CHAPTER 6

CONCLUSIONS AND SUGGESTIONS
6.1 CONCLUSIONS

Digital libraries store materials in electronic format and manipulate large collections of those materials effectively. Research into digital libraries is research into network information systems, concentrating on how to develop the necessary infrastructure to mass manipulate the information on the Net. Witten (2002) indicated to digital library as a collection-building tool. The social aspect of digital libraries emphasizes the activities people engage in when they create, seek, and use information resources. Adachi (2000) presented NACSIS-ELS, a digital library system of Japanese academic journals. Furthermore, many projects were launched for using digital libraries in different fields in the world such as Information Digital Video Library; Illinois Digital Library Project; Alexandria Digital Library Project; University of Michigan Digital Library Project (UMDL); University of Berkeley Digital Library Project; the Stanford Digital Library Project; University of California CD-ROM Information System; and British Library’s Initiative for Access. Digital libraries (Fox E. A., et al., 1995; Levy & Marshall, 1995) have been developed to efficiently organize, store, and provide access to the rapidly increasing amount of digital information.

Some features of digital libraries had been discussed, such as, i) Digital libraries are organizations with specific objectives or goals. [UNECA (2003)] ii) Digital libraries are made up of digital collections. iii) Digital libraries serve a defined community or set of communities. iv) Digital libraries are set-up to serve users, and the information needs of the target community or set of communities determine the information content and services of the digital library. Users through a single user-
friendly interface access digital libraries. Documents of a digital library are available in
digital format. Digital libraries are to be used by individuals working alone.

Furthermore, the advantages of digital libraries have been emphasized by Rama
Nand Malviya, (2008)\textsuperscript{40} such as, digital libraries provide access to much richer content in
a more structured manner. Digital libraries can provide very user-friendly interface,
giving clickable access to its resources, whereas, traditional libraries are limited by
storage space, digital libraries have the potential to store much more information, simple
because digital information requires very little physical space to contain them. The cost
of maintaining a digital library is lower than that of a traditional library. Digital libraries' information resources are available for access to users around the clock. UNECA
(2003)\textsuperscript{49} also pointed out to the infrastructure requirements for digital libraries, such as,
availability of appropriate information and communication infrastructure on which the
digital library will be built, availability of standards which manage the digital information
resources. For good quality information resources, databases, and effectiveness of
information searching and retrieval, electronic information management standards should
be employed.

Evaluation of digital libraries is an essential component for the design of effective
digital libraries. Digital libraries are designed for users so more user friendly techniques
should be developed in this field. The present research, therefore, concentrated on
assessment of some of the digital library techniques from users' perspectives and tried to
answer the research questions.

The digital library promotes learning through personal ownership and
management of the learning process while connecting the learner with the content and
communities of learners and educators. The use of information and communication technologies to support learning activities (a field now known as education technology) has fostered the educational digital libraries (EDL). Digital library unites rather than divides. Therefore, there is a need of present time to develop and promote digital libraries.

In order to enhance learning through distant mode Yemen established the first digital collection of information, called The National Information Center as first step to construct a digital library in Yemen. (see http://www.yemen.nic.info.)

The terms such as usability, active learning, and digital libraries are important in this research and are defined by renowned authors in this area of research. For example, International Standards Organization (ISO), Judy Jeng (2005a, 2005b), Nielsen (1993) definition were considered for “usability”; IBM (1994), Lesk (1997) cited by Malvia, R. N., 2008; Waters (1992), Lynch et al. (1995), Berkeley (1994) cited in Larson, Ray R., 1994, Witten & Bainbridge (2002), were considered for “Digital library”.

The main objectives of this study were to explore various techniques of learning by using digital library; evaluate these techniques of digital library; and highlight the need for education by using the digital library techniques.

It has been found by literature review that some researchers have concentrated on the digital library design, attributes, and extract information such as Wu and Witten (2006), Dong and Agogino (2001), etc., whereas, others concentrated on studying educational digital library as specific digital libraries and specific users, (e.g., Digital Library for Earth System Education (DLESE), MathDL, BiosciEdNet (BEN), and the
Microbelibrary. In addition, some researchers have analyzed the usability of the digital libraries such as Xie (2008)\textsuperscript{56}, Teal Anderson and Sayeed Choudhury (2008)\textsuperscript{45}, Zani-Sabihi, Ghinea and Chen (2006)\textsuperscript{14}, Judy Jeng (2005a, 2005b)\textsuperscript{25,26}, etc.

Learning technology standards specify learning object metadata and interoperability. This research concentrated on the evaluation of Berkeley Digital Library with respect to its usability attributes and learning activities of the learners. With respect to digital materials, three actions create the tools for active learning (Active consuming, Information Gathering, and Information Seeking). Questionnaire which consisted of three parts was a research tool developed by the investigator. Different statistical techniques and statistics programs were used in this research such as multiple regressions with backward methods, normality, reliability, factor analysis using SPSS 17.0 Program. Structural equation modeling techniques were used by applying AMOS 5 Program which determined the relationship between the latent variables and observed variables and detected the direction of the impact of some variables toward others. The core of this study was to study the influences among “effectiveness, efficiency, and satisfaction”; “efficiency & satisfaction”; “effectiveness & satisfaction”; “learning activities, usability, and the ease of use”; “experience of using the Internet & Internet”; “learnability of the digital library & ease of learn”; “time spent, number of steps required for using the digital library materials, and satisfaction”; “learning activities, satisfaction, and learnability”; “activities, active learning, and learning”; “time spent, number of steps, usability, and activities”; “satisfaction, usability, and active learning”; “learnability, usability, and learning”; “information seeking, active learning, and learning”; and “active consuming, active learning, and learning".
A model and suite of instruments were designed and successfully tested.

Given the fact that digital objects carry information in digital libraries and their respective metadata specifications, the proposed dimensions of quality for these two concepts can be connected to the life cycle of information in digital libraries (Borgman, 1996\textsuperscript{5}). Information seeking and learning processes cannot be separated (Cole, 1999\textsuperscript{8}; Marchionini, 1995\textsuperscript{10}). Therefore, the relationship between information seeking and learning, and digital libraries, information seeking and learning were discussed.

Digital libraries extend such interdisciplinary approach by making diverse information resources available beyond the physical space shared by groups of learners. Digital libraries open new learning opportunities for global rather than just local communities. Many of the data sets and computational tools of digital libraries were originally developed to enhance professional learning. Digital libraries combine technology and information resources to allow remote access, breaking down the physical barriers between resources. Digital learning material provides many opportunities to provide an authentic learning content. Especially, digital learning materials provide many opportunities to engage each student individually in studying. Digital learning materials provide several opportunities to prevent cognitive overload. Digital libraries are potentially highly interactive environments encouraging electronic learning between its users (Microsoft, 2003\textsuperscript{17}; Jose et al., 2002\textsuperscript{28}; Kearsley, 2000\textsuperscript{29}).

Today, active learning is a highly discussed issue; it brings students into the process of their own education taking them beyond the role of passive listener and note taker, and allowing the student to take some direction and initiative in classroom instruction (Jayawardana, 2001\textsuperscript{24}). Teachers can distribute lecture notes and other
required materials via the Web. Learners then get the opportunity to use learning materials freely and independently, collecting other related materials on the Web as well (Dodge, 1996; cited in Jayawardana, 2001). At the same time the digital library is a machine readable representation of materials over the Internet, which might be found in a University library together with organizing information, intended to help users find specific information, well managed, and supports searching of digital objects. It should be looked as a set of tools and objects that support students’ learning and information task. Students are looking for learning materials or an information that are easy and intuitive to use or important to study. This study considered both reading activities with static digital library materials and listening/watching activities with audio-visual library materials. Active consuming is a composition of active reading, active listening, and active watching. It discussed the information gathering (copying, downloading, etc.) and information seeking (searching, browsing, navigating, etc.) in the contexts of the digital library and provided tools that play role in improving activities in any learning environment. It applied student-centered formal leaning and usability testing techniques to measure learning activities from the perspectives of active consuming, information gathering, and information seeking; also to measure usability from the perspectives of effectiveness, efficiency, satisfaction, and learnability that considers both performance elements as well as satisfaction.

In the research model, learning construct was selected that leads to learning activities and usability of the digital library. Most of the hypotheses were tested, verified and accepted.
The following conclusions have been drawn upon the results which were obtained after statistical analysis of the data.

I Conclusions based on relationships between effectiveness, efficiency and satisfaction (research question 1 and hypothesis No. 1):

i. RQ1: Do the effectiveness and efficiency of using the digital library materials have influences on students' satisfaction?

ii. H01: The levels of effectiveness (of digital libraries) will have a significant impact on learner's efficiency and satisfaction (table No. 5.1.3).

The students were found satisfied with searching documents or papers that were available in BDL and did many tasks such as copying and reading these papers or e-books.

II Conclusion based on relationships between efficiency and satisfaction (research question 2 and hypothesis No. 2):

i. RQ2: Does the efficiency of using the digital library materials have influences on students' satisfaction?

ii. H02: The levels of efficiency will have a significant impact on learner's satisfaction (tables No. 5.1.4, 5.1.5 and 5.1.6).

The students were satisfied with searching documents and videos that were available in BDL, performed many tasks such as copying and reading these papers or e-books, and also downloading videos and watching some videos, and performed multi-tasks such as abstracting and extracting important information.

On the other hand, students were not satisfied with searching audios and listening to them because of the reason that they might be more interested in reading papers, documents, e-books, and watching videos for different subjects but they have less interest in listening to audios.
III Conclusion based on relationships between effectiveness and satisfaction research question 3 and hypothesis No. 3:

i. RQ3: Does the effectiveness of using the digital library materials have influences on students' satisfaction?
ii. H03: The levels of effectiveness will have a significant impact on learner's satisfaction (table No. 5.1.7).

The results led to conclude that the students were satisfied with searching texts available in word document or papers and did many tasks such as copying and reading these papers or e-materials.

The reasons behind the above finding may be that the students had experienced Web Sites such as Google, Yahoo, etc. in their University. They used to visit Internet café and searched for some information through papers or e-books to complete their learning tasks.

IV Conclusion based on learning activities & usability and satisfaction research question 4 and hypothesis No. 4:

i. RQ4: What are the influences of learning activities and usability on the ease of use of the digital library?
ii. H04: The levels of learning activities and usability will have a significant impact on ease of use of the digital library (table No. 5.1.8).

The digital library is a place that provides a set of integrated tools based on individual user's requirements and interests with respect to his access to digital library materials. These tools support active learning and usability of the digital library techniques by integrating the learner's personal library and a remote digital library.

V Conclusion based on relationships between Experience and Internet research question 5 and hypothesis No. 5:

i. RQ5: What are the differences between students' experience and using Internet?
ii. H05: The levels of learner's experience will have a significant impact on using the Internet (table No. 5.1.9).

It was concluded that, the students heavily relied on the Internet for their academic activities. It was also noted that there were differences between students' experience and using Internet because of differences of interests & preferences, availability of information under one site, time, variety of resources to collect data and human communication.

VI Conclusion based on relationships between Learnability research question 6 and hypothesis No. 6:

i. RQ6: What are the influences of the digital library learnability on the ease of learn?
ii. H06: The levels of digital library learnability will have a significant impact on ease of learn of the digital library (table No. 5.1.10).

The results led to conclude that, learnability is the most fundamental digital libraries' usability attribute. The digital library system should be made easy to learn and should guarantee good performance so that the students can rapidly start getting some work with the digital library system. It can also be noted that, the learnability of the BDL had positive impact and major influences on ease of learn as mentioned in this study.

VII Conclusion based on relationships between Time spent & ease of the system research question 7 and hypothesis No. 7:

i. RQ7: What are the influences of the time spent for using the digital library on students' satisfaction?
ii. H07: The levels of time spent using the digital library will have a significant impact on learner's satisfaction (tables No. 5.1.11, 5.1.12 and 5.1.13).

It can be noted that, the hypothesis holds true in the category of “looking for papers or e-books” but in the category of “search for videos”, the results were not so,
because of the fact that motivation led students to spend more time with large satisfaction. The downloading of a video will take time rather than copying text. However, the watching of video gave positive impact and greater satisfaction. Though, downloading audio also takes some time but less than downloading video, however, the listening to an audio decreases students' satisfaction which means more time spent, less satisfaction.

It can further be noted that, the time spent in searching for BDL has positive impact and strong influences on students' satisfaction (on text and video), but negative and weak influences on audio.

**VIII Conclusion based on relationships between Number of steps & ease of the system research question 8 and hypothesis No. 8:**

i. **RQ8:** Can the number of steps of using the digital library materials lead to the full students' satisfaction?

ii. **H08:** The levels of steps to reach the digital library materials will have a significant impact on learner's satisfaction (tables No. 5.1.14, 5.1.15 and 5.1.16).

It can be noted that, the number of steps involved in searching BDL has positive impact and strong influences on students' satisfaction (video) but negative and weak influences in text and audio categories.

When students see a video and have opportunities to interact with the educator or teacher, they are more satisfied; however, when they listen to an audio or read text, they find it tiring. An active conversation is more satisfying than a silent conversation.
IX Conclusion based on relationships between Learning activities & ease of the system research question 9 and hypothesis No. 9:

i. RQ9: What are the influences of learning activities on students' satisfaction?

ii. H09: The levels of learning activities will have a significant impact on the learner's satisfaction (tables No. 5.1.17, 5.1.18 and 5.1.19).

Learning activities cover most of the part of this study. These activities such as searching, browsing, listening, watching, reading, copying, downloading etc. are increasing day by day with education changing situations of education. It was found that more activities led to larger satisfaction but fewer activities led us to lesser satisfaction.

X Conclusion based on relationships between Learning activities & ease of learn research question 10 and hypothesis No. 10:

i. RQ10: What are the influences of learning activities on learnability of the digital library?

ii. H010: The levels of learning activities will have a significant impact on the digital library learnability (table No. 5.1.20).

The results led to conclude that learning activities had negative impact and weak influences on learnability of the BDL.

XI Conclusion based on relationships between Activities and active learning hypothesis No. 11:

i. H011: The levels of activities will have a significant impact on the active learning (table No. 5.2.1.1).

It can be noted that activities and active learning had positive impact on learnability of the BDL.
XII Conclusion based on relationships between *Time spend, usability & activities* hypothesis No. 12:

i. H012: *The usability will have a significant impact on amount of time spent* (table No. 5.2.1.1).

According to the obtained results, the time spent and usability had negative impact on students’ activities while using BDL.

XIII Conclusion based on relationships between *usability & Number of steps* hypothesis No. 13:

H013: *The usability will have a significant impact on the levels of steps* (table No. 5.2.1.1).

The number of steps and usability showed a positive impact on learning of the BDL.

XIV Conclusion based on relationships between *usability & Satisfaction* hypothesis No. 14:

i. H014: *The levels of satisfaction and usability will have a significant impact on active learning* (table No. 5.2.1.1).

The results led to conclude that satisfaction and usability had positive impact on active learning of the BDL.

XV Conclusion based on relationships between *usability & Learnability* hypothesis No. 15:

i. H015: *The levels of learnability and usability will have a significant impact on learner’s learning* (table No. 5.2.1.1).

Learnability and usability showed a negative impact on learning of the BDL.

XVI Conclusion based on relationships between *active learning & Information seeking* hypothesis No. 16:

i. H016: *The levels of information seeking and active learning will have a significant impact on learner’s learning* (table No. 5.2.1.1).
Information seeking and active learning had positive impact on learning of the BDL.

XVII Conclusion based on relationships between active learning & Active consuming hypothesis No. 17:

i. H017: The levels of active consuming and active learning will have a significant impact on learner's learning (table No. 5.2.1.1).

Active consuming and active learning had positive impact on learning of the BDL.

Note: Hypotheses No. 11, 13, 14, 16 and 17 supported the answer for questions No. 11, 12, 13, 14, 15, 16 and 17.

XVIII Conclusions based on the analysis of students' comments for the attributes of Usability

The following conclusions are based on students' comments regarding the usability (table No. 5.3.1):

i. The organization of the digital library's content was straightforward and easy to look up at things.

ii. The terminologies too were straightforward, understandable, clearly described and explanatory.

iii. The attractiveness of color, graphics, and readability were not complicated and were found suitable with regard to font features.

iv. The students perceived the system to be easy to navigate and with the back option that helped them to get the correct pathway.

v. The overall reaction of students led to conclude that they were fully satisfied with ease of use, organization of information, terminologies, attractiveness and mistake recovery.

vi. The students felt bored with the site design in the first instance, but when used it the next time and more, they felt comfortable.

vii. The subjects' comments regarding navigation indicated that links should be stable and self-explanatory.

viii. Most of the students who participated in this study indicated that a click was enough to simply get what they could expect.

According to Jayawardana (2001) the tools of the digital library can support active learning by integrating the user's personal library and remote digital library that students have a lack of these tools. This means that the students with extra training on the...
digital library tools can search or browse the digital library easily; therefore, this will increase the interaction between the students and the digital library, which further increases students' satisfaction. It leads to support the usability (usefulness) of the digital library materials.

From the results it could be inferred that activities and usability of the digital library, and active learning had the strongest total effect ($\beta=1.000$) on learning, followed by information seeking ($\beta=.966$), and then by effectiveness of using the digital library materials ($\beta=.691$), and finally by information gathering ($\beta=.642$).

In the last part of the study, the researcher discussed the implications of the findings in different categories, such as traditional pedagogical shift, teacher preparation and curriculum reform, teacher professional development and policy reform, equality of educational opportunities for all students. The suggestions for future researches were also discussed and submitted for future researchers.

6.2 EDUCATIONAL IMPLICATIONS OF THE FINDINGS

The present study found most of usability attributes to have positive impact on learnability and learners' satisfaction. Learning activities had also positive impacts, such as impact of activities and active learning on students' learning; impact of information seeking and active learning on students' learning; impact of active consuming and active learning on students' learning.

System designers and developers must acknowledge that a system's ease of use is dependent on any particular task context (Keil, et al., 1995). To ensure a system's usability and learning activities, system designers and developers should start with a clear
understanding of learners' requirements and needs. However, it is important to gain a clear understanding of how and why teachers and students are using technology, what is the need for traditional pedagogical shift? What are the needs in teachers' preparation and curriculum reform? How they can be effective in teachers professional development and policy reform, and for providing equality of educational opportunities for all students.

In order to integrate technology in schools, teacher education programs play a crucial role. Teacher preparation on technologies should provide teachers with a solid understanding of various media, their affordance, and constraints. Such understandings can only emerge when teachers are actively involved in teaching and learning with technology across the various disciplines. It is essential to look at teachers' backgrounds, their comfort level with technology, the affordances associated with the specific technology, and the human and technological infrastructure.

6.2.1 NEED FOR TRADITIONAL PEDAGOGICAL SHIFT

Technology skills should be taught as part of curriculum. One can learn how to use a computer while working on a meaningful task. Teacher preparation should not be based on training for “computer literacy” but should prepare teachers for using technologies to construct, represent, and share knowledge in real life contexts. Teachers should be taught about how to use technology for constructing, organizing, and communicating knowledge (Barron, Goldman, 1994). The history of technology use in education shows that the first inclination is to use new technology in the same traditional ways as the old technology (Cuban, 1986; Means, 1994).
The digital libraries (DLs) today are a result of an advanced technology. These DLs include different resources that help teachers and students to improve their educational skills. Therefore, teachers should get training on how they could use DLs such as browsing, navigation, and searching their materials. Old curricula and pedagogical approaches should be reformed, and if necessary replaced, to take advantage of the affordances of the new media (Vrasidas C. & Melsaas M., 2001). Learning is a result of construction, collaboration, reflection, and negotiation within a rich context in which learning is situated (Brown, Collins, & Duguid, 1998). Technology has the potential to support constructivist learning and be used for active, authentic, and cooperative activities (Jonassen, Peck, Wilson, 1999). Harasim (1995) opined that computer-mediated education facilitated educational approaches, which shifted the focus from “knowledge transmission to knowledge building” (p. 205). Knowledge building results when learners interact with their peers, collaborate, discuss their ideas, form arguments, and negotiate meaning. Information technologies and computer networks shift the role of the teacher from knowledge transmitter to that of facilitator who provides opportunities for interaction and meaning making to all learners.

Additionally, in a teacher education course, a variety of evaluation technologies can provide information about the learners’ thinking processes, self-reflective skills, performance in completing real-world authentic tasks, and ability to identify technology solutions to instructional problems. Traditional tests can also be used but they should not be the only method of evaluation. Other evaluation techniques include the collection of students’ projects and assignments, students’ self-evaluations, reflective journals, and class presentations of sample lessons (Vrasidas C. & Melsaas M., 2001).
6.2.2 TEACHER PREPARATION & CURRICULUM REFORM

In a course on educational technology for teachers, the goal should not simply be to teach the use of several technology systems, their advantages, and disadvantages. Instead, the goal should be to provide students with opportunities to think like experts in making instructional decisions, selecting media for appropriate use, structuring learning activities, and employing sound pedagogical strategies in real-life contexts. Furthermore, teacher preparation programs should not simply offer a course in educational technology, but also demonstrate effective use of technology in teaching teachers several other courses.

Constructivist approach and uses of technology in teaching should be modeled in the teaching of other subject matters such as mathematics education, science education, and social studies. For instance, in science education, future teachers should be taught with technology in ways that model appropriate technology-based learning for science education.

Several rich interactive multimedia systems exist in the market that allow students to work in groups to review video vignettes of classroom teaching, identify good practices, and discuss them with peers. At Arizona State University, the teacher preparation programs for both in-service and pre-service teacher training on mathematics methods make extensive use of an interactive multimedia program called Mathedology (Technology Based Learning & Research, 1998). Mathedology is based on a digital library of classroom video depicting primary teachers teaching mathematical concepts using the National Council of Teachers of Mathematics' (NCTM) professional standards on discourse. The program includes video episodes of elementary mathematics teachers.
modeling the NCTM professional standards on discourse, expert commentary in audio format, content based on the NCTM Curriculum and Evaluation Standards, and animations of mathematical concepts. Students can view the video vignettes of teachers and discuss them with peers. Mathedology provides a rich content for teachers to develop an understanding of appropriate mathematics teaching in primary schools. Such multimedia systems provide all students and teacher a common and rich content for discussion, much richer than text descriptions of settings. In addition students can listen to teachers shown in vignettes and understand what math educators and other experts have to say about the teaching strategies used in the video episode (Vrasidas C. & Melsaac M., 2001).

The BDL has the same features of the Mathedology but with several subjects such as Chemistry, Biology, Microbiology, Education, Physics, English, Arts, Medical ... etc. Its rich-environment allows prospective teachers to experience real-life scenarios of classroom teaching, construct multiple perspectives, and reflect on their practice. BDL programs include video, audio, animation, encyclopedia, news, graphics, text, communication canalization ... etc. that provides multiple conversations between both teachers and students, teachers together, and students together.

6.2.3 TEACHER PROFESSIONAL DEVELOPMENT AND POLICY REFORM

According to Ertmer (2005), "It takes five to six years for teachers to accumulate enough expertise to use technology in ways advocated by constructivist reform efforts" (p. 27). To integrate technology in teaching, pre-service teachers need to be well prepared, but also in-service teachers need to deepen their knowledge and skills.
as well. In-service teachers need time to develop, master, and reflect on technology-based learning approaches. They need time and incentives to participate in lifelong professional development. In addition, students need training to use these technologies to construct their knowledge in flexible ways and in a short time. Digital libraries will help teachers and students to value and encourage up-to-date knowledge, skills, and qualifications. However, a skills-based or competency-based compensation pay system might be a better way to value and reward teacher knowledge and skills. Students in this study used BDL and found it quick and accurate. As digital libraries improve their techniques, students and teachers will increase their use of digital libraries. Findings from this study suggest that creators of digital libraries should remember their target audience, teachers and students, and should not forget their original goal of creating materials that are, ideally, core-related, age-appropriate, interactive, engaging, aesthetically pleasing, and accountable.

6.2.4 EQUALITY OF EDUCATIONAL OPPORTUNITIES

Timothy E. Morse (2004) discussed the multidimensional meaning of the term digital divide as: (a) the effect of this phenomenon as it relates to equality of educational opportunity for all students and (b) ways to address it. The reason every student must develop basic technology literacy skills is that the use of computer technology is becoming increasingly commonplace in every facet of society. Even though computer technology is being used more frequently throughout society, its use is not equitable among the social groups in society, a circumstance that could result in negative outcomes
for students with limited access to computer technology. Thus, the inequitable use of computer technology has been referred to as the digital divide.

According to Gorski (2002)\(^9\), this learn “has traditionally described inequalities in access to computers and the Internet between groups of people based on one or more social or cultural identifiers” (p. 28), such as race or gender. Brown\(^6\) and colleagues stated that schools attended by students from diverse ethnic backgrounds as well as students from families living in poverty are likely to offer less access to most types of technology. If every student is to be afforded an opportunity to develop basic technology literacy skills, the first issue that must be addressed is eliminating the inequities that exist with respect to each student’s access to the computer technology. Simply stated, if a student is to learn how to use computer technology, he must first have ready access to it (Collins, 1991; Kozma & Croninger, 1992\(^9\)). Brown (2000)\(^6\) noted that there is an emphasis in some inner city schools to use computer technology to enable students to acquire basic academic skills, whereas in schools that are more affluent it is used to develop the students’ critical, higher-order thinking skills. As such, Clark and Gorski (2001)\(^7\) challenged educators to think about how they will use technology with their students before doing so and specifically noted that educators should juxtapose the issues of what can be done with technology and what should be done with it. However, administrators and policy makers need to set clear agendas regarding the educational and curriculum goals they would like to achieve with the help of new technology innovations.

Literature on educational change reveals that teachers facilitate integration of such innovations into daily classroom realities (Sarason, 1971\(^4\); Popkiewicz, 2000\(^3\)). To avoid such a situation, policy makers and administrators implementing educational
innovations need to adopt a model that will blend the top-down and bottom-up strategies (Fullan, 1993\textsuperscript{17}) because, as Fullan\textsuperscript{17} argued, effectiveness of educational change depends on the level of coordination between these two strategies. Within such a model, policy makers and administrators must give teachers "agency" (Sarason, 1971\textsuperscript{41}) in both the planning and implementation of an innovation. This "agency" as Fullan and Stiegelbaur (1991)\textsuperscript{18} argued, should not be based on administrators' assumptions that teachers were involved because they had been placed on major committees or project teams. True teacher involvement takes place when teachers are engaged in every stage of educational change, including goal setting and planning, budget and curriculum designing, and implementation of innovation (Wiburg, 1997\textsuperscript{57}).

Teachers also need to be provided with more opportunities for control within their own classrooms system. To help teachers in this respect, administrators can provide teachers with display devices and central monitoring systems that will allow them to determine the times students may access technology and the time they may not, as well as the degree of access with regard to Internet and digital libraries sites. Administrators, policy makers, and teacher educators also need to recognize that school-wide and college technology initiatives are a complex process that involve far more than putting computers in classrooms. Individuals in charge of implementing innovations need to realize that teacher, like students, are comprised of "different type of learners who cannot be treated the same way" or expected to "progress at the same pace when integrating technology into their individual practice (Snoeyink & Ertmer, 2001-2002)\textsuperscript{43} (p.104).
6.2.5 OTHER IMPLICATIONS

In the light of findings of the present research work the followings implications have been suggested:

1. Establish the DL web site for education purpose in Universities and colleges because DLs are beneficial for distance education that allows multi-directional interaction between students and teachers and students with each other. DLs can incorporate a variety of multimedia elements such as text, graphics, audio, video, animation, etc. The incorporation of these communication mediums has the potential to address all students' learning style; both instructors and students are able to author and publish their work to a global audience, and the posting of the students' projects, papers, and other student work may be used for modeling, discussion, and review in DLs (See DL Principles, Dong & Agogino, 2001).

2. To help learn and use technology in general and specifically DLs for instructional purpose, there is a need to provide assistance to existing teachers by a professional staff member or a teacher colleague to increase comfort and productivity levels. Show concrete curricular items that would benefit more with the use of digital libraries (DLs) and computer technology rather than traditional tools, and make opportunities to observe constructivist ways of teaching with technology in other teachers' practice to show other than word processing, note taking. Moreover, teacher-led-technology uses must be created as well as more student-centered learning environments in their universities or schools must be created. (See Use of Hypertext, Snyder, 1998).
3 To help students learn and use technology and DLs, they need to be prevented from the digital divide on economic grounds. Administrators who implement digital library initiatives need to make such digital libraries open to every student free of charge. Students need early training on DLs web site to support the learnability of the DLs (See Diognene Project, Vergara et al., 2003).

4 Flexible training schedules and several course materials are needed (See Diognene Project, Vergara et al., 2003).

5 DLs collection should meet the users' information needs as well as provide easy access to users (See Topic-Map based system, Dicheva & Dichev, 2004).

6 Library as a place needs to make sure that there are enough computers for students to use; printers and photocopiers are all usable; the network is connected, and the ready-to-serve on-site technical assistance is available (See Pathway Project, Steven Scott et al., 2007; ensuring equality of educational opportunity in the digital Age, Timothy E. Morse, 2004).

6.3 SUGGESTIONS FOR FUTURE RESEARCH

This research extends the following suggestions for future researches:

i. The study was primarily conducted on Undergraduate English Language students in Taiz University. Not much is known about the use of DLs at other levels of education, so future researches may conduct studies on other levels of education than undergraduate level. If learning and EDLTs is to fully be assessed, additional studies on undergraduates in other disciplines with different backgrounds need to be conducted.
ii. Researches may be conducted on topics such as, the effect of DLs on the learning and teaching. This research has pointed out that Digital Library Techniques (DLTs) have influences on learning. Additional studies that focus on DLs to assess the learning will help clarify the degree to which Digital Libraries affect students' education and learning methods, approaches or any other educational aspects. Further studies may be conducted to clarify the potential relationship between professional development activities and experience.

iii. The current research relied on quantitative data only. Students of other subjects may interpret the terms describing learning and DLTs that were used in the instrument differently. Thus, it is recommended that future studies couple the questionnaires with classroom observations and analysis of documents related to the participants' teaching, such as syllabi and handouts.

iv. A more granular approach to investigate into various aspects of learning assessment may be applied.

v. Use of other demographic informations as variables of interest may provide a more clear picture of learning of undergraduates of English Language who are using DLs. For example, this research did not investigate into differences based on gender and age. Focus on variables such as these may add to understand of what currently appears to be individual differences among students.
vi. Researches related to the impact of institutional support on the education and diffusion of technology may clarify the role of institutional grants to support the scholarship of teaching and learning or the impact of departmental support on learning and education through DLs.

vii. Finally, instruments used in this study may be valuable tools for others studying similar problems, therefore, further testing and refinement of these instruments could be taken as topics of future researches in this field.

6.4 SUMMARY

This dissertation consists of six (6) chapters arranged as follows: in chapter 1, the researcher described the digital library's concepts, features, advantages and the impact of technology on education and learning. It stated the problem and research questions, significance of the study, objectives, hypotheses, and definition of important terms.

In chapter 2, literature review was discussed related to digital libraries, problems issues and challenges of the digital libraries and their usability. In chapter 3 a detailed description of the conceptual framework has been presented, for instance, in section 1, the researcher discussed the multimedia information retrieval and communication, its model, elements, and media interaction. Secondly, information retrieval, content-based image retrieval, and hypertext and hypermedia conceptualization were also discussed. In section 2 of this chapter, the framework of information-seeking, relationships between
learning, information seeking, and digital libraries, and scaffolding and personalization have been given.

The chapter 4 described in detail the research design, population and sample, research tools, data collection, and statistical techniques. The reliability, validity of the instrument, preliminary findings of the pilot study, factor analysis, and normality were also explained.

The next chapter (5) concentrated on data analysis and its interpretation. The results of the study and the related key findings were demonstrated which were mostly positive and fulfilled the objectives of the study.

Finally, in chapter 6, the implications of findings were discussed and the needs for changes in the field of education according to these study findings were indicated. The chapter concluded with important points with the perspective of the research findings and some previous studies and conclusions were drawn accordingly. In the end a few suggestions were made for future researches in this area of Educational technology.
REFERENCES


292


294

