedia serve as triggers that readers can use to expand the text in order to learn more about a topic. This accomplished not only by providing more text but also by bringing it to life with sound, pictures, music, and video.

Penuel, Korbak, Cole & Jump (2002) explains one of the key reasons why multimedia projects may be so successful is that they allow students to feel that what they are doing is "real" and requires their active participation to be successful. According to Wenger (1998), the work of *imagination* is in part to locate engagement "in broader systems in time and space, conceiving of the multiple constellations that are contexts for our practices". In this sense, one key to the success of the project was the extent to which the Web pages the students designed helped students situate their work in a broader, more "real" community than just their local school. Providing a real audience for students is critical if projects are to be as successful as this one was in engaging students and helping them imagine their projects as something different than a typical classroom assignment.

Multimedia learning materials can enable the integration of constructivist learning principles integration of constructivist learning principles such as:

- Multi- goal oriented activities
- Project- based activities
- Problem- based activities

These activities require learners to consider a variety of domains and perspectives, which is essential for of domains and perspectives, meaningful learning and building awareness.

2.3.2 Learning and Multimedia

Creating instructional multimedia is very much like building a house or producing a movie. The first step isn't to pick up a hammer or a video camera. The first step is to carefully lay out the plans for what you hope to accomplish and how you plan to do it. Granted, if you know a little bit about construction or movie producing it could prove beneficial, but chances are you'll rely on others for many aspects of either sort of project. The same is true for creating instructional multimedia. Notice that we use the term "instructional". This distinguishes the focus from the development of multimedia without specific instructional goals and objectives. With the advent of simpler interfaces for authoring languages and with so many people now experienced enough with computers to create basic forms of multimedia, it is increasingly difficult to locate truly "instructional" multimedia -- software that has underlying objectives of teaching a specific academic subject of focus. This information will prepare you to create such instructional materials. As the focus of education changes from attempts at teaching students all there is to know about a specific subject (a goal that is no longer achievable due to the increasing amount of human knowledge in nearly every discipline) to more practical approaches toward providing foundational skills of learning such as problem solving and working collaboratively, multimedia as an instructional tool is finding a place in the forefront of education. It is unfortunate that often the end product becomes the sole focus of multimedia development. Although a great deal of learning might be inferred to have happened in order to get the end product, inferences are not the best approach to ensuring that the learning took place. From an instructional perspective there is a tremendous value attributed to the multimedia development process. Students must select their topics, research these topics, structure the information that they want to portray in their multimedia product and then organize and portray it in a way that makes sense to themselves and to their audience (http://www.itrc.wvu.edu).

2.3.3 Types of Educational Software

2.3.3.1 Skill Programs

The skill-focused programs generally afford the user practice in skills they have already started to acquire through their classroom experience.

2.3.3.2 Knowledge Programs

A great example of using a project, as a basis to learning about basic physics, is Pinball Science. This program has you actually building your own pinball machines, which will fully operate when you have completed your construction work.

2.3.3.3 Early Learning

Early learning programs generally are for kids in the 3 to 6 age range. These programs are both skill and knowledge focused and tend to explore, in an introductory fashion, the basics such as letters and numbers as well as help start developing children's thinking skills.

2.3.3.4 Multi-Subject By Grade

These programs offer a variety of both skill and knowledge focused learning and testing by the grade level.

2.3.3.5 Thinking and Problem Solving

All of the programs in the categories above have on thing in common. They all deal with content skills and knowledge. Thinking and Problem Solving programs help kids develop their underlying thinking skills. Thinking and Problem Solving programs can really develop different types of logical thinking processes, as well as encourage and develop creative thinking in solving a problem or creating some form of construction. What really stands out with top quality software of his type is how many different exercises and types challenges can be build into one program.

2.3.3.6 Simulation Learning

Simulation Learning is where you have a chance to examine a subject area, make a whole bunch of choices and then run the simulation, which will show you what happens as results of your choices. Based on what happens you try other things or change things and see what happens then (www.sjsu.edu)

In terms of Laurillard's model of learning simulations provide the opportunity for learners to operate at the level of actions; they are **interactive** media. Learners use skills rather than learning concepts as abstractions; they can put concepts into practice. If, instead of the user providing inputs, the inputs are built-in we would have a demonstration and the lack of interaction reduces the educational value.

2.3.4 Design of the Instructional Materials

Users can create multimedia material for education by using authoring systems. An authoring system is a software package that supports trainers and developers so that they can produce interactive multimedia courses efficiently. Multimedia Authoring tools provide the important framework you need for organizing and editing the elements of your multimedia project, including graphics, sounds, animations, and video clips. Authoring tools used for designing interactivity and the user interface, for presenting your project on screen, and for assembling multimedia elements into a single, cohesive project. With multimedia authoring software, you can make

- Video or movie productions
- Hypermedia Stack
- Web page or site
- Animations
- Demo disk and interactive guided tours
- Computer Presentations
- Interactive kiosk applications
- Interactive training
- Simulations, prototypes, and technical visualization.

The increased user-friendliness of multimedia development tools enables even the learners themselves to create their own instructional materials. Liz Hammond-Karreemaa, a college instructor at Malaspina College on Vancouver Island, has developed a multimedia package on killer whales, based on local wildlife resources, in such a way that learners can create their own reports from the materials she has assembled.

The basic tool set for building multimedia projects contains one or more authoring systems and various editing applications for text, images, sounds, and motion video. A few additional applications are also useful for capturing images from the screen, translating file formats, and moving files among computers when you are part of team- these are tools for the housekeeping tasks that make your creative and production life easier.

Essential components of authoring systems:

- Facilities that allow developers, who may not be computers experts, to enter the training content onto screens in an attractive way
- Support for linking screens of training material together into modules.
- Support for a range of question types so that the course designers can choose the most appropriate for a particular situation and provide variety for the student.
- Response analysis that takes the student's answers to questions, provides feedback, and makes branching decisions based on the student responses.

Other features that will usually be provides with differing levels of sophistication are multimedia support, recording of student and course details and support for the internet. Some authoring systems were design to be easily to use by people with limited computer skills. Others can support users with different levels of computer expertise by having, for example a programming or scripting language that the less technically skilled developing never need to see. The complete authoring system may be very comprehensive or quite simple you generally get what you pay for (Dean, 2002).

2.3.5 The Design Principles of the Graphical User Interface

Computer is becoming more important in the human life in the all areas. Computer interfaces must be user-friendly and understandable for the users. Interface is providing interaction between computer and user. These interfaces must be design suitable for widely users. It is argued that the user-interface to instructional multimedia is strategically important: if it is poorly designed students will not be intrinsically motivated to make use of the product or to learn with it. Interfaces that motivate learners are realistic, easy to use, challenging and engaging. Superior interfaces have some of the elements of a game: they provide the user with a functional model of task, content and processes; they encourage exploration and engagement; and they demonstrate cognizance of design considerations such as interactivity, functionality, learner control and cognition (Stoney & Wild, 1998).

Human Computer Interface or Interaction name gave to area of expertise studies of interface design in middle of 1980s' (Preece, 1994). There are two main design principle of the graphical user interface (Norman, 1999). These are Visibility and Affordance. *Visibility:* The user can to meet with the goal knowledge or frame in the best graphical user interface. *Affordance:* The user must know offered the control mechanism for achieve to the knowledge easily.

2.3.5.1 The Design of Graphical User Interface (GUI)

There are five processes for the design of GUI:

1- Product and content design

2- Institutional identity design

3- Information design

4- Interaction design

5- Presentation design

1- Product and Content Design

The contents of the product and the plans are prepared before the design of interface. The product design is very important, because the product design must satisfy learner demand.

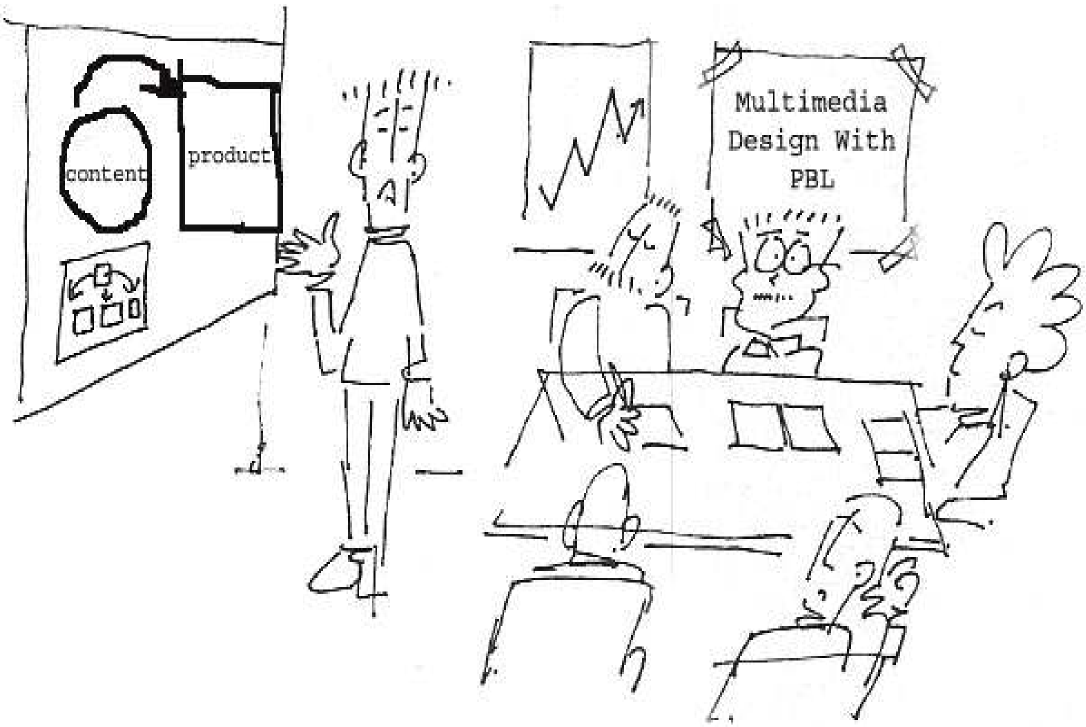

Figure 2.3: A Multimedia Team is working on a Project

2- Institutional Identity Design

There is institutional identity for each graphical user interface. This structure is providing integrity in the all pages of product. The user must understand characteristic features of product in first view.

3- Information Design

Decide to institutional identity, before the writing, interface appeared and sound.

4- Interaction Design

There are 10 basic principles for provide interaction design. (Apple 89):

Use of Metaphors

The functions must be simulating of real world on the screen. For instance, the user can understand delete icon when it is same as a recycle bin.

Direct Manipulation

The designer must be design interaction buttons. Interaction buttons helps the users to understand easily.

Visibility

The interaction design must be suitable to the principles (see, perception and press). The designer can give hints when user's pointer on the buttons.

Consistency

Everything must be in consistency on the interaction for the user have to concentrate.

Predictability

User can to find what premise previous pages. If users can't find their expectations, user will be disappointed.

User Control

The users to show presentation themselves control. They can change color setting. They can use start, pause options in their presentations.

Feedback and Dialog

The best multimedia gives hints to the users. For instance when user's pointer on the start button shows a comment line "Press for start".

Forgiveness and Natural Constraints

The designer can to take measure when user made an error. The user to warn by multimedia when occur an error.

Perceived stability

If the designer uses usual symbols in multimedia user can understand easily. For instance, the designer can be use ampoule symbol for help button.

Aesthetic integrity

The designer prepares the attractive multimedia for the user. Everything must be uses easily.

Fenrich (2005) explained interactivity is active learner participation in the learning process. This is essential for effective learning. Users can active interactivity in a number of ways:

- Learners can answer questions that require thinking.
- Students can be actively involved with a simulation or an educational game.
- The application can incorporate the learner's existing knowledge and experience.

- Students can make comments and annotations.
- Learners can modify the computer program.
- Students can discuss the content in pairs or groups of three.

Interactivity is not selecting menu items. This is really a navigation activity. Authoring and interactivity also characterize non-computer approaches to using multiple media, but computers provide a potential advantage in supporting a more decentralized, and in some ways richer environment for learning. Digital multimedia learning environments will not replace teachers, but we believe they have great potential for complementing classroom learning and *inquiry-based learning* where the learning process has driven by student initiative, and involves potentially more open-ended learning situations (Mack & Masullo, 1997).

5- Presentation Design

Interactive multimedia products and press media are differences. The differences are between interactive multimedia and press media; communication type, screen design, and background design.

2.3.6 Principles of Screen Design

2.3.6.1 Layout

Multimedia screens consist of several design elements, including text, pictures, icons, triggers, and buttons. The relationships among these elements on the screen called layout. When you create a multimedia screen, you should plan its layout so your content presented with good balance. Think of dividing the screen into regions, of which some will be pictorial, with others consisting of blocks of text. You must also think about how the user will interact with your screen and include the appropriate navigational buttons and hypertext links.

2.3.6.2 Font Selection

TrueType font technology enables you to place any font on the screen in any size and color you want. There are hundreds of different fonts available from vendors such as Adobe and Corel. However, be careful when you choose a font for a multimedia application you intend to publish. If the font you choose is not installed on the user's machine, you screen will not appear as intended.

2.3.6.3 Text Sizing

Text size measured in points, which tell how high the character is. TrueType fonts can be size to any standard point size. They can also be stretch and squeeze to create a wide variety of nonstandard sizes. In print media, a point is 1/72 inch. In multimedia, a point is about the height of a single pixel on a 640 x 480 computer screen. Due to different-sized monitors, the actual size of the text will vary somewhat depending on the physical height of the screen.

2.3.6.4 Placing Text on Photographic Backgrounds

Exercise care when placing text on photographic backgrounds. Some photos are so busy that text placed atop them is difficult to read. A drop shadow can improve the readability of text placed on photographic backgrounds.

2.3.6.5 Arranging Text and Pictures on the Screen

Although drop-shadowed text looks cool overlaid on pictures that are not too busy to detract from the readability of the text, you should not overuse text overlay. It is often better to position text above or below a picture, or to flow text around a picture, rather than overlay text on top of an image. Navigational icons normally work best when they appear lined up in the same region of the screen instead of being scattered about the screen. Try to position the icon in a logical order. For example, it is logical to place the page-back icon in the lower left corner of the screen, and page-forward in the lower right. Here is a suggested sequence of icons that gives the user the option to page back, quit, return to the menu, print the screen, or page forward:

Figure 2.4: Logically Navigations

2.3.6.6 User Friendliness

It is important that multimedia screens be easy to use. When you plan your layout and decide where you will place pictures and text on you screen, make sure you include navigational buttons, icons, or hypertext to clarify what the navigational options are and where the user should click to navigate. Because hypertext includes words, your hypertext can be self-documenting. For example, the phrases Return to the menu, next page, previous page, stop, print screen, and Quit can appear in hypertext which, when clicked, makes what they say happen. Iconic navigation is often more effective, takes up less screen space, and works had better with international audiences because the icons can understood regardless of what language the user speaks. For example, instead of the hypertext phrases, you can use icons like these:

Figure 2.5: User Friendly Navigations

Be consistent. If you adopt navigational icons, use them consistently through your application. If you use hypertext navigation, be consistent in how you word the directions.

2.3.6.7 Metaphors

In multimedia screen design, a metaphor is a way of thinking about new media in terms of something the user already knows. For example, when a multimedia application launches a series of images that the user will view sequentially, it may help to use the metaphor of a slide show. You might even use the icon of a slide projector to launch the slide show. In addition to providing buttons to move back and forth through the slides, you could carry the slide projector metaphor a bit further and make a left mouse click show the next slide, and a right click back up a slide, just like the remote control buttons on a 35mm slide projector.

2.3.6.8 Adopting a Common Look and Feel

Avoid the temptation to demonstrate every trick you know when you design a multimedia application. Keep it simple. Do not make every screen look and work a different way. Rather, adopt a common look and feel so the user will be able to navigate intuitively after getting used to how your screens work. It is frustrating to use an application that mixes metaphors and changes what icons mean on different screens. Be consistent. If users have to relearn how to use your application every time they run it, your design is not intuitive.

Successful designers develop the ability to think like a user and imagine them being a first-time user of the application. If you can learn to think like the user, look through the eyes of a novice at the screen you are designing, and imagine how the first-time user will interact with your application, you will become a good multimedia designer. Remember that most users are not as smart as you are. You cannot underestimate the skills of the average user. By definition of the term average, half of all users are below average. A successful design takes into account the needs of all potential users (Hofstetter, 2001).

2.3.7 Multimedia and Training Quality

One unexpected result of the multimedia revolution is the opportunity to improve the quality of training. Many training programs lacking in instructional design repurposed as multimedia distance learning programs because of the lure of cost savings in travel, space allocation, salaries, and time away from the job. As a result, there is an opportunity to make formerly wobbly classroom programs into something well designed that delivers the learning objectives. Recent studies, like one conducted by The Forum Corporation, indicate that there is plenty of room for improvement. Some 58 percent of the business leaders interviewed in a 1999 survey were dissatisfied with the overall effectiveness of training, and 57 percent did not feel they were getting a return on their training investment. In 1994, the American Association for Interactive Multimedia published a report that highlighted the following advantages of multimedia education:

- The assimilation rate is 65% higher than with traditional method.
- The training consistency is 50 to 60% better.
- The assimilation speed is 38 to 70% higher.
- The memorization of information is 25 to 50% higher.

Instructional designers are concerned about context, which is why they like to do need analyses. Nevertheless, their real work, like an architect, is in the building process: assessing, extracting, molding, refining, and repurposing the content for learning results. The needs analysis phase may take weeks, but the building phase typically takes months. Each activity, bulleted list, or case study is part of the overall program design and must advance its purpose. In a well-designed training program, nothing is accidental--just like a well-designed building. Everything that is true about the importance of instructional design in traditional training development is even more critical when multimedia is involved. Why? The multimedia training product must serve as both content and instructor (Troupin, 2000).

To increase the effectiveness of educational multimedia designs remember to:

- Make sure that each type of media used provides cues and clues for the other.
- Insure that the amount of information presented has not reached the capacity limit of your learners.
- Maintain relevancy between channels -- if your content is not relevant, i.e., doesn't reinforce the other channels, then learning will be decreased.
- Keep the "bells and whistles" to a minimum.
- Animation without narration has about the same effect as no instruction.
- With multimedia your instructional products can reach learners that prefer to read, listen, or use a hands on approach.
- Use the largest screen size possible.

Use multiple image presentations when:

- making comparisons
- developing interrelated concepts
- illustrating relationships
- showing spatial/dimensional traits (Foster, 1999).

Multiple representations it is better to present an explanation in words and pictures than solely in words. The first principle is simply that it is better to present an explanation using two modes of representation rather than one. For example, students who listened to a narration explaining how a bicycle tire pump works while also viewing a corresponding animation generated twice as many useful solutions to subsequent problem solving transfer questions than did students who listened to the same narration without viewing any animation (Mayer & Anderson, 1991, 1992). Similarly, students who read a text containing captioned illustrations placed near the corresponding words generated about 65% more useful solutions on a subsequent problem-solving transfer test than did students who simply read the text (Mayer, 1989; Mayer & Gallini, 1990). We call this result a multimedia effect. The multimedia effect is consistent with a cognitive theory of multimedia learning because students given multimedia explanations are able to build two different mental representations—a verbal model and a visual model--and build connections between them. Students had better understand an explanation when corresponding words and pictures presented at the same time than when they separated in time. Hede and Hede offer a model of the myriad factors that affect the potential for learning from multimedia figure 2.5 (Mayer & Anderson, 1991, 1992; Mayer & Sims, 1994). Words should be presented auditorily rather than visually. For example, students who viewed an animation depicting the formation of lightning while also listening to a corresponding narration generated approximately 50% more useful solutions on a subsequent problem-solving transfer test than did students who viewed the same animation with corresponding on-screen text consisting of the same words as the narration (Mayer & Moreno, 1995).

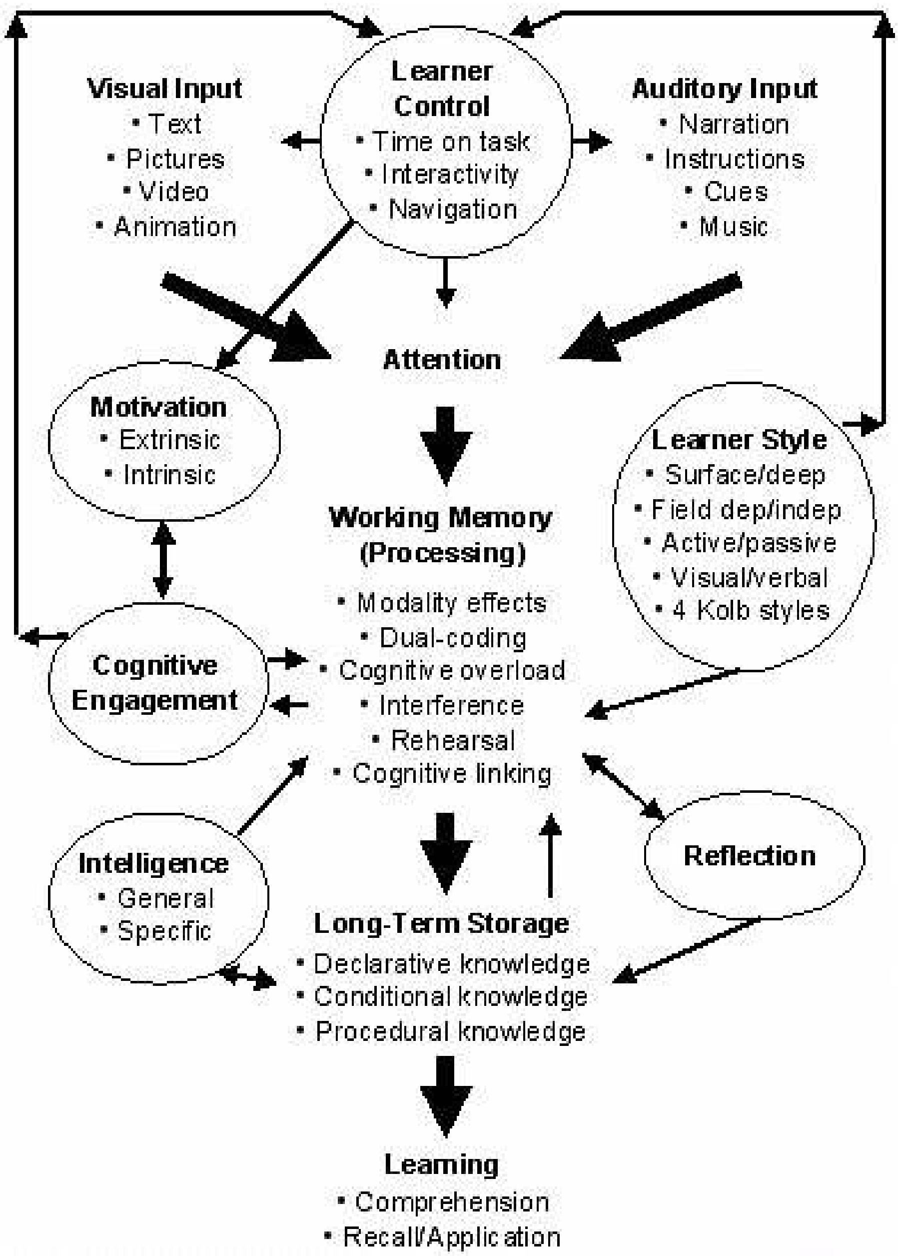

Figure 2.6: Hede and Hede's model of multimedia effects on learning (2002).

Schitai (1998) argued that developing effective educational courseware programs requires more than just using the operational capabilities of the computer. Applying the following three instructional design principles can help ensure that learning has indeed occurred:

1. Define and implement learning strategies to function as information processors that would help students understand, retain and apply the newly learned material.
2. Provide individualized feedback for typical mistakes that students make while learning the new material.

3. Determine media combinations and appropriate interactivity level to fit the target audience and the selected learning strategies.

CHAPTER 3

METHODOLOGY

This chapter describes the research model, study group, data collection instrument, and data analysis. Studies carried out under each heading described in detail.

3.1 Research Model

The study investigated whether teacher candidates conforms to the design principles of instructional materials and that if there are significant differences between teacher candidates' according to genders, number of products and branches. The research was conducted with in the frame of general survey model and questionnaires.

3.2 Study Group

This study was applied to a randomly selected sample of 202 teacher candidates (102 females and 100 males) who took the course "Instructional Technologies and Material Development" and created project at the beginning of the 1st term of 2006-2007 academic year from various departments of Near East University. The departments have included pedagogical courses. All the teacher candidates had created instructional materials as multimedia based products. These departments were "Teacher Certificate Program", "Computer Education and Instructional Technology", "Pre-School Teaching", "Teaching in Sport and Physical Education" and "English Language Teaching".

3.3 Data Collection Instruments and Application

In this study, in order to reach the aims in a scientific way, preparation of the questionnaire and application are described below.

The questionnaire consists two parts. First part was added to questionnaire by researcher. It includes four personal information questions about respondents. Researcher selected "Project Based Learning Checklist" and sub topics of checklist from http://pblchecklist.4teachers.org/. After these selections site has created checklist automatically. Created “Project Based Learning Checklist” was a checklist questionnaire consisting of the following dimensions: preparation process (7 item); organization (9 item); media use (10 item); navigation (9 item); appearance (16 item); resources (11 item). “Project Based Learning Checklist” transformed to a Likert-type questionnaire by the researcher. Two translators who were fluent in English and Turkish languages independently translated the original “Project Based Checklist” into Turkish. These translations were harmonized, and then checked by independent back-translation by another two translators who were fluent in the English and Turkish languages. After harmonization of the back-translation with the original in English, the Turkish translation was considered grammatically and semantically equivalent to the original version in English, and given to specialists who worked in the field of Instructional Technologies from NEU and EMU. After their suggestion, the Turkish version of the questionnaire pre-tested on 15 teacher candidates.

Researcher took a permit from the teacher of “Instructional Technologies and Material Development Course” and than explained the aim and rules of study to teacher candidates, later questionnaires were applied during the 2006-2007 first semester. The questionnaires were applied to only voluntary students. Although a total of 235 questionnaires copies were distributed, only 202 copies of the questionnaire duly returned. Turkish and English questionnaires can be seen in Appendix B.

3.4 Validity and Reliability

The Likert’s five-point questionnaire was used, where 5 indicates from always to 1, Never. The scale has total 62 positive expressions. Each question phrased so that “Always” represented a positive reaction to the design and development of effective instruction materials; for example, expression 1 was: I planned my time wisely to assure access to needed materials. Both subscale scores and total scale scores computed in the study. Means, standard deviations and correlation coefficients calculated for each six subscales and the total scores. Reliability obtained by the use of alpha coefficient. Cronbach’s alpha is the most commonly used for assessment of reliability because its convenience and efficiency. Assessing internal reliability is important in scales. It raises the question of whether scales are measuring a single idea; hence, whether the items that make up scale are internally consistent. (Population Services International, 2006) The reliability of a measure indicates the extent to which it is without bias and hence ensures consistent measurment across time and across the various items in the instrument. In other words, the reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept and helps to assess the "goodness" of a measure. (Sekaran, 2003)

The studies for all scale and its factors of reliability and means are presented in tables respectively.

Table 3.1 Correlations Between Subscales

	Number of Items	Mean	SD	Prepare	Organization	Media use	Navigation	Appearance	Resource Use	Total
Prepare Subscale	7	25,3	4,1	...	0,42	0,49	0,30	0,29	0,29	0,54
Organization Subscale	9	35,0	5,1	...	...	0,57	0,39	0,54	0,40	0,75
Mediause Subscale	10	34,9	7,3	...	...	...	0,46	0,52	0,42	0,75
Navigations Subscale	9	34,9	7,1	...	...	...	...	0,58	0,32	0,68
Appearance Subscale	16	64,8	10,0	...	...	...	...	...	0,38	0,80
Resource Use Subscale	11	42,6	7,1	...	...	...	...	...	...	0,64

The means, standard deviations of the subscale scores and the total score as well as the correlations among the subscale scores are indicated in Table 3.1. As seen in Table 3.1, the lowest mean was obtained on the Prepare subscale, and the highest mean was obtained on the Appearance subscale. Correlations among these subscales ranged between .29 and.58. According to Chin (1998), Cronbach's alpha of at least 0.70 is a recommended value for reliable construct. According to Sekaran (2003), The closer reliability coefficient gets to 1.0, the better. In general, reliabilities less than .60 are considered to be poor, those in the .70 range, acceptable, and those over .80 good. Reliabilities analyzed separately for each factor. The results indicate that the composite reliability value ranges from 0.15 to 0.62. The Cronbach's alpha for the entire questionnaire was 0,93. Thus, the internal consistency reliability of the measures used in this study can be considered to be better.

Table 3.2 Item-Total Statistics

		Sub-Scale Corrected Item-Total Correlation	All Scale Corrected Item-Total Correlation
Prepare Process	I planned my time wisely to assure access to needed materials.	0,39	0,47
	I made a timeline of when key components needed to be done.	0,35	0,28
	I made an outline or storyboard to organize my thoughts and ideas.	0,24	0,15
	I decided on a topic and several subtopics.	0,42	0,33
	I brainstormed questions that needed to be answered about the topic.	0,46	0,29
	I brainstormed details that would help support my ideas.	0,48	0,25
	I used feedback from others to refine my topic and questions.	0,18	0,31
Organization	I used an outline or storyboard to organize my ideas, information and thoughts.	0,39	0,43
	I organized my ideas in a meaningful and logical way.	0,40	0,40
	I gave a full explanation of my topic and subtopics.	0,39	0,36
	I clearly answered questions people might have about the topic.	0,31	0,42
	I included a meaningful title slide.	0,39	0,43
	I included an introduction or Table of Contents.	0,49	0,36
	I included details that made my presention more complete and/or more interesting.	0,49	0,38
	I included a conclusion.	0,47	0,36
	I included a Bibliography or Resources Used slide.	0,29	0,36
Media-Use	I used original art, animations or photographs.	0,50	0,47
	I used orginal music or sound effects.	0,54	0,43
	I used voice-overs.	0,56	0,42
	I used art, animations, or photographs made by others.	0,53	0,49
	I used music or sound effects made by others.	0,56	0,38
	I cited all resources I include that were made by others.	0,40	0,31
	I used media in accordance with copyright.	0,37	0,44
	I used media ethically and appropriately.	0,43	0,51
	My media helps the user understand my topic better.	0,42	0,56
	My media makes my presentation more interesting.	0,43	0,54

Navigation-Use	Users can easily find their way through my presentation.	0,69	0,43
	Users can easily backtrack or repeat parts of the presentation.	0,70	0,49
	Users can easily skip parts of the presentation.	0,70	0,48
	Navigation tools are easy to locate.	0,74	0,58
	Navigation tools are labeled when necessary.	0,62	0,55
	Navigation tools are located in a similar place on each slide.	0,62	0,51
	Navigation tools lead to logical destinations.	0,61	0,57
	Navigation tools work.	0,76	0,56
	User can always easily quit the presentation.	0,75	0,59
Appearance-Design	I balanced design aspects with content.	0,46	0,48
	I used only a few fonts.	0,31	0,31
	I used my fonts in a consistent manner.	0,46	0,46
	Titles and headings are easy to distinguish from other text.	0,55	0,52
	The words on my slides are easy to read.	0,69	0,55
	The words on my slides are spelled correctly.	0,62	0,47
	The text areas and graphic areas appear balanced.	0,68	0,55
	The graphics are easy to see.	0,77	0,62
	Graphics are clear and not pixilated.	0,72	0,54
	My background is not distracting.	0,67	0,54
	The colors on my slides look good together.	0,71	0,54
	The slides appear to go together; they make a cohesive whole.	0,69	0,55
	Sounds and music are easy to hear.	0,45	0,47
	Transitions are not distracting or boring.	0,09	0,19
	There is not too much time or too little time between slides.	0,61	0,55
	The slides look neat and use white space well.	0,70	0,62
Resource-Use	I used a variety of resources when collecting information.	0,51	0,79
	I consulted resources that showed different perspectives on the topic.	0,52	0,79
	I used electronic resources	0,46	0,79
	I used print resources.	0,53	0,78
	I used reference materials.	0,56	0,78
	I used documentaries or news interviews.	0,45	0,79
	I used interviews with people affected by the topic.	0,44	0,79
	I used portions of videos, films, or television shows to gather information.	0,39	0,80
	I used material in accordance with copyright.	0,46	0,79
	I used resources ethically and appropriately.	0,44	0,79
	I cited my resources.	0,50	0,79

The calculating for Prepare Process factor' of reliability and means are presented in table 3.2 respectively.

The results indicate that the composite reliability value ranges from 0.29 to 0.49. The Cronbach's alpha for the "Project Prepare" factor giving 0.72. Therefore, "Project Prepare Process" factor can be considered acceptable.

The results indicate that the composite reliability value ranges from 0.29 to 0.49. Calculated with item analyses Cronbach's Alpha coefficient of the "Project Organization Process" factor giving 0.72. Therefore, "Project Prepare Process" factor can be considered to acceptable.

The results indicate that the composite reliability value ranges from 0.37 to 0.56. Calculated with item analyses Cronbach's Alpha coefficient of the "Media Use Process" factor giving 0.80. Therefore, "Media Use" factor can be considered good.

The results indicate that the composite reliability value ranges from 0.61 to 0.76. Calculated with item analyses Cronbach's Alpha coefficient of the "Navigational Tools" factor giving 0.91. Therefore, "Navigational Tools" factor can be considered bettering.

The results indicate that the composite reliability value ranges from 0.09 to 0.77. Calculated with item analyses Cronbach's Alpha coefficient of the "Appearance" factor giving 0.89. Therefore, "Appearance" factor can be considered to be good.

The results indicate that the composite reliability value ranges from 0.37 to 0.50. Calculated with item analyses Cronbach's Alpha coefficient of the "Resource Use Process" factor giving 0.79. Therefore, "Appearance" factor can be considered to acceptable.

3.5 Analysis of Data

Collected data was analyzed with SPSS 13 The results obtained in the research analyzing, described, and later interpreted by creating tables using appropriate statistical techniques in the direction of the suggestions of statistical experts.

Frequency (f) percentage (%), T-test, Anova, One-way Anova, Tukey, LSD test, mean ($\overline{X}$), standard error (s), min and max values were used for analyzed to collected data. Responses based on likert-type scale values given in table 3.3 In order to check whether or not there was a real difference in the evaluation of teacher candidates.

Tablo 3.3 Interval values of PBL and Instructional Material Production Applications

1.00	*1.79*	*Never*
1.80	2.59	Rarely
2.60	3.39	Occasionally
3.40	4.19	Mostly
4.20	5.00	Always

CHAPTER 4

RESULTS

In this chapter, the results obtained are discussed in the view of the fundamental aims of the research.

4.1 Descriptive Information of Teacher Candidates

In this section, statistical descriptive information of teacher candidates is given briefly.

1 Personal Findings According to Teacher Candidates' Gender

The frequencies of teacher candidates' genders calculated as shown in table 4.1.

Table 4.1: Frequencies of teacher candidates' gender

Gender	Frequency	Valid Percent
Female	102	50,5
Male	100	49,5
Total	202	100,0

Teacher candidates characteristics of the sample surveyed include following: %50,50 (f=102) female, %49,50 male. This result indicates that numbers of teacher candidates are almost equal according to genders.

2 Personal Findings According to Teacher Candidates' Branches

The frequencies of teacher candidates' branches are shown in table 4.2.

Table 4.2: Distribution of Respondents by Branches

Branch	Frequency	%
Teacher Certificate Program	39	19,3
Computer Education and Instructional Technology	48	23,8
Pre-School Teaching	38	18,8
Teaching in Sport and Physical Education	38	18,8
English Language Teaching	39	19,3
Total	202	100,0

The participants were teacher candidates who enrolled “Instructional Technologies and Materials Development” courses from variety departments of Near East University. Results indicate that participants were 19,30% from Teacher Certificate Program, %23,80 from Computer Education and Instructional Technology, %18,80 from Pre-School Teaching, %18,8 from Teaching in Sport and Physical Education, and %19,30 from English Language Teaching. These results indicate that ratios of teacher candidates are almost equal according to branches.

4.1.3 Personal Finding According to Teacher Candidates’ Number of Designed Material

The frequencies of teacher candidates’ created project are shown in table 4.3

Table 4.3: Distribution of Respondents by Project Numbers

	Frequency	Valid Percent
1 time	10	5,0
2 times	25	12,4
3 or more times	167	82,7
Total	202	100,0

Approximately 82.70% of the sample had created an instructional multimedia material for three or more, with 12.4% had created instructional multimedia materials for two (see table 4.3). Only 5% had created instructional multimedia material one time.

4.2 The Experiences of Teacher Candidates in Creating Instructional Multimedia Materials in PBL

In this part, the results obtained are discussed into view of the "teacher candidates' adequate, knowledge, skills, and experience on creating instructional multimedia materials".

Insufficiency

4.2.1 The Experiences of Teacher Candidates of Preparation Operations of Creating Instructional Multimedia Materials in PBL

The mean scores and standard deviations for teacher candidates' responses to the seven statements in the Preparation Operations experience sub-scale has been shown in table 4.4.

Table 4.4: "Sub- scale" of Teacher Candidates Experiences on the Preparation Operations of Creating Instructional Multimedia Materials in PBL

Prepare Operations	N	Minimum	Maximum	Mean $\overline{X}$	Std. Deviation
I planned my time wisely to assure access to needed materials.	202	2,00	5,00	3,96	0,79
I decided on a topic and several subtopics.	202	1,00	5,00	3,87	1,00
I used feedback from others to refine my topic and questions.	202	1,00	5,00	3,78	0,95
I brainstormed questions that needed to be answered about the topic.	202	1,00	5,00	3,63	1,06
I brainstormed details that would help support my ideas.	202	1,00	5,00	3,60	0,99
I made a timeline of when key components needed to be done.	202	1,00	5,00	3,41	1,05
I made an outline or storyboard to organize my thoughts and ideas.	202	1,00	5,00	3,07	1,33
Prepare Operations General	**202**	**15,00**	**34**	**25,35**	**4,11**

Table 4.4 shows teacher candidates' experience scores according to preparation Operations of Creating Instructional multimedia materials in PBL.

Teacher candidates explained that mostly: “I planned my time wisely to assure access to needed materials.” ($\overline{X}$=3,96), “I decided on a topic and several subtopics.” ($\overline{X}$=3,87) ,“I used feedback from others to refine my topic and questions.” ($\overline{X}$=3,78), “I brainstormed questions that needed to be answered about the topic” ($\overline{X}$=3,63), “I brainstormed details that would help support my ideas.” ($\overline{X}$=3,60) “I made a timeline of when key components needed to be done.” ($\overline{X}$=3,41)

Teacher candidates explained that occasionally: “I made an outline or storyboard to organize my thoughts and ideas.” ($\overline{X}$=3,07).

Prepare Operation General- Table 4.4 shows teacher candidates’ experience mean $\overline{X}$=25,35 according to preparation Operations of Creating Instructional multimedia materials in PBL. These results indicate that teacher candidates mostly conform to preparation Operations.

Figure 4.1 shows teacher candidates' conform level of preparation operations.

Figure 4.1: Teacher Candidates’ Conform Level of Preparation Operations

Insufficiency

7,00 12,60 18,20 23,80 29,40 35,00

Never Rarely Occasionally Mostly Always

Insufficiency

4.2.2 The Experiences of Teacher Candidates on Organization Operations of Creating Instructional Multimedia Materials in PBL

The mean scores and standard deviations for teacher candidates’ responses to the nine statements on the Organization operations sub-scale are shown in table 4.5.

Table 4.5: "Sub- scale" of Teacher Candidates Experiences on the Organization Operations of Creating Instructional multimedia materials in PBL

Organization	**N**	**Minimum**	**Maximum**	**Mean** $\overline{X}$	**Std. Deviation**

I included a meaningful title slide.	202	1,00	5,00	4,16	1,01
I organized my ideas in a meaningful and logical way.	202	1,00	5,00	4,12	0,80
I clearly answered questions people might have about the topic.	202	1,00	5,00	4,05	0,84
I included details that made my presentation more complete and/or more interesting.	202	1,00	5,00	3,99	0,90
I used an outline or storyboard to organize my ideas, information and thoughts.	202	1,00	5,00	3,94	0,93
I gave a full explanation of my topic and subtopics.	202	1,00	5,00	3,94	0,97
I included an introduction or table of contents.	202	1,00	5,00	3,86	1,17
I included a conclusion.	202	1,00	5,00	3,76	1,15
I included a bibliography or resources used slide.	202	1,00	5,00	3,17	1,31
Organization Operations General	**202**	**17,00**	**45,00**	**35,04**	**5,17**

Table 4.5 shows teacher candidates' experience scores according to Organization Operations of Creating Instructional multimedia materials in PBL.

Teacher candidates explained that mostly: "I included a meaningful title slide." ($\overline{X}$=4,16), "I organized my ideas in a meaningful and logical way." ($\overline{X}$=4,12), "I clearly answered questions people might have about the topic." ($\overline{X}$=4,05) "I included details that made my presentation more complete and/or more interesting." ($\overline{X}$=3,99) "I used an outline or storyboard to organize my ideas, information and thoughts." ($\overline{X}$=3,94) "I gave a full explanation of my topic and subtopics." ($\overline{X}$=3,94) "I included an introduction or table of contents." ($\overline{X}$=3,86) "I included a conclusion" ($\overline{X}$=3,76)

Teacher candidates explained that occasionally conform: "I included a bibliography or resources used slide." ($\overline{X}$=3,17).

Organization Operations General – Table 4.5 shows teacher candidates' experience mean $\overline{X}$=35,04 according to Organization Operations of Creating Instructional multimedia materials in PBL. These results indicate that teacher candidates mostly conform to Organization operations.

Figure 4.2 shows teacher candidates' conform level of organization operations

Figure 4.2: Teacher Candidates’ Conform Level of Organization Operations

Insufficiency

9,00 16,20 23,40 30,60 0 37,80 45,00

Never Rarely Occasionally Mostly Always

4.2.3 The Experiences of Teacher Candidates on Media-Use Operation of Creating Instructional Multimedia Materials

The mean scores and standard deviations for teacher candidates’ responses to the 10 statements on the Media-use operations sub-scale shown in table 4.6.

Table 4.6: "Sub- scale" of Teacher Candidates Experiences on the Media-Use Operations of Creating Instructional multimedia materials in PBL

Media Use	N	Minimum	Maximum	Mean $\overline{X}$	Std. Deviation
My media helps the user understand my topic better.	202	1,00	5,00	4,22	0,91
I used media ethically and appropriately.	202	1,00	5,00	4,21	1,04
My media makes my presentation more interesting.	202	1,00	5,00	4,08	1,02
I used original art, animations or photographs.	202	1,00	5,00	3,85	1,15
I cited all resources I include that were made by others.	202	1,00	5,40	3,64	1,34

I used media in accordance with copyright.	202	1,00	5,00	3,59	1,30
I used art, animations, or photographs made by others.	202	1,00	5,00	3,19	1,31
I used original music or sound effects.	202	1,00	5,00	2,76	1,31
I used music or sound effects made by others.	202	1,00	5,00	2,69	1,42
I used voice-overs.	202	1,00	5,00	2,65	1,31
Media – Use General	**202**	**10,00**	**50,00**	**34,92**	**7,36**

Table 4.6 shows teacher candidates' experience scores according to Media – use Operations of Creating Instructional multimedia materials in PBL.

Teacher candidates explained that always: "My media helps the user understand my topic better." ($\bar{X}$=4,22) and "I used media ethically and appropriately." ($\bar{X}$=4,21).

Teacher candidates explained that mostly: "My media makes my presentation more interesting." ($\bar{X}$=4,08), "I used original art, animations or photographs."($\bar{X}$=3,85) "I cited all resources I include that were made by others." ($\bar{X}$=3,64) "I used media in accordance with copyright." ($\bar{X}$=3,59).

Teacher candidates explained that occasionally conform: "I used art, animations, or photographs made by others." ($\bar{X}$=3,19), "I used original music or sound effects." ($\bar{X}$=2,76), "I used music or sound effects made by others."($\bar{X}$=2,69), "I used voice-overs." ($\bar{X}$=2,65).

Media-Use General – Table 4.6 shows teacher candidates' experience mean $\bar{X}$=34,92 according to Media - Use Operations of Creating Instructional multimedia materials in PBL. These results indicate that teacher candidates mostly conform to Media-Use operations.

Figure 4.3 shows teacher candidates' conform level of media - use operations.

Insufficiency

Figure 4.3: Teacher Candidates' Conform Level of Media- Use Operations

10,00 18,00 26,00 34,00 42,00 50,00
0

Never Rarely Occasionally Mostly Always

4.2.4 The Experiences of Teacher Candidates on Navigation – Use Operation of Created Instructional Multimedia Materials

The mean scores and standard deviations for teacher candidates' responses to the nine statements on the Navigation-use operations sub-scale are shown in table 4.7.

Table 4.7: "Sub- scale" of Teacher Candidates Experiences on the Navigation-Use Operations of Creating Instructional multimedia materials in PBL

Navigation	N	Minimum	Maximum	Mean $\overline{X}$	Std. Deviation
Users can easily find their way through my presentation.	202	1,00	5,00	4,04	1,01
Users can easily backtrack or repeat parts of the presentation.	202	1,00	5,00	4,04	0,98
User can always easily quit the presentation.	202	1,00	5,00	4,01	1,07
Users can easily skip parts of the presentation.	202	1,00	5,00	3,95	1,03
Navigation tools are easy to locate.	202	1,00	5,00	3,88	0,88
Navigation tools lead to logical destinations.	202	1,00	5,00	3,85	0,98
Navigation tools work.	202	1,00	5,00	3,79	1,03

Navigation tools are labeled when necessary.	202	1,00	5,00	3,74	1,04
Navigation tools are located in a similar place on each slide.	202	1,00	5,00	3,62	1,14
Navigation Tools General	**202**	**9,00**	**45**	**34,96**	**7,10**

Table 4.7 shows teacher candidates' experience scores according to Navigation - use Operations of Creating Instructional multimedia materials in PBL.

Teacher candidates explained that mostly: "Users can easily find their way through my presentation." ($\overline{X}$=4,04), "Users can easily backtrack or repeat parts of the presentation." ($\overline{X}$=4,04), "User can always easily quit the presentation." ($\overline{X}$=4,01), "Users can easily skip parts of the presentation." ($\overline{X}$=3,95), "Navigation tools are easy to locate." ($\overline{X}$=3,88) "Navigation tools lead to logical destinations."($\overline{X}$=3,85), "Navigation tools work." ($\overline{X}$=3,79), "Navigation tools are labeled when necessary." ($\overline{X}$=3,74) "Navigation tools are located in a similar place on each slide." ($\overline{X}$=3,62)

Navigation Tools General – Table 4.7 shows teacher candidates' experience mean $\overline{X}$=34,96 according to Navigation - Use Operations of Creating Instructional multimedia materials in PBL. This result indicates that teacher candidates mostly conform to Navigation –use operations.

Figure 4.4 shows teacher candidates' conform level of navigation - use operations.

Insufficiency

9,00 16,20 23,40 30,600 37,80 45,00

Never Rarely Occasionally Mostly Always

Figure 4.4: Teacher Candidates' Conform Level of Navigation- Use Operations

4.2.5 The Experiences of Teacher Candidates on Appearance Design Operations of Created Instructional Multimedia Materials

The mean scores and standard deviations for teacher candidates' responses to the 16 statements on the Appearance design operations sub-scale shown in table 4.8.

Table 4.8: "Sub- scale" of Teacher Candidates Experiences on the Appearance Design Operations of Creating Instructional multimedia materials in PBL

Appearance	N	Minimum	Maximum	Mean $\overline{X}$	Std. Deviation
Titles and headings are easy to distinguish from other text.	202	1,00	5,00	4,29	0,87
The words on my slides are easy to read.	202	1,00	5,00	4,28	1,00
Graphics are clear and not pixilated.	202	1,00	5,00	4,27	0,90
The graphics are easy to see.	202	1,00	5,00	4,23	0,94
The slides appear to go together; they make a cohesive whole.	202	1,00	5,00	4,20	0,96
The words on my slides are spelled correctly.	202	1,00	5,00	4,19	0,97
The text areas and graphic areas appear balanced.	202	1,00	5,00	4,19	0,92
The colors on my slides look good together.	202	1,00	5,00	4,17	0,98
My background is not distracting.	202	1,00	5,00	4,17	0,97
The slides look neat and use white space well.	202	1,00	5,00	4,08	1,02

I balanced design aspects with content.	202	1,00	5,00	4,06	0,90
I used my fonts in a consistent manner.	202	1,00	5,00	4,01	0,95
There is not too much time or too little time between slides.	202	1,00	5,00	4,00	0,96
Sounds and music are easy to hear.	202	1,00	5,00	3,77	1,23
I used only a few fonts.	202	1,00	5,00	3,71	1,01
Transitions are not distracting or boring.	202	1,00	5,00	3,09	1,37
Appearance General	202	16,00	80	64,80	10,07

Table 4.8 shows teacher candidates' experience scores according to Appearance Design Operations of Creating Instructional multimedia materials in PBL.

Teacher candidates explained that always: "Titles and headings are easy to distinguish from other text." ($\overline{X}$=4,29), "The words on my slides are easy to read."($\overline{X}$=4,28), "Graphics are clear and not pixilated."($\overline{X}$=4,27), "The graphics are easy to see." ($\overline{X}$=4,23), "The slides appear to go together; they make a cohesive whole." ($\overline{X}$=4,20).

Teacher candidates explained that mostly: "The words on my slides are spelled correctly." ($\overline{X}$=4,19), "The text areas and graphic areas appear balanced." ($\overline{X}$=4,19), "The colors on my slides look good together."($\overline{X}$=4,17), "My background is not distracting." ($\overline{X}$=4,17) "The slides look neat and use white space well." ($\overline{X}$=4,08), "I balanced design aspects with content." ($\overline{X}$=4,06) "I used my fonts in a consistent manner." ($\overline{X}$=4,01) "There is not too much time or too little time between slides." ($\overline{X}$=4,00) "Sounds and music are easy to hear."($\overline{X}$=3,77), "I used only a few fonts." ($\overline{X}$=3,71).

The means of operations, which teacher candidates occasionally conform: "Transitions are not distracting or boring." ($\overline{X}$=3,09)

Appearance General - Table 4.8 shows teacher candidates' experience mean $\overline{X}$=64,80 according to appearance design operations of creating instructional multimedia materials in PBL. These results indicate that teacher candidates mostly conform to appearance design operations.

Figure 4.5 shows teacher candidates' conform level of appearance design operations.

Insufficiency

Figure 4.5: Teacher Candidates' Conform Level of Appearance Design Operations

16,00 28,80 41,60 54,40 67,20 80,00

Never Rarely Occasionally Mostly Always

4.2.6 The Experiences of Teacher Candidates on Resources – Use Operation of Created Instructional Multimedia Materials

The mean scores and standard deviations for teacher candidates' responses to the 11 statements on the Resource-use operations sub-scale are shown in table 4.9.

Table 4.9: "Sub- scale" of Teacher Candidates Experiences on the Resource-Use Operations of Creating Instructional multimedia materials in PBL

Resources	N	Minimum	Maximum	Mean	Std. Deviation
I used a variety of resources when collecting information.	202	1,00	5,00	4,52	0,78
I used electronic resources (Internet, CD-ROMs).	202	1,00	5,00	4,38	0,84
I used resources ethically and appropriately.	202	1,00	5,00	4,26	1,00
I consulted resources that showed different perspectives on the topic.	202	1,00	5,00	4,19	0,90
I used print resources (books, magazines, textbooks, newspapers).	202	1,00	5,00	4,11	1,03
I cited my resources.	202	1,00	5,00	4,05	1,14
I used material in accordance with copyright.	202	1,00	5,00	3,80	1,26
I used reference materials (encyclopedia, dictionaries, thesaurus, atlas, etc.)	202	1,00	5,00	3,78	1,25
I used documentaries or news interviews.	202	1,00	5,00	3,29	1,30

I used portions of videos, films, or television shows to gather information.	202	1,00	5,00	3,11	1,38
I used interviews with people affected by the topic.	202	1,00	5,00	3,08	1,29
Resource use general	**202**	**11,00**	**55,00**	**42,63**	**7,12**

Table 4.9 shows teacher candidates' experience scores according to Resource-Use Operations of Creating Instructional multimedia materials in PBL.

Teacher candidates explained that always: "I used a variety of resources when collecting information."($\overline{X}$=4,52), "I used electronic resources (Internet, CD-ROMs)." ($\overline{X}$=4,38) "I used resources ethically and appropriately." ($\overline{X}$=4,26).

Teacher candidates explained that mostly: "I consulted resources that showed different perspectives on the topic." ($\overline{X}$=4,19) ,"I used print resources (books, magazines, textbooks, newspapers)." ($\overline{X}$=4,11), "I cited my resources." ($\overline{X}$=4,05), "I used material in accordance with copyright." ($\overline{X}$=3,80), "I used reference materials (encyclopedia, dictionaries, thesaurus, atlas, etc.)" ($\overline{X}$=3,78) ".

Teacher candidates explained that occasionally conform: "I used documentaries or news interviews."($\overline{X}$=3,29), "I used portions of videos, films, or television shows to gather information." ($\overline{X}$=3,11), "I used interviews with people affected by the topic." ($\overline{X}$=3,08)

Resource Use General- Table 4.9 shows teacher candidates' experience mean $\overline{X}$=42,63 according to Resource-use Operations of Creating Instructional multimedia materials in PBL. These results indicate that teacher candidates mostly conform to resource-use operations.

Figure 4.6 shows teacher candidates' conform level of Resource-use operations.

Insufficiency

Figure 4.6: Teacher Candidates' Conform Level of Resource-Use Operations

11,00 19,80 28,60 37,40 46,20 55,00

Never Rarely Occasionally Mostly Always

4.3 The Results of Evaluations According to Genders

A t-test was performed to find out whether or not there was a significant statistical difference between the genders for the evaluations of "Creating of Instructional multimedia materials in PBL" The results of evaluations according to gender are shown in Table 4.10

Table 4.10: The T-test Results of Evaluations of "Creating of Instructional multimedia materials" According to Gender

	Gender	N	Mean	Std. Deviation	Std. Error Mean	T	P	Explanation
Prepare	FEMALE	102	25,8529	4,22017	0,41786	1,760	0,080	p>.05
	MALE	100	24,8400	3,95101	0,39510			
Organization	FEMALE	102	35,5686	4,56311	0,45182	1,458	0,146	p>.05
	MALE	100	34,5100	5,70574	0,57057			
Media-use	FEMALE	102	35,3176	6,54994	0,64854	0,759	0,449	p>.05
	MALE	100	34,5300	8,12958	0,81296			
Navigations	FEMALE	102	35,3235	7,04605	0,69766	0,723	0,470	p>.05
	MALE	100	34,6000	7,17318	0,71732			
Appearance	FEMALE	102	66,6471	8,41927	0,83363	2,668	0,008	p<.05
	MALE	100	62,9200	11,25524	1,12552			
Resource-use	FEMALE	102	43,5098	6,51692	0,64527	1,765	0,079	p>.05
	MALE	100	41,7500	7,62290	0,76229			

* The mean difference is significant at the .05 level.

Preparation Operations: The results showed that, means are similar for preparation operations according to gender (male: $\overline{X}$=24,84, S=3,95, female: $\overline{X}$=25,85, S=4,22). There is no significant difference between the performance of male and female teacher candidates ($t=1{,}760$, $p>0.05$). Males and females tended to have the same amount of preparation experience.

Organization Operations: The results showed that, means are similar for Organization operations according to gender (male: $\bar{X}=34{,}51$, $S=5{,}70$, female: $\bar{X}=35{,}56$, $S=4{,}56$). There is no significant difference between the performance of male and female teacher candidates ($t=1{,}458$, $p>0.05$).

Media-Use Operations: The results showed that, means are similar for media-use operations according to gender (male: $\bar{X}=34{,}53$, $S=8{,}12$, female: $\bar{X}=35{,}31$, $S=6{,}54$). There is no significant difference between the performance of male and female teacher candidates ($t=0{,}759$, $p>0.05$).

Navigation –Use Operations: The results showed that, means are similar for navigation-use operations according to gender (male: $\bar{X}=34{,}60$, $S=7{,}17$, female: $\bar{X}=35{,}32$, $S=7{,}04$). There is no significant difference between the performance of male and female teacher candidates ($t=0{,}723$, $p>0.05$).

Appearance Design: The appearance design ability on project based learning is significantly different between male and female respondents (male: $\bar{X}=62{,}92$, $S=11{,}25$, female: $\bar{X}=66{,}64$, $S=8{,}41$), indicating that female respondents were better in appearance design of instructional multimedia materials, as compared to the male respondents ($t=2{,}668$, $p<0.05$).

Resource-use Operations: The results showed that, means are similar for Resource-use operations according to gender (male: $\bar{X}=41{,}75$, $S=7{,}62$, female: $\bar{X}=43{,}50$, $S=7{,}62$). There is no significant difference between the performance of male and female teacher candidates ($t=1{,}760$, $p>0.05$). Tsai's (2005) research findings have supported that there is no significant difference between the use of various resources of male and female students.

4.4 The Results of Evaluations According to Teacher Candidates' Branches

One-way analysis of covariance was (ANOVA) used to find out whether or not there was a significant relationship between the branches and results of evaluations in each branch.

4.4.1 Differences between the Teacher Candidates' Experiences of Preparation Operations According to Branches

Table 4.11 gives the data for the preparation operations of the teacher candidates.

Table 4.11: Teacher Candidates results of preparation operations according to Branches

		N	Mean	Std. Deviation	F	P	Exp.
Prepare	Teacher Certificate Program	39	25,641	3,876	3,76	0,006	p<.05
	Computer Education and Instructional Technology	48	25,104	3,666			
	Pre-School Teaching	38	25,474	4,566			
	Teaching in Sport and Physical Education	38	24,000	4,165			
	English Language Teaching	39	27,231	3,766			
	Total	202	25,351	4,110			

* The mean difference is significant at the .05 level.

Compared using post hoc analysis (Tukey's Honestly Significant Difference, HSD) to determine exactly which groups were different. Means for branches: Teacher Certificate Program $\overline{X}$= 25,64, "Computer Education and Instructional Technology $\overline{X}$= 25,10, Pre-School Teaching $\overline{X}$= 25,47, Teaching in Sport and Physical Education $\overline{X}$= 24,00 and English Language Teaching $\overline{X}$= 27,23.

The results showed that "Teaching in Sport and Physical Education" students are significantly lower on preparation operations than "English Language Teaching" students (f=3,760, p<.05).

4.4.2 Differences between the Teacher Candidates' Experiences of Organization Operations According to Branches

Table 4.12 gives the data for the organization operations of the teacher candidates.

Table 4.12: Teacher Candidates Results of Organization Operations According to Branches

		N	Mean	S.D	F	P	Exp.
Organization	Teacher Certificate Program	39	36,256	4,309	2,627	0,036	p>.05
	Computer Education and Instructional Technology	48	35,479	4,652			
	Pre-School Teaching	38	34,842	4,734			
	Teaching in Sport and Physical Education	38	33,158	6,524			
	English Language Teaching	39	36,385	5,087			
	Total	202	35,045	5,175			

* The mean difference is significant at the .05 level.

There was no significant difference between branches means of teacher candidates on organization operations. Teacher Certificate Program $\overline{X}$= 36,25, Computer Education and Instructional Technology $\overline{X}$= 35,47, Pre-School Teaching $\overline{X}$= 34,84, Teaching in Sport and Physical Education $\overline{X}$= 33,15 and English Language Teaching $\overline{X}$= 36,38. (f=2,627, p>.05). One can say that all branches of teacher candidates have similar experiences of organization operations.

4.4.3 Differences between the Teacher Candidates' Experiences of Media- use Operations According to Branches

Table 4.13 gives the data for the media-use operations of the teacher candidates.

Table 4.13: Teacher Candidates Results of Media-Use Operations According to Branches

		N	Mean	Std. Deviation	F	P	Exp.
Media-use	Teacher Certificate Program	39	34,154	5,927	4,589	0,01	p<.05
	Computer Education and Instructional Technology	48	37,875	6,950			
	Pre-School Teaching	38	35,168	7,208			
	Teaching in Sport and Physical Education	38	31,816	8,776			
	English Language Teaching	39	36,795	7,087			
	Total	202	34,928	7,366			

* The mean difference is significant at the .05 level.

Compared using post hoc analysis (Tukey's Honestly Significant Difference, HSD) to determine exactly which groups were different. Teacher Certificate Program $\overline{X}$= 35,15, Computer Education and Instructional Technology $\overline{X}$= 37,87, Pre-School Teaching $\overline{X}$= 35,16, Teaching in Sport and Physical Education $\overline{X}$= 31,81 and English Language Teaching $\overline{X}$= 36,79.

The results showed that Teaching in Sport and Physical Education students are significantly lower on media-use operations than Computer Education and Instructional Technology students and English Language Teaching students (f=4,589, p<.05).

4.4.4 Differences between the Teacher Candidates' Experiences of Navigation-use Operations According to Branches

Table 4.14 gives the data for the Navigation-use operations of the teacher candidates.

Table 4.14: Teacher Candidates Results of Navigation-Use Operations According to Branches

		N	Mean	Std. Deviation	F	P	Exp.
Navigations	Teacher Certificate Program	39	36,538	5,808	1,269	0,284	p>.05
	Computer Education and Instructional Technology	48	36,645	5,146			
	Pre-School Teaching	38	34,500	9,517			
	Teaching in Sport and Physical Education	38	33,447	8,255			
	English Language Teaching	39	34,205	5,292			
	Total	202	34,965	7,101			

* The mean difference is significant at the .05 level.

There was no significant difference between branches means of teacher candidates on Navigation tools -use operations. Teacher Certificate Program $\overline{X}$= 36,53, Computer Education and Instructional Technology $\overline{X}$= 36,64, Pre-School Teaching $\overline{X}$= 34,54, "Teaching in Sport and Physical Education $\overline{X}$= 33,44 and English Language Teaching $\overline{X}$= 34,20 (f=1,269, p>.05). One can say that all branches of teacher candidates have similar experiences of navigation tools -use operations.

4.4.5 Differences between the Teacher Candidates' Experiences of Appearance Design Operations According to Branches

Table 4.15 gives the data for the Appearance Design operations of the teacher candidates.

Table 4.15: Teacher Candidates Results of Appearance Design Operations According to Branches

		N	Mean	Std. Deviation	F	P	Exp.
Appearance	Teacher Certificate Program	39	68,385	7,642	5,354	0,000	p<.05
	Computer Education and Instructional Technology	48	68,910	7,067			
	Pre-School Teaching	38	66,921	8,461			
	Teaching in Sport and Physical Education	38	60,895	14,195			
	English Language Teaching	39	63,026	9,767			
	Total	202	64,802	10,075			

* The mean difference is significant at the .05 level.

Compared using post hoc analysis (Tukey's Honestly Significant Difference, HSD) to determine exactly which groups were different. Means for branches: Teacher Certificate Program $\overline{X}$= 68,38, Computer Education and Instructional Technology $\overline{X}$= 68,91, Pre-School Teaching $\overline{X}$= 66,92, Teaching in Sport and Physical Education $\overline{X}$= 60,89 and English Language Teaching $\overline{X}$= 63,02.

The results showed that Computer Education and Instructional Technology are significantly highest on appearance design operations than English Language Teaching students and Teaching in Sport and Physical Education students. Moreover, Teacher Certificate Program students highest on appearance design operations than Teaching in Sport and Physical Education students (f=5,354, p<.05).

4.4.6 Differences between the Teacher Candidates' Experiences of Resource-Use Operations According to Branches

Table 4.16 gives the data for the Resource-use operations of the teacher candidates.

Table 4.16: Teacher Candidates Results of Resource-Use Operations According to Branches

		N	Mean	Std. Deviation	F	P	Exp.
Resource -use	Teacher Certificate Program	39	42,641	6,243	,790	0,533	p>.05
	Computer Education and Instructional Technology	48	42,270	8,118			
	Pre-School Teaching	38	42,211	6,675			
	Teaching in Sport and Physical Education	38	42,789	6,679			
	English Language Teaching	39	44,590	7,390			
	Total	202	42,639	7,123			

* The mean difference is significant at the .05 level.

There was no significant difference between branches means of teacher candidates on Navigation tools -use operations. Teacher Certificate Program $\overline{X}$= 42,64, Computer Education and Instructional Technology $\overline{X}$= 42,27, Pre-School Teaching $\overline{X}$= 42,21, Teaching in Sport and Physical Education $\overline{X}$= 42,78 and English Language Teaching $\overline{X}$= 44,59. One can say that all branches of teacher candidates have similar experiences of Resource -use operations (f=,790, p>.05).

4.5 The Results of Evaluations According to Teacher Candidates' Project Number

One-way analysis of covariance was (ANOVA) used to find out whether or not there was a significant relationship between the branches and results of evaluations in each group.

4.5.1 Differences between the Teacher Candidates' Experiences of Preparation Operations According To Their Project Number

Table 4.17 gives the data for the Preparation operations of the teacher candidates according to their project number.

Table 4.17: Teacher Candidates results of preparation operations according to their project number

	Number of project	N	Mean	Std. Deviation	F	P	Exp.
Prepare	1 time	10	23,400	5,562	2,688	0,070	p>.05
	2 times	25	24,400	4,193			
	3 or more times	167	25,766	3,871			
	Total	202	25,480	4,036			

* The mean difference is significant at the .05 level.

There was no significant difference between groups' means of teacher candidates on Preparation operations. Teacher candidates' who improved 3 or more times instructional multimedia materials $\overline{X}$= 25,76, 2 times $\overline{X}$= 24,40, 1 time $\overline{X}$= 23,40 (f=2,688, p>.05). One can say that project number of teacher candidates is not effect to preparation operations because results showed that all teacher candidates had similar experiences on preparation operations.

4.5.2 Differences between the Teacher Candidates' Experiences of Organization Operations According to Their Project Number

Table 4.18 gives the data for the Organization operations of the teacher candidates according to their project number.

Table 4.18: Teacher Candidates Results of Organization Operations According to Their Project Number

	Number of project	N	Mean	Std. Deviation	F	P	Exp.
Organization	1 time	10	33,700	5,697	1,712	0,183	p>.05
	2 times	25	33,840	3,923			
	3 or more times	167	35,551	5,208			
	Total	202	35,248	5,112			

* The mean difference is significant at the .05 level.

There was no significant difference between groups' means of teacher candidates on Organization operations. Teacher candidates' who improved 3 or more times instructional multimedia materials $\overline{X}$= 35,55, 2 times $\overline{X}$= 33,84, 1 time $\overline{X}$= 33,70 (f=1,712, p>.05). The results showed that all teacher candidates had similar experiences on organization operations.

4.5.3 Differences between the Teacher Candidates' Experiences of Media- Use Operations According to Their Project Number

Table 4.19 gives the data for the Media-Use operations of the teacher candidates according to their project number.

Table 4.19: Teacher Candidates Results of Media-Use Operations According to Their Project Number

	Number of project	N	Mean	Std. Deviation	F	P	Exp.
Media- use	1 time	10	31,640	8,947	4,205	0,016	p<.05
	2 times	25	32,280	7,391			
	3 or more times	167	35,970	7,075			
	Total	202	35,299	7,322			

* The mean difference is significant at the .05 level.

Compared using post hoc analysis (Tukey's Honestly Significant Difference, HSD) to determine exactly which groups were different. Teacher candidates' who improved 3 or more times instructional multimedia materials $\overline{X}$= 35,97, 2 times $\overline{X}$= 32,28, 1 time $\overline{X}$= 31,64. The results showed that students who improved 3 or more times instructional multimedia materials are significantly highest on Media-Use Operations than students who improved only 2 times instructional multimedia materials (f=4,205, p<.05).

4.5.4 Differences between the Teacher Candidates' Experiences of Navigation Tools - Use Operations According to Their Project Number

Table 4.20 gives the data for the Navigation Tools -Use operations of the teacher candidates according to their project number.

Table 4.20: Teacher Candidates Results of Navigation Tools-Use Operations According to Their Project Number

	Number of project	N	Mean	Std. Deviation	F	P	Exp.
Navigations	1 time	10	31,100	13,404	2,599	0,077	p>.05
	2 times	25	33,720	7,569			
	3 or more times	167	35,605	6,289			
	Total	202	35,149	6,985			

* The mean difference is significant at the .05 level.

There was no significant difference between groups' means of teacher candidates on Navigation Tools - Use operations. Teacher candidates' who improved 3 or more times instructional multimedia materials $\overline{X}$= 35,60, 2 times $\overline{X}$= 33,72, 1 time $\overline{X}$= 31,10 (f=2,599, p>.05). The results showed that all teacher candidates had similar experiences on Navigation Tools-use operations.

4.5.5 Differences between the Teacher Candidates' Experiences of Appearance Design Operations According to Their Project Number

Table 4.21 gives the data for the Appearance Design operations of the teacher candidates according to their project number.

Table 4.21: Teacher Candidates Results of Appearance Design Operations According to Their Project Number

	Number of project	N	Mean	Std. Deviation	F	P	Exp.
Appearance	1 time	10	62,800	9,659	1,615	0,201	p>.05
	2 times	25	63,120	9,103			
	3 or more times	167	66,371	10,159			
	Total	202	65,792	10,046			

* The mean difference is significant at the .05 level.

There was no significant difference between groups' means of teacher candidates on Appearance Design operations. Teacher candidates' who improved 3 or more times instructional multimedia materials $\overline{X}$= 66,37, 2 times $\overline{X}$= 63,12, 1 time $\overline{X}$=

62,80 (f=1,615, p>.05). The results showed that all teacher candidates had similar experiences on Appearance Design operations.

6.5.6 Differences between the Teacher Candidates' Experiences of Resource-Use Operations According to Their Project Number

Table 4.22 gives the data for the Resource-Use operations of the teacher candidates according to their project number.

Table 4.2: Teacher Candidates Results of Resource-Use Operations According to Their Project Number

	Number of project	N	Mean	Std. Deviation	F	P	Exp.
Resource-use	1 time	10	38,500	6,096	3,137	0,046	p<.05
	2 times	25	41,320	7,674			
	3 or more times	167	43,371	6,742			
	Total	202	42,876	6,906			

* The mean difference is significant at the .05 level.

Compared using post hoc analysis (Tukey's Honestly Significant Difference, HSD) to determine exactly which groups were different. Teacher candidates' who improved 3 or more times instructional multimedia materials $\overline{X}$= 43,37, 2 times $\overline{X}$= 41,32, 1 time $\overline{X}$= 38,50. The results showed that students who improved 3 or more times instructional multimedia materials are significantly highest on Resource-Use Operations than students who improved only 1 time instructional multimedia materials (f=3,137, p<.05).

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This chapter covers the conclusions and recommendations of the study. Obtained results were compared with literature data and explained.

7.1 Conclusions

This investigation suggests that using the challenge of student-generated instructional multimedia materials that would teach “future” students about key theories, would encourage learners to think carefully about the design of their instructional multimedia material and to produce a more active level of learning with Project Based Learning.

The study indicated that the experiences of students produced instructional multimedia materials. It is an important result that the approximately 82.70% of the sample had created instructional multimedia materials 3 or more times.

The results suggests that teacher candidates mostly conforms to preparation, organization, media-use, navigation tools use, appearance design and resource use operations’ rules of developing instructional multimedia materials in Project Based Learning. These results are satisfactory for us.

In that study teacher candidates mostly reported that they planned their time wisely. Besides Penwel’s (2002) study showed that his multimedia project’ students were likely to finish the project in time allotted. ISTE (1997) explained that one goal in project-based learning is for students to increase their skills in budgeting their time and other resources.

It is an important result that the teacher candidates mostly used feedback from others to refine their topics and questions. It is interesting to note that this result is similar to the results reported by Zhang (2000). Zhang reported that the pre-service teachers were often receptive to feedback from the K-8 students.

It is an interesting result that the students mostly added an introduction and table of contents to their instructional multimedia materials, although they have occasionally added, a bibliography or resources and used slide to their instructional multimedia materials. Bibliography is an important point for the all projects, articles, books, etc. and these results are not satisfactory for us. Moreover, another interesting result is that teacher candidates reported that their instructional multimedia materials help the user understand the topic better although, students added sound recording to their instructional multimedia materials occasionally.

It is an important result that teacher candidates mostly conformed navigational tools rules when they added navigations to their instructional multimedia materials. Teacher candidates reported that users could easily find their way through their presentation. In addition, they reported that navigational tools lead to logical destination.

The study showed that teacher candidates mostly conformed to the appearance design operation. The graphics are very important in a multimedia. Graphics must be clear and easy to see. These results indicate that teacher candidates always use good graphics in their instructional multimedia materials.

Teacher candidates reported that they always research from electronic resources for their project. Also McLachlan's (2003) study results showed that his students had a strong reliance on electronic resources 76,40%. In addition, teacher candidates reported that they consulted printed sources mostly. (Books, magazines, textbooks, newspapers) McLachlan's (2003) research findings have supported that his students used printed sources as part of their research %63,20. However, the results indicate that teacher candidates occasionally use interviews with related people.

Most of the differences found between genders were very small. In the study some moderate differences are: females are higher on appearance design.

Although Passig's (1999) research indicates a significant difference between boys and girls in the influence of the design of interactive *multimedia* on time on task. Boys showed a greater covert time-on-task than girls did. In this study, males and females tended to have the same amount of preparation experience, The study has shown that there is no significant difference on organization operations and media-use operations performance of male and female teacher candidates.

It is important that instructional multimedia materials interfaces be easy to use. The places and icons of navigation buttons in two genders are at acceptable and high level. That means the students' gender do not affect the preference of navigation button.

Passig and Haya (1999) researched gender differences in kindergarteners' learning interest from different designs of multimedia interfaces. They found a significant difference between boys and girls in the influence of the design of interactive multimedia stories level of satisfaction with the interfaces. Girls preferred interfaces that stressed color and the display or appearance of the scene. Although this study h appearance design of instructional multimedia materials than male teacher candidates were.

There is no significant difference between the resource use performance of male and female teacher candidates. Tsai's (2005) research findings have supported that there is no significant difference between the use of various resources of male and female students.

It is an important result that there were not any significant difference between branches on organization, navigation tools –use, and resource-use operations. All branches were at acceptable and high level for these three operations. The students in all branches prefer same way to collect data from resources.

This study has shown that Teaching in Sport and Physical Education students are significantly lower on preparation operations than English Language Teaching Students. Students from Computer Education and Instructional Technology and English Language Teaching showed more acceptable performance on “media – use” than these from Teaching in Sport and Physical Education. One of the reasons for this might be that English Language Teaching and Computer Education and Instructional Technology students have produced more projects than Teaching in Sport and Physical Education students. Because Teaching in Sport and Physical Education students' courses are generally related with sport, dance etc. and they have more projects about them. Although English Language Teaching students' courses are generally related with language teaching, Computer Education and Instructional Technology students' courses are generally related with software, and they have many chances to produce instructional multimedia materials.

The results indicated that Computer Education and Instructional Technology students are significantly highest on appearance design operations than English Language Teaching and Teaching in Sport and Physical Education students. In addition, Teaching Certificate Program students scored the highest on appearance design operations than Teaching in Sport and Physical Education students. One of the reasons for this might be that Computer Education and Instructional Technology students take Graphic Design courses in their departments. The Graphic design course is an obligatory course for them. Therefore these students learn the rules of appearance design.

Students who have developed instructional multimedia materials for three times used more acceptable resources than those who developed only once. In addition, the results showed that teacher candidates who produced instructional multimedia materials for 3 times used more successful on media use than those who produced produced only 2 times.

7.2 Recommendations

If we want to increase the number of multimedia projects teachers might have some experience with project-based learning, educational technology, and Internet based and multimedia technologies. School's administrators should organize in-service courses to teachers and teacher candidates about project based learning and its' activities. Other schools' project based learning activity videos may be shown to them.

Teachers can benefit from online Project Based Learning resources. Web contains Project Based Learning and Multimedia resources and forums for teachers and students. Teachers can join those forums and share their knowledge's with other teachers.

Copyright issues and bibliography rules should explain to students who producing instructional course materials. Teachers must develop an understanding of copyright issues.

When two or more people learn or work together, the calendar is one of the most basic tools for coordination (Tolsby, Nyvang & Holmfeld, 2003). Instructional multimedia design process should be determined at preparation stage.

When designing projects, it is important to ensure that everything planned will help you meet the intended learning objectives. Brainstorming activities should be increased. Brainstorm is a useful way of getting started or generating new ideas.

In project-based learning, teacher candidates may produce products separately or with a team. Collaborative learning is a useful way of learning. Thus, we must encourage students to collaborative studies. If students work with a team, they can produce better products than working alone. "When dealing with students with low learning motivation, it is very important to keep them interested in learning. Interesting lessons would keep the students interested and enable them to do their own self-directed learning and research" (Tan and Leong, 2003). Microsoft office directors (2003) explained that teamwork and cooperation are keys to success in today's information-rich, highly technical work force.

Most studies showed that the boys are more successful on produced software than. However, this study showed that there is no any significant difference between genders. Moreover, the girls are more successful on the appearance design stage. In order to prevent this effect teacher should motivate students by form in heterogeneous groups according to gender, culture, nationality etc.

According to Hutchings and Standley (p. 59) one of the strong characteristics of PBL is Team-based Learning. They point out that multi-cultural teams are more effective than monoculture teams because of the synergy that comes from the sharing of different thinking processes and values. Diversity leads to creating problem solving. It also creates a climate in which students learn to appreciate and learn from each other's differences.

The project based learning should be increased. Teachers should explain the importance and effects of computer, multimedia materials et. to students from department of Teaching in Sport and Physical Education.

Teachers may invite students' parents, friends or experts to their project presentations and these presentations may be showing them to ask questions and give feedback. When experts give good feedback to them, teacher candidates see themselves as imaginative, talented and intelligent. This process should increase their motivations.

REFERENCES

Afro Global Alliance. (2007). retrieved April, 2, 2007 from http://www.afroglobal.org/aceducation.html

Akar, H. (2003). *Impact Of Constructıvıst Learnıng Process On Preservıce Teacher Educatıon Students' Performance, Retentıon, And Attıtudes.* From: http://etd.lib.metu.edu.tr/upload/3/1102136/index.pdf

Alkan, C. (1997). *Eğitim Teknolojisi.* Ankara: Anı Yayıncılık.

Andrews, S. & D. Tilton. (1993). *How multimedia and hypermedia are changing the look of maps*. Proceedings of AUTOCARTO 11. Minneapolis, MN, 348-366.

Apple Computer. (1989). *HyperCard Stack Design Guidelines*, Addison-Wesley Publishing Company, CA.

Atmaca, S. & Aslan, F. (2006). *Proje Tabanlı Öğrenmede Bitki Kulübü Örneği* International Educational Technology Conference. Volume 1

Balajthy, E. (1996). *Using Computers technology to aid the disabled reader. In LR. Putman (Ed.),* How to become a better reading teacher: strategies for assessment and intervention. Englewood Cliffs, NJ: Merrill.

Bartscher, K., Gould, B., & Nutter, S. (1995). Increasing student motivation through project based learning. Master's Research Project, Saint Xavier and IRI Skylight. (ED 392-549).

Barron, B. J. S., Schwartz, D. L., Vye, N. J., Moore, A., Petrosino, A., Zech, L., Bransford, J. D., & The Cognition and Technology Group at Vanderbilt. (1998). Doing with understanding: Lessons from research on problem- and project-based learning. *The Journal of the Learning Sciences,* 7.

Beal, J.W. (1995). The Civil War: An example of integrating Linkway into the social studies curriculum. *Hyper Nexus* 5, 3-6.

Becker, H. J., Wong. Y. T., & Ravitz, J. L. (1999). Computer use and pedagogy in Co-NECT schools, A comparative study. Teaching, learning, and computing: 1998 *National Survey Special Report.* Irvine, CA: University of California.

Bereiter, C. & Scardamalia, M. (1999). *Process and product in PBL research.* Toronto: Ontario Institutes for Studies in Education/University of Toronto.

Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palinscar (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist*, 26(3/4), 369-398.

Boaler, J. (1997). Experiencing school mathematics; *Teaching styles, sex, and settings*. Buckingham, UK: Open University Press.

Boaler, J. (1998a). *Alternative approaches to teaching, learning, and assessing mathematics.* Paper presented at the European Conference for Research on Learning and Instruction. Athens, Greece.

Boaler, J. (1998b). Open and closed mathematics: Student experiences and understandings. *Journal for Research in Mathematics Education*, 29.

Boaler, J. (1999). *Mathematics for the moment, or the millennium? W*hat a British study has to say about teaching methods. Education Week, March 31, 1999.

Bostock, Stephen (1995). Classifications of educational software. From: http://www.keele.ac.uk/depts/aa/landt/lt/docs/atcbttyp.htm

Brown, J. S., Collins, A., and Duguid, P. (1989). *Situated Cognition and the Culture of Learning*. *Educational Researcher* 28 : 32-42.

Carr, T., & Jitendra, A. K., (2000). *Using hypermedia and multimedia to promote project - based learning of at-risk high school students, Intervention in school and clinic* (H.W. Wilson - EDUC). Sep 2000. Vol. 36, Issue 1, p. 40.

Cavus, N. (2007). *The Effects of Using Learning Management Systems On Collaborative Learning For Teaching Programming Languages.* Non puplished Doctoral's thesis, University of Near East, Nicosia, Cyprus.

Chard, S. C. (1992). *The project approach: A practical guide for teachers*. New York: Scholastic.

Ching, Cynthia Carter; Marshall, Sue and Kafai, Yasmin (1998). *Give Girls Some Space: Gender Equity in Collaborative Technology Activities*. In: Conference Proceedings of the 19th Annual National Educational Computing Conference. Int. Soc. Technol. Educ, Eugene, OR, USA, 1998, pp. 67-78.

Cognition and Technology Group at Vanderbilt, (1990) "*Anchored Instruction and Its Relationship to Situated Cognition.*" Educational Researcher 19

Cognition and Technology Group at Vanderbilt (CTGV). (1992). The Jasper experiment: An exploration of issues in learning and instructional design. *Educational Technology Research and Development,* 40, 65-80.

Cook, E., M., (2001). *Principles of Interactive Multimedia.* London: McGrawHill

Dean, C. (2002). *Technology Based Training & On-line Learning. An overview of authoring systems and learning management systems available in the UK.*

Dede, C. (1993). Beyond distributed multimedia: A virtual forum for learning. Unpublished paper. Center for Interactive Educational Technology. August, p. 3. Fairfax, VA.

Demirel, Ö. (2005). *Eğitimde Yeni Yönelimler* Ankara: Pegem A Yayıncılık.

Demirel, Ö., Başbay, A., Uyangör, N., Bıyıklı, C (2005). *Proje Tabanlı Öğrenme Modelinin Öğrenme Sürecine ve Öğrenci Tutumlarına Etkisi.* From: http://www.epo.hacettepe.edu.tr/eleman/bolu.doc

Dewey, J., *(1907). The school society. Chicago:* University of Chicago Press.

Dewey, J., (1958). *Democracy and Education*. New York: Macmillan Company.

Dewey, J., (1938) *Experience and Education.* New York: Collier Macmillan.

Durkheim, E., (1956). *Education and Sociology*. Ilinois: Free Press.

Durkheim, E. & Marcel M. (1963). *Primitive Classification.* University of Chicago Press

Edelson, D. C., Gordon, D. N, & Pea, R. D. (1999). Addressing the challenge of inquiry based learning. *Journal of the Learning Sciences*, 8.

Expeditionary Learning Outward Bound (1999). A design for comprehensive school reform. Cambridge, MA: Expeditionary Learning Outward Bound.

Ertürk, S., (1982). *Eğitimde Program Geliştirme.* 4. Basım Ankara: Yelkentepe Yayınları.

England, E. & Finney, A., (1999). *Managing Multimedia Project Management for Interactive Media.* Addisson – Wesley

Evnin, J. (2006). *Prepare, Project, Present: Using Technology to Encourage Effective Presentations.* from: http://josh.ev9.org/p3/files/Josh_Evnin_CapstonePaper.pdf

Fenrich, P. (2005). *Creating Instructional Multimedia Solutions: Practical Guidelines for the Real World.* Informing Science Press: Netherlands.

Fiske, E.R. (1998). Computers at the Crossroads. Canadian Vocational Journal, 33 (2), 10-12.

Fosnot, C. T. (Ed.). (1996). *Constructivism: theory, perspectives, and practice.* New York; Teachers College, Columbia University.

Foster, M. (1999) *Multimedia design controversies* from: http://coe.sdsu.edu/eet/Articles/MessMulti/start.htm

Foyn, B., Maus, E. (2003). *Designing tools and contents for project based learning with net-based curriculum* from: http://eric.ed.gov

George Lucas Educational Foundation (2002). *Instructional Module, Project-Based Learning.* retrieved April, 2, 2007 from http://www.edutopia.org/modules/PBL/whypbl.php

Gergen, K.J. (1994). Social construction and the educational process. In L. P. Steffe, and J. Gale (Eds.), *Constructivism in education.* New Jersey: Lawrence Erlbaum Associates.

Gibson,I.S., O'Reilly, C., Hughes, M. (2002) Integration of ICT within a project-based learning environment. *European Journal of Engineering Education*, V-27, I-1 p. 21 – 30.

GLEF Staff, (2001). *Project-Based Learning Research.* From: http://www.edutopia.org/php/article.php?id=Art_887&key=037

Goodman, A. (2006) *Why Bad Presentations Happen to Good Causes: And How to Ensure they Won't Happen to Yours.* Cause Communications.

Gordon, R. (1998). Balancing real-world problems with real-world results. Phi Delta Kappan, 390-393.

Han, S. & Bhattacharya, K. (2001). *Constructionism, Learning by Design, and Project-based Learning. In M. Orey (Ed.), Emerging perspectives on learning, teaching, and technology.* From: http://www.coe.uga.edu/epltt/LearningbyDesign.htm

Hannafin, M.J., & Hill, J.R. (2007). *Epistemology and the design of learning environments.* In R.A. Reiser & J.V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (2nd ed.). (pp. 53-61). Saddle River, NJ: Merrill/Prentice Hall.

Hede, T., Hede, A. (2002). *Multimedia effects on learning: Design implications of an integrated model.* In S. McNamara and E. Stacey (Eds), Untangling the Web: Establishing Learning Links. Proceedings ASET Conference 2002, Melbourne. from http://www.aset.org.au/confs/2002/hede-t.html

Hofstetter, T.,F. (2001). *Multimedia Literarcy.* America. McGraw – Hill

Houghton Mifflin Company. (1998). Background Knowledge & Theory. Project Based Learning Space. From: http://college.hmco.com/education/pbl/background.html#Students

Horan, C., Lavaroni, C.. & Beldon, P. (1996). Observation of the Tinker Tech Program students for critical thinking and social participation behaviors. Novato, CA: Buck Institute for Education.

Hutchings, K.,Standley, M., (2000) *Global Project Based Learning with Technology,* Eugene, OR: Visions Leadership Series, Visions Technology in Education.

Issa, R., A., Cox, F., R., Killingsworth, F., C.(1999) *Impact of Multimedia-Based Instruction on Learning and Retention.* J.4 Comp. in Civ. Engrg., V 13- I-4, pp:281-290.

itrc.wvu.edu (2006) *Overview of Multimedia Course Development.*West Virigine University. From: http://www.itrc.wvu.edu/coursedev/preproduction/chapter01.html

ISTE. (1997). Projects: Road Ahead. Foundations for The Road Ahead: Project-Based Learning and Information Technologies. From http://www.iste.org/Content/NavigationMenu/Research/Reports/The_Road_Ahead_Background_Papers_1997_/Project-Based_Learning.htm

Johnson, D.W. & Johnson, R.T. (1989). Social skills for successful group work. *Educational Leadership*, 47(4), 29-33.

Jones, B.F., Rasmussen, C.M., Moffit, M.C. (1997): *Real-life Problem Solving: A Collaborative Approach to interdisciplinary Learning*, Waschington, DC: American Psychological Association, 1997

Joseph, H. and Fleiss, L. (1981) *Statictical Methods For Rates and Proportions.* Sec. Ed. John Wiley and Servis.

Joyce, B.R., Weil, M. & Calhoun E. (2003). *Models of Teaching* . 7. edition, USA: Allyn & Bacon

Karasar, N, (2005) *Bilimsel Araştırma Yöntemi,* İstanbul: Nobel.

Kay, R., (2006). Addressing Gender Differences in Computer Ability, Attitudes and Use: The Laptop Effect. *Journal of Educational Computing Research.* V-34, n-2, p187-212.

Kell, A. C. (2006). Effects of Using Project-Based Instruction in Increasing Student Achievement in Financial Literacy. *Instructional Technology Monographs 3* (2). Retrieved 03/06/2007, from http://projects.coe.uga.edu/itm/archives/fall2006/ashleykell.htm.

Klein, B., S., (2002) *Learning principles and applications. 4. edition, McGraw-Hill*
League for Innovation (2000, 1999, 1998). League connections and leadership abstracts. www.league.org

Kulik, Kulik and Cohen, "A Meta-Analysis of OUtcome Studies of Keller's Personalised System of Instruction" (1979) 34 *American Psychologist* 307.

Kulik, J. A., Kulik, C. C., & Cohen, P. A. (1980). *Effectiveness of computer-based teaching: A meta-analysis of findings.* Review of Educational Rresarch, 50(4), 525-544.

Kulik, J. A., & Bangert-Drowns, R. L. (1983). Effectiveness of technology in precollege mathematics and science teaching. *Journal of Educational Technology Systems*, 12, 137-158.

Kulik, J. A., Bangert, R. L., & Williams, G. W. (1983). Effects of computer-based teaching on secondary school students. *Journal of Educational Psychology*, 75, 19-26.

Lehrer, R. Erickson, J. S., & Coneell, T. (1994). *Learning by designing hypermedia documents.* Computers in the Schools.

Liu, M. & Y. Hsiao. (2002). Middle school students as multimedia designers: A project-based learning approach. *Journal of Interactive Learning Research*, 13 (4), 311-337

Liu, M., Jones, C. & Hemstreet, S. (1998). A study of the multimedia design and production process by the practioners. *Journal of Research Computing in Education*. 30(3), 254-280.

Liu, M. (1998) The effect of hypermedia authoring on elementary school students' creative thinking. *Journal of Educational Computing Research*. 19, pp. 27-51.

Liu, M. & Pedersen, S. (1997). *The Effect of Being Hypermedia Designers on Elementary School Students' Motivation and Learning of Design Knowledge.* From Educational Resources Information Center.

Liu, M. & Rutledge, K. (1997). The Effect of a "learner as multimedia designer" environment on at-risk high school students' motivation and learning of design knowledge. *Journal of Educational Computing Research*.

Liu, M., (2003). Enhancing learners' cognitive skills through multimedia design. *Interactive Learning Environments, 11(*1*),* 23-39.

Liu, M. (2005). *Enhancing Learners' Cognitive Skills Through Multimedia Design.* Interactive Learning Environments, Vol. 11, No:1, pp:23-39.

Mann. L. B. (2006). Making Your Own Materials. From: http://www.itdl.org/Journal/Oct_06/article02.htm

Martin, N., & Baker, A. (2000). *Linking work and learning toolkit*. Portland, OR: worksystems, inc., & Portland, OR: Northwest Regional Educational Laboratory.

Masullo, M., Mack, R.,(1997), *Educational Multimedia: Perspective In Evolution*. ED-MEDIA & ED-TELECOM 97, Calgary, Canada.

Matejka, D. (2004). *Project-Based Learning in Online Postgraduate Education.* Issues in Informing Science and Information Technology. P. 489-495. Available from: http://proceedings.informingscience.org/InSITE2004/073matej.pdf

Mayer, R. E. & Anderson, R. B. (1991). Animations need narrations: An experimental test of a dual-coding hypothesis. *Journal of Educational Psychology*, 83, 484-490.

Mayer, R. E. & Anderson, R. B. (1992). The instructive animation: Helping students build connections between words and pictures in multimedia learning. *Journal of Educational Psychology*, 84, 444-452.

Mayer, R. E. & Gallini, J. K. (1990). When is an illustration worth ten thousand words? *Journal of Educational Psychology*, 82, 715–726.

Mayer, R. E. & Moreno, R. (in press). A split-attention effect in multimedia learning: Evidence for dual information processing systems in working memory. *Journal of Educational Psychology*, 90, 000–000.

Mayer, R. E. & Sims, V. K. (1994). For whom is a picture worth a thousand words? Extensions of a dual-coding theory of multimedia learning. *Journal of Educational Psychology*, 86, 389 – 401.

Mayer, R. E. (2000). *Multimedia Learning*, Cambridge, UK: Cambridge University Press.

McGrath, D. (2003). Designing to Learn: A Focus on Design in Project-Based Learning. *Learning & Leading with Technology*. Volume 30, Number 6

McLachlan, J., McHarg, J., Goding, L., & Caldarone, E. (2003). *An Evaluation of the Use of a Virtual Learning Environment and Digital Libraries in a New Medical School.* JISC Final Report.

MicroSoft Corporation (2006). *Movie Maker 2,1 for Windows.*

MicroSoft Corporation (2006). *Photo Story 3,0 for Windows.*

Microsoft Online (2003). *Implementing project-based learning in your classroom.* From: http://office.microsoft.com/en-us/help/HA011887681033.aspx?mode=print

Milken Family Foundation. (1999). *Information Technology Underused in Teacher Education* From: http://www.mff.org/edtech/article.taf?_function=detail&Content_uid1=131

Montgomery, L.A. (2000), *The effect of SURWEB Hypermedia Construction on Development of Complex Knowledge Structures, Creative Thinking, and Research Process Skill of Utah Sixth grade Social Studies Students,* from: http://www.suu.edu/faculty/montgomery/surweb2000.html (2/09/2006)

Moursund, D., Bielefeldt, T., & Underwood, S. (1997). *The road ahead—project based learning.* Retrieved September 9, 2002, from http://www.iste.org/research/roadahead/pbl.html

Moursund, D., Bielefeldt, T. and Underwood, S.(1997). Foundation for the Road Ahead: Project-Based Learning and Information Technologies. From http://www.iste.org/

Moursund, D. (1999). *Project-based learning using information technology*. Eugene, OR: International Society for Technology in Education.

Nadelson, L. (2000). Discourse: Integrating problem solving and project-based learning in high school mathematics. *Northwest Teacher*, 1(1), 20. from: http://www.nwrel.org/msec/nwteacher/spring2000/textonly/discourse.html

National Skills Standard Board. (1996). www.nssb.org

Neo, M., and K. Neo (2001). Innovative teaching: Using multimedia in a problem-based learning environment. *Educational Technology & Society Education* 4(4).

Nunn, P., S. (1956). *Education Its Data and First Principles.* London: Edward Arnold (Publishers) Ltd.

Office of education. (2001). *Why do project-based learning?* retrieved September, 2, 2007, from http://pblmm.k12.ca.us/PBLGuide/WhyPBL.html

Özcan, O. (2003). *İnteraktif Media Tasarımında Temel Adımlar.* İstanbul: Kültür Yayınları.

Özdamar, K. (1999). *Paket Programlar İle İstatistiksel Veri Analizi.* Kaan Kitabevi, Eskişehir.

Papastergiou, Marina. (2005). *Learning to Design and Implement Educational Web Sites within Pre-Service Training: A Project-Based Learning Environment and Its Impact on Student Teachers.* Learning, Media and Technology, Vol. 30, No. 3. From http://search.epnet.com/login.aspx?direct=true&db=eric&an=EJ721226

Passig, D, Levin, H. (19*99). Gender Interest Differences with Multimedia Learning Interfaces. Gender Interest Differences* with *Multimedia* Learning Interfaces.

Penuel, W., Korbak, C., Cole, K. & Jump, O. (2002). *Imagination, Production, and Collaboration in Project-Based Learning Using Multimedia.*

Penuel, W.R., & Means, B. (1999). *Observing teaching practice in project-based learning using multimedi: A Tool for Evaluators.* Paper presented at the Secretary of Education's National Conference on Educational Technology. Washington, D.C. From: http://www.ed.gov.technology/1999/whitepapers. 07-01-2007

Penuel, W. R., & Means, B. (2000). Designing a performance assessment to measure students' communication skills in multi-media-supported, project-based learning. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans.

Percival, F. & Ellington, H. (1988). *A handbook of educational technology* (2nd Ed.), London: Kogen Page.

Preece, J. (1994). *Human & Computer Interaction.* USA: Addison – Wesley

Project Based Learning, (2002). *Checklist to support Project Based Learning and evaluation.* From http://4teachers.org

Railsback, J. (2002). Project-Based Instruction: Creating Excitement for Learning. Portland, OR: Northwest Regional Educational Laboratory. Retrieved November, 9, 2006, from http://www.nwrel.org/request/2002aug/profdevel.html

Reigeluth, C.M. (1983). *Instructional design: What is it and why is it?* In Charles M. Reigeluth (Ed.). Instructional design models and theories: An overview of their current status, Volume 1 (pp. 3-36). Hillsdale, NJ: Lawrence Erlbaum Associates.

Reigeluth, C.M. (1999). *What is instructional design theory?* In Charles M. Reigeluth (Ed.). Instructional design models and theories: A new paradigm of instructional theory, Volume 2 (pp. 5-29). Hillsdale, NJ: Lawrence Erlbaum Associates

Riley, D. & Pace, C. (1997) *Improving Teaching Eficiency with Multimedia Teaching Aids, Computing in Civil Engineering*, *In Adams,* T M (ed.) Proceedings of the Fourth Congress held in conjunction with A/E/C Systems '97, Philadelphia, Pennsylvania, ASCE, New York, pp. 129–35.

Ross, S. M. et al. (1999). *Two- and three-year achievement results on the Tennessee value added assessment system for restructuring schools in Memphis.* Memphis: Center for Research in Educational Policy, University of Memphis.

Russell, B. (1930). *On Education.* London: George Allen & Unwin Ltd.

Schitai A. (1998). Educational Courseware: Instructional Design Links to Learning. *Online Journal of Distance Learning Administration*, Volume I, Number IV State University of West Georgia, Distance Education. From: http://www.westga.edu/~distance/schitai14.html

Seels, B. B., & Richey, R. C. (1994) *Instructional technology: The definition and domains of the field*, Washington, DC, USA: Association for Educational Communications and Technology.

Simkins, M. (1999). *Project-based learning with multimedia.* Thrust for Educational Leadership, 10552243, Mar/Apr99, Vol. 28, Issue 4

Simkins, M., Cole, K., Tavalin, F., & Means, B. (2002). *Increasing Student Learning Through Multimedia Projects.* From http://www.ascd.org

Simsek, N. (2005). Perceptions and Opinions of Educational Technologists Related to Educational Technology. *Educational Technology & Society*, 8 (4), 178-190.

Sizer, T. R. (1984) Horace's compromise--the dilemma of the American high school : the first report from A study of American high schools, co-sponsored by the National Association of Secondary School Principals and the Commission on Educational *Issues of the National Association of Independent Schools Boston* : Houghton Mifflin.

Skolnikoff, E. B. (1994). *Knowledge without borders? Internalization of the research universities.* In J. R. Cole, E. G. Barber, & S. R. Graubard (Eds.), The research university in a time of discontent (pp. 333-360). Baltimore: The John Hopkins University Press.

Solomon, G. (2003). Project-based learning: A primer. *Technology & Learning, 23* (6), 20

Spoehr, K.T. (1993). *Profiles of hypermedia authors: How students learn by doing.* Paper presented at the annual meeting of the American Educational Research Association, Atlanta, GA.

SRI International. (2000). *Silicon valley challenge 2000: Year 4 Report*. San Jose, CA: Joint Venture, Silicon Valley Network. From: http://pblmm.k12.ca.us/sri/Reports.htm

Staff, G. (2001). *Project-Based Learning Research.* Retrieved November, 12, 2006, from http://www.edutopia.org/php/article.php?id=Art_887&key=037

Stepien, W. & Gallagher, S. (1993). *Problem-based learning: As authentic as it gets. Educational Leadership*, 51

Stoney, S., & Wild, M. (1998). *Motivation and interface design: Maximising learning opportunities*. Journal of Computer Assisted Learning, 14(1), 40. from the PsycINFO database.

Tan Lay Hong and Peggy Leong (2003), *Professional Development of ITE Teachers through Learning Circles*, Teacher Education Institute 2003.

Technology and Education Reform: Technical Research Report – (1995) 8. Technology Supports for Project-Based Learning. From: http://www.ed.gov/pubs/SER/Technology/ch8.html

Thomas, W.,J., (2000). *A review of Research on Project-Based Learning.* San Rafael, CA: Autodesk From http://www.autodesk.com/foundation

Tolsby,H., Nyvang, T., & Holmfeld,L., (2003). *A Survey of Technologies Supporting Virtual Project Based Learning.*

Tretten, R. & Zachariou, P. (1995). *Learning about project-based learning: Self-assessment preliminary report of results*. San Rafael, CA: The Autodesk Foundation.

Troupin, P., (2000) *The Role of Instructional Design in Multimedia Develeopment.* Learning Circuits. From http://www.learningcircuits.org/2000/feb2000/Troupin.htm

Tsai, C.-C. (2005). Preferences toward Internet-based Learning Environments: High School Students' Perspectives for Science Learning. *Educational Technology & Society*, 8 (2), 203-213

Vaughan, T., (1994). *Multimedia Making It Work.* Osborne: Mc-Graw-Hill

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge: Cambridge University Press.

Wolff, S.,J., (2001), *Design Features for Project- Based Learning.* Oregon State University

Woolfolk, A. E. (2001). *Educational psychology* (8^{th} Ed.). Boston: Allyn and Bacon.
Ullah, L. (2003). *Global Project-Based Learning.* Instructional Technology Masters Degree Program Project. From: http://www.lullah.com/gpbl/globalpblpaper.pdf

U. S. Department of Labor. (1991). The secretary's commission on achieving necessary skills. Washington, D.C. from www.academicinnovations.com/report.html

Zhang, S. (2002). *Students' Perceptions of Multimedia Classrooms at East Tennessee State University.* From http://etd-submit.etsu.edu/etd/theses/available/etd-1107102-151006/unrestricted/ZhangS111302b.pdf

Zhang, Y. (2000). *A Project-Based Learning Approach to Helping Pre-Service Teachers Develop Technology Competencies..* From http://ts.mivu.org/default.asp?show=article&id=1034. The article is reprinted here with permission of the publisher.

APPENDIX A

Links to Online Resources to Support an Online PBL Course

Software and Technology Resources

Course Management and Learning Management Software

- Comparison of Course Management Systems: http://www.edutools.info/course/
- Blackboard: http://www.blackboard.com/
- WebCT: http://www.webct.com/
- Moodle: http://www.moodle.org/

Web Page Authoring Software

- Dreamweaver: http://www.macromedia.com/software/dreamweaver/
- Front Page: http://office.microsoft.com/en-us/FX010858021033.aspx

Multimedia Software

- PowerPoint for Windows: http://office.microsoft.com/en-us/FX010857971033.aspx
- PowerPoint for Macintosh: http://www.microsoft.com/products/info/product.aspx?view=22&pcid=bdec4ba8-7dab-4ede-b51f-eb568d9ca85f&type=ovr
- QuickTime Free Player and QuickTime Pro: http://www.apple.com/quicktime/download/
- Macromedia Flash: http://www.macromedia.com/software/flash/
- Flash Player: http://www.macromedia.com/shockwave/download/download.cgi?P1_Prod_Version=ShockwaveFlash
- Shockwave Player: http://sdc.shockwave.com/shockwave/download/download.cgi?
- Real Player: http://www.real.com/
- Windows Media Player: http://www.microsoft.com/windows/windowsmedia/mp10/default.aspx

Instant Messengers

- AOL Instant Messenger: http://www.aim.com/
- ICQ Instant Messenger: http://www.icq.com/
- MSN Instant Messenger: http://messenger.msn.com/
- Yahoo Instant Messenger: http://messenger.yahoo.com/

APPENDIX B

Proje Tabanlı Ders Yazılım Materyalleri Geliştirilme Çalışmalarının Değerlendirilmesi

Sizlerin daha iyi eğitim alabilmeniz için “Proje tabanlı eğitime yönelik tutumlarınız” konusunda bir araştırma yapılmaktadır. Ankete vereceğiniz cevapları daha önce hazırladığınız ders yazılımları ile ilişkilendirerek cevaplandırınız. Bu çerçevede tutumlarınızdan yararlanılmak üzere, dikkatli bir yaklaşımla seçilen öğrencilerden biride siz oldunuz. Sizden istenen, her bölümdeki soru ve ifadeleri dikkatlice okuyarak, söz konusu soru ve ifadeye katılma durumunuzu, size en uygun düşen seçeneği puanlamanızdır.

Anket formunu doldurmanız **10 dakikayı geçmeyecektir.**

Anketteki soru ve ifadelere vereceğiniz cevapların, bu çalışma çerçevesinde kullanılacağından emin olabilirsiniz. Araştırmanın yapılması sırasında gösterdiğiniz duyarlılıktan dolayı sizlere şimdiden teşekkür ederiz.

Fezile ÖZDAMLI

1. Cinsiyetiniz
   a)Kız b)Erkek

2. Sınıfınız
   a)1 b)2 c)3 d)4

3. Branşınız
   a) Alan Öğretmenliği
   b) Bilgisayar ve Öğretim Teknolojileri Öğretmenliği
   c) Okul Öncesi
   d) Bilgisayar Enformatik
   e) Sosyal Bilgiler
   f) Türkçe Öğretmenliği
   g) İngiliz Dili Öğretmenliği
   h) Matematik
   i) Beden Eğitimi ve Spor Yüksekokulu
   j) Resim Öğretmenliği
   k) Müzik Öğretmenliği

4. Almış olduğunuz eğitimde bugüne kadar proje yaptınızmı, yaptıysanız kaç kez?
   a)Yapmadım
   b) 1 kez
   c) 2 kez
   d) 3 veya daha fazla

5. Ülkeniz (Lütfen Yazınız)

Aşağıdaki bölümlerde 5(Her Zaman)'den 1(Hiçbir Zaman)'e doğru puanlar vermeniz istenmektedir.

		Her Zaman (5)	Çoğunlukla (4)	Ara sıra (3) (Orta Sıklıkta)	Nadiren (2)	Hiçbir Zaman (1)
Hazırlık Aşaması	İhtiyacım olan tüm materyallere ulaşmak için zamanımı akıllıca planladım.					
	Önemli kısımların ne zaman yapılacağıyla ilgili zaman çizelgesi hazırladım.					
	Fikirlerimi ve planlarımı belirtmek için bir taslak veya makale hazırladım.					
	Bir konu ve birkaç alt konuya karar verdim.					
	Konuyla ilgili cevaplanması gereken sorular hakkında beyin fırtınası yaptım.					
	Fikirlerimi desteklemeye yardım edecek detaylar hakkında beyin fırtınası yaptım.					
	Konuyu ve yazılımı geliştirirken başkalarından da dönüt aldım.					
Organizasyon		Her Zaman (5)	Çoğunlukla (4)	Ara sıra (3) (Orta Sıklıkta)	Nadiren (2)	Hiçbir Zaman (1)
	Fikirlerimi, bilgi birikimimi ve düşüncelerimi organize etmek için plan veya taslak kullandım.					
	Fikirlerimi anlamlı ve mantıklı bir şekilde organize ettim.					
	Ana konu ve alt konular için tüm açıklamaları verdim.					
	Konu hakkında sorulabilecek tüm soruları açıkca cevapladım.					
	Slayt başlıklarını konu için anlamlı olacak hale getirdim.					
	Giriş veya içindekiler kısmı ekledim.					
	Yazılımım eksiksiz ve daha ilgi çekici yapmak için detayları atlamadım.					
	Sonuçlar kısmını ekledim.					
	Yazılıma bir biblografya veya kaynakların kullanımı slaydı ekledim.					
Yazılımın Hazırlanması		Her Zaman (5)	Çoğunlukla (4)	Ara sıra (3) (Orta Sıklıkta)	Nadiren (2)	Hiçbir Zaman (1)
	Özgün görsel sanat, canlandırma (animasyon) ya da fotoğraflar kullandım.					
	Özgün müzik ya da ses efekti kullandım.					
	Seslendirme (Anlatı) kullandım.					
	Başkalarına ait görsel sanat, canlandırma ve fotoğraflar kullandım.					
	Başkalarına ait müzik ve ses efekti kullandım.					
	Başkalarına ait kaynakları kullandığım zaman kime ait olduklarını belirttim.					
	Yazılımı telif haklarına uygun olarak hazırladım.					
	Yazılımı ahlaki kurallara uygun olarak hazırladım.					
	Yazılımım kullanıcnın konuya daha iyi anlamasına yardımcı olur.					
	Hazırladığım yazılım sunumumu daha ilgi çekici hale getirdi.					

Aşağıdaki bölümlerde 5(Her Zaman)'den 1(Hiçbir Zaman)'e doğru puanlar vermeniz istenmektedir.

Yönlendirme Araçları		Her Zaman (5)	Çoğunlukla (4)	Ara sıra (3) (Orta Sıklıkta)	Nadiren (2)	Hiçbir Zaman (1)
	Kullanıcılar yazılım içerisinde kolayca gezebilirler.					
	Kullanıcılar yazılımın herhangi bir yerine geri dönebilirler veya bölümü tekrar çalıştırabilirler.					
	Kullanıcılar istemedikleri slaydı kolayca atlayabilirler.					
	Yönlendirme araçları kolayca bulunabilir.					
	Yönlendirme araçları gerekli durumlarda gösterildi.					
	Yönlendirme araçları tüm slaytlarda benzer kısımlara yerleştirildi.					
	Yönlendirme araçlarında mantıksal yönler kullanıldı.					
	Yönlendirme araçlarının tümü çalışmaktadır.					
	Kullanıcı her zaman yazılımdan kolaylıkla çıkabilir.					

Görünüş		Her Zaman (5)	Çoğunlukla (4)	Ara sıra (3) (Orta Sıklıkta)	Nadiren (2)	Hiçbir Zaman (1)
	Tasarım öğeleriyle içeriği dengeledim.					
	Sadece birkaç font kullandım.					
	Fontları tutarlı bir biçimde kullandım.					
	Başlıkları ve alt başlıkları diğer yazılardan ayırt etmek kolaydır.					
	Slaytlardaki kelimleler kolayca okunabilir.					
	Slaytlardaki kelimelerde yazım hatası yoktur.					
	Yazı ve grafik alanları dengeli görünüyor.					
	Grafikler kolayca gözüküyor					
	Grafikler temiz ve nettir.					
	Arka plan göz alıcı/yorucu değildir.					
	Slaytlarda kullanılan tüm renkler uyumlu gözüküyor.					
	Slaytlar birbiriyle uyumludur; uyumlu bir bütün oluşturdular.					
	Sesler ve müzikler kolayca duyulabiliyor.					
	Slaytlardaki ve nesnelerdeki geçişler gözalıcı ve sıkıcıdr.					
	Slaytlar arasındaki geçiş süreleri ne çok kısa ne de çok uzundur.					
	Slaytlar temiz(düzgün) görünüyor ve beyaz alanlar iyi kullanılmıştır.					

Kaynaklar		Her Zaman (5)	Çoğunlukla (4)	Ara sıra (3) (Orta Sıklıkta)	Nadiren (2)	Hiçbir Zaman (1)
	Bilgileri toplarken çeşitli kaynaklardan yararlandım.					
	Konuya farklı perspektiflerden bakan kaynaklara başvurdum.					
	Elektronik kaynaklardan yararlandım (Internet, CD-ROM).					
	Basılı kaynaklardan yararlandım (Kitap,magazin, gazete…)					
	Referans materyaller kullandım (Ansiklopedi, sözlük, deyimler dizini, atlas vb.)					
	Belgesellerden veya haberlerden yararlandım.					
	Konuyla ilgili kişilerle yapılan mülakatları kullandım.					
	Bilgi toplamak için video, film ve televizyon şovlarını kullandım.					
	Kaynakları telif haklarına uygun olarak kullandım.					
	Kanyankları ahlaki kurallara uygun olarak hazırladım.					
	Kullandığım kaynakların kimlere ait olduğunu belirttim.					

An Evaluation of Projects to Prepare Course Software with Project Based Learning

You are the one who is chosen carefully for this survey about "Project Based Learning"

To fill this questionnaire will not exceed 10 minutes. Please relate your previous projects process with these questions. (The projects are about course software.) We want from you to read this questionnaire carefully and choose an answer which is close to you, your experience and perceive.

Your answer will never be given to anyone. All responses to this survey are kept confidential. You can be sure that your answer exactly will be use for this study's aim. Thanks for your cooperation and help.

Fezile ÖZDAMLI
Assoc. Prof. Dr. Hüseyin UZUNBOYLU

1. Gender.
a) Female b) Male

2. The class that you are continuing.
a)1 b)2 c)3 d)4

2. Department. (Please Write)

----

4. How many time you prepared projects?
   a) Never
   b) 1 time
   c) 2 times
   d) 3 times or more than 3 times

5. Your Country? (Please Write)

After you read the following expression, please choose the best one to fit for yourself.

		Always (5)	Mostly (4)	Sometimes (3)	Rarely (2)	Never (1)
Preparation	I planned my time wisely to assure access to needed materials.					
	I made a timeline of when key components needed to be done.					
	I made an outline or storyboard to organize my thoughts and ideas.					
	I decided on a topic and several subtopics.					
	I brainstormed questions that needed to be answered about the topic.					
	I brainstormed details that would help support my ideas.					
	I used feedback from others to refine my topic and questions.					

After you read the following expression, please choose the best one to fit for yourself.

		Always (5)	Mostly (4)	Sometimes (3)	Rarely (2)	Never (1)
Organization	I used an outline or storyboard to organize my ideas, information and thoughts.					
	I organized my ideas in a meaningful and logical way.					
	I gave a full explanation of my topic and subtopics.					
	I clearly answered questions people might have about the topic.					
	I included a meaningful title slide.					
	I included an introduction or Table of Contents.					
	I included details that made my presention more complete and/or more interesting.					
	I included a conclusion.					
	I included a Bibliography or Resources Used slide.					

After you read the following expression, please choose the best one to fit for yourself.

		Always(5)	Mostly(4)	Sometimes (3)	Rarely (2)	Never (1)
Media Use	I used original art, animations or photographs.					
	I used orginal music or sound effects.					
	I used voice-overs.					
	I used art, animations, or photographs made by others.					
	I used music or sound effects made by others.					
	I cited all resources I include that were made by others.					
	I used media in accordance with copyright.					
	I used media ethically and appropriately.					
	My media helps the user understand my topic better.					
	My media makes my presentation more interesting.					

After you read the following expression, please choose the best one to fit for yourself.

		Always(5)	Mostly(4)	Sometimes (3)	Rarely (2)	Never (1)
Navigation	Users can easily find their way through my presentation.					
	Users can easily backtrack or repeat parts of the presentation.					
	Users can easily skip parts of the presentation.					
	Navigation tools are easy to locate.					
	Navigation tools are labeled when necessary.					
	Navigation tools are located in a similar place on each slide.					
	Navigation tools lead to logical destinations.					
	Navigation tools work.					
	User can always easily quit the presentation.					

After you read the following expression, please choose the best one to fit for yourself.

Appearance		Always(5)	Mostly(4)	Sometimes (3)	Rarely (2)	Never (1)
	I balanced design aspects with content.					
	I used only a few fonts.					
	I used my fonts in a consistent manner.					
	Titles and headings are easy to distinguish from other text.					
	The words on my slides are easy to read.					
	The words on my slides are spelled correctly.					
	The text areas and graphic areas appear balanced.					
	The graphics are easy to see.					
	Graphics are clear and not pixellated.					
	My background is not distracting.					
	The colors on my slides look good together.					
	The slides appear to go together; they make a cohesive whole.					
	Sounds and music are easy to hear.					
	Transitions are distracting or boring.					
	There is not too much time or too little time between slides.					
	The slides look neat and use white space well.					

After you read the following expression, please choose the best one to fit for yourself.

Resources		Always(5)	Mostly(4)	Sometimes (3)	Rarely (2)	Never (1)
	I used a variety of resources when collecting information.					
	I consulted resources that showed different perspectives on the topic.					
	I used electronic resources (Internet, CD-ROMs).					
	I used print resources (books, magazines, textbooks, newspapers).					
	I used reference materials (encyclopedia, dictionaries, thesaurus, atlas, etc.)					
	I used documentaries or news interviews.					
	I used interviews with people affected by the topic.					
	I used portions of videos, films, or television shows to gather information.					
	I used material in accordance with copyright.					
	I used resources ethically and appropriately.					
	I cited my resources.					