

**INVESTIGATING ELECTRONIC PORTFOLIO IN PRE-
SERVICE TEACHER EDUCATION IN THE GULF
REGION**

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INVESTIGATING ELECTRONIC PORTFOLIO IN PRE-SERVICE TEACHER EDUCATION IN THE GULF REGION

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By

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1 Electronic portfolios in context: Introduction to the research

Keeping its higher education systems competitive in the 21st century, the technology era, is the vital task of higher education in the Gulf Region as well as throughout the world (Abdullah, 2001; Alaasemi, 2003; Al-Nagim, 2002; Watson, 2001). Nowadays, computer technology is all around us, in the government systems, in medical systems, in the banking systems, as well as in many activities of everyday life such as the shopping centers using technology in their activities (Al-Nesif, 2001). Since our prospective teachers are going to teach our children (the new generation), it is important to remind them that our children should be able to deal with technology. It is known that today's children are growing up with technology, so their abilities in handling technology and more than this in finding and managing information and in communicating are different from the previous generations' abilities (Al-Nesif, 2001).

Although this dissertation, "Investigating electronic portfolios in pre-service teacher education in the Gulf Region," has a specific focus on two particular countries, it reflects questions that are currently being asked at many organizations for higher education world wide. The research documented in this dissertation investigates the effectiveness of using an electronic portfolio with or without the associated use of a Web-based support system as applications of technology that can be used in order to enhance and document professional and academic growth in the students in pre-service teacher education.

This chapter starts with general information about technology in the educational community and the influence of computer technology in Section 1.1, and in particular in pre-service teacher education, Section 1.2. This is followed in Section 1.3 with an overview of the higher education system in the Gulf area, in particular in Kuwait and Qatar, the target groups of the applied portions of this research. Section 1.4 illustrates the deficiencies in documenting and improving or enhancing professional and academic growth in the higher-education context in the Gulf Region, as well as teachers' opinions about the adequacy of their preparation with regard to the use of technology as part of professional development. From this, the problem statement and the research questions are formulated in Section 1.5. Finally, Section 1.6 will give an overview of the chapters in this dissertation.

1.1 The influence of computer technology in education

Information and communication technologies are vital factors in shaping the new global economy and producing rapid changes in society. Through the past decade, the new technology tools have fundamentally changed and transformed people's perspectives and practices with respect to communication methods and doing business, as well as their learning processes (Duke, 2002). Throughout the last decades, electronic media and technologies have influenced our society, lifestyles and therefore also our educational systems (Heinrich, Molenda, Russell, & Smaldino, 1996). Khvilon and Patru (2002) state that "Educational systems around the world are under increasing pressure to use the new information and communication technologies (ICTs) to teach students the knowledge and skills they need in the 21st century" (p. 3). The amazing pace of growth of technologies in all aspects of our life, especially in education, necessitates us to change our perspectives of adopting and implementing technologies in our learning system (Heinrich, Molenda, Russell, & Smaldino, 1996). Thus, adopting and adapting to "the technology of the 21st century" is unavoidable for everybody in society and in particular in the educational context (Ali, 2003; Collis & Moonen, 2005). As a consequence, educational leaders worldwide are striving to utilize this technology positively in learning to keep abreast with the technology era and the evolution in workplace demands. Therefore educational leaders are giving high priority to the objectives of: (a) using technology as a tool to serve or support the learning processes, and (b) using technology to equip learners with the latest professional technological skills.

Electronically supported learning can occur in many ways. Web-based technology can be used to providing stimulating contexts to reinforce the learning and teaching processes. Programmed or tutorial instruction (previously called Computer Assisted Learning, CAL, and Computer Assisted Instruction, CAI) was one of the early ways to use computer technology for learning. However, even in the early 1980s the contrast between using computer technology as a sort of substitute for the teacher, and using it as a tool with the guidance of the teacher was already well established (Collis & Moonen, 2005). At the beginning of the 1990s, electronic tools beyond standalone computers were introduced to the education communities: the Internet started to be used to connect learning environments in different locations and to provide a platform via which users could share knowledge, perspectives, and cultural issues worldwide (Heinrich, Molenda, Russell, & Smaldino,

1996). Thus computer technology can supply many different types of tools, resources, and systems (collectively often referred to as “e-learning” or “online learning”) in order to accomplish students’ and instructors’ needs. Supporting learning with a Web-based system and tools can become “the fruit of the incorporation of technology into education” (Ingram & Hawthorn, 2003; see also Ali, 2003; and Cameron, 2003). Web-supported instruction can be for distance education or used as a complementary tool in classroom instruction. The Internet, particularly the World Wide Web, has become as a fertile phase for delivering knowledge and information and for providing instruction in electronic formats (Ali, 2003; Roberts, Conn, Lohr, Hunt, & Duffy (2003). Moreover it can be an important medium for access to resources to improve the quality of teaching and learning and to promote collaboration at a distance (Ali, 2003; Barrett, 2001; Cameron, 2003; Summerville, 2002). The variety of resource types that can be published, such as text, graphics, audio, and video, makes it attractive for many learners and instructors as well. Another privilege of using Web tools and systems to support learning, that they can be available independence of place and time (Fisher, 2002).

Instructors in higher education are now regularly placing course materials in Web-based environments as well as resources to support classroom instruction (Janicki, Schell, & Weinroth, 2002). But, as much as course Web environments can help to produce good quality learning, they can also in the other be associated with a low quality of learning. Changing pedagogy is important. The transfer from a traditional didactic teaching approach to an approach centered on the learners demands an instructional delivery model that promotes interactive learning and critical thinking (Ali, 2003). It is important that the use of electronic resources takes place in explicitly planned structures that relate the technology use to the objectives of the course. In higher education, most universities, colleges, and institutions are stimulating the use of technologies in their learning processes in order to improve the quality of the outcomes (graduates) and meeting the needs of the work force in their respective countries (technological skills) (Barrett, 2001; Cameron, 2003; Summerville, 2002). Boon (2001) stated that e-learning should involve more than creating course material on the Web and making it available free of charge to everyone; it “involves more than transferring information in electronic form. It involves teaching strategies like communication [discussion, chat, questions and answers]; formative assessment, participation, case studies and problem solving, assignments, demonstrations, simulations and record keeping” (p. 162).

Ali (2003) summed up the benefits of using technology-supported learning as the following (p. 43):

- Asynchronous communication facilitates communication between students and faculty-this deals with problems of time and convenience;
- Online learning facilitates online research;
- Online learning individualizes instruction;
- Communities of learners-students engage in interaction with other students/faculty; and use various ways to engage in discussions;
- Content improvement: online learning such as Web-based instruction makes it easy to update content; and
- Scalability: adjustments can easily be made, for example, adjustments can be made to course arrangements and communicated with a Web environment.

In contrast, Ali (2003) notes that the use of electronic tools and resources for learning also has disadvantages. They can include the following (p. 43):

- Sluggishness: multimedia can make access to information slow and difficult;
- Expensive: initial and/or maintenance costs can be high;
- Non-intuitive: online learning requires skills; and
- Unsystematic: lack of structure can be confusing and inconvenient.

Thus, depending on how electronic tools and systems are integrated into the curriculum and into learning activities in courses, they can influence learning processes very much. “ICT is not only perceived as a catalyst for change, but also for change in teaching style, change in learning approaches, and change in access to information” (Watson, 2001, p. 251). Reflecting the penetration of computer technology in society, teachers’ and students’ roles can considerably change. Teachers can become facilitators in the new learning environment instead of being direct knowledge providers. Along with the changes in teachers’ roles, students’ roles also can be changed from being primarily receivers of information to becoming active in learner-centred learning, responsible for their own learning processes (Collis & Moonen, 2005; Leh, 2002).

But what does this mean in terms of actually implementing changes in established ways of teaching and learning? And are the participants in

the educational system indeed willing to adopt and adapt and eventually willing to change to use the tools of e-learning? Or is there still a majority in the educational sector that will resist collaborating with the change?

This dissertation will focus on this broad issue of the implementation of computer technology in education, but at the same time it will focus on a particular sector of education, namely higher education in the Gulf Region, and more specifically, pre-service teacher education in Kuwait and Qatar. Given the broad range of technological applications possible in education, also a specific kind of technology is chosen, namely electronic portfolios. The reasons for this will be developed in Chapters 2 and 3. In addition, from the literature it is known that instructors and students need help and support when working with new technology and learning in new ways. Thus a Web-based support system will be designed and developed to help students and instructors with the processes involved with electronic portfolios. This kind of support system will be introduced in Section 2.1.3. The focus for using both electronic portfolios and a Web-based support system to accompany the portfolio use is on stimulating professional and academic growth, particularly relating to skills in using technology as well as in new ways of communicating.

1.2 Computer technology in teacher education

In many parts of the world the opinion is often expressed that pre-service teacher preparation programs do not adequately prepare future teachers to teach with technology. Moreover, there are serious concerns in term of teachers' continuing professional development (CPD). UNESCO is particularly active not only in documenting these concerns but in helping decision makers develop strategic objectives and planning for effective use of technology in teacher education (Resta, 2005). In UNESCO's Division of Higher Education, the focus is on prompting and improving the "quality of educational processes through the diversification of contents and methods and promoting experimentation, innovation, the diffusion and sharing of information and best practices as well as policy dialogue" (Khvilon & Patru, 2002, p. 3). To reap the full benefits of computer technology in learning, it is essential that pre-service and in-service teachers have basic computer-related skills and competencies, which are translated in this research as components of professional and academic growth. Teacher preparation programs must supply pre-service teachers with professional competencies relating to the application of technology to learning as well as provide up-date training sessions for in-service teachers.

Moreover, new pedagogical models as well as new tools to improve the learning processes and outcomes need to be designed and developed. Consequently, for more productive learning environments for pre-service teachers, teacher preparation programs also need to develop strategies and plans to enhance the teaching-learning process within their programs and to assure that all future teachers are well prepared to use the new technologies as tools for learning. Therefore, the rapid development of information and communication technology is forcing educational leadership to stimulate teacher preparation programs to restructure around new pedagogies and to infuse the use of information and communication technology in order to “ensure that pre-service teachers not only understand how to use a computer but also how to design high quality technology-enhanced lessons” (Angeli, 2005, p.384).

A particular way in which technology is being used for reform in many pre-service teacher education programs worldwide is through the use of electronic portfolios as tools for students to present their work and reflections on their work in an integrated way, making use of Web-based technology (Moonen, Collis, & Anderson, 2005). Portfolios are increasingly being seen “as well-constructed, purposeful and individualized collections of artifacts capturing the complexities of learning and teaching, and demonstrating the creator’s abilities, progress, achievement and effort of what he/she can do” (Wieseman, 2004, p.2). Electronic portfolios will be described in more detail and their uses in teacher education expanded upon in Chapter 2. Two major reasons that electronic portfolios are used are to introduce new methods of authentic assessment and also to provide an opportunity for students to develop their own skills in presenting themselves and their work and ideas using electronic tools and systems. Portfolios are excellent tools for reinforcing learning and making formative and summative decisions about learners’ knowledge, skills, dispositions, and growth. Growth and learning are clearly important attributes of a quality instructional technology program (Wilkerson & Lang, 2003). Montgomery (2002) states that “Three powerful trends anchored in the educational reform movement are rapidly converging in ways that directly impact the evolution of the digital teaching portfolio and the preparation of teachers for the 21st century. The first of these trends, the movement of teacher preparation programs toward the adoption of professional teaching standards, drives the other two: the need for performance-based teacher assessment and an accompanying need for new technological tools to record and organize evidence of successful teaching” (p. 3). Many other educators are advocating the use of electronic portfolios in teacher education (Barrett, 2005; Boulware,

Bratina, Holt, & Johnson, 1997; Bird, 1990; Brown, 2002; Campbell, Cignetti, Melenzyer, Nettles, & Wyman, 2001). Barrett (2005) states that “portfolios are not so much an instructional strategy to be researched, but more of a means to an end: to support reflection that can help students understand their own learning and to provide a richer picture of student work that documents growth over time” (p. 2).

Thus, this research will examine the electronic portfolio, as well as a Web-based support system to help students and instructors in the portfolio processes as well as to integrate the portfolio processes with the rest of the course activities. At the same time it will look at the restructuring of pedagogies that occurs when electronic portfolios and features of a Web-based support system become embedded in teaching and learning. The objective of the portfolio context is improving pre-service teachers’ professional and academic growth. The particular setting for the research is pre-service teacher education in two countries in the Gulf Region. The following section presents an overview about the research context.

1.3 Higher education in the Gulf Region

In the late 1960s, the Gulf countries began reconstructing their education systems and other cultural aspects of their societies. They have invested heavily in education, transforming it from a privilege into a right. Sections 1.3.1 and 1.3.2 describe the educational systems of Kuwait and Qatar.

1.3.1 The Kuwait higher education system

Kuwait hosts two major higher educational entities: Kuwait University and the Public Authority for Applied Education and Training. Next to this, Kuwait hosts several private higher education institutes in order to fulfill local labor forces demands.

- **Kuwait University**

Kuwait University is the only public university in Kuwait. The university was established in 1966. Since then it has grown from 400 students to nearly 18,000. Kuwait University is a co-ed institution, made up of five campuses in Kuwait City. The staff and faculty members have expanded from only 31 faculty members at the start, to include now staff in a number of colleges and departments, which are: Arts; Commerce, Economics, and Political

Science; Engineering and Petroleum; Law; Islamic and Islamic Studies; Medicine; Allied Health and Nursing; Science; Education; Graduate Studies; and the Women's College (Ministry of Education Kuwait, no date). The specific context in this research is the College of Education.

- The Public Authority for Applied Education and Training

The Public Authority for Applied Education and Training (PAAET) was established in 1982. The aim was to fill the need for technical and vocational training in Kuwait which is reflected by the various educational facilities that have been created. Today, PAAET is comprised of two sectors: Applied Education and Training. The Authority is charged with providing and developing a national labor force to meet the development requirements of the nation. It is also works towards diversifying of Kuwait's national economy by training students for careers beyond the oil industry (Ministry of Education Kuwait, no date).

Given the aim of this dissertation some information is given about teacher education in both institutions. The Faculty of Education at Kuwait University offers a four-year Bachelor's degree program for intermediate and secondary teachers. The College of Basic Education at the PAAET offers four-year Bachelor's degree programs for elementary teachers. The Teacher Training Faculty of Kuwait University offers higher-level study programs for teachers whereby they may obtain a Higher Teaching Diploma or a Master's Degree in Teaching. Besides this, the teachers who would like to work in a higher-education institute as assistant teachers and instructors in technical colleges should obtain at least a Master's degree, which is offered by the College of Graduate Studies at Kuwait University (Ministry of Education Kuwait, no date).

- Other institutions of higher education

There are several other higher education institutions in Kuwait such as the Higher Institute of Dramatic Arts. Kuwait is the only country in the Gulf that sponsors music education. Its Musical Academy offers general education and musical training for students from secondary school to college graduation. Kuwait University provides lifelong higher education in their Continuing Education & Community Service Centre. This Centre offers courses in Languages, Computer Sciences, Business Administration and Accounting Sciences, Statistics and Insurance, Economics,

Secretarial Studies, Humanities, Arts and General Knowledge, as well as In-service Training programs (Ministry of Education Kuwait, no date).

- Private higher education

There are several private universities that have been established in Kuwait in order to pursue filling the deficiencies in the capacities of the government sponsored higher education institutions. One of those universities, which opened in September 2002, is The Arabic Open University. It provides distance education with added enhancements characteristic of a quality educational institution. The university consists of four faculties, which are: the Faculty of Business Administration, the Faculty of Computer Studies, the Faculty of Education Studies, and the Faculty of Language Studies. The University offers a Bachelor Degree. In addition, there are new universities opened in Kuwait from various countries, such as the United States of America and Canada.

1.3.2 The Qatar higher education system

Higher education is an essential prerequisite to progress in any society. Therefore, since its establishment in 1973, Qatar State has focused on improving its higher education system. Qatar hosts two major higher educational entities: the University of Qatar (public university), and the Qatar Foundation for Education Science and Community Development (QF, private sector). The QF hosts numerous private universities, colleges, and institutes.

- The University of Qatar

Qatar University is the only public university in Qatar. It was established in the mid 1970s. Qatar University has focused on ensuring quality education in all its programs. Hence, a few years ago, it has undergone education reform and implemented a comprehensive reform plan to improve the quality of higher education in Qatar and to prepare graduates to compete in the global market. Therefore, the University of Qatar is proud of its history, achievements and clear vision for the future. In keeping with its vision it strives to adopt suitable advanced curricula, uses of information technology and new teaching methodologies, and they continuously review and advance their programs. Moreover, they cooperate with domestic, regional and international bodies to

advance science and build bridges that strengthen prosperity. A new academic structure has been established to include a central College of Arts and Sciences.

- The Qatar Foundation for Education Science and Community Development

In 1995, in order to bring radical improvements in the field of education and social development, Sheikha Mouza, the wife of the Emir of Qatar, established the Qatar Foundation for Education Science and Community Development (QF). In 1997, the Qatar Foundation set out on a strategic plan to create the Education City. This entity covers an area of 800 hectares. Higher education institutions from the USA, UK, and Europe were invited to bid for setting up their campuses in the Education City.

In 1998, Virginia Commonwealth University, Richmond USA, set up their women's only campus at the Education City. The VCU-Qatar offers four-year BA degrees in fine arts, graphics, interior design, and fashion design. Other universities from the USA which have established their campuses at the Education City include the Weill Cornell Medical College (WCMC-Qatar), offering a six-year integrated program taught by the Cornell faculty. The two-year non-degree pre-medical program is followed by a four-year medical program leading to the MD. degree. The present intake is 16 students who will qualify in 2008. Texas A & M University - Qatar (TAMU-Q) provides undergraduate engineering degrees in chemical, electrical, mechanical and petroleum engineering. The present intake is 61 students. Carnegie Mellon University Qatar offers undergraduate degree programs in business and computer science. Their present intake is 41 students.

The Science and Technology Park (STP) was established in December 2004. It incorporates research and business being conducted throughout the institutions in Education City to promote the development of intellectual property and design of cutting-edge technology.

Even though the higher education systems in the Gulf region are improving themselves, still, there are some deficiencies in the Gulf Region's higher education. The deficiencies that are appearing in Kuwait and Qatar are described in the next section.

1.4 Status and deficiencies in the Gulf Region higher education system

In this section, an overview is given of the current situation in higher education in the Gulf Region (Section 1.4.1), in particular in terms of deficiencies in pre-service teacher education. An exploration was conducted for this research in order to verify the predicted deficiencies in teacher preparation program outcomes. Section 1.4.2-1.4.5 give an overview of how the exploration was carried out and the results from the perspectives of higher education faculty members, in-service teachers, and a key person involved with the labor force and workforce employment. From these explorations, the key problem to be addressed by the research can be stated at a general level (Section 1.4.6).

1.4.1 Reform initiatives

Both Kuwait and Qatar are striving to reform their higher education outcomes in order to provide their societies with well-equipped graduates who are capable of responding to the emerging needs of the labor force. The former Minister of Education in Kuwait, dr. Mosaed Al-Haron, refers to these developments in the following statement:

“Technology has revolutionized the way we work and is now set to transform education. Children cannot be effective in tomorrow’s world if they are trained in yesterday’s skills” (Al-Haron, 2003).

Sheikha Mouza, the wife of the present Emir of Qatar and who is in charge of developing the education system in Qatar, has said that her philosophy is that people are the wealth of the nation, therefore, educating the nation is the first priority of her agenda. She aims to develop and utilize human potential through a network of centers, and a unique Education City with branch campuses of world-class educational institutions, in order to evolve the nation to produce an increasing number of high-quality professionals among its graduates of higher education.

Sheika Mouza’s plans for an Education City is one example of a strategy to improve higher education in the Gulf Region. Another direction for strategy relates to what occurs within the curriculum and the teaching and learning processes. Saleh (2005) said that “a problem in academic achievement is being caused by the content of curriculum and teaching methods” (p.5). Although there are many ways in which

curriculum and teaching methods can be reformed, a particular focus is on ways in which ICT can be integrated into the teaching and learning processes.

In response to the low level of in-service teachers' technological skills the Ministry of Education, starting from 2004, requires that all teachers who are pursuing a promotion in their career have to obtain the ICDL (International Computer Driving License) or the ECDL (European Computer Driving License) certificate. Moreover, these two licenses are not only required from in-service teachers in K-12 schools but also are required for faculty members in higher education (at the University of Kuwait and PAAET) (Al-Nesif, 2001).

In this respect, Ali (2004) stated that the Kuwaiti education system is already taking steps to implement technology support for learning in their public education system since 2002. He mentioned that there is a new national project called "E-Learning Environment" which will be fully implemented by the Ministry of Education in 2005, which will bring school to home for all public school learners via the use of network technology. The goal of this project is to provide learners with the electronic support environment they need such as e-books, support for learning activities, and support for doing exercises at home. Moreover the project provides extra on-line tutoring, which means that the availability of the teachers is increased from not only during the day in order to respond to their students' inquiries on-line after the school day.

However, despite these initiatives it can be predicted that higher education in the Gulf Region has deficiencies and to overcome these deficiencies, procedures will have to be implemented to force higher education to focus on these deficiencies. Teacher education as a part of higher education in general is an especially important sector in terms of improving deficiencies, in that deficiencies in the preparation of teachers will also result in deficiencies in the preparation of their eventual students in the schools of the region. Thus this research will focus particularly on pre-service teacher education in the Gulf Region. Within this focus, the particular strategy of introducing electronic portfolios as a tool for curriculum change as well as changes in teaching and learning methods will be investigated.

In order to begin the research with specific insights into pre-service teacher education in the Gulf Region, an exploration was conducted for this research in order to verify the predicted deficiencies in the processes and outcomes of teacher preparation programs as well as

deficiencies in higher education more generally. The results of these explorations are discussed next, beginning with a general overview of how the explorations were carried out.

1.4.2 Preliminary exploration

In order to do an initial exploration of the deficiencies of Gulf region higher education outcomes for this research, the researcher developed three sets of questionnaires. For higher education faculty members, a questionnaire was used to explore faculty members' attitudes toward the change process. The second questionnaire focused on the local labor force and its opinions about the degree to which higher education graduates are adequately prepared for the job market. The third was a questionnaire accompanied by interviews for practicing teachers (in-service teachers) to investigate their opinions about their own professional development and the role of technology in that development. The respondents are shown in Table 1.

Table 1. Respondents to the initial exploration

Country	District	Respondents	Total distributed
Kuwait	Higher education faculty members	6	18
	Local labor force members	1	5
	In-service teachers	15	15

The questionnaires are given and the responses are discussed in Sections 1.4.2.1-1.4.2.3.

1.4.2.1 Responses of higher education faculty

For higher education faculty members, a questionnaire was used to explore faculty members' attitudes toward the change process. The questionnaire was based on the Stages of Concern (SoC) Model (Hall & Hord, 2001; to be discussed in Section 4.2), either within a course or on an organization level. The questionnaire was developed along four dimensions, which are: the faculty member's awareness of deficiencies in the higher education system, cultural resistance to change in higher education, issues relating to the adaptation and implementation of new teaching and learning methods using technology, and awareness and readiness for introducing electronic portfolios.

Figure 1 shows an overview of the questionnaire and the main question that was underlying the questionnaire.

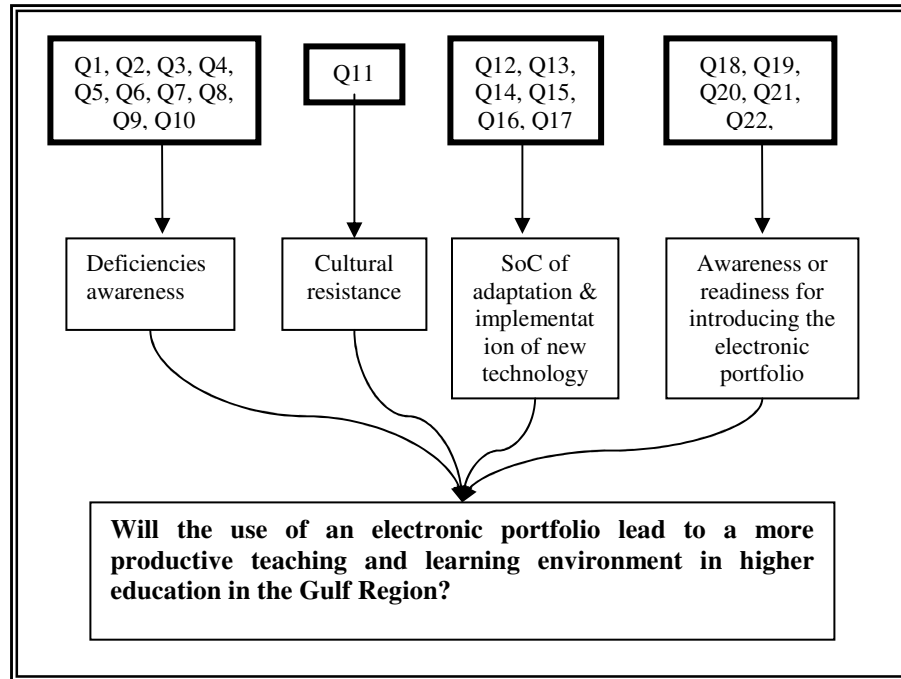


Figure 1. Concept mapping for the faculty members' questionnaire

The questionnaire contained 22 questions, with responses to each item on a five-point scale with values SD= Strongly disagree, D=Disagree, UD= Undecided, A= Agree, SA= Strongly agree. Table 2 shows the items on the questionnaire along with the results.

Table 2. Faculty members' perspectives on their graduates (N=6)

Question	SD	D	UD	A	SA
Higher education graduates are satisfying the local labor force's needs.		4	1		1
Higher education graduates are equipped with up to date professional skills.	1	4		1	
Higher education graduates are documenting their professional and academic growth by physical evidence.	6				
Higher education graduates are equipped with up to date technology skills.		4	1	1	
The deficiencies in our graduates have to do with: <ul style="list-style-type: none"> - Course delivery - Teaching styles - Assessment methods - Faculty members - The students themselves 			2 2 2 1		4 4 4 6 5
I support the notion of equipping learners with learner centered, self- evaluation, and reflection abilities.					6
Graduates have to be equipped with up to date communication skills, such as using e-mail, the Internet, on-line discussion forums, and still, face to face communication.				2	4
I support the notion that learners have to document their professional and academic growth by physical evidence.		1		5	
I support the notion that learners have to develop either a paper portfolio or an electronic portfolio in order to document their professional and academic growth.		1	1	4	
An electronic portfolio can be considered as an authentic assessment technique in order to improve students' professional and academic growth.				6	
My organization/department has undergone education reform.					6

My organization/department's reform was because of: - The need to keep abreast of the technology era. - Fulfilling the labor force's demands.				2	4 6
Our organization/department's objectives are fully fulfilling the labor force's needs.		4	2		
Our organization/department is accomplishing its objectives with our recent course delivery.	4	1		1	
Our organization has an authentic assessment method.	4		1	1	
I support the use of the portfolio as a compulsory requirement for employment.		1		3	2
Higher education faculty members encounter challenges in order to embed interactive instruction.					6
I do like embedding various teaching methodologies in my course (linear and non linear)				1	5
I do like using web based course resources as instructional tools.				2	4
I do like using collaborative learning (linear and non linear techniques) in order to improve students' professional and academic growth.				6	
I do like using a portfolio as an: -Assessment tool - Presentation tool - Documentation tool - Reflection tool - Archival tool				3 1 1 2	6 3 5 5 3
A portfolio has to include the following: - Statement of educational philosophy - Resume (CV) - Archive of student's work - Papers/ reports - Interesting links - Evidence of communication about learning activities		2		2 1 2	6 4 6 6 3 4

From the responses given by the faculty members, the following statements can be supported:

- Students need an authentic assessment tool in order to improve and document their professional and academic growth.
- Students have to be equipped for the 21st century.
- Faculty members need an authentic assessment technique in order to evaluate their course outcomes.
- Faculty members need to keep abreast with the evolution of technology and embed new techniques in their courses, such as Web based course environments and electronic communication tools.
- At the organizational level, administrators should consider an electronic learning environment and electronic learning resources as obligatory requirements in order to improve and enhance their learning outcomes.

1.4.2.2 Responses of a member of the local labor force

The purpose of this questionnaire was to explore the local labor force's perspectives on the adequacy of the outcomes of higher education. The questionnaire contained 12 questions, with the responses to each on a five-point scale, with values SD= Strongly disagree, D=Disagree, UD= Undecided, A= Agree, SA= Strongly agree. Table 3 shows the responses of the one respondent, a person with experience of more than 15 years.

Table 3. Local labor force's perspective on the outcomes of higher education outcomes (N=1)

No.	Question	SD	D	UD	A	SA
1	Kuwait higher education graduates are satisfying our labor force needs.		1			
2	Kuwait higher education graduates are equipped with up to date professional skills.	1				
3	Kuwait higher education graduates have physical evidences of their professional and academic growth.	1				
4	Kuwait higher education graduates are equipped with up to date technology skills.	1				
5	Kuwait higher education objectives are fully fulfilling the labor force's needs.			1		

6	Kuwait higher education system is accomplishing its objectives with their recent course delivery.			1		
7	I support the notion of equipping learners with learner centered, self- evaluation, and reflecting ability.					1
8	Graduates have to be equipped with up to date communication skills, such as using e-mail, Internet, and on-line discussion forums, as well as face to face communication.					1
9	I do support the notion of learners having to document their professional and academic growth by physical evidence.					1
10	Learners have to develop either a paper portfolio or an electronic portfolio in order to document their professional and academic growth.				1	
11	A portfolio should be compulsory as a requirement for employment.				1	
12	A portfolio should include the following: <ul style="list-style-type: none"> - A statement of educational philosophy - Resume (CV) - An archive of the student's work - Paper/ reports - Interesting links - Evidence of communication involving activities 					1 1 1 1 1 1

The member of the labor force had opinions that were similar to those of the higher education faculty members. In particular:

- Graduates of higher education should be able to document their accomplishments by physical evidence.
- Higher education has to change its method of assessment.
- Higher education has to adopt and implement the 21st century technology.

1.4.2.3 Responses of in-service teachers

The researcher interviewed the 15 in-service teachers who responded to the survey request to ask their opinions about their professional development and their use of technology. The sample had been selected randomly through Public School District Department- Ministry of Education – Kuwait. The interviews were held through telephone

conferences. Table 4 shows the questions that were discussed and a summary of the responses

Table 4. In-service teachers' interview questions

No.	Question	SD	D	UD	A	SA
1	I do enjoy doing things on the computer	9		2	4	
2	I do think getting a promotion in my job depends on my computer skills					15
3	I do think that I'm an expert in using a computer	11	2		1	1
6	Children enjoy lessons on the computer					15
7	I believe that in-service teachers need periodic up grading of their professional skills				2	13
8	I believe in-service teachers need periodic training in using computers					15
4	I do think that the recent assessment method promoted by the Ministry of Education is an unauthentic tool					15
5	I do support the notion of having a new assessment method in order to document my progress in my career					15
6	Producing lessons that use computers is compulsory for my promotion criteria.					15
7	I need external assistance to produce my computer lessons	2			2	11
8	Producing computer lessons through the help of a commercial agency costs me too much.					15
9	Working with computers makes me uncomfortable.		4	1		10
10	Promotion in my job doesn't depend on my computer skills	15				
11	I'm a novice in using a computer	2				13
12	Using electronic instruction could not attract children's attention	15				
13	In-service teachers do not need: - Periodic up grading in their professional skills - Periodic training in using computer	15 15				
14	The assessment method for promotion at the Ministry of Education is an authentic tool.	15				

15	Producing lesson materials for the computer by a commercial agency is not expensive	15				
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In Table 4 it can be concluded that:

- In-service teachers are unsatisfied with the current assessment method used for promotion in their jobs.
- In-service teachers need periodic up grading and training in their professional skills.
- Most in-service teachers are novices in using a computer.

1.4.3 Implications from the exploratory study

According to previous analyses of deficiencies, higher education institutions in the Gulf Region are suffering from:

- Their graduates lacking adequate professional and technological skills.
- Inappropriate assessment methods, and the unavailability of authentic assessment methods (see Section 2.4 for a discussion of authentic assessment).
- Limited use of technology in order to emphasis and enhance some professional (communication, collaborative learning) and technological skills.
- Resistance from higher education faculty members for using electronic resources and systems for learning.
- Inadequate up grading and training of faculty members in order to adopt and implement new technologies for teaching and learning.

The exploratory investigations supported all but one of these conclusions (the one exception was that there was not evidence that higher education faculty members are resistant to using technology for new ways of teaching and learning). The main finding from the exploratory studies was that there are deficiencies in professional development skills as well as the technology skills of the graduates of higher education.

According to the deficiencies analysis focusing on teacher preparation programs the researcher extracted the following:

- Higher education needs to make adequate use of technology in order to increase students' technological skills and professionalism to acceptable levels.
- Higher education needs an authentic tool to document pre-service teachers' academic and professional progress within a course or at a program level.
- Higher education systems need to make use of an electronic support system in order to successfully implement electronic portfolios in higher education in the Gulf Region. The purpose of using such an electronic support system is to reduce obstacles encountered by either faculty members or pre-service teachers during the portfolio development procedures and also to provide the tools for better communication and peer review about the portfolios during development.

Based on this initial analysis and the fact that there seems to be little formal discussion or progress in improving teaching and learning in pre-service teacher education in the Gulf Region to eliminate these deficiencies, the researcher has reacted, from her point of view, to seek a step to the solution, which is integrating electronic tools and resources to improve pre-service teachers' academic and professional growth. The researcher found that the use of (paper-based) portfolios was already common within teacher education as a method for collecting pre-service teacher's work/ assignments (within a course). It was also found that a small group of faculty members in Kuwait University, who used paper portfolios in their courses, used them as a requirement to pass the course. Additionally, the University of Qatar is undergoing a reform project which involves integrating electronic portfolios on the faculty members' level as well as on the students' level. Thus there was a starting point in place for the research.

Therefore, the purpose of adopting electronic portfolios in the Kuwait and Qatar contexts is to provide the teacher preparation programs with a tool that stimulates deeper learning processes, provides quality documentation of the pre-service teacher's progress, and requires the pre-service teachers to improve their technological skills. Furthermore, in order to reach these goals with electronic portfolios, some sort of support system is needed to help instructors and students learn more about portfolios, integrate the portfolio process with other course processes, and bring communication and peer interaction into the portfolio development process. According to this conclusion from the exploratory analysis, this research will examine the use of an electronic portfolio accompanied by an electronic support system for working with

the portfolio to attempt to reach a more productive teaching and learning environment in pre-service teacher education in the Gulf Region. The following section elaborates on this in the problem statement and the research questions.

1.5 Problem statement and research questions

In this section, the problem statement for the research is further discussed, followed by a statement of the research questions and hypotheses which structure the research.

1.5.1 Problem statement

The research will focus on the use of an electronic portfolio in order to enhance students' professional and academic growth. Moreover based on Angeli (2005) as well as other researchers (Resta, 2005), teacher preparation programs need detailed and explicitly structured pedagogies in order to be able to redesign their method courses to make effective use of electronic portfolios. Since the context in which this research takes place is already familiar with the portfolio concept in terms of requiring paper-based portfolios in some courses for pre-service teachers, the researcher predicted that modifying the usage of the existing paper-based portfolio and replacing it with an electronic portfolio will lead to a positive impact on students' professional and academic growth. However, the researcher also predicted that the use of the portfolio will be more effective if it is supported by other electronic tools that help students and the instructor to embed the portfolio processes within the course as well as stimulate communication and peer review about the portfolios when they are under development.

Based on this, it can be concluded that there is a need for:

- An effective tool to improve learner progress (professional and academic growth)
- An authentic assessment tool that meets specific criteria in order to attain learners' professional and academic growth
- A documentation tool to document (physical evidences) learner's professional and academic growth
- A lifelong learning tool
- A new instructional approach (using electronic tools) in order to enhance learners' professional and academic growth.

According to the researcher's perspectives, these needs can be addressed through substituting the paper portfolio with an electronic

portfolio and supporting the electronic portfolio development process with a Web-based support system. The problems for this research are how to design and create such a support system, what happens when it is used in practice, and how can this use in practice be improved so that implementation can occur on a broad scale?

To address these problems, the research is structured around sets of research questions which in turn lead to both conceptual and applied phases of the research.

1.5.2 The research questions

Based on the problem stated in Section 1.5.1, the following overall research questions are formulated:

In what ways can the use of an electronic portfolio lead to a more productive teaching and learning environment in higher education in the Gulf region?
Under what conditions can the use of the electronic portfolio be strengthened given the context of higher education in the Gulf Region?

The two questions relate to the “why” and the “how” of using an electronic portfolio in the context of higher education in the Gulf Region, and more specifically in pre-service teacher education.

From these overall research questions three sets of sub-questions can be derived. The first set are conceptual; the second set relating to specific investigations that translate the conceptual answers into the specific setting of pre-service teacher education in the Gulf Region; the third set relates to consolidation and recommendations for further application and research.

Conceptual questions:

1. What is an electronic portfolio?
 - a. What are possible components of an electronic portfolio and of an electronic support system to help students and instructors in the processes of using an electronic portfolio?
 - b. What are goals and ways of using an electronic portfolio in higher education and in particular in pre-service teacher education?

- c. What learning theories can underlie the use of electronic portfolios and in particular how to these relate to the use of electronic portfolios for pre-service teacher education?
2. In what ways can an electronic portfolio contribute to pre-service teachers' professional and academic growth?
 - a. What is academic growth?
 - b. What is professional growth?
 - c. What is the role of an e-portfolio in pre-service teachers' professional and academic growth?
 - d. What are considerations for course design in pre-service teacher education so that professional and academic growth are stimulated and integrated with electronic portfolio use?
3. What are key factors for implementing an electronic portfolio in higher education?
 - a What are key factors at the organization, curriculum, instructor and student levels that affect the change process when introducing new technologies and teaching methods?
 - b What are specific recommendations to improve the likelihood of successful implementation of electronic portfolios in pre-service teacher education?
 - c How should be taken into consideration in the design of a Web-based support system to accompany portfolio use to increase the likelihood of use of the system in practice?

Design and investigation questions:

- 4 What are the requirements for the design of tools to support the use of electronic portfolios in the context of pre-service teacher education in the Gulf Region?
 - a What are the components of the electronic portfolio itself?
 - b What are the components of a support system to help students in the development of their electronic portfolios?
 - d What functionalities are needed for students in the support system?
 - d What functionalities are needed for the instructor in the support system?
 - e What are key requirements relating to usability of the support system?

The Web-based support system designed for this research became known as the Electronic Portfolio Support System. It was the tool used in the three investigations that then took place in the pre-service teacher

education context in the Gulf Region. The research questions that steer these investigations follow.

5. Research questions for Investigation 1:

- a What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic Portfolio Support System, and how are these used for improvements in the support system?

Following the 1st Investigation, the conditions are in place to study the hypothesis:

The use of electronic portfolios with the support of the Electronic Portfolio Support System will lead to more professional and academic growth of pre-service teachers than the use of paper portfolios alone.

This hypothesis is one of the focuses of the research questions in the 2nd Investigation.

6. Research questions for Investigation 2:

- a What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?
- b. What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic Portfolio Support System, and how are these used for improvements in the support system?

Following the 2nd Investigation, the conditions are in place to study two additional hypotheses:

- *The use of electronic portfolios with the support of the Electronic Portfolio Support System will lead to more professional and academic growth of pre-service teachers than the use of electronic portfolios without Electronic Portfolio Support System and both of these will lead to more professional and academic growth than paper portfolios alone.*
- *The results of the electronic portfolio process will be more positive for students using the Electronic Portfolio Support System than for students not using the Support System.*

These hypotheses are the focuses of the research questions for the 3rd Investigation.

7. Research questions for Investigation 3:
 - a. What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio without the use of the Electronic Portfolio Support System compared to when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?
 - b. What are differences in the level of understanding and quality of production of electronic portfolios by pre-service teachers when the Electronic Portfolio Support System is used, compared to when it is not used?

Recommendations:

Finally, the last set of research questions deals with the consolidation and further application of the research.

- 8 Recommendations
 - a. What are recommendations for the further implementation of electronic portfolios in pre-service education in the Gulf Region?
 - b. What are directions for further research more generally?

The answers to the questions should give instructors and higher education decision makers in the Gulf region a useful vision on how to organize successful reforms relating to the electronic portfolio.

The next section will give an overview of the chapters in this dissertation in relation to the research questions.

1.6 Overview of the dissertation

This chapter started with an overview about the role of computer technology in society, in education generally, and particularly in teacher education. Also, it provided an overview about the research context, namely the higher education system in the Gulf Region, and with more specific contexts, namely the Kuwait higher education system as well Qatar higher education. Concerns about the deficiencies in the professional and academic growth of graduates from pre-service teacher education in the Gulf Region were identified. To respond to these, an approach involving new teaching methodologies in pre-service teacher

education that make use of electronic portfolios and are supported by a Web-based support system for both students and teachers was introduced. How to realize this approach and what actually happens when used in practice will be the focuses of the dissertation. From this, the research questions and hypotheses were introduced.

Towards a more specific understanding of the ideas behind this research, Chapter 2 presents a theoretical framework in relation to electronic portfolios and issues related to the instructional methods that can accompany the use of a portfolio. The functionalities that can be present in an electronic portfolio or in a support system to help students and instructors understand the develop electronic portfolios are identified. The role of a portfolio and that of an electronic portfolio in teacher preparation programs, and the use of the electronic portfolio as an authentic assessment tool will also be presented in this chapter. Several learning theories and activities will be discussed in Chapter 2 in relation to an electronic portfolio, such as the constructivism theory, deep learning, learning with peers, collaborative learning, non-linear instructional methods, learning from hypertext and learning using a Web-based learning environment will also be explored.

In order to come to a more specific understanding of role of the electronic portfolio in pre-service teacher preparation programs, Chapter 3 focuses on the meaning of academic and professional growth and their main aspects for pre-service teachers. Moreover, in this chapter, the requirements needed to improve the academic and professional growth of pre-service teachers through the use of electronic portfolio will be examined. These requirements include the need for course redesign so that the overall learning environment is more productive in terms of stimulating academic and professional growth. An analysis of a productive course environment in which electronic portfolio use plays a part concludes the chapter.

Factors that influence the successful implementation of innovations such as the electronic portfolio in practice are the focus of Chapter 4. The chapter will look at supporting implementation within the specific course, with a focus on the use of Web-based support systems. The chapter will also look at implementation from the instructors' perspective as well as from the organizational perspective. The chapter concludes with a list of factors that will be important to consider in implementing electronic portfolios in pre-service teacher education.

Building on this conceptual research, Chapters 5-8 describe investigations in actual practice in the Gulf Region. Chapter 5 presents

the research methodology for these investigations including the research approach, subjects, instruments, and design. The dependent variables for the investigations will be indicators of academic and professional growth, in measurable form.

Chapter 6 presents the design of the Electronic Portfolio Support System, the Web-based system designed for the research to help students and instructors integrate electronic portfolios into a course. Based on the initial version of the Electronic Portfolio Support System, the 1st Investigation in practice is described. This investigation involved exploratory use of the Electronic Portfolio Support System by students and instructors, followed by a formative evaluation concerning the functionality and usability of the system. The results of the formative evaluation are described, and the way they are used to design and produce a new version of the Electronic Portfolio Support System is also documented.

Chapter 7 presents the 2nd Investigation, which had two parts. A particular course in the PAAET pre-service teacher education program was the setting for the investigation. Students were randomly assigned to one of two Portfolio Context groups, one of which used the Electronic Portfolio Support System to develop an electronic portfolio and the other of which constructed a paper portfolio according to the usual procedures in the course. The two groups are compared on a number of indicators of professional and academic growth at the start and finish of the course. The second part of the investigation involved another formative evaluation of the Electronic Portfolio Support System, through a detailed study of the group of students who used it during the investigation. The results of their experiences are described in the chapter, along with the conclusions that were made about desirable changes in the Electronic Portfolio Support System. The chapter concludes with a description of how the Support System was redesigned.

Chapter 8 presents the 3rd Investigation, in which nearly 300 pre-service teachers in Kuwait and Qatar participated in a required course in one of three ways: building a paper portfolio, and building an electronic portfolio with and without the help of the revised Electronic Portfolio Support System. Descriptions of the procedure, data collection, methods, results, analyses, ideas, and conclusions are presented in the chapter.

Chapter 9 is the conclusion with recommendations for further research. In the next chapter an overview will be given about the electronic portfolio, types of e-portfolios, advantages and disadvantages of electronic portfolios in the education field, and the role of the electronic portfolio in the higher education system generally, and particularly in teacher education.

2 Conceptual review: Electronic portfolios for learning

The chapter begins with an overview of portfolios, paper-based and electronic, and for electronic portfolios a review of their options in terms of technical functionalities. Functionalities that can be part of an electronic support system to use along with specific tools for developing electronic portfolios are also identified (Section 2.1). Following this, the use of portfolios in higher education and in particular pre-service teacher education are discussed (Section 2.2), also in the context of particular learning theories and how they can be represented in portfolio processes (Section 2.3). Section 2.4 integrates these lines of discussion by focusing on a particular aspect of the use of portfolios in learning: for authentic assessment. The applications of these results with regard to electronic portfolios are discussed with respect to the research in this dissertation (Section 2.5). This chapter responds to the first set of research questions (Section 1.5.2):

1. What is an electronic portfolio?
 - What are possible components of an electronic portfolio and of an electronic support system to help students and instructors in the processes of using an electronic portfolio?
 - What are goals and ways of using an electronic portfolio in higher education and in particular in pre-service teacher education?
 - What learning theories can underlie the use of electronic portfolios and in particular how do these relate to the use of electronic portfolios for pre-service teacher education?

2.1 Portfolios: Definitions and characteristics

Portfolios can be defined in many ways and can consist of many different combinations of functionalities for both students and instructors. Sections 2.1.1-2.1.3 discuss these general aspects particularly in respect to electronic portfolios and of functionalities for electronic support resources to help students and instructors make use of electronic portfolios.

2.1.1 *Definitions of a portfolio*

Portfolios have a long history. In general, portfolios are organized collections of artifacts, with a purpose beyond just being a collection. For example, portfolios are:

“containers of documents that provide evidence of someone’s knowledge, skills, and/or dispositions” (Bird, 1990, p.250).

Reflective comments are often added to the contents of a portfolio, increasing the purpose of a portfolio to self analysis. For example, portfolios are:

“Vehicles for ongoing assessment that are composed of purposeful collections which examine achievement, effort, improvement, self-evaluation, and goal setting” (Tierney, 1991, p. 2).

“A fusion of processes and product. It is the processes of reflection, selection, rationalization and evaluation, together with the product of those processes” (Winsor & Ellefson, 1995, p. 68).

“A cumulative record of progress that fosters reflective thinking and can be used for advisement, assessment, and eventual placement” (Mokhtari, Yellin, Bull, & Montgomery, 1996, p.246).

“A collection of authentic and diverse evidence, drawn from a larger archive representing what a person or organization has learned over time on which the person or organization has reflected, and designed for presentation to one or more audiences for a particular rhetorical purpose” (Barrett, 2005).

With these sorts of emphases on critical reflection, it is natural that portfolios have been seen as valuable learning tools in educational settings. Portfolios in these contexts are seen as:

“A learning environment in which the learner constructs meaning” (Paulson & Paulson, 1994, p. 61).

“A purposeful collection of student work that exhibits the student’s efforts, progress and achievements in one or more areas. The collection must include student participation in

selecting contents, the criteria for selection, the criteria for judging merit, and evidence of student self-reflection” (Paulson, Paulson, & Meyer, 1991, p. 60).

Portfolios are also seen as valuable for on-going professional development. There are many examples of this for practicing teachers. For example, portfolios are:

“A quality record of a teacher’s practice selected for a particular purpose. It is a discriminating collection of teaching materials that may assist in demonstrating significant career achievements. Described as a “living” document, the portfolio contains selected cameos of teaching practice captured over a defined period of time. These examples demonstrate the teacher’s thinking about the nature and substance of personal professional practice and its outcomes” (Standards Council of the Teaching Profession, 1997, p.3).

“An organized collection of complex, performance-based evidence that indicates a teacher’s knowledge, skills, and dispositions, best practices, growth over time, and professional goals” (Department for Education and Skills, 2005, p.1).

“Not expected to be a comprehensive account of all of a teacher’s accomplishments, but a *selective* one that highlights the distinctive features of that individual’s approach to teaching, at the same time, however, the portfolio should be more than a few snapshots, but should reflect a person’s accomplishments over time and in a variety of contexts” (Wolf, 1991, p. 36).

Thus, a portfolio is a collection of artifacts that are given meaning by way they are used and reflected upon. The medium by which this occurs and which makes the portfolio available to others has an influence on how it achieves its purpose.

“An electronic portfolio uses electronic technologies, allowing the portfolio developer to collect and organize portfolio artifacts in many types (audio, video, graphics, text). A standards-based electronic portfolio uses hypertext links to organize the material to connect artifacts to appropriate goals or standards” (Barrett, 2000, p.15)

The format of a portfolio affects its function in a variety of ways. These include: determining what is in the portfolio in terms of medium (for example, a paper based portfolio cannot include a video of an individual

performing a certain task), determining how the materials in a portfolio are cross-referenced to each other and to other resources, and determining how many people in what locations can access the portfolio and give feedback. Paper-based portfolios are less-rich environments than electronic portfolios in all these respects. In addition, electronic portfolios can be embedded in larger electronic support environments that provide access to tools for creating the portfolio, including for adding hyperlinks to show the relationship of entries to each other and to things outside the portfolio such as course objectives, communicating with others about portfolios, sharing one's portfolio with others even when it is in construction, giving feedback to others about their portfolios, and making available resources of a variety of forms to enrich the learning experience that surrounds the development of a portfolio in a course setting.

When used in an electronic context, the term “portfolio” is multidimensional, and can include electronic portfolio items, electronic portfolio systems, or electronic portfolio presentations (Roberts, Aalderink, Cook, Feijen, Harvey, Lee, & Wade, 2005). Electronic portfolio items could be seen as “learning objects”, files that might be stored or referenced in an e-portfolio system. Roberts and his colleagues state that “emerging standards recognize certain key types of e-portfolio items” (p. 6). An electronic portfolio system in contrast “is a collection of tools that allows various operations to be performed with e-portfolio items, for example: uploading products to a file store, entering reflective statements, and making presentations” (Roberts, et. al, 2005, p. 6). Thus the boundary between the electronic portfolio itself and the system that supports its integration into larger learning processes may not always be clear.

2.1.2 Advantages and disadvantages of electronic portfolios

Many authors have discussed the comparative advantages and disadvantages of electronic portfolios compared to paper-based portfolios (Arter & Spandel, 1995; Baron, 1996; Barrett, 2001; Polonoli, 2000; Ring, 2002). For instance, “electronic portfolios promote learner self-evaluation even as they maximize the use of diverse learning strategies” (Bastist & Banerjee, 2004). Herman and Morrell (1999) argue that electronic portfolios “shift the balance from teacher-centered learning to student-centered learning” (p.4).

Electronic portfolios have several advantages that should be considered as important for their value. In contrast, there are disadvantages, but

these disadvantages generally depend on factors in relation to the environment which is surrounding the development of the electronic portfolio, not the electronic portfolio itself.

- Advantages

Integration of technology: An electronic portfolio is a good example of integrating technology into the curriculum in various ways by constructing and linking learner artifacts with standards by using technology. Moreover, the hyperlinking available in electronic portfolios helps to integrate deep learning through shifting the responsibility to the students to make decisions, and thus better control their learning, developing, maintaining, revising, thinking, reflecting their work (Ring, 2002).

Demonstration of communication/computer skills: Electronic portfolios show how the learners are demonstrating various communication skills through the development of their electronic portfolios, beside, they show proficiency in using technology (Polonoli, 2000).

Motivation/assessment: Electronic portfolios can motivate students more than paper based portfolios by allowing them to showcase their portfolios via the World Wide Web (WWW) or on CD-ROMs. In this situation, the motivation will be stronger and the effect becomes deeply motivational (Boulware, Bratina, Holt, & Johnson, 1997).

Feedback: Electronic portfolios are better instruments for feedback than paper portfolios, which allows for the improved evaluation of the efficiency of learning goals, the effectiveness of learning strategies, and the clarity of knowledge presentation (Barrett, 2001).

Storage/ size: The most obvious advantage is the storage size. The student can have large amounts of materials placed on a small medium such like a CD, DVD or a Web site. What can be placed on these kinds of storage media is equivalent to many binders or boxes (Barrett, 2001).

Quantity/economy: “There is always some cost involved in reproduction of anything. Using computer media can reduce the costs considerably. Any comparison with

photocopying paper portfolios shows the economy and practicality of an electronic portfolio. A Web site is in many cases completely free. In some cases, where a base fee is required, expansion and addition to the site costs nothing extra. None of these factors are true for traditional formats” (Galloway, no date, p. 2).

- Disadvantages

Cost: starting an electronic portfolio needs a technical infrastructure, which is costly in the beginning. Usually, this step occurs at the organization, school, or department level in that decision makers must be convinced more broadly than only for using an electronic portfolio that it is important to keep abreast of technological developments to achieve a high level of learner performance. However, this disadvantage is only a short term problem, later on, as institutions routinely have networked infrastructures to support learning developing an electronic portfolio will cost nothing extra in terms of the infrastructure needed. The infrastructure, such as computer labs with hardware and software, Internet connections, and technical support, needs an appropriate budget in order to hit the acceptable starting level for an electronic portfolio approach.

Security: according to the security issue, “a computer file is far from secure. Any computer file can be easily lost either through oversight and error or because of more technical media failure” (Galloway, no date, p.2). Therefore, providing security to each student portfolio could be very expensive since it requires a secure database system to strengthen security.

Changes in ways of working: For both instructors and students, using an electronic portfolio involves new ways of communicating, presenting one’s work, communicating, organizing one’s work, and sharing one’s work. Working on screen is not always as convenient as writing comments on paper, for either the instructor or student. Also, both students and instructors must develop new technical skills.

Thus the advantages seem to outweigh the disadvantages, but the disadvantages can be strong enough to cause an institution or instructor to choose for paper based portfolios. An institution may need evidence

that an electronic portfolio approach is worth overcoming the disadvantages.

2.1.3 Characteristics and options for an electronic portfolio

Generally speaking, Siemens (2004) presents the electronic portfolio components, which are (p.3):

- Personal information
- Education history
- Recognition: awards and certifications
- Reflective comments
- Courseware: assignments, projects
- Instructors' comments
- Previous employers' comments
- Goals, plans
- Personal values and interests
- Presentations, papers
- Personal activities – volunteer work, professional development

Barrett (2002, p. 1) has identified four types of evidence that can be placed in a portfolio:

- Artifacts: documents produced during normal academic work
- Reproductions: documents of student work outside the classroom
- Attestations: documentation generated about student's academic progress
- Productions: documents prepared just for the portfolios. These productions include:
 - Goal statements: Students' personal interpretations of each specific purpose for the portfolios
 - Reflective statements: Students observations as they review and organize the evidence in their portfolios
 - Captions: Statements attached to each piece of portfolio evidence, articulating relationships to objectives and professional and academic growth

In an electronic portfolio, all of these items are expressed in electronic form, with hyperlinking to demonstrate connections.

In terms of physical presentation, there is little to say about paper based portfolios. However, electronic portfolios require some sort of

electronic platform for creation and publication. These platforms might be proprietary or open source, they might be Web-based or they might stand alone on a user's PC. They require some form of electronic presentation, beyond being assemblies or collections of items made for a purpose such as demonstrating competence in a field. An electronic portfolio can be considered as a personal website, with specific audiences and purposes. Lopez Fernández, 2003, lists one approach to key dimensions around which electronic portfolios can differ, as summarized in Table 5.

Table 5. Dimensions of electronic portfolios in higher education (Lopez Fernández, 2003)

Main dimensions	Categories	Options
Content of the electronic portfolio: General level	Multimedia design	Navigation approaches to move among the content Amount of user choice in the contents Selection of types of media for the contents
	Instructional design	The relation of the portfolio to the course objectives Approach taken to the description of evidence in the portfolio Audience and purpose for the portfolio Philosophy for use of the portfolio
Components of the electronic portfolio: Specific items		
	Artifacts	Organization of artifacts Appropriate choice of artifacts Creativity demonstrated in the artifacts
	Reflection	Connection between reflections and artifacts Level of reflection Overall reflection expressed in the e-portfolio
	Objectives	Criteria for grading the portfolio

Lopez Fernández's criteria are based on pedagogical perspectives in which a student is "an active agent of developing his/her knowledge using this tool, auto-regulating his/her process of learning with the

influence of other agents (like their teachers, peers, etc.), and being assessed through it” (Lopez Fernández, 2003). She aims at “providing a general view for helping to define an effective e-portfolio developed in a virtual learning environment based on components of the modern theories of learning” (Lopez Fernández, 2003, p. 6).

Possible components of electronic portfolios can also be expressed in other groupings. Barrett (2002) includes pedagogical aspects but mentions technical aspects as well, as shown in Table 6.

Table 6. Components of electronic portfolios (Barrett, 2002, p. 1)

Factor	Keys
Storage space: Amount available	<ul style="list-style-type: none"> - To store digital artifacts - To store learner self-reflection and self-assessment on each artifact - To store feedback on each artifact from assessor(s) (independent validation)
Security	<ul style="list-style-type: none"> - Tools to restrict access, setting permissions to view: <ul style="list-style-type: none"> o Artifacts only o Artifacts with reflection o Artifact with reflection and feedback - Tools to set permissions separately for faculty to view portfolios and provide feedback on work.
Linking and grouping	<ul style="list-style-type: none"> - Tools to organize the portfolio in a variety of ways (flexibility in organization) including: <ul style="list-style-type: none"> o By standards or learning outcomes o By course o By date (entered, last updated, etc.) - Tools to group around or link to: <ul style="list-style-type: none"> o Goals for the portfolio, contents of portfolio o Course goals or standards o Resume
Reflection	<ul style="list-style-type: none"> - Tools to present a reflection on a specific grouping of artifacts (i.e., to explain how this collection demonstrates the achievement of a standard or learning goal) - Tools to allow the student to state her own learning goals and future directions

Publishing	<ul style="list-style-type: none"> -Tools to create a variety of portfolios, depending on audience and purpose: <ul style="list-style-type: none"> o Assessment portfolio (a highly-structured portfolio demonstrating achievement of learning goals or standards, with independent validation and feedback on artifacts/reflections from faculty) o Showcase portfolio (a collection of artifacts, with reflections, that demonstrate growth over time, highlighting specific achievements) - Tools that allow the individualization of the portfolio, to allow creativity of expression in the presentation
Portability	<ul style="list-style-type: none"> - Functionalities that allow the archiving work in a portable format such as: <ul style="list-style-type: none"> o CD-ROM o HTML or PDF archive - Functionalities that allow students to take their portfolio to another institution or maintain it on their own.

Another approach to the characteristics of electronic portfolios was reported by Lorenzo and Ittelson (2005), based on the work of the EDUCAUSE Learning Initiative (formerly, NLII). Table 7 presents components of an electronic portfolio and of tools and systems which can support the use of an electronic portfolio, which can vary from institution to institution.

Table 7. Options for electronic portfolios (adapted from Lorenzo & Ittelson, 2005)

General aspects:

Background Information
Institution/vendor
Tool name
Website URL
Sponsor/developer
Funding source
Primary users
Contact person, e-mail

<p>Purpose:</p> <p>For the student:</p> <ul style="list-style-type: none">Student achievement-Individual courseStudent achievement-Academic program/Major/UniversityDocument attainment of learning outcomesDocument of service, learning, internshipsDocument of study abroadEmployer communicationGraduate school applicationCreative self-expression
<p>For the institution:</p> <ul style="list-style-type: none">Program assessmentCourse assessmentFaculty assessment
<p>For the instructor:</p> <ul style="list-style-type: none">Teaching AssessmentCourse AssessmentOther

Technical features and functionalities:

<p>Technical requirements/considerations:</p> <ul style="list-style-type: none">ScalabilityPortabilityFTP clientOperating systemsInteroperability/compatibility with other systemsBrowserCookiesJavaScriptDatabaseNetworkServerServer administration
<p>Application features:</p> <ul style="list-style-type: none">CommunicationInstructor feedbackPeer review/feedbackAnonymous review/feedbackDiscussion groupsEmail notification (new items)Group emailChat

Collaboration features:

- Create subgroups
- Collaboration tool
- Membership in multiple communities
- Ability to change shared documents

Teaching- and learning features:

Pedagogy features:

- Planning/goal setting tool
- Built-in learning modules
- Organizational flexibility
- Framework for creativity
- Guided reflection component
- Flexible levels of guidance/feedback

Assessment features:

- Self assessment component
- Formative assessment component
- Summative assessment component
- Links to standards/predefined goals
- Progress to degree tracking tool
- Grade tracking
- Export to grade book

Back-office features:

Content management features :

Collect

Import & save artifacts in multiple formats

Authenticate artifacts

Add annotations/captions to artifacts

Maintain archive of material

Multiple presentation formats

Select

Display/View different subsets of content

Export artifacts to other formats

Feed collaborative work into individual portfolio (vice versa)

Link artifacts to goals/standards

Add Images/objects from database

Bookmarking/annotation

Use of templates

Automatic versioning

Document indexing & searching

Searchable & linkable glossary

Searchable image archive

Reflect

Link artifacts to reflection/demonstration learning

Workflow controls

Feedback loop

Prompted questions

Storage aspects:

Links to digital repository

Document archive

Housed on university server

Central maintenance

Size limit/capacity

Access aspects:

Web based

Granularity of access levels/views

Control levels-Internal

Defined by student

Defined by instructor/advisor

Defined by institution

Defined by system

Control levels-External

Defined by owner

Defined by institution

Defined by system

Read only access for guests

Integration with other campus/commercial systems Course management system Online assessment tool Registrar's data Learning objects repository/metadata base Career planning & placement center data Advising center data University library
Course management aspects: Incorporate student enrollment data Integrate student assessment/grading Record keeping Analysis & reporting
Security aspects: Login authentication Course authorization Single sign-on Secure transactions
Customization aspects: Interface/skins Flexible organization schemes Content presentation Access controls

User support features:

User support aspects: Demo/tutorial Documentation Instructor help desk On-line support Phone support/Help desk Accessibility
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Table 7 shows that there can be many different functionalities available in the tools used for creating electronic portfolios. Some of these functionalities are directly focused on the students, while others are focused on the instructors or the institution. Many of the functionalities may be integrated directly with the electronic portfolio itself or available via separate systems (such as communication or collaboration tools) or even outside of computer technology (such as phone support). A number of the features are specifically oriented toward user support.

In this research, a distinction is made between the tools needed for creating an electronic portfolio, and the tools and system that provides support for the portfolio process and integration of the process with other course and institutional processes. We will call a set of html templates as the basic element of the electronic portfolio itself, and an accompanying Web-based system in which these templates may or may not be available for downloading or filling in as a Support System. The accompanying Web-based system developed for this research (See Section 6.2) will be called the Electronic Portfolio Support System. Many of the functionalities identified in Table 7 relate to the Electronic Portfolio Support System, not the specific tool for building an electronic portfolio itself.

2.2 An overview of portfolios in education

Portfolios have been used in many fields of study to highlight the best work of individuals, organization, or contexts (Barrett, 2005). The portfolio idea came into schools and educational systems in the 1970s, at first in Great Britain and New Zealand, but now portfolio thinking is spreading to schools and higher education all over the Western world. Portfolios have long been used by artists, architects, and others who need to collect and show their work in an effective way. Moreover, portfolios have been used in medicine, healthcare, and music. For instance, in the UK in 2001, the Imperial College School of Medicine (ICSM) launched portfolios in their programs in order to facilitate the transition from undergraduate medical students to professional practitioners. The emphasis is on the student as a self-directed and active (adult) learner (Mckimm, 2001). Recently, in the United States, Great Britain, Canada, Australia, and the European Union different higher education consortiums are moving to the use of portfolios, and in particular, electronic portfolios, in order to certify learners' progress within a program as well as to evaluate those programs for accreditation (Barrett, 2001; Czech & Amber, 2002; Courts & McInerney, 1993). Section 2.2.1 gives a general view of portfolios in education and Section 2.2.2 focuses on the use of electronic portfolio in teacher education.

2.2.1 Types of portfolios for education

In order to use any device/tool, there must be goals in order to achieve the objectives from using that device/tool; likewise this is the situation for the electronic portfolio. For instance, artists, who were the pioneers in maintaining portfolios historically, often use their collections for

seeking further work, or for simply demonstrating their art; additionally, it is useful to note that an artist's portfolio usually includes only their best work. Another example of a portfolio and its goals is "financial portfolios" which contain a comprehensive record of financial transactions and investments that represent a person's monetary worth. This is often a summative record that paints a comprehensive picture of what is, rather than a plan of what might be in the future (Barrett, 2005). Moreover, business portfolios such as e-bay and Amazon, are considered sectors of the commercial domain. Those types of portfolios have as a goal to present a comprehensive record of those companies' products and activities. By contrast, in educational goals, Barrett (2005) stated, "an educational portfolio contains work that a learner has collected, reflected, selected, and presented to show growth and change over time, representing an individual or organization's human capital" (p. 2). Moreover, most important, a crucial component of learner's educational portfolio is the reflection element on individual pieces of work (often called "artifacts") as well as an overall reflection on the story (main purpose) that the portfolio tells. Many other researchers (Barrett, 2005; Corwin, 2003; Kimeldorf, 1996) have stated that there are many purposes/goals for portfolios in education. There are portfolios that center on learning, assessment, employment, marketing, and showcase or best work. Danielson and Abrutyn (1997) have identified nine different types of portfolios which are used in the educational context:

- working portfolios,
- display or presentation portfolio,
- assessment portfolios,
- community service portfolios,
- interdisciplinary portfolios,
- subject area portfolios,
- admission portfolios,
- employment portfolios,
- skill area portfolios.

With so many purposes/goals for portfolios it becomes clear that the term "portfolio" should always have a modifier or adjective that describes its purpose.

2.2.2 *Electronic portfolios in teacher education*

In the specific context of teacher education, an overview of types of uses of portfolios will be given, followed by a review of trends and developments over time including some current examples, and a summary of specific learning benefits for pre-service teachers (Sections 2.2.2.1-2.2.2.3).

2.2.2.1 General categories of portfolios for pre-service teacher education

In the particular context of pre-service teacher education, Wolf (1998) has delineated three basic types of portfolios:

- *Learning portfolios*, which are “personalized collections of learners’ work that emphasize ownership and self-assessment. The main purpose of the learning portfolio is providing learners with an opportunity to explore, extend, showcase, and reflect on their own learning” (p. 12). Likewise, Polonoli (2000) said that a learning portfolio has to present the students’ path toward learning mastery through their collection of indicators of gradual academic growth during their learning process. So this type gives a reflection of their personal growth and learning.
- *Assessment portfolios*, which are “selective collections of teachers’ work for standardized assessment. The primary purpose of this type of portfolio is to evaluate teacher performance for certification licensure, or professional advancement” (p. 13).
- *Employment portfolios*, which are “customized and attractive collections of information given by teachers to prospective employers and are intended to establish a teacher’s suitability for a specific professional position” (p. 14).

These different types can be seen intermingled in the review that follows of developments with portfolios in teacher education.

2.2.2.2 Overview of developments with portfolios in teacher education

Portfolios are widely used in teacher education programs (Ring, 2002). Portfolios were introduced in teacher preparation programs in the

1970s. One of the locations for initial experiences was the Florida State Board of Education competency based teacher education program which mandated portfolios in teacher education programs. Teacher candidates have prepared portfolios to demonstrate their competency in selected areas during their probationary year of supervised teaching in other settings as well (Huebner, 1996; Polonoli, 2000; Ring, 2002).

In 1987, a project led by Stanford University developed an assessment tool in order to track both students' progress and that of the pre-service teacher programs. They initiated a project called TAP (the Teacher Assessment Project) which was an attempt to initiate alternative teacher assessment procedures in order to score pre-teachers' progress within the program (Ring, 2002). The TAP primarily focused on "the role that portfolios can play in the evaluation of school teachers, it is important to keep in mind that a teacher's portfolio can (and should) serve purposes beyond evaluation, such as promoting the development of exemplary practices." (Wolf, 1991, p.15). The TAP developed a scoring procedure for an individual's portfolio, either student or teacher, and that scoring used multiple evaluators. Thus, scoring represented an blend of criteria (judgments from different raters and different preference points; Wolf, 1991). Although each university participating in the project implemented the portfolio process differently, there was enough agreement about the contents to allow scoring of the portfolios across the 25 institutions for levels of reflectivity. Although there is no longer any centralized portfolio program among these universities, each of the universities has sustained the use of portfolios as a significant part of pre-service teacher education (Ring, 2002, p.24).

Ause and Nicastro (1997) provide three benefits of portfolios in teacher education: empowering students, the creation of new communities of teachers working together for a common goal, and the closing of the gaps between institutions. They argue that the greatest advantage for students is the opportunity portfolios provide for empowering students to reflect on their learning process and progress. Barton and Collins (1993) add: "the portfolio allows faculty to view student work in the context of teaching as a complex activity with interrelated elements. A brief set of exam questions, no matter how carefully structured cannot capture this complexity. Through a consistent emphasis on relating the parts to the whole, the portfolio provides a larger context to structure each piece of evidence it contains. Faculty may use this structure as a lens to focus, but not reduce their vision of the specific evidence that constitutes the complex act of teaching. Advisement is strengthened by this process as each portfolio entry helps the faculty advisor to focus on students' overall professional development, not just their course work

and personalities. Moreover, they contend, portfolios help students become more articulate” (p. 201).

Mokhtari, Yellin, Bull, and Montgomery (1996) conducted research on the impact that portfolios have on pre-service teachers’ knowledge and attitudes. Their findings suggest that exposure to and use of portfolios in teacher education programs can play a critical role in positively influencing pre-service teachers’ belief and attitudes toward using portfolios. Krause (1996) studied how 42 elementary pre-service teachers constructed meaning about portfolios during the introductory phase of an assessment system. She explored “the transfer effects of an instruction intervention such as a meaningful and relevant portfolio-like experience on students’ comprehension of portfolios” (p. 131). Krause randomly divided the students into three groups, one intervention group and two control groups. The intervention group participated in a guided portfolio experience, entitled *My Life in a Bag*, which gave students an opportunity to collect, select, and reflect on personally meaningful items. Krause found that the students who participated in the *My Life in a Bag* activity demonstrated significantly increased knowledge and understanding of the portfolio process following an intervention. As well, she found that after the intervention students were significantly more likely to reflect conditional (when and why portfolio knowledge is useful) and procedural (what it is and how to do it) knowledge of the process. Mokhtari, Yellin, Bull, and Montgomery (1996) suggested that: “in the classroom, portfolios encourage teacher self-direction and reflection and form the basis for professional development” (p.248). Likewise Arter and Spandel (1995) argue that “the perceived benefit from instruction is that the process of assembling a portfolio can help develop student self-reflection, critical thinking, responsibility for learning, and content area skills and knowledge. However, it is important to point out that most of the evidence to support these claims comes from logical argument and anecdote. There exists very little “hard” evidence that demonstrates the impact of portfolios on students.” (p.38).

In 1997, the National Council for Accreditation of Teacher Education (NCATE) concluded that a majority of teacher education programs were not accomplishing the standards that they needed to achieve in terms of preparing teachers for the 21st century classrooms. NCATE recommended technology education as a key to the teacher preparation process. Aligned with the Interstate New Teacher Assessment and Support Consortium (INTASC), NCATE standards (1997-2005) require teacher candidates to be able to appropriately and effectively integrate technology to support their learning. One of the particularly relevant

NCATE recommendations is that teacher education programs post student portfolios for electronic review (Czech & Amber, 2002; Barrett, 2001; Bastist & Banerjee, 2004; Ring, 2002).

Zemba-Saul and Severs (1999) in their study examining pre-service science teachers' emerging understanding of subject-specific pedagogy using web-based portfolios, found that portfolio development can provide an effective vehicle for examining pre-service teachers' emerging understanding of subject-specific pedagogy. However, the data did not strongly support nor refute added benefits to prospective teachers when the portfolios are developed/authored in an hypermedia environment. The researchers found limited evidence that the web-based environment in which the portfolios were crafted supports deep reflection. However, they found that the technology appeared to support critical reflection in that the students studied discovered that more traditional text-based artifacts were not as powerful in demonstrating their ideas. Thus, they were forced to create new artifacts that often required them to synthesize course projects, school-based experiences, and other activities" (pp. 29-30).

Portfolios can also be used by the organization to illustrate how the prospective teachers' course work and fieldwork reflect the teacher preparation program's focus. Hill and Land (1998) contend that using situated contexts helps to assure that knowledge is not separated from either the process or context of applying it.

In response to NCATE requirements, teacher education programs in many universities are using an electronic web-based system that provides students access to their records and an easy means of submitting evidence in support of their attainment of required skills and experience (Bastist & Banerjee, 2004). Thus the portfolio has become embedded in the teacher education curriculum, and in particular has become popular as an assessment tool (Wolf, 1998).

To conclude this overview of portfolios (particularly electronic portfolios) in pre-service teacher education, three examples will be presented of the use of an electronic portfolio in this context.

- University of Florida:

In 1999, the College of Education at the University of Florida had undergone great change processes in order to: (a) improve pre-service teachers' achievements as well as documenting that achievement; (b) improve pre-service teachers' technological

skills as well as professionalism skills; and (c) seek the accreditation of the program. A study was implemented in the Masters program of the Secondary Teacher Education Program in the College of Education at the University of Florida. The study investigated the implementation of an electronic portfolio project throughout a one-year program for pre-service teachers in secondary education. The objectives from developing electronic portfolio were:

- Improve pre-service teachers' technological skills,
- Emphasize a constructivist approach (see Section 2.3.1) in pre-service teachers' learning processes (to reach the level of the Florida Accomplished Practices)

The results were that the “e-portfolio contributes to a student's professional growth and their understanding of the Florida Accomplished Practices. The portfolio acted as a catalyst for students' professional growth as evidenced by (1) their increased understanding of the FAPs, (2) their reflective development, (3) collaboration with their peers, and (4) increased technology understanding and use. For this reason it is crucial that the students begin their portfolios early in their first semester or during their minor in the undergraduate part of their program and revisit the portfolios regularly throughout the remainder of their program” (Ring, 2002, p.138).

▪ University of Houston

A study was conducted by Pierson and Rapp in 2001 at the University of Houston, Curriculum and Instruction Department. The focus of this study was using a new authentic assessment tool, a web-based portfolio, as a solution to document and provide evidence of learning in the Masters program. This approach was expected to allow learners to play a key role in directing their own learning, to demonstrate creative design, and to conveniently access work on any platform. Electronic portfolios were seen as an ideal collection and presentation format for this purpose. Students store their learning artifacts on a department server, which is automatically secured by a password protection. The procedures are the following: each student attending the Masters program should take a required course to learn about technical procedures related to maintaining the portfolio, as well as strategies for selecting portfolio items and for composing personal reflections on their

work. During each course, students review and reflect on their own learning so they have a clear timeline of their own growth. After the students become more mature, they began to create connections among those artifacts by making interfaces to customize the presentation for multiple audiences. In their final semester, students review their entire portfolios to select items that demonstrate achievement of program objectives and they then write reflections to accompany each item. Initial informal feedback from students is positive. The institution remains committed to further developing and strengthening the assessment process of the students' portfolios.

- Zayed University:

In the United Arab Emirates, Zayed University is considered to be the only Gulf Region higher education institution which implements electronic portfolios at the organization level, which is mandatory to graduate from university. This started in October 2002 for the 2nd & 3rd year students as well as the faculty members of the university. The program has been used in the university ever since. The objectives of the electronic portfolio approach are:

- To track an individual's process of reflecting on and analyzing activities and performance
- To identify strengths and weaknesses
- To help students in academic planning, co-curricular involvement, and career development
- To present evidence about individual or organizational growth and development, and the differentiation and integration of knowledge
- To support curricular innovation, connection with scholarship, and course design

2.2.2.3 Summary of specific benefits of electronic portfolios for pre-service teachers

This section summarizes the above discussion about the value of developing electronic portfolios in pre-service teacher education programs:

- One value is that developing electronic portfolios allows pre-service teachers to give voice to the values and attitudes

which underpin their program's standards (objectives) and to see how those objectives are transformed to professional practice. Those processes (professional practices) that are documented in the pre-service teacher electronic portfolio are firmly grounded in the context of "real" career experiences. The portfolio will "illuminate pre-service teachers' abilities in blending teaching approaches with subject knowledge in subtle ways to attain learning achievement within particular contexts (their specializations)" (Barrett, 2005; see also SCTP, 1997; California State University, 2004).

- Other value is that an electronic portfolio determines the depth of thinking and quality of the actions taken by the pre-service teachers. It should demonstrate that the teacher's practice is consistent with agreed standards of professionalism. According to Winsor and Ellefson (1995) the combination of collection, selection, and reflection enables learners to become more active participants in their education, thus reflective practitioners. Moreover, Ring (2002) stated, in the same manner, that "narrative-story telling is one of the most ubiquitous and powerful forms of human communication and learning. Portfolios tell the story of the student. As our classrooms become more constructivist in nature, there will be greater opportunities for students to share information and ideas" (p. 25). Bird (1990), also stated that "professional portfolios should contain the five intertwined clusters of teaching activity which reveal and illuminate the classroom teacher's role and practice in multiple dimensions—teaching a class, planning and preparation, student and program evaluation, interaction with other educators, and interaction with parents" (p.250). Therefore, electronic portfolios can assist in the valuation processes of teacher performance, often within a professionally supportive and familiar context. Also, they provide the pre-service teacher with an opportunity to confer a legacy of ideas and reflections which might constructively inform the practice of other colleagues through the portfolio presentations. Documented examples of exemplary professional practice can be shared with others for adaptation to their own settings, leading to further good practice. Moreover, the process of planning and preparing portfolio entries may change the way in which teachers regard themselves professionally. The carefully structured, reflective portfolio confirms the teacher as

a professional involved in critical decision making and problem resolution (SCTP, 1997).

- An electronic portfolio, as SCTP (1997) states, “provides a ‘mental work space’ in which teachers can interpret and reflect upon their teaching practice and its outcomes. Portfolio development is seen as a professionally formative activity which can also help overcome the isolation of teaching. In developing a portfolio the teacher may seek advice and support from a colleague or colleagues. Such interaction counters the solitary nature of the teaching task, contributing to and expanding professional discourse within the school community. As a vehicle for demonstrating professional teaching behaviour, the portfolio gives others a glimpse of the valuable work that is proceeding in classrooms” (p.3). Additionally, Ring (2002) states that “if we use the portfolio as a formative tool, a means through which students are able to begin to think about their work, and how they want to present themselves to the world, the portfolio becomes a way of empowering students. Thus, contributing to a new way of learning and ultimately a new way of teaching” (p.26). Similarly, Krause (1996) stated that formative use allows “numerous opportunities for the learner to think flexibly and non-linearly about how and to what degree learning and change over time have occurred” (p.130, cited from Ring, 2002, p.26).

Thus, Yancy and Weiser (1997) describe this knowledge development as “rather than our learning about portfolios proceeding as a spiral, then, we might instead think of it as developing in waves, with one wave of practice preparing the next wave of theorizing about that practice, with an intermediate wave extending new practice. By such reflective ‘wave action’ is knowledge created” (p. 11). According to Ring (2002), “these ‘waves’ of intellectual growth begin to permeate the pre-service teachers’ educational experience at the University of Florida as they transition from student to teacher” (p.15).

Research on change places change as a process, not an event (Hall & Hord, 1987; Rogers, 1995). “Portfolios retain almost uniquely the potential for documenting the unfolding of both teaching and learning over time and combining that documentation with opportunities for teachers to engage in the analysis of what they and their students have done” (Ring, 2002, p. 15).

These are not new ideas for teachers and teacher education. Dewey (1915) believed that true new knowledge and mental growth are compelled by a systematic teaching method of assignment followed by memorization and recitation. However, he argued that for a more learner-centered classroom where exploration and engagement were encouraged. The electronic portfolio presents a new tool and opportunity for this type of exploration and engagement.

2.3 Portfolio use from the perspective of learning theory

Many researchers emphasize the quality of learning that can occur with portfolio use. For example, Bruner (1986) as well as Barrett (2005) believe that narrative-story telling is a form of human communication and learning. Since an emphasis in 21st century instruction is become more constructivist in nature, there will be an emphasis in portfolio use for students to share information and ideas. Although portfolios are a popular addition to the teacher education curriculum, research efforts have focused more on portfolio assessment than on anything else. In contrast, Ring (2002) argued that, because portfolios are dynamic and flexible, they allow and encourage students to communicate in richer ways. To effectively use portfolios in teaching pre-service teacher education, portfolios must be seen less as end products and more as a process through which students learn. Krause (1996) argued that the portfolio itself has the potential to inform learning. Courts and McInerney (1993) state about portfolios that it “should help learners become integral and conscious participants in the learning process” (p. 85). All of these perspectives relate to learning theory. In this section, major perspectives from learning theory will be reviewed that provide important foundations of electronic portfolio use in pre-service teacher education. These include constructivism, cognitive flexibility theory, and collaborative learning (Sections 2.3.1-2.3.3). These perspectives are integrated in a discussion of the electronic portfolio as a “deep learning pot” (Section 2.3.4). A brief comment on the implications of these theories for the instructor concludes the discussion (Section 2.3.5).

2.3.1 Constructivism

Constructivism is based on the assumption that learners are active participants in the learning process, constructing knowledge in a meaningful, authentic context (Polonoli, 2000). Instead of viewing a portfolio solely as an assessment tool, the portfolio has the potential to assist with learning, learning about learning, and learning about teaching each informing the other, which reflects deeper learning.

Jonassen (1996) believes that learning theory is in the midst of a revolution, in which researchers and theorists are arguing about what it means to know something and how we come to know it. Fosnot (1996) states that “Constructivism is a theory about knowledge and learning; it describes both what ‘knowing’ is and how one comes to ‘know’” (p. ix).

Constructivism is related to ways of change, in turn involved with new approaches to knowledge and the construction of knowledge. Many educational philosophies have contributed to constructivism. For instance, Piaget (1974) believed that the pre-eminent challenge in how learners construct knowledge depends upon what they already know, believe, and interpret. Hence, all these play an active role in constructing knowledge. Likewise Vygotsky (1978) argued that the creation of knowledge is dependent on context and relationships. Jonassen, Peck, and Wilson (1999) provide an example of this process: “Knowledge construction results from activity, so knowledge is embedded in activity. Nearly every child in American schools is required to memorize the states and capitals. But they probably do not make much meaning for those facts, if they have not experienced them in a rich way. If, however, students attend a field trip to the state capital, then they construct some meaning for it, although not always the meaning that the teacher intends” (p. 3). This idea captures how constructivist theory depends on the learner’s active participation in the learning environment. Reisetter and Fager (1995) conclude that constructivism is the foundation of learning and understanding, built around present understanding. Consequently, the knowledge that students possess when they enter the classroom will influence their learning. Student-centered and constructivist approaches to learning are central to the electronic portfolio development process.

The importance of understanding knowledge construction within a context should not be undervalued when infusing an innovation into an existing system (Rogers, 1995). Research by Hill and Land (1998) concluded that the student-centered learning process depends upon the learner’s ability to monitor learning needs and to engage in planning and evaluation activities. This practice places greater responsibility upon the learner to ensure that the learning that takes place. Hill and Land (1998) label such learning environments as *Open Ended Learning Environments* (OELE) where learners construct a “web” of concepts and share them communally with other students. Similarly, Duffy and Cunningham (1996) proposed in their constructivist learning environment that both student to student and student to teacher dialogue are important instructional tools. Moreover, constructivist learning environments promote cooperation over competition, and

communication and investigation over direct instruction (Duffy & Cunningham, 1996).

Brooks and Brooks (1993) argue that a constructivist framework challenges teachers to create environments in which they and their students are encouraged to think and explore. They stated, “This is a formidable challenge. But to do otherwise is to perpetuate the ever-present behavioral approach to teaching and learning” (p. 30).

Brown, Collins, and Duguid (1989) propose that authentic activity is essential to an environment that encourages knowledge construction. Authentic activity is the way learners gain access to tasks that are meaningful and purposeful. (Brown, Collins, and Duguid (1989) write that authentic activity, which means the ordinary practices of the culture, is important for learners because it is the only way they gain access to the perspective that enables practitioners to act meaningfully and purposefully. Brown and his colleagues claim that it is activity that shapes or polishes skills. The “collect, select, reflect” model of portfolio development is an example of an authentic activity in a constructivist learning environment. Students collect illustrations throughout their coursework and field experiences, select at least one appropriate illustration for each objective/standard, and reflect on why they believe that this illustration is appropriate. Reflection processes encourage pre-service teachers to make meaningful connections between artifacts and standards/objectives, which, as a consequence, prompts pre-service teachers to think and explore. Therefore, constructing an electronic portfolio is expected to be a constructivist experience to influence pre-service teachers’ academic and professional growth.

Technology can play an important role in the learner’s construction of knowledge. Jonassen, Peck, and Wilson (1999) state that “Constructivism is a relatively new idea to education, and is an even newer idea to educational technology” (p. iii). Jonassen (1996) argues that technologies are most effectively used as tools to construct knowledge *with*, making technology a tool to think and learn *with*. Jonassen, Peck, and Wilson (1999) state that “If we accept that our goal as technology-using educators is to support meaningful learning, then we should use technologies to engage students in active, constructive, intentional, authentic, and cooperative learning” (p. 7). Brown, Collins, and Duguid (1989) argue that “People who use tools actively rather than just acquire them, by contrast build an increasingly rich implicit understanding of the world in which they use the tools and of the tools themselves” (p. 33). Likewise Jonassen (1996) states that “Knowledge

of any tool is required in order to use that tool” (p. 9), and proposes the development of mind-tools, computer-based tools, and electronic learning environments that have been adapted or developed to function as thinker partners with the learner in order to engage and facilitate critical thinking and higher-order learning. As pre-service teachers are expected to become more proficient with technology, the act of constructing an electronic portfolio becomes equal with the technology involved and students begin to show their ability to balance between using technology and their understanding of knowledge construction. So when they select illustrations and they add them to their portfolios they know why they select them as well as how to add them. Jonassen (1996) states that “mind-tools engage learners in reflective thinking, which leads to knowledge construction” (p. 13). Just as innovation diffusion moves continuously, appropriate and effective technology use develops over time as teachers move continuously from beginner to a more advanced users.

Johnson and Liu (2000) also discuss how technology can create constructivist learning environments. They contend that to successfully integrate information technology, future teachers need to be competent in a variety of computer applications, they need to be able to design interesting and challenging problem-based learning situations (course activities), and they need to understand and become comfortable in designing constructivist learning environments themselves.

Jonassen, Peck and Wilson (1999) indicate another relationship between electronic portfolio creation and constructivism: The aspect of hyperlinking. “Like multimedia and hypermedia construction, web-site (e.g. electronic portfolio) construction is first and foremost constructive (constructionist, to use Papert’s term). Our research with hypermedia construction showed that learners reflect a lot on their designs, making sure that they are desirable and interesting to other students” (p. 36). Other arguments by Wickliffe (1997) and Fischer (1997) state that through the creation of hypertext documents students can begin to better know themselves as learners, and in doing so they learn to pay attention to the reader of the document (or portfolio). The electronic portfolios developed by pre-service teachers are hyperlinked documents allowing both the reader and the writer easy and controllable navigation. Moreover, hyperlinks allow for deeper understanding and explanation through links that go from summary statements to complete documents, related items, and reflections. In addition to displaying artifacts efficiently, links can allow the collection of material in a personal archive to become broader and more thoughtful (Hartnell-Young & Morriss, 1999).

In summary, Reisetter and Fager (1995, p.7) note that constructivism serves as an appropriate theme for the use of electronic portfolios in teacher preparation. Three points serve to address the appropriateness of this approach:

1. Constructivism provides for a coherent view of teaching.
2. Constructivism contends that learners must be actively involved in their own representations of knowledge.
3. Students benefit from integrated schematic structures in the learning process.

The next section will explain how students can use their creation of electronic portfolios to build up their knowledge in a flexible way.

2.3.2 *Cognitive flexibility theory*

Related to the paradigm of constructivism is the individual's level of cognitive flexibility. Spiro, Feltovich, Jacobson, and Coulson (1991) in their research on Cognitive Flexibility Theory, noted that cognitive flexibility refers to the ways in which knowledge is assembled and stored as well as for flexible retrieval. They suggested that "people acquire knowledge in ill-structured domains by constructing multiple representations and linkages among knowledge units. Learners visit, and more importantly revisit, the same case or concept information in a variety of contexts" (p. 27). Cognitive flexibility theory (Spiro, et. Al, 1991) is a model that has had a considerable amount of impact on understanding the process of acquiring knowledge through hypertext. According to Spiro, et. Al., (1991), "this 'new constructivism' is doubly constructive: (1) understandings are constructed by using prior knowledge to go beyond the information given; and (2) the prior knowledge that is brought to bear is itself constructed, rather than retrieved intact from memory, on a case-by-case basis" (p. 28). In addition, they argue that "any effective approach to instruction must simultaneously consider several highly intertwined topics, such as: the constructive nature of understanding; the complex and ill-structured features of many, if not most, knowledge domains; patterns of learning failure; and a theory of learning that addresses known patterns of learning failure" (p. 24).

Cognitive flexibility theory proposes that learning from various media depends on the application of prior knowledge to go beyond the information given. Spiro et al., (1991), explained that "the

reconstruction of knowledge requires that it first be deconstructed—flexibility in applying knowledge depends both on schemata (theories) and cases first being disassembled so that they may later be adaptively reassembled” (p.186). The implication of this model is relevant to hypertext-based learning because hypertext offers the possibility of coming at a topic from various perspectives. For example, if a learner accesses a single document from multiple sites, he or she will come to that document with multiple perspectives, depending on the point of origin or learning goal. In this way, CFT predicts that the mental representations resulting from repeated, ill-structured hypertext use will be multifaceted, and one’s ability to use that knowledge should theoretically be more flexible.

The process of creating a portfolio with hyperlinks contributes to the summative assessment process. When using the portfolio for assessment, the transformation from “artifacts” to “evidence” is not always clear. Linking reflections to artifacts makes this thinking process more explicit. The ability to create links from multiple perspectives (and multiple goals) also overcomes the linearity of two-dimensional paper portfolios, permitting a single artifact to demonstrate multiple standards (i.e., teacher preparation standards in higher education).

Using a hyperlinked format allows pre-service teachers to create links among illustrations, ideas, and theories. This concept and work linkage enables students to begin to think “more flexibly and non linearly” (Spiro, et. Al., 1991) about their academic and professional growths.

In this context, Reisetter and Fager (1995) argue that “it is critical for professors to assist students in making connections within and across knowledge domains. As educators, build these connections and as students become themselves more expert in their field, their own knowledge structures will become more complex, integrated and flexible” (p. 3). Spiro, et. Al., (1991), argue for the use of hypertext environments to promote cognitive flexibility in ill-structured domains. A nonlinear medium like hypertext is very well suited for the kinds of “landscape criss-crossing” recommended by Cognitive Flexibility Theory.

Therefore, the hypertext medium is important to the success of developing and implementing electronic portfolios. Enabling pre-service teachers to connect “within and across knowledge domains” their artifacts with standards, stimulates a rich learning environment as well as promotes a high level of cognitive flexibility (Spiro, Feltovich, Jacobson, & Coulson, 1991).

2.3.3 *Collaborative learning*

Collaborative learning as Koschmann (1996) defines it is “a reculturative process that helps students become members of knowledge communities whose common property is different from the common property of the knowledge communities they already belong to, which highlights what collaborative learning is meant to accomplish and rebounds with the view of learning as entry into a community of practice” (p. 21). Also he had another definition which is “the mutual engagement of participants in a coordinated effort to solve problems together” (p.13). These definitions point out a commitment to learning through doing, the engagement of learners in the cooperative (as opposed to competitive) pursuit of knowledge, the transitioning of the instructor’s role from authority and chief source of information to facilitator and resource guide. Britton (1990) notes that “just as the individual mind is derived from society, a student’s learning is derived from the community of learners” (as cited in Johnson & Johnson, 1996, p. 787). He also advises positioning students in groups and giving them the opportunity to generate their own culture, community, and procedures for learning. Moreover, he says that learning is derived from dialogues and interactions with other students and sometimes the teachers.

Thus collaboration through sharing knowledge, experience, good practice and resources can enhance and support learning and teaching. A collaborative approach can ensure that a greater range of expertise is available to provide common standards of assessments, equipment, software, training and support to students and ensure that recommendations are appropriate and quickly implemented with quality assurance and monitoring of support (Fisher, 2003; Way, 2003; Geer, & Hamill, 2003). Chen, Benton, Cikatelli, & Yee (2004) state that “Technology (supported) collaborations provide ways to heighten student learning by exposing the educator / student to new content and technology, real world experiences, career guidance and community resources. The purposes of technology collaboration are to create real-world environments that employ the context in which learning is relevant, and to focus on realistic approaches to solving real-world problems embracing Jonassen’s (1996) concepts of applying constructivism to the development of learning environments” (p.47).

Beyond pre-service teacher education, using technology fosters communication and cooperation with colleagues inside or outside the school system for the development of learning activities for students (Bracewell, Laferrière, & Gregoire, 1998; Chen, Benton, Cikatelli, &

Yee, 2004; Murphy, Cifuentes, & Shih 2004). Technology can be useful in order to develop collaborations among learners, where learners follow certain principles of effective communication that helps them to be able to listen and learn from each other. For instance, an electronic discussion forum is a successful professional development tool and a source of ongoing support for the use of learning technologies for teachers (Bracewell, Laferrière, & Gregoire, 1998; Murphy, Cifuentes, & Shih, 2004). Collaboration between learners, educators, and their community is an effective way to promote lifelong learning. It also helps learners develop an interest in future involvement within the community. Knowledge acquisition through collaborative learning is meaningful. It can be attained through exchanging ideas, peer reviews, making arguments, giving feedback, and collaborating with classmates to construct new ideas and concepts (Geer & Hamill, 2003).

Providing support for activities that foster collaboration among learners is a challenge for instructors and course designers as well (Carr-Chellman & Duchastel, 2000; Cifuentes, Murphy, Segur, & Kodali, 1997; Cifuentes & Shih, 2001). Harris and Curran (1998) identify three major sorts of “tele-collaborative” learning activities (see also Cifuentes & Shih, 2001; Kamhi-Stein, 1997; Leh, 1997):

- Interpersonal exchange through tutorials, small-group, and panel discussions.
- Information collection and analysis, and problem solving through instructional environments and website database projects.
- Problem solving through brainstorming, project-based work, simulation/role-play, collaborative problem-solving activities, and case-based learning.

All of these can be incorporated into learning activities involving the construction of electronic portfolios, if appropriate tools and support are available. For example, a electronic discussion forum provides a structure for capturing “here’s how I did it” comments. By using the discussion forum, learners can post questions, issues and problems, and receive feedback from other participants. Electronic discussions enable learners to work together to share ideas and work through challenges with more time for reflection that is the case with face to face discussions. It also provides a forum for coaching and mentoring activities.

The use of a discussion forum is type of collaborative learning. There are two types of electronic discussion forums, synchronous and asynchronous (Geer & Hamill, 2003; Murphy, Cifuentes, & Shih, 2004). Synchronous discussion means learners participate in on-line discussions using synchronous technology such as Net Meeting and online chat rooms, and is centered on open-ended questions and statements that are posted for responses from learners. Asynchronous discussions allow more time for responses to be drawn from the materials being reviewed in the course. Sharing those responses will help construct the learner's knowledge and build the social interaction as well (Geer & Hamill, 2003, Ring, 2002).

Thus to accomplish constructivist, collaborative learning, there should be tools available within a Web-based support system that accompanies electronic portfolio construction to stimulate communication and sharing. Those tools can lead pre-service teachers to improve their academic and professional growth.

2.3.4 Electronic portfolio development process as a deep learning pot

Deep learning involves reflection, is developmental, is integrative, is self-directive, and is lifelong (Cambridge, 2004). The literature suggests that portfolios can be as sources of deep learning (Campbell, Cignetti, Melenzyer, Nettles, & Wyman., 2001; Gathercoal, Love, Bryde, & McKean, 2002). Deep learning can be achieved through the development of the electronic portfolio when the purpose is to foster learning and document growth over time based upon a constructivist model. Barrett and Carney (2005) argue that "portfolio authoring reflects the tenets of constructivism in that it allows for students to begin their learning at many different starting points; reader critique challenges the student's original insights, prompting reflection and revision" (p. 2). They described this type of portfolio as first and foremost a device for the teacher and learner to assess skills, reflect upon learner's learning, and establish new learning plans. Moreover, they emphasize the process of developing the electronic portfolio rather than the product (artifacts), and the assessment (which is formative in nature). They tell that portfolio is truly a story of learning which it is owned by the learner, structured by the learner, and told in the learner's own voice (literally or rhetorically).

Thus the development processes of the electronic portfolio can powerfully affect the pre-service teacher's academic (performance) and

professional growth (Barrett, 2001; Boulware, Bratina, Holt & Johnson, 1997; Bird, 1990; Brown, 2002; Campbell, Cignetti, Melenyzer, Nettles & Wyman, 2001). Furthermore, traditional processes of portfolio development can be enhanced by alternatives that use technology. Table 8 presents traditional processes and alternatives by using technology.

Table 8. Electronic portfolio development processes (Barrett, 2000, p. 1)

Traditional processes	Description	Alternatives by using technology
Collection	Teachers and students learn to save artifacts that represent the successes (and “growth opportunities”) in their day-to-day teaching and learning	Archiving
Selection	Teachers and students review and evaluate the artifacts they have saved, and identify those that demonstrate achievement of specific standards	Linking/Thinking
Reflection	Teachers and students become reflective practitioners, evaluating their own growth over time and their achievement of the standards, as well as the gaps in their development	Storytelling
Projection	Teachers and students compare their reflections to the standards and performance indicators, and set learning goals for the future. This is the stage that turns portfolio development into professional development and supports lifelong learning	Collaborating
Presentation	Teachers and students share their portfolios with their peers. This is the stage where appropriate “public” commitments can be made to encourage collaboration and commitment to professional development and lifelong learning	Publishing

However, the development processes of electronic portfolios might be considered deep learning or surface learning, depending on the way that the processes are supported in the course and integrated with the objectives of the course. Table 9 presents this comparison.

Table 9. Learning with electronic portfolios, in terms of support and integration in the course (adapted from Barrett, 2004b, p. 8)

Deep Learning versus Surface Learning	
Attributes of Deep Learning	Attributes of Surface Learning
Learners relate ideas to previous knowledge and experience.	Learners treat the course as unrelated bits of knowledge.
Learners look for patterns and unrelated principles.	Learners memorize facts and carry out procedures routinely.
Learners check evidence and relate it to conclusions.	Learners find difficulty in making sense of new ideas presented.
Learners examine logic and argument cautiously and critically.	Learners see little value or meaning in either courses or tasks.
Learners are aware of the understanding that develops while learning.	Learners study without reflecting on either purpose or strategy.
Learners become interested in the course content.	Learners feel undue pressure and worry about work.

The differences between deep and surface learning depend on the instructional design of the course and portfolio process which in turn depends on the instructor and also the support that both the instructor and student have for the portfolio process.

2.3.5 Implications for the instructor

Implementing technology into a traditional teaching context can be useful as a tool for changing existing practices. Dimock and Boethel (1999) state that “technology is a catalyst for change in classroom processes because it provides a distinct departure, a change in context that suggests alternative ways of operating. Technology can drive a shift from a traditional instructional approach toward a more eclectic set of learning activities that include knowledge-building situations for

students” (p.20). Additionally, Dimock and Boethel (1999) suggest that “when technology supports the creation of constructivist learning environments, student roles change. Students often become peer mentors and mentors for their teachers as well” (p. 39). Change occurs when technology becomes infused into the learning content. Becker (1990) stated that teachers need easy-to-use and powerful software tools to help them handle this change, and need examples and models of how to use these tools in integrated ways.

Thus, when using electronic portfolios, instructors are also being asked to engage with students in new ways (such as monitoring small group work, conferencing with students over portfolios, coaching performance) and to assume more authority for evaluation than previously, but with little assistance or practice in designing and using new instructional and assessment strategies. Aschbacher (1994) stated that “in an environment that has typically rewarded swift, tidy work, many teachers, like their own students, require much reassurance that they have permission to take time to ponder and discuss new concepts, participate in a ‘grungy’ process, as one teacher put it, and make mistakes along the way. Even with such reassurance, however, many teachers are reluctant to lower their tenuous comfort zone—by risking the loss of what little control, respect, motivation to learn, and academic success that they are able to command among students in the current school environment” (p. 28).

2.4 Electronic portfolios and authentic assessment

Assessment is the process of “assembling, summarizing, organizing, interpreting, and possibly reconciling pieces of existing knowledge, and communicating them so that they are relevant and helpful to an intelligent but inexperienced decision-maker” (Parson, 1995, p. 465). In other words, it is “the formal or informal process of gathering evidence to gauge the progression of student learning” (Polonoli, 2000, p.5). Portfolios have been used in the education system as a form of authentic assessment/performance assessment (Ring, 2002; also see Section 2.2). Section 2.4.1 gives some general comments about approaches to assessment involving portfolios, particularly in a constructivist learning environment. Section 2.4.2 relates these more specifically to electronic portfolios.

2.4.1 Authentic assessment

Before the learner can be actively involved in constructing his or her own knowledge, assessment must change to become a developmental,

formative, and authentic process. There are many ways to describe the assessment of students, and many terms to label this practice. For example, Cushman (1999) uses the term enlightenment, not evaluation, to describe her approach in the assessment of her students. Martin-Kniep (1998) defines authentic assessment tasks as those that require students to engage with real or plausible problems and challenges. These problems are contextualized and require that students use knowledge and skills to engage in disciplined inquiry and present their learning to an audience that could naturally use or care about the information presented. Martin-Kniep defines process assessment, as a form of authentic assessment, as the assessment of students' thinking about their learning or performance, and outcomes as statements that define what students should to know, be able to do, or value.

Van Sickle and Hoge (1991) argued that attention to this form of assessment enables students to develop higher order thinking skills and to develop strategies for learning. When assessment follows a constructivist form, then consequently the student will have a more active role in the assessment process. By its very definition, constructivism indicates that assessment should become an ongoing developmental process. According to Nickerson (1989), "If higher order cognitive functioning is a major goal of education, assessing such functioning is likely to be futile until better methods are developed for measuring success in this regard" (p. 24).

LeMahieu, Gitomer, and Eresch (1995) found that "although the purpose of student selection is to engender and support a reflective and self-evaluative capacity...this is possible only if students have deep understandings about the nature of quality in their work and are able to make judgments that accurately reflect a valid assessment of that quality" (p. 13). Deming (1986) suggests a quality control cycle to facilitate this scaffolding in which students are participants both in setting and applying the standards.

2.4.2 Electronic portfolios and authentic assessment

Barton and Collins (1993) believe the first and most significant act of portfolio preparation is the decision on the purpose of the portfolio. Many instructors look to portfolio development as a product, a summative way to evaluate their students at the end of the semester. But in doing so, the portfolio becomes barely a new way to evaluate students, usually using the same evaluation criteria used in the past. Therefore, the formative approach to authentic assessment as a new way of learning is ultimately a new way of teaching (Fullan, 1991).

Formative use allows “numerous opportunities for the learner to think flexibly and non-linearly about how and to what degree learning and change over time have occurred” (Krause, 1996, p. 130).

In pre-service teacher education, authentic assessment not only relates to constructivist learning but also to the academic and professional growth of the students. Martin-Kniep (1998) defines process assessment as the assessment of students’ thinking about their learning or performance, and outcomes as statements that define what students should to know, be able to do, or value and thus can be related to authentic assessment. In the “collect, select, reflect” model of portfolio development, students must build a case for the illustrations they choose to include in their portfolio: Why did I choose to use this illustration and how does it address my competency in related to a particular program objective standards?

Moon (1997) and Aschbacher and Herman (1991) have both noted that a shift to performance assessments requires a deeper level of conceptual involvement and intense reflection not only on the part of students, but also from their instructors. Table 10 gives an overview of two approaches for the use of electronic portfolios for assessment, one related to matching academic accomplishments to course objectives, and the other to stimulating and assessment on-going professional development.

Table 10. Two approaches to assessment and portfolios (adopted from Barrett, 2004a, p. 4)

Portfolios used for assessment of learning	Portfolios that support assessment for learning
Purpose of portfolio prescribed by institution	Purpose of portfolio agreed upon with the learners
Artifacts mandated by institution to determine outcomes of instruction	Artifacts selected by learners to tell the story of their learning
Portfolio usually developed at the end of a class, term or program – time limited	Portfolio maintained on an ongoing basis throughout the class, term or program – time flexible
Portfolio and/or artifacts usually “scored” based on a rubric and quantitative data is collected for external audiences	Portfolio and artifacts reviewed with learners and used to provide feedback to improve learning
Portfolio is usually structured around a set of outcomes, goals or standards	Portfolio organization is determined by learner or negotiated with mentor/advisor/teacher
Portfolios are sometimes used to make high stake decisions	Rarely used for high stakes decisions

Portfolios used for summative results – what has been learned to date? (Past to present)	Portfolios used for formative guidance- what are the learning needs in the future? (Present to future)
Mainly extrinsic motivation	Mainly intrinsic motivation
Audience: external – little choice	Audience: learner, family, friends – learner can choose

In pre-service teacher education, it is the use of portfolios to support assessment for learning which is most appropriate, and also most fitting with a constructivist approach to learning.

Many approaches to the evaluation of students' work with portfolios involves combinations of the two approaches shown in Table 10. Lopez Fernández (2003) suggests using her five key dimensions of electronic portfolios for pre-service teacher education (multimedia design, instructional design, artifacts, reflection, relation to course objects; see Section 2.1.3) as indicators of both academic and professional growth as well as the quality of the portfolios themselves. Table 11 expands on Table 5, to indicate criteria for the assessment of the quality of electronic portfolios.

Table 11. Criteria for the assessment of the quality of electronic portfolios produced by pre-service teachers (adapted from Lopez Fernández , 2003)

Main sets of criteria	Categories	What is the quality of the electronic portfolio in terms of...?
General aspects of the electronic portfolio	Multimedia design	Navigation User choice Appropriate use of multimedia Appropriate use of text Appropriate respect of copyright laws Making use of hyperlinking
	Instructional design	Integration with course objectives Organization of academic evidences Design for its audience and purpose Educational philosophy

Main sets of criteria	Categories	What is the quality of the electronic portfolio in terms of...?
Components of the electronic portfolio		
a. Product components	Artifacts	Organization of artifacts Variety: Typology and expertise Appropriate content Creativity of the artifacts
	Reflection	Connection between reflections and artifacts Evidence of high order thinking, meta-cognition Level of reflection Overall reflection about the e-portfolio
	Standards	List of standards Grade of understanding Achievement of academic evidence
b. Process components	Assessment	Criteria for assessment Opportunity to create his/her own assessment Opportunity to participate in assessing other peers Instruments for assessing the portfolios during the development process
	Feedback	Between the student and his/her teacher Between other participants Communication tools Validation of the learning evidence
	Presentation	Presentation of academic evidence Learning goals Portrayal of the owner Culture of evidence Final components
c. Agents for effective use	Individual learning	Originality Autonomous learning Personal values and philosophy
	Social learning	Communication Participation Roles and privacy
	Individual and social learning	Integrate autonomy with sociability Member of a “community of learning” Member of a collaborative “network of learning”

Table 11 shows not only criteria for assessing students' work with electronic portfolios, but also criteria for improving the process of electronic portfolio development as a constructivist learning experience.

2.5 Conclusion and the goals of an electronic portfolio for this research

This section concludes the conceptual study of electronic portfolios with a review of the research questions (Section 2.5.1) and the application of the results of the review to the current research (Section 2.5.2).

2.5.1 Conclusions relating to the research questions

The research questions for this chapter were:

2. What is an electronic portfolio?
 - What are possible components of an electronic portfolio and of an electronic support system to help students and instructors in the processes of using an electronic portfolio?
 - What are goals and ways of using an electronic portfolio in higher education and in particular in pre-service teacher education?
 - What learning theories can underlie the use of electronic portfolios and in particular how to these relate to the use of electronic portfolios for pre-service teacher education?

From this chapter, the main results are:

- In terms of components of an electronic portfolio:

Portfolios can be paper based or electronic. The electronic format has advantages compared to the paper based format, but also some disadvantages for use in practice.

The term electronic portfolio can mean many different things, depending on the goals of the portfolio, but also on the functionalities chosen for the portfolio itself and for tools and resources that help students and instructors use portfolios effectively and embed them within other course and organizational processes and electronic systems. Many different

decisions must be made in terms of what tools to make available for the portfolio construction and publishing process, as well as for the support and integration of the portfolio in other course processes.

- In terms of goals and ways of using electronic portfolios:

Electronic portfolios can be used in many ways in pre-service teacher education, in particular (a) as assessment, (b) as learning experiences, or (c) as presentation (showcase).

Although there can be many different types of goals, important goals for electronic portfolios are constructing knowledge, connecting prior knowledge with new knowledge, providing space for mental work, promoting authentic activities, promote cooperation over competition, engaging in disciplined inquiry, and supporting authentic assessment methods. Also with the electronic portfolios the goals can include acquisition of skills with technology and professional skills relating to technology and communication.

Electronic portfolios will be most effective if they are developed using a constructivist learning approach, emphasize hyperlinking as a form of cognitive flexibility, and involve the students in collaboration and peer interaction during the process of development. These underlying learning perspectives will lead to the portfolio being part of deep learning.

- In terms of authentic assessment:

Electronic portfolios can serve as tools for authentic assessment, including self assessment of the pre-service teacher relative to academic and professional growth.

Criteria for the assessment of the quality of the portfolios produced by students should include focuses on both the product and the process. Product aspects relate to the design of the portfolio as a hyperlinked, multimedia product and to its instructional design. Other criteria relate to the extent to which the entries in the portfolio are good choices for evidence of academic and professional growth, relate well to the course objectives/standards, and give evidence of deep reflective thinking and cross-linking. Process criteria include how well

students help each other via communication and peer feedback during the portfolio construction process.

2.5.2 Applying the results to the current research

An electronic portfolio can be embedded in different levels of higher education, such as the administration level, the college level, the faculty level, the department level, the course level, or the individual level. In this research, the use of electronic portfolio will be at the course level. These will be courses provided through teacher preparation programs in the Gulf Region, namely the Public Authority of Applied Education and Training in Kuwait, the University of Kuwait, and University of Qatar.

The developing of electronic portfolios in the current research will be by pre-service teachers in two Gulf Region countries, primarily for learning reflecting constructivism and deep learning with an emphasis on reflection on the pre-service teachers' academic and professional growth. Moreover, the electronic portfolio will be an assessment tool in order to provide stakeholders (faculty members, organizational decision makers, educational leadership, and future employees such as the Ministry of Education) with physical evidence of their graduates and future employees in terms of achieving academic and professional objectives. Electronic portfolios will also be seen as a solution to confront the 21st century demands, particularly with respect to outcomes reflecting professional and technology use skills. The use of specific criteria (criteria for evaluating digital portfolio) will be required, and will be adopted from Lopez Fernández (2003), to assure authentic measurement of pre-service teachers' academic and professional growth.

Hence, regarding the research objectives, the focus will be upon several goals to be achieved through the development of pre-service teacher electronic portfolios in higher education in the Gulf Region. These are summarized in Figure 2.

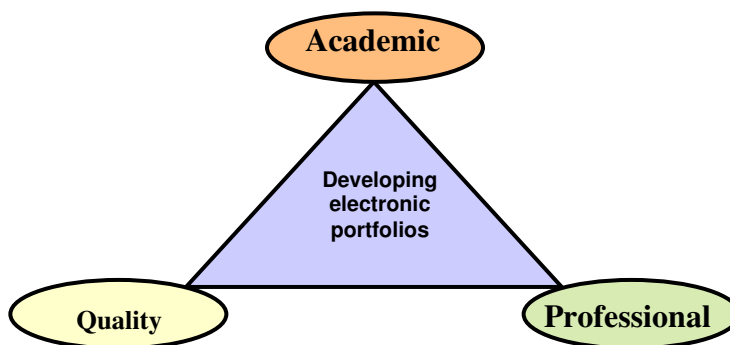


Figure 2. Research goals, electronic portfolio

As shown in Figure 2, the emphasis in the research of developing portfolios in teacher preparation programs is to show evidence of fulfilling the program standards. The applied investigations of this research will take in specific courses of the teacher preparation programs in three locations in the Gulf Region. Therefore, the research objectives must relate to these course objectives, which are: (a) Academic performance, such as knowledge of subject matter, critical thinking, and how to plan and develop a good learning environment including the appropriate use of technology; and (b) Professional performance, which involves professional communication, technological skills, insight into the role of the teacher, and collaborative learning. Moreover, the courses involved are graduation requirements; hence, the pre-service teachers must be able to express and reflect professionally on their academic and professional growth. Thus leads to the quality goal for the portfolios produced. This goal relates to the collection of course artifacts in the electronic portfolio. However, extra aspects will also be stressed to provide deep insight in the quality of the portfolios produced. These include:

- Rationale statements, expressing the purpose of the portfolio and a reflection in connection to course objectives,
- Resume to represent the students themselves,
- A statement of educational philosophy, which transfers previously learned theories into practice in order to convey that the students are ready for their future careers, and
- Examples of previous experiences, (optional), in order to give deep insight about professional growth.

An emphasis in the research will be for pre-service teachers to attain deep learning through the portfolio development processes and activities associated with their electronic portfolios. For instance, learners relate ideas to previous knowledge and experience through the linking of ideas and artifacts in the portfolios but also in discussions about the portfolios. Thus, the specific definition of electronic portfolio to be used in this research is:

A purposeful collection of pre-service teachers' artifacts (work) hyperlinked in an electronic environment which includes reflections on their progress (academically and professionally), to accomplish course or program objectives/standards as well as document their growth.

In addition to the tools for the electronic portfolio itself, an electronic support system will also be designed and used, to provide resources and tools for the process of creating the electronic portfolio as part of a course. Many of the functionalities discussed in Section 2.1.3 will be integrated into the support system rather than being directly a part of the electronic portfolios themselves.

The assumption to be investigated in the research is that the use of an electronic portfolio supported by an electronic portfolio support system will lead to more productivity and achievement in pre-service teacher education. This assumption will be answered through Chapters 7 and 8 of this dissertation.

3 Conceptual review: Course design to integrate professional and academic growth and electronic portfolios

In both Chapters 1 and 2, it was emphasized that education systems are striving to supply society with well qualified teachers who demonstrate a high degree of professionalism in their behaviour (Barrett, 2005; CSU, 2004; Mokhtari, Yellin, Bull, & Montgomery, 1996; NCATE, 1997-2005; SCTP, 1997; Winsor & Ellefson, 1995). This requires standards against which to provide evidence of academic and professional growth. In many countries there is a demand that teacher preparation programs present their pre-service teachers' academic and professional growth according to the standards of the particular teacher education program as well as state/provincial/country standards and goals (CSU, 2004; NCATE, 1997-2005; SCTP, 1997). In this chapter, criteria for academic and professional growth are discussed in more detail (Section 3.1) and related to the use of electronic portfolios (Section 3.2). Combining electronic portfolios as well as academic and professional growth within a pre-service teacher education course requires a course design that integrates both. Considerations for course design so that the course that makes use of an electronic portfolio is more broadly a productive environment for professional and academic growth are presented (Section 3.3). The chapter concludes (Section 3.4) with a comment on its application to the particular context for this research (pre-service teacher education in Kuwait and Qatar) and for the investigations in Chapters 6, 7, and 8. The research question and sub-questions addressed in this chapter are:

In what ways can an electronic portfolio contribute to pre-service teachers' professional and academic growth?

What is academic growth?

What is professional growth?

What is the role of an electronic portfolio in pre-service teachers' professional and academic growth?

What are considerations for course design in pre-service teacher education so that professional and academic growth are stimulated and integrated with electronic portfolio use?

3.1 Professional and academic growth

In this section professional and academic growth as general concepts and as important outcomes of pre-service teacher education are discussed (Sections 3.1.1 and 3.1.2).

3.1.1 Professional growth

Professional growth (sometimes called professional development or professional progress) is an essential element for professionals in any field, such as industry, commerce, service, and education. The professional growth of individuals in their careers will eventually affect the beneficiaries, such as those in the enterprise, organization, community, society, and nation in which the professionals work. Whereas the education sector is the provider of graduates already displaying professionalism, therefore, the burden is on the system to begin the process of professional growth even in pre-service education courses.

In the dictionary, the word professional is defined as “Having or demonstrating a high degree of knowledge or skill: adept, expert, master, masterful, masterly, proficient, skilled, skillful”. And the word Growth (synonymous terms are Progress or Development) is defined as “the act of moving forward toward a goal” or “gradual improvement or growth or development”. From these definitions of individual words, the term Professional Growth is defined in the dictionary as “the generation of knowledge or the acquisition of experience, skill, and information that enables one to perform at a higher level of proficiency in his or her profession”.

Standards for professional growth in pre-service teachers can be defined in many ways. One way is shown by the course objectives in several pre-service education programs in the Gulf Region, as shown in Table 12.

Table 12. Example of course objective related to professional growth in pre-service education

Learn from and with peers; collaborative learning	Pre-service teachers interact with their peers in ways that contribute to a positive learning environment which supports the intellectual, personal, and social development of all involved.
Strengthen communication skills	Pre-service teachers use effective communication techniques with students and other stakeholders.
Use technology to support instruction	Pre-service teachers use technology as available in schools to collect and analyze data and interpret results, to communicate with peers and other stakeholders, and to manage, evaluate, and improve instruction in ways appropriate to the their students. Pre-service teachers provide their students with opportunities to actively use technology and facilitate access for their students to the use of electronic resources.
Gain insight into the roles of teachers	Pre-service teachers understand the roles of the teacher, and are able to work with various educational professionals such as practicing teachers, administrators, and other stakeholders to accomplish the continuous improvement of their own educational experiences and those of their students.

The four sets of objectives shown in Table 12 indicate aspects of professionalism which should continue to grow throughout the careers of teachers, from within their pre-service training throughout their work as practicing teachers. All teachers must keep growing in these forms of professionalism. The item relating to the use of technology is perhaps the most challenging, in that technology itself is in a continual state of change.

3.1.2 Academic growth

Academic growth relates to the results of learning processes to achieve new knowledge or information in order to attain standards.

The word academic is defined in the dictionary as “scholarly performance: a student’s academic average” or “Concerned primarily with theories rather than practical matters”. The word Growth was defined previously in Section 3.1.1. Combining these leads to a definition of the term Academic Growth as the “gradual improvement of scholarly performance moving forward toward a goal”.

Academic growth in a course in pre-service education relates specifically to the material to be learned in the course. In courses in pre-service education relating to educational technology and its role in lesson planning in the Gulf Region, objectives for academic growth are shown in Table 13.

Table 13. Academic growth objectives for pre-service education

Develop critical thinking about instruction	Students use appropriate instructional design techniques and pedagogical strategies which promote and enhance the critical, creative, and evaluative thinking capabilities of their students.
Demonstrate knowledge and skills with educational technology	Students demonstrate knowledge and skills with educational technology.
Create and maintain positive learning environments	Students create and maintain positive learning environments in which their students are actively engaged in learning, social interaction, cooperative learning and self motivation.
Gain insight into instructional planning	Students plan, implement, and evaluate effective instructional design models in a variety of learning environments.
Use technology to support instruction	Students use technology as available in schools to collect and analyze data and interpret results, to communicate with peers and other stakeholders, and to manage, evaluate, and improve instruction in ways appropriate to the their students. Students provide their students with opportunities to actively use technology and facilitate access for their students to the use of electronic resources.
Gain insight into the roles of teachers	Learner understand the roles of teacher, and are able to work with various education professionals such as teachers, administrators, and other stakeholders to accomplish the continuous improvement of their own educational experiences and those of their students.

In comparing Table 13 with Table 12 it can be seen that two of the objectives had also been listed under professional growth (use technology and roles of teachers). That is because in pre-service courses, sometimes the knowledge to be acquired in the course itself (i.e., for academic growth) is also the sort of knowledge needed for on-going professional growth within and beyond the course. In other words, the content of some pre-service teacher education courses is also the basis for their on-going professional growth within and beyond the course.

3.2 Relating academic and professional growth to electronic portfolios

While electronic portfolios are focused on evidence of the pre-service teacher's academic growth, the process of developing an electronic portfolio can also be seen as directly relating to professional growth. In addition, evidence of this professional growth can also be captured and reflected upon in the portfolios. In this section, these ideas of academic and professional growth as the dependent variables of portfolio construction are discussed.

Brown (2002) stated that "Lifelong learning, reflective practice, professional development and integration of ICT (information and communication technology) can all be addressed in pre-service teacher education through the use of electronic portfolios" (p.1). Through the development of electronic portfolios, students will demonstrate their creative, technical, organizational and reflective abilities (professional growth and depending on the course, also academic growth) to varying degrees. Moreover, the development of electronic portfolios enables learners to explore multiple forms of expression and develop information literacy skills to equip them for greater use of electronic information and communication sources. These are also evidence of professional growth. Montgomery (2002) states that outstanding teachers learn from their experiences and continuously seek to prune their own professional practice. Thus, reflection is a form of professional growth that can also be associated with the portfolio process. Thus electronic portfolios can serve as a meaningful and highly effective tool that demonstrates to others (such as the Ministry of Education) the knowledge, skills, and dispositions teacher candidates have gained in the complex process of teaching (Montgomery, 2002). Moreover, Bartell, Kaye, and Morin (1998) (as quoted from Montgomery, 2002) realized that portfolios are valuable to students in order to promote reflection and self-directed growth, building good teaching qualifications, encouraging collaborative dialogue and enriched discussions, documenting growth, and integrating the diversity of the teacher preparation experiences. Grant and Huebner (1998) note that when pre-service teachers incorporate personal beliefs into their professional practice this results in "powerful learning", which means "a self-regulated learning process in which the teacher's mind is proactive, problem-oriented, attentionally focused, selective, constructive and directed toward ends" (p. 34). These lead to deep learning with respect to both academic and professional growth. Grant and Huebner also found that constructivist patterns of thinking were

particularly appropriate for pre-service teachers and that powerful learning takes place when a meaningful question concerning professional practice was posed, data collected, and reflection on relationships between the data and the question were undertaken. These sorts of reflective processes are examples of professional growth. Table 14 shows how different forms of deep learning involving collecting, selecting, thinking, reflecting, and linking (Barrett, 2005; Barrett & Carney, 2005; Roberts et al., 2005; Montgomery, 2002; Polonoli, 2000) can be related to electronic portfolio development.

Table 14. Electronic portfolio development processes related to academic and professional growth

No.	The stages	Course activities and requirements
1	Collection	Pre-service teachers collect all relative artifacts that present their understanding of requirements and objectives and which present the purpose, audience, and reflection on the procedures in relation to knowledge and professional acquisition. Moreover, they collect and save work from previous courses that relate to the course standards.
2	Selection	Pre-service teachers review the available topics in order to select several that are the most relevant and can be used in their assignments in order to achieve the course objectives.
3	Reflection	Pre-service teachers reflect by developing a statement of rationale about each project in the course with a connection to the course standards in order to present their deep understanding of the standards and course objectives. Moreover, they are also obligated to develop a rationale statement about the purpose of developing their electronic portfolios.
4	Projection	After comparing the reflections with the standards/objectives and performance indicators (which appeared from peer discussion and elsewhere in the course) the pre-service teachers present their learning goals and teaching plans in the framework of their stated educational philosophy.
5	Presentation	Pre-service teachers share their portfolios with peers and receive feedback before the final evaluation.

Moreover, the specific contents of the electronic portfolio are also developed in a multi-step way in order to prove the students' understanding of the course objectives. Table 15 shows how the processes involved in individual projects in a course, that are later reflected upon in the electronic portfolio, can also be seen in terms of academic and professional growth in a pre-service course involving the use of technology for lesson development.

Table 15. Development processes in the course activities

No.	The processes	Course activities and requirements
1	Decide/Assess	Pre-service teachers analyze the projects' topics in relation to course objectives and reflect on their progress within the course by defining the needs and audience for the project (beneficiaries) and prime goals from producing the project.
2	Design/Plan	After the pre-service teachers determine the content and sequence of the presentation, they have to explore which application software should be used in order to achieve the project objectives.
3	Develop	Pre-service teachers start to develop the projects after they have gathered the needed materials. They can use concept mapping to help come to a plan for the organization of the projects and lessons and develop the products through the application software which was chosen.
4	Implement	Pre-service teachers implement their projects and present them to their peers as well as the instructor or assistant instructor in order to pre-evaluate and receive feedback.
5	Evaluate	Pre-service teachers receive feedback as pre-evaluation before the final version, and using that feedback the pre-service teachers will either make correction to their works, or try to explain in an argument statement what their reasons were for their design decisions.

Given these arguments, it can be concluded that developing electronic portfolios can improve pre-service teachers' academic and professional growth through the constructivist approach to knowledge acquisition and by reflection on their learning progress. Miller's (1990) Pyramid of

Competence helps picture the relation of the electronic portfolio to performance evidence. Miller divides competence into four levels, which are: Knows, Knows how, Shows how, and Does, as shown in Figure 3.

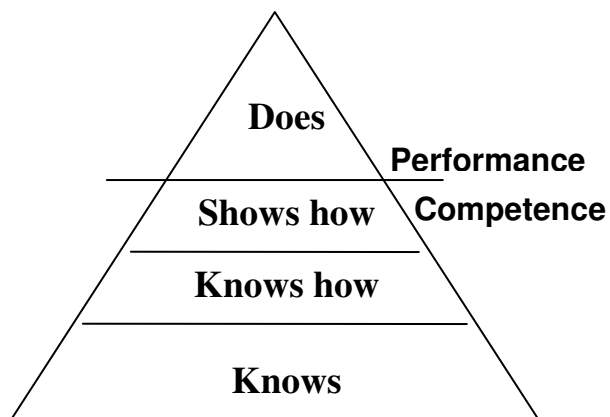


Figure 3. Pyramid of Competence (Miller, 1990)

In Figure 3, Competence is equivalent to the academic and professional growth, and Performance is equivalent to the assessment of the electronic portfolios themselves. Table 16 presents this in more detail.

Table 16. Miller's Pyramid of Competence model (1990) in relation to the developing of electronic portfolios

Miller's type of competence	Description		Relation to portfolio development process
	Academic	Professional	
Knows	Knows about the course objectives/standards in relation to knowledge of subject matter, critical thinking, and how to design and develop a learning environment	Knows about the course objectives/standards in relation to the use of technology, planning, communication, understanding the role of teacher, and collaborative learning	Preparation for the start of the development process

Knows how	<ul style="list-style-type: none"> - Collects artifacts that present his or her understanding of course objectives - Selects which artifacts most appropriately present his or her understanding of the standards. - Writes a rationale statement of his or her understanding of the standards in relation to the artifacts 	<ul style="list-style-type: none"> - Uses communication tools in order to share and exchange ideas about their work. - Plans how to proceed in representing the artifacts -Decides which application software is most suitable to develop these artifacts - Reflects on the roles of the teacher through the perspective of one's educational philosophy 	Collect, select/think, develop, & reflection
Shows how	<ul style="list-style-type: none"> - Presents a draft version of the portfolio contents (artifacts) 	<ul style="list-style-type: none"> Receives feedback and reflection either from peers or instructors 	Projection/implement
Does	<ul style="list-style-type: none"> -Presents a complete version of electronic portfolio containing artifacts and rationale statements 	<ul style="list-style-type: none"> Bases the presentation on the educational philosophy which reflects a pre-service teacher's roles in relation to the standards 	Presentation/evaluation

In order to carry out the steps in Table 15 and Table 16, the functionalities of electronic portfolios and of their support systems shown in Section 2.1.3, Table 7, can provide the operational tools to use to develop and manage electronic portfolio items. A Web-based support system for electronic portfolio processes can provides functionalities to upload products or to store files, to enter reflective statements, to provide peer reflection as well as instructor or assistant reflections, to provide a means for communication to exchange ideas and views in relation to the electronic portfolio development, and to make presentations. All of these can help strengthen the pre-service teachers' academic and professional growth. In terms of the components

of the electronic portfolio itself, the following are particularly relevant in terms of demonstrating academic and professional growth:

- A statement of the purpose of the electronic portfolio

This component of the portfolio should contain an introduction, a statement of the purpose of developing the electronic portfolio, a reflection on what has been achieved after passing through the development processes, a description of the intended learners for the materials contained in the portfolio, and table of contents for the portfolio.

- Resume

This component should contain a short summary of the pre-service teacher's educational and professional (if it is available) background. The objective is to train the pre-service teachers to represent themselves in a professional way.

- Course requirements (in terms of competencies, standards or objectives)

This is the second most important element of the portfolio because it presents the learner's academic growth in relation their work during the course. The pre-service teacher should give a rationale statement for different items in the portfolio to explain their relation to the course standards/objectives. These comments should reflect the deep learning that has occurred during the course.

- Educational philosophy

This component of the portfolio should illustrate the learner's professional growth in relation to the standards through the expression the educational philosophy. Through it the pre-service teachers presents their understanding of the standards using their own words which outlines their progress during the studying period.

- Previous experiences (archive)

The purpose of this component of an electronic portfolio is making links between previous work and their program

standards and training the pre-service teachers to document their works for further use and for sharing it with colleagues.

Thus the creation of an electronic portfolio not only demonstrates growth that has occurred outside of the portfolio but can be in itself a source of professional and academic growth. “Well-designed portfolios represent important, contextualized learning that requires complex thinking and expressive skills” (Barrett, 2005, p.3). The process of creating an electronic portfolio involves reflecting metacognitively on learning represented in evidence, making a case that the artifacts constitute evidence of achievement, and making connections in their learning (Barrett, 2005; Campbell, Cignetti, Melenyzer, Nettles & Wyman, 2001; Ring, 2002).

3.3 Course design for academic and professional growth involving portfolios

The constructivist approach to electronic portfolio development with its focus on professional as well as academic approach requires a review of overall course design. At the general level, there will be a change in instructor and students’ attitudes about the learning processes, and about acquiring and using technological skills for communication and presentation. Brown (2002) found “new activities for the teacher and learner in a constructivist classroom environment. The teacher is a process facilitator, a designer of tasks or cognitive tools, a resource organizer and a source of cognitive support (strategy sharing, modeling and apprenticing learners as problem solvers). The learner is a producer of resources who needs to learn to organize those resources, share strategies, and work collaboratively and cooperatively with fellow learners. Collectively, the reciprocal actions of teacher and student are at various times active, reflective, individual, collaborative, cooperative, creative, expressive and most important of all – flexible” (p. 1). This is similar to the “contributing student” approach to course design (Collis & Moonen, 2001; 2005).

This implies that the course in which portfolio development occurs must be designed to include continuous follow up activities such as: discussion, the exchange of knowledge and information, collaborations among students and feedback. In contrast, many current pre-service teacher education courses, at least in the Gulf Region, are characterized by:

- Little focus on a constructivist model in building learners' achievements. Course procedures tend to emphasize memorizing what is in the textbook in order to pass the course.
- An emphasis on the standardized assessment method which is testing. If there is the use of a portfolio (in paper format), it is for collecting their work (assignments) together at the end of the course, but has no more than marginal importance in course grading processes.
- Little flexibility in the time and place of carrying out their course requirements, having to finish them during the scheduled computer laboratory sessions only.
- Little encouragement from the administration level (motivationally or financially) to use alternative learning and teaching strategies.

Thus current course designs do not lead to productive environments for professional and academic growth or for the meaningful use of electronic portfolios. What is needed in terms of course design for a more productive learning environment?

From the theoretical perspectives on learning that should underlie electronic portfolio use in pre-service teacher education (Section 2.3), the course in which portfolio use occurs should reflect:

- A constructivist environment for building knowledge and experiences.
- A collaborative environment for students to exchange ideas and perspectives to build their communication skills as well their professionalism.
- A flexible environment that provides freedom in place and time to gain their knowledge as well as getting support.
- A support environment to facilitate help during the development of course assignments or the electronic portfolio itself (Barrett, 2005; Gathercoal et al., 2002; Siemens, 2004; Treuer & Jensen, 2003).

Figure 4 visualizes these requirements for a productive course environment in terms of stimulating professional and academic growth and a meaningful process for electronic portfolio development.

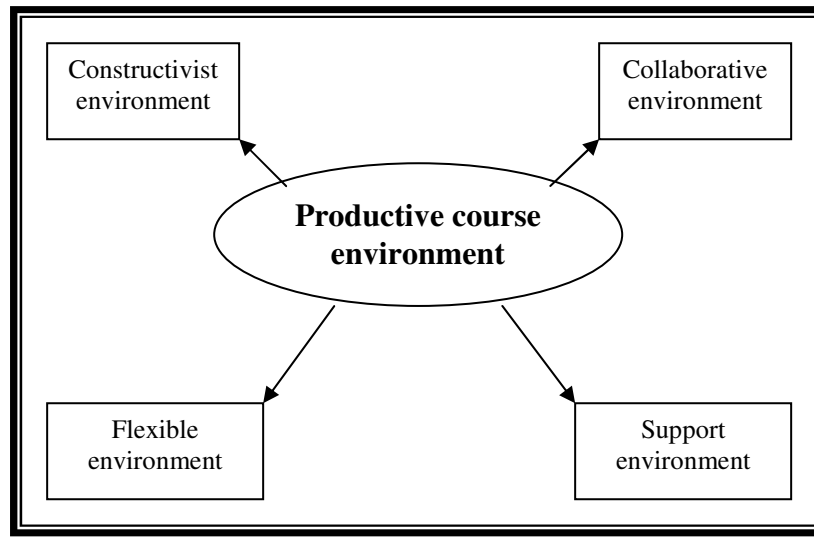


Figure 4. Four dimensions of a productive course environment

Figure 4 presents four factors in course design which are correlated with each other to lead to successful implementation of electronic portfolios to improve pre-service teachers' academic and professional growth.

- **Constructivist environment:**

As explained in Section 2.3.1, a constructivist approach is of importance of developing electronic portfolios. What does a constructivist course environment provide? That environment has to include assignments that guide pre-service teachers through the steps of the electronic portfolio development processes, such as collect, select, develop, reflect, make links, and present results in terms of authentic activities. Moreover, constructing activities by using prior knowledge to going beyond the information given is positively important to improve academic and professional growth. Course design should include activities that stimulate reflection from peers or instructors about constructing information, knowledge, and perceptions about the electronic portfolio concept as well as the standards through the discussion forum or online support (Abdullah, 2001; Alaasemi, 2003; Barrett, 2005; Gathercoal et al., 2002; Siemens, 2004; Treuer & Jenson, 2003).

- Flexible environment

A flexible environment to build knowledge requires that pre-service teachers take more personal responsibility for finding their own ways and pace of gaining information or knowledge. The flexibility to navigate between the course resources within an electronic support environment helps pre-service teachers to decide from where they should begin their searches for resources. Flexibility on time and place plays a crucial role in encouraging learners to be engaged within the development processes for electronic portfolios. Such a feeling of personal engagement is considered a factor of successful implementation (see Section 4.3) of the electronic portfolio in higher education. Flexibility in selecting their own artifacts with different types of formats (text, video, graphic, and audio) allows creativity as well as encouragement to be more involved in the developing of their electronic portfolio (Brown, Collins, and Duguid, 1989; Collis & Moonen, 2001; Jonassen, 1996; Jonassen, Peck, & Wilson, 1999).

- Collaborative environment

In Section 2.3.3 it was argued that collaboration between learners and their instructors or their peers is a powerful learning tool. Sharing knowledge and gaining new information are the essential elements of collaborative learning. Moreover, giving peer feedback and reflections are valuable aspects of collaborative learning. So designing a course so that a collaborative learning environment is present during the development of pre-service teachers' electronic portfolios will help the students to exchange ideas, information, and new knowledge as well as provide a stimulus to work together. Collaborative activities can be achieved beyond the time of the face to face portions of the course through using the discussion forum or online chat, as well as within the class session (Fisher, 2002-2003; Geer & Hamill, 2003; Koschmann, 1996; Way, 2003).

- Support environment

Previous studies (Barrett, 2005; Barrett & Carney, 2005; Gathercoal et al., 2002; Treuer & Jenson, 2003) proved that any support provided to the pre-service teacher during the development, such as tutorials, instruction, resources, technical

support, help desk positively affects their learning and product outcomes. An electronic support environment can help build self-confidence in pre-service teachers since the support is available at all times and in the same electronic form as the portfolio itself (Barrett, 2005; Barrett & Carney, 2005; Campbell et al., 2001; Gathercoal et al., 2002; Ring, 2002).

With these are the underlying bases for course design, Figure 5 shows a general model for a productive course environment involving electronic portfolios for professional and academic growth.

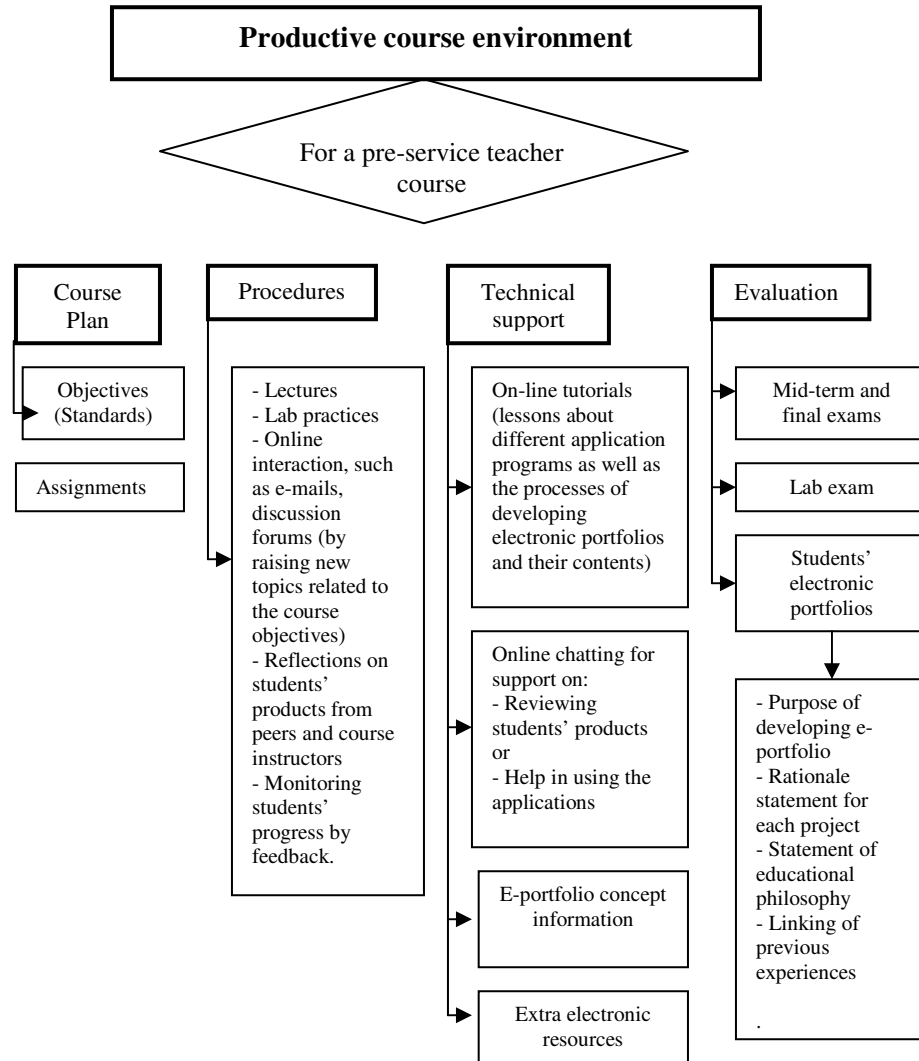


Figure 5. Design for a productive course environment including electronic portfolios

Figure 5 shows the four components of a productive course environment in which electronic portfolio processes take place. Much of the technical support and some of the course procedures can take place within a Web-based support system used within the entire course and also for the specific support needed for electronic portfolio development.

3.4 Applying the results to the current research

This research is taking place with teacher preparation programs in the Gulf Region. The specific goals for the electronic portfolios relate to professional and academic growth as discussed in Sections 3.1 and 3.2. The research also focuses on how to motivate and coach students to become more reflective and active participants in the learning process. Thus a productive course environment as described in Section 3.3 will need to be designed for the research.

In this research the academic growth will be measured against the objectives of the courses involved in the investigations. These objectives emphasize critical thinking, knowledge of subject matter, and skill in planning and creating a learning environment using technology for lessons in the pre-service teachers' own disciplines. The specific academic objectives for the courses involved are discussed in Section 7.1.1 and 8.1.1.

Professional growth is defined in the dictionary as “the generation of knowledge or the acquisition of experience, skill, and information that enables one to perform at a higher level of proficiency in his or her profession”. In this research the professional growth will be measured against the standards given in the course objectives, which are skill in the professional use of technology, communication skills, skill in planning, insights into the role of the teacher, and skill in participating in collaborative learning. The specific professional objectives for the courses involved are discussed in Section 7.1.1 and 8.1.1.

An integration of constructivism, flexibility in course procedures, provision of an electronic support system, and stimulation of collaborative experiences will be stressed in the course design for the investigations in order to achieve the positive impact of electronic portfolios in pre-service teacher electronic. The learning and teaching strategies of the courses will have to change in order to achieve the desired levels of pre-service academic and professional growth. Therefore, the main functions of a Web-based support system for electronic portfolio development are:

- Increasing learner autonomy and self direction.
- Stimulating reflection and deep learning.
- Facilitating the progression of portfolio development.

Section 6.2.2 describes the design of this Web-based support system in detail.

The electronic portfolio development processes themselves should focus on empowering the learners as they collect, select, link, reflect, and present items and reflections in their portfolios. Miller's Pyramid of Competence (1990; Section 3.2) which consists of four levels, three of them representing competence development and the fourth representing the performance in terms of the quality of the actual portfolio which is produced, will steer the design process for the research.

The electronic portfolios developed by the pre-service teachers in the investigations of this research (Chapters 7 and 8) should display metacognitive reflection on learning represented in evidence, making a case that the artifacts selected constitute evidence of achievement, and making connections in their learning. Therefore, the pre-service teachers will develop electronic portfolios, with hyperlinking and multimedia resources, with the following components:

- Discussion of the purpose of the electronic portfolio
- A professionally done resume
- A demonstration of how products developed in the course reflect course requirements (in terms of competencies, standards and objectives)
- A statement of educational philosophy
- Links to previous experiences (via an archive).

This is the plan for the design of a course and the support within for electronic portfolio development. In Chapters 5, 6, 7, and 8 this planning is put into practice for specific settings in the Gulf Region. But before this, one further conceptual review will take place. This relates to implementation factors that can help or become barriers to realizing such plans in practice. These factors are the focus of Chapter 4.

4 Conceptual review: Implementation issues for electronic portfolios

This chapter describes implementation issues with regard to implementing an electronic portfolio in pre-service teacher education. Section 4.1 gives information about the educational change process when new ways of teaching and learning using technology are implemented. Section 4.2 focuses on the specific case of electronic portfolio implementation in teacher education. Factors influencing a Web-based support site for electronic portfolio development are discussed in Section 4.3. The chapter concludes by applying the conceptual results to the current research context. The research question and associated sub-questions addressed in this chapter are:

What are key factors for implementing an electronic portfolio in higher education?

- What are key factors at the organization, curriculum, instructor and student levels that affect the change process when introducing new technologies and teaching methods?
- What are specific recommendations to improve the likelihood of successful implementation of electronic portfolios in pre-service teacher education?
- What should be taken into consideration in the design of a Web-based support system to accompany portfolio use to increase the likelihood of use of the system in practice?

4.1 Educational change

Much research has been conducted that deals with the concept of educational change. Fullan (1991, 1993, 2001) and Rogers (1995) are key figures in understanding the change process in education, particularly in terms of response to an innovation. Collis and Moonen (2001) are among those who specialize on the change process in relation to the use of computer technology in education, including teacher education. In this section, a general overview is given on educational change and stages in the change process (Section 4.1). Then the focus becomes more specific, to implementing change relating to electronic portfolios in pre-service teacher education (Section 4.2). Section 4.3 goes further into detail, into key factors that relate to the implementation of a Web-based support system as part of a “productive course environment” (see Section 3.3, Figures 4 and 5) for portfolio use. Section 4.4 applies the conceptual results to the specific context for this research.

4.1.1 General features of change in the educational context

Fullan (2001) stated about understanding change that “the goal is to develop a greater feel for leading complex change, to develop a mindset and action set that are constantly cultivated and refined” (p. 34). Moreover, he gave some considerations for understanding the change process. He stated that “educational change presumably is to help schools accomplish their goals more effectively by replacing some structures, programs and/or practices with better ones” (p.15). According to Fullan (1993) educational change is “technically simple and socially complex” (p. 65). He also mentioned that change should start by identifying what the change process will involve. For example, he defined the change process within a classroom as involving (a) curriculum materials, (b) teaching practice, and (c) beliefs or understanding about curriculum and learning practices.

Fullan (1993) describes the change process as consisting of three phases as shown in Figure 6.

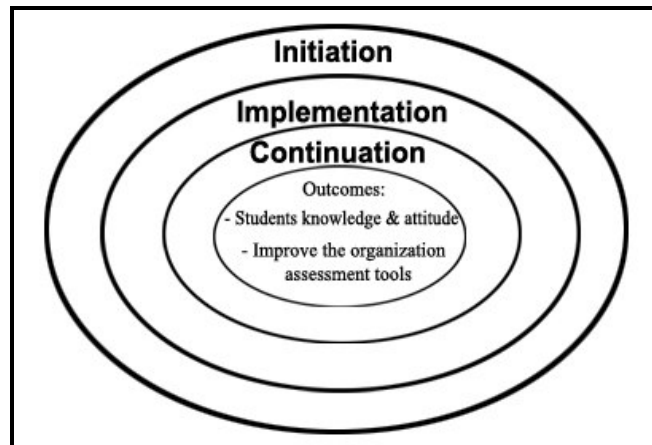


Figure 6. A simplified overview of the change process (Fullan, 1993, p. 7)

In terms of Figure 6:

- The Initiation phase, which is also called mobilization or adoption. This phase consists of the processes that lead up to the start of a change process and includes a decision to adopt or proceed with a change.
- The Implementation phase, which is usually the first two or three years of use of an innovation and involves the first experiences of attempting to put an idea or reform into practice.

In this stage formative evaluation is continually occurring, leading to modifications of the innovation and implementation planning.

- The Continuation phase, which also called incorporation or institutionalization, refers to whether the change gets built in as an ongoing part of the system or disappears by way of a decision to discard the innovation or simply to let it fade away through attrition.

The Outcomes shown at the center of Figure 6 are not a change process phase. The outcomes are the result of the change process phases. Innovation relating to pre-service teacher education, the outcomes can relate to improvements in pre-service teachers' academic and professional growth.

Collis and Moonen (2001) discuss the three stages in terms of innovations involving computer technology and more-flexible learning.

- Pre-initiation and initiation which consists of the considerations that lead decision makers in the department, faculty, or university to choose to implement the use of new forms of ICT on a broader level and produce a strategic plan for this process.
- Implementation which involves the project-level experimentation with the innovation and on-going formative evaluation of the implementation process. Through these initial experiences, a fine-tuning of the methodology is developed.
- Institutionalization which is the final stage of change process which occurs when the new innovation becomes part of mainstream processes in the organization and is used by departments, faculties or whole universities without the support of a special project.

Collis and Moonen also note that change occurs in two main directions: bottom up and top down. Bottom-up change occurs when a few key individuals or events stimulate a multiplier effect. Top-down change occurs when decisions or policy are announced from central levels (such as department heads, institutional administration, or government policy makers) requiring the implementation. Both bottom-up and top-down change are necessary for successful implementation; finding the balance and the timing for emphasizing one or the other are major challenges.

Combining both bottom up and top down, Fisser (2001) presents five successive phases of ICT implementation applicable to a university context:

- Incidental and isolated use of ICT by one or more instructors
- Increasing awareness of ICT relevance for education, at all levels
- Emphasis on ICT coordination and hardware
- Emphasis on didactic innovation and ICT support
- Use of ICT- integrated teaching and learning, independent of time and place (p. 21).

In whatever way the change processes are defined, Fullan states that “research findings on the change process should be used less as instruments of ‘application’ but more as means of helping practitioners and planners ‘make sense’ of planning, implementation strategies, and monitoring” (p. 47).

4.1.2 Factors influencing the change process

Fullan (1993) also notes that “the change may be externally imposed or voluntarily sought; explicitly defined in detail in advance or developed and adapted incrementally through use; designed to be used uniformly or deliberately planned so that users can make modifications according to their perceptions of the needs of the situation” (p. 65). An important observation about change is that the success of the change process and particularly of the implementation stage is correlated with factors that affect the implementation. These factors might work against or with the implementation. If they work positively to support the implementation this improves the chance of transfer to mainstream practice. But, when they work negatively, they become barriers to the change. Moonen and Kommers (1995) indicate that “a logical approach to stimulate a change process is to concentrate on innovative factors that can be manipulated to steer the change process” (p. 49).

With regard to change processes involving technology, Ely (1990) stated eight factors for adoption, implementation, and institutionalization of educational technology innovations, and these factors are:

- Dissatisfaction with status quo
- Knowledge and skills exists among key actors
- Resources are available
- Time is available

- Rewards or incentives exist for participants
- Participation is expected and encouraged
- Commitment is given by those who are involved
- Leadership is evident

Similarly, Fullan (1993) stated 12 factors organized into three main categories, containing nine critical factors, which are:

- Characteristics of the innovation or change project, which consists of four sub-factors:
 - Need for the change
 - Clarity of the change
 - Complexity of the change
 - Quality/ practicality of the proposed change
- Local roles, which also consists of four sub-factors:
 - District decision makers
 - Community members
 - Principal (school leaders)
 - Teachers
- External factors, which consists of one sub-factor:
 - Government and other agents

Al-Najjar (2002) has carried out a recent effort in implementing a facet of ICT in one of the countries of the Gulf region, Kuwait. She conducted a study in the PAAET to introduce the use computer-based training as a part of a course. She used Fullan's implementation model after adding some modifications in order to achieve successful implementation in Kuwait. In particular, she replaced Fullan's category "local characteristics" with "acceptance".

Figure 7 shows Al-Najjar's conceptualization.

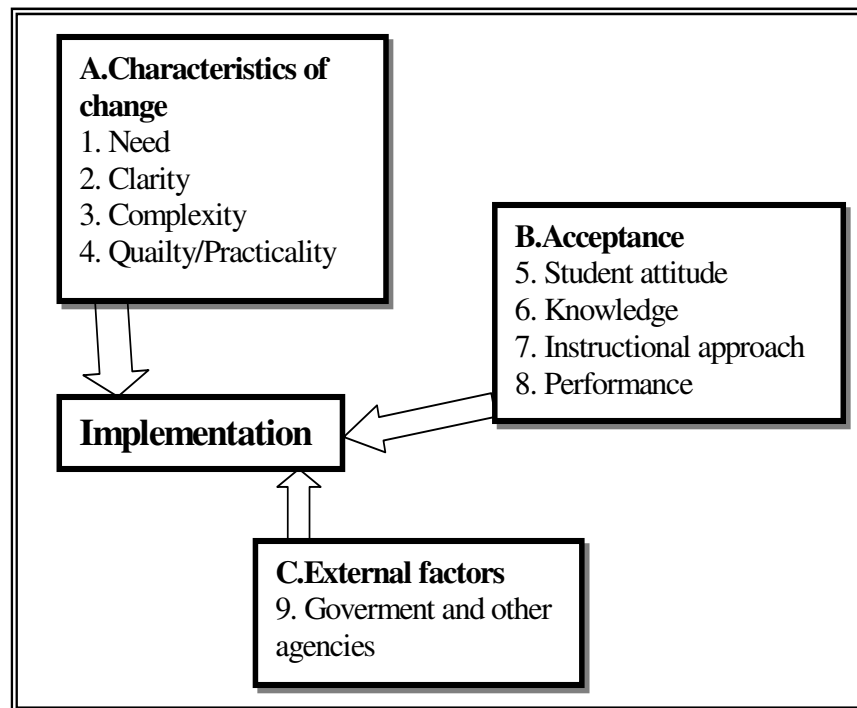


Figure 7. Factors influencing ICT implementation in the PAAET (Al-Najjar, 2002)

Also in terms of identifying factors that relate to the success or failure of change, Collis and Moonen (2001) specify two important factors for the implementation stage, which are (a) the ease of use of the innovation; and (b) the level of personal engagement felt by the end user of the innovation. They relate these to the perceived educational effectiveness and to factors in the environment to predict “an individual’s likelihood of making use of a technological innovation for a learning-related purpose” (Collis & Moonen, 2001, p.25). This prediction is done using the 4-E Model (Collis, Peter, & Pals, 2001) where the factors (a) Environment (the institutional context), (b) Educational effectiveness (perceived or expected), (c) Ease of use and (d) Engagement (the potential adopter’s personal response to technology and to change) are interrelated. Table 17 describes these factors.

Table 17. Factors influencing the use of a technological innovation in learning related practice (Collis & Moonen, 2001, p. 53)

“E” cluster	Key sub-factors and their indication
Environment: the institution’s profile with respect to technology use	Organizational-context sub-factor: -The vision, support and actual level of use within the institution for technology use for learning-related purposes. -The readiness to change among the people in the institution when it comes to the use of technology in education.
Education effectiveness: perceived gain from the technology use	Long-term pay-off sub-factor: -Likelihood of long-term tangible benefit for the institution or individual. Short-term pay-off sub-factor: -Pay-off such as efficiency gains, doing routine tasks associated with learning more quickly. Learning effectiveness sub-factor: -New forms of valuable learning experiences, valuable support to the existing curriculum.
Ease of use: ease or difficulty in making use of technology	Hardware/network sub-factor: -The network is convenient to access, adequate in terms of speed and bandwidth, and reliable. Computer and printer access are convenient. Software sub-factor: -Software associated with the technology is user-friendly, does what the user wishes and is easy to learn.
Engagement: personal engagement about technology use for learning related purposes	Self-confidence sub-factor: -Personal orientation towards trying out new ways to carry out learning-related tasks, being interested in new technological developments and sharing these interests with others. Pleasure with the Web sub-factor: -Particular interest in new technologies, currently the Web.

Figure 8 shows the interrelationship of these factors.

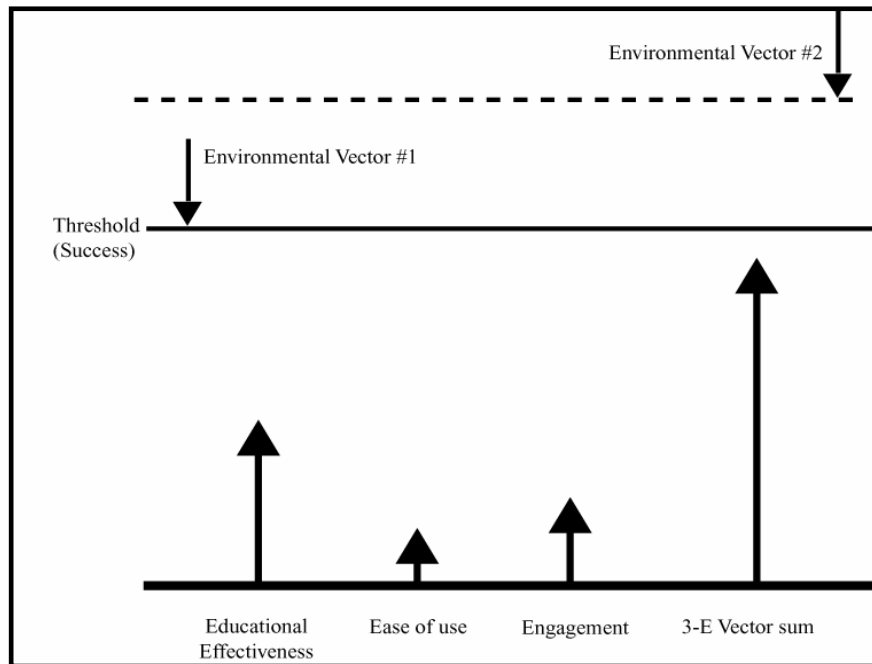


Figure 8. The 4 E-Model (Collis & Moonen, 2001, p. 25).

In Figure 8, two different implementation scenarios are contrasted in terms of the 4 E-Model. In Environment 1 implementation is likely to succeed while in Environment 2, implementation is not likely to succeed, even though both have the same vector sum for the Effectiveness, Ease of Use, and Engagement vectors.

All of these lists of factors that affect educational change mention the key roles of particular actor groups. This is discussed further in the next section.

4.1.3 Key actors in educational change

Rogers focuses on the change process for an innovation with a particular emphasis on the roles of individuals in the process. Innovation is defined by Rogers (1995) as “an idea, practice or object that perceived as new by an individual or other unit of adoption” (p.11). The focus is on how the innovation can, and will, be adopted by different users to fit their different contexts (Hall, 1980). This process is called the diffusion of an innovation. Diffusion as defined by Rogers (1995) is “the process by which an innovation is communicated through certain channels over time among the members of a social system” (p. 5). Roger (1995) has stated four components of innovation diffusion: (a) the innovation itself, (b) the time taken to be adopted, (c)

communication channels used for the diffusion process, and (d) the social system in which the diffusion takes place. People are key factors in the communication and social system. Rogers also describes how groups of people vary along the change continuum. He classifies these individuals into five adopter groups: innovators, representing 2.5% of the individuals in a system; early adopters, who adopt the new ideas and become “the opinion leaders” representing 13.5%; early majority, 34% who follow the opinion leaders moving toward change; late majority, also 34%, who take more time to carefully examine the innovation and look for the benefits associated with the change; and finally the laggards, 16% of the individuals who are resistant to change, and may even try to weaken the innovation. Rogers hypothesized that the take-up process for the adoption of an innovation would generate a normal bell-shaped curve.

There is general agreement that individuals are key factors in the diffusion or institutionalization of an innovation. Three key parameters of the change process the innovation itself, the implementation process, and the individuals involved. According to Hall and Hord (1987) implementation is a phase of the change process; innovations are usually adapted during implementations; and consideration must be given to individual users and nonusers of an innovation who are involved in the change process. Therefore, in studying change process, consideration must be given to how the attitudes of individuals to the new innovation are shaped during the change process.

A key actor group are the instructors involved in a situation where technology is to be introduced into a course situation. Fullan (1993) emphasized that “teachers’ capacities to deal with change, learn from it, and help students learn from it will be critical for the future development of societies. They are not now in a position to play this vital role. We need a new mindset to go deeper” (p.ix). So he suggested that “to become expert in the dynamics of change, educators, administrators and teachers alike, must become skilled change agents”(p. 4). Fullan defined a change agent as “being self-conscious about the nature of change and the change process”(p.12). He explained the effective change agent as having “four core capacities required as a generative foundation for building greater change capacity: personal vision-building, inquiry, mastery, and collaboration” (p. 12). Likewise, Rogers (1995) stated factors which are required for a successful change agent: (a) effort, (b) client orientation, (c) compatibility with clients’ needs, and (d) empathy.

Fuller's research (1969) relates to the work of Hall and his colleagues (Hall, 1980; Hall & Hord, 1987; Hall & Rutherford, 1976; Hall, Wallace, & Dossett, 1973). Hall and Hord (1987) proposed that as pre-service teachers progress through teacher education programs and into in-service work, they move through a developmental sequence of "concerns" about technology use. Teachers in their early stages of experience are most probably self-oriented; they focus on their one technical skills and the effects of these on practical aspects of teaching. Consequently, as they gain training, and experience, their concerns shift to questions and needs related to the task of teaching. Finally, with additional experience, training, self-confidence, and success teachers develop more impact related concerns. Fuller (1969) confirmed that "new teachers typically focus on the technical aspects of their teaching. They label this period the "survival" phase in which the new teacher is concerned primarily with managing a lesson or a classroom rather than drawing connections to the student and the context of the classroom" (p. 209). Next, teacher development rises from the survival stage to the mastery stage where students become the focus of the teacher's consideration.

Following these observations, the Concerns-Based Adoption Model (CBAM), developed by Hall, Wallace, and Dossett (1973), focuses on the intended adopters and how they approach change. The CBAM model brings an additional emphasis to the understanding of change as a process by focusing on the instructor as an individual. From the CBAM perspective each individual will adopt the innovation in his/her teaching their own way but according to a predictable sequence. CBAM experience suggests that, in school settings, because administrators and other decision-makers are not in the classroom, they are not reliable sources of information about actual classroom practice. The CBAM considers the Stages of Concern (SoC) and the Levels of Use (LoU) of the innovation as well as the innovation itself. Hall and Rutherford (1976) concluded that there are seven stages of concern that individuals move through when facing innovation: awareness, information, personal, management, consequence, collaboration and refocusing. Fuller, Hall and Rutherford (1976) abstract these seven stages into three: self, task, and impact. Also, like Fullan (1993), they argue that the successful implementation of an innovation requires the appropriate intervention as well as a need for change agents to assist with the facilitation of an innovation.

Many studies have been done using the CBAM model to describe instructors' reactions to new technologies. For example, Cicchelli and Baecher (1989) investigated the concerns of teachers regarding the use

of microcomputers in the classroom. In this study 78 teachers at the elementary, junior high, and high school levels completed the Stages of Concern Questionnaire (Hall, Wallace, & Dossett, 1973). They confirmed in this study the same findings of the earlier studies of Fuller, Hall, and Rutherford (1969) and Hall and Rutherford (1976) which are that the concerns of the teachers at all levels develop in an hierarchical order, beginning with self, then moving to task, and finally go regularly to impact. Table 18 shows this progression, from highest level to lowest level.

Table 18. Stages of concern about an innovation (from Hall & Hord, 2001)

	Stages of Concern	Expressions of Concern
IMPACT	6. Refocusing	I have some ideas about something that would work even better.
	5. Collaboration	How can I relate what I am doing to what others are doing?
	4. Consequence	How is my use affecting learners? How can I refine it to have more impact?
TASK	3. Management	I seem to be spending all of my time getting materials ready.
SELF	2. Personal	How will using it affect me?
	1. Informational	I would like to know more about it.
	0. Awareness	I am concerned about it.

Other actors besides instructors are important in implementation. Fullan (2001) also focuses on decision makers at the organizational level. In order to clarify these actors and their role in decision making, Fullan (2001) uses a scheme of “authority position” in relation to the change process. He suggests the scheme shown in Figure 9 to select appropriate actors. The scheme has two dimensions, which are: (a) authority dimension (in authority or not?), and (b) change effort dimension (is the actor initiator or recipient?). He uses the term “coper” to designate the one who copes with the implementation.

		Authority position	
		YES	NO
Relation to change effort	Initiator or promoter	I Planner (e.g., policymaker)	II Planner (e.g., developer)
	Recipient or responder	III Coper (e.g., principal)	IV Coper (e.g., teacher)

Figure 9. Change situations according to authority position and in relation to the change effort (Fullan, 2001, p. 105)

Factors that influence the change process will be different for each of these groups of actors.

4.2 Factors affecting the implementation of electronic portfolio in the pre-service teacher education context

The implementation of electronic portfolios in pre-service teacher education will be affected by all of the concerns and factors discussed in Section 4.1. Barrett (2002) developed a list of criteria affecting implementation, as a part of the discussion held by the E-PAC (Electronic Portfolio Action Committee). She grouped the factors into six main categories, which are: storage space, security, linking and grouping, reflection, publishing, and portability, which are present in Table 19.

Table 19. Criteria for the implementation of electronic portfolios in teacher education (Barrett, 2002, p. 1)

Factor	Factors affecting implementation
Enough storage space	<ul style="list-style-type: none"> - To store digital artifacts - To store learner self-reflection and self-assessment on each artifact - To store feedback on each artifact from assessor(s) (independent validation)
Flexible security levels	<ul style="list-style-type: none"> - Ability to restrict access, setting permissions to view: <ul style="list-style-type: none"> o Artifact only o Artifact with reflection o Artifact with reflection and feedback - Ability to set permissions separately for faculty to view portfolio and provide feedback on work.
Tools for linking and grouping within the portfolio	<ul style="list-style-type: none"> - Ability to organize portfolio in a variety of ways (flexibility in organization) <ul style="list-style-type: none"> o By standards or learning outcomes o By course o By date (entered, last updated, etc.) - Ability to link to: <ul style="list-style-type: none"> o Goals for portfolio, contents of portfolio o Learning goals or standards o Resume
Tools for entering reflections	<ul style="list-style-type: none"> - Ability to reflect on a specific grouping of artifacts to make a particular case (i.e., how this collection demonstrates achievement of a standard or learning goal)
Tools for publishing	<ul style="list-style-type: none"> -Ability to create a variety of portfolios, depending on audience and purpose: <ul style="list-style-type: none"> o Assessment portfolio (a highly-structured portfolio demonstrating achievement of learning goals or standards, with independent validation and feedback on artifacts/reflections from faculty) o Showcase portfolio (a collection of artifacts, with reflections, that demonstrate growth over time, highlighting specific achievements) -Ability to individualize the portfolio, to allow creativity of expression in the presentation
Support for portability	<ul style="list-style-type: none"> -Ability to archive work in a portable format such as: <ul style="list-style-type: none"> o CD-ROM o HTML or PDF Archive -Capacity for students to take their portfolio to another institution or maintain it on their own.

Barrett also identified eight different levels of portfolio implementation in order to measure the status of the individual (faculty member), department, program, faculty, or organization level in implementing electronic portfolios. These are:

Levels of Portfolio Implementation (Barrett, 2002)

0. A collection of artifacts
1. A collection of artifacts with reflective statements
2. A collection of artifacts with reflective statements and self-assessment
 - A learning portfolio (journal entries with associated artifacts)
 - A showcase or marketing portfolio (a “celebration of learning” or an employment portfolio)
3. A collection of artifacts with reflective statements and self-assessment, linked to course outcomes, program outcomes, or standards
 - A non-validated assessment portfolio
4. A course-centered portfolio: A collection of artifacts with reflective comments and self assessment, linked to course outcomes including validation and feedback from faculty, used for course assessment
5. A program-centered portfolio: A collection of artifacts with reflective comments and self-assessment, linked to program outcomes including validation and feedback from faculty, used for program assessment
6. A standards (or goals)-centered portfolio: A collection of artifacts with reflective comments & self-assessment, linked to standards including validation and feedback from faculty, used for individual learning support and program assessment
7. A learner-centered portfolio: A collection of artifacts with reflective comments and self-assessment, linked to learner goals or outcomes including validation and feedback from faculty, used to support individual learning, growth, professional development.

Each higher level will bring more complexity into the implementation process.

Gathercoal, Love, Bryde, and McKean (2002) reported about a study that was conducted at California Lutheran University School of Education relating to critical success factors that “must to present and

active in order to implement a webfolio system” (p.34). A Webfolio is a Web-based system to support electronic portfolio development. Table 20 presents these factors with remarks on the factors that relate to single faculty implementation.

Table 20. Critical factors for successful implementation of Webfolios
(Gathercoal, et al, 2002, p. 35)

No.	Critical Factor	Sub-descriptors and needed operators	Needed for single faculty implementation
1	Information services cooperation	Information service can support the Internet traffic to and from the webfolio server.	✓
2	Administrative support	Administration rewards participants: - Faculty participants are not punished for negative feedback on student evaluations of teaching. (A small portion of students will “punish” teachers for new course requirements involving technology.) - Dollars are committed to the various requirements indicated in the checklist.	✓
3	Technology infrastructure	All participants have Internet access.	✓
		All classrooms have Internet access with computer display projection units.	✓
4	Portfolio culture	Students complete portfolios as a program requirement.	
		Students complete portfolios as requirements in a course. The portfolios carry a significant weight in determining the course grade.	✓
		The student’s work in the portfolio defines the student to faculty and recruiters.	✓
		Multiple faculty/supervisors/mentor s read and comment on	

		students' portfolio work.	
5	Student learning-centered culture	Faculty members routinely give students assignments in written form.	✓
		Students routinely address unstructured problems.	✓
		Faculty grade and provide feedback on students' work.	✓
6	Project champions	The push for adopting and implementation of webfolios comes from faculty.	
		A group of faculty members gives the commitment and stamina to make the webfolio system work.	
7	Implementation milestones	An implementation plan exists, with reasonable milestones that are measurable and that collectively lead to full implementation.	
8	Training and help resources	Open computer lab assistance is available for students and faculty.	
		Opportunities exist for faculty/mentor training (multiple times and place).	
		Webfolio documentation is available for faculty/mentors and students.	✓
9	Faculty commitment	Faculty committed to presenting course assignments in a uniform format, such as:	✓
		- Statement of standard	
		- Student assignment	✓
		- Detail/help/Internet resources	
		- Assessment description	
		Teams of faculty agree to cast program standards into a uniform format including an artefact-producing activity demonstrating mastery of program standard modules.	

10	Standards- or competency-based curriculum	The academic unit has explicit program standards. Rules may mandate these standards, they may be recommended by professional organizations, or the academic unit may define them independently.	
11	Integrated curriculum developed by teams of faculty	Faculty teams periodically review and revise the content of the curriculum and are aware of the content of courses making up the entire program. Course and/or program requirements are designed and sequenced to build student mastery of standards.	
12	Feedback provided by Supervisors and mentors use the Webfolio	Multiple perspectives are represented in the feedback to students. Students value varied feedback from multiple sources.	

Siemens also addressed suggestions for successful implementation of electronic portfolios within an institution, however, he emphasized that an institutional approach for electronic portfolios can be a difficult task. He argues that to make electronic portfolios be effective, the concept needs to be embedded into the overall processes of instruction and assessment. The ideal implementation of portfolios would be accompanied by these factors (2005, p. 5):

- The portfolio is viewed as a personal, learner-in-control tool. It is treated as central to the learning and assessment process.
- Learners are introduced to the concept, and instructed on how to use the system (both from a technical and from a “how will this help you” perspective).
- The curriculum has been designed to require learners to use the portfolio in completing their course work and assignments.
- The portfolio is used for assessment of learning objectives. Instructor feedback can be integrated back into the portfolio and treated as an artifact.

- Learners are provided staged advising sessions evaluating their effective use of portfolios (this is a meta-cognitive evaluation of portfolio use).
- An electronic portfolio culture exists, encouraging learners to include personal life experiences, awards, non-academic activities, and other character/learning revealing artifacts in their portfolio.
- Dialogue, debate, discussion, and examples of electronic portfolio use are common.
- Time is allotted for portfolio development.
- Faculty understand and promote the value of electronic portfolios.
- Technical details are well managed, resulting in a simple, positive end user experience.

Stone (1998) notes the importance of providing guidance and support while developing and implementing teaching portfolios. He examined two groups of pre-service teachers to determine an effective way of introducing them to the portfolio process. Each of the two groups was introduced to portfolios at different stages of their professional program and received varying levels of guidance and support. The results were the following:

“The majority (75%) of the group that received support near the beginning of their first student teaching experience believed that portfolios accurately communicated and documented learning and accomplishments. Only 48 % of the second group, which began portfolio construction with their final student teaching assignment, agreed that portfolios were worthwhile in communicating and documenting learning” (p.110).

He concluded that the introduction of portfolios must be carefully planned and take place early in the teacher preparation program and that students must be taught how to select artifacts and reflect on their learning.

Roberts, Aalderink, Cook, Feijen, Harvey, Lee, and Wade (2005) also note that electronic portfolio implementation is difficult. According to their analysis, the following issues are critical (p. 8):

- Clear definition of the goals for e-portfolio projects
- Maintaining multiple stakeholder perspectives
- Developing processes (pedagogical, administrative, technical) in collaboration

- Ensuring institutional support both managerial and functional
- Integrated technologies

They also stated that the most common use of electronic portfolios focus on “counseling, assessment, planning, or a combination of the three” (p. 8). Few cases are being used electronic portfolio as institution wide systems, which mean that the use is limited to particular student groups with a limited number of staff members. Also, they state that “a multi-disciplinary approach is essential with the involvement of all of stakeholders” (p. 8). This reflects the fact that most portfolio implementation projects tend to concentrate on teachers too much in relation to the difficulties of coaching and assessing students. In contrast, students are considered an unproblematic group since they have grown up in a digital age. However, Roberts and his colleagues state that the “students’ perspective should not be underestimated” (p. 8). They suggest that the electronic portfolio has to be embedded in students’ everyday workflow in an attractive way, and that a way has to be found to make the element of reflection become appealing for students. Students need to have flexible control over the time they work on portfolios as well as engage voluntarily during the development of their electronic portfolios.

In relation to the observation that teachers are key players in the portfolio implementation process, Roberts and his colleagues (2005, p. 8) note the benefit of staff members working with electronic portfolios for their own development. They note however that there are different discipline cultures that may stimulate or inhibit the uptake of electronic portfolios by instructors. As staff will have developed institutional and professional survival strategies under pressure of multiple demands on their attention, electronic portfolios for them must also have tangible rewards. In addition, department managers or other decision makers should be actively engaged from start to finish in electronic portfolio projects. They state that “the lines of development are best chosen as a result of a bottom up process, but after the decisions are made, management should define a strategic framework in a goal-directed way. Institution-wide support units should also be involved” (p. 8).

Fullan’s observations about the importance of instructors in any implementation also relate to the implementation of electronic portfolios. Fullan (1993) mentions that “teachers’ jobs are more complex than ever before. They must respond to the needs of a diverse and changing student population, a rapidly changing technology in the workplace, and demand for excellence from all segments of society. The global marketplace raises the stakes ever higher in its performance

demands of school” (p. 5). These pressures also affect the instructors confronted with the implementation of portfolios.

Focusing more specifically on the technical requirements for implementing electronic portfolios, Lorenzo and Ittelson (2005) note the importance of technical aspects relating to the following on implementation success:

- Scalability
- Portability
- FTP clients
- Operating systems
- Interoperability/compatibility with other systems
- Browser
- Cookies
- Database
- Network
- Servers
- Server administration

In addition, issues related to adequate storage, to control of access and security all will have an impact on the success of electronic portfolios.

Combining these observations, Table 21 summarizes key factors that will influence the implementation of electronic portfolios in pre-service teacher education.

Table 21. Success factors of implementing electronic portfolios

Factors	Description
Support	<ul style="list-style-type: none"> - Technical support for the Internet traffic to and from the electronic portfolio server - User support <ul style="list-style-type: none"> ▪ Online availability ▪ Demo/tutorials ▪ Instructor help desk ▪ Phone support/help desk ▪ Discussion forum for support ▪ Change agent availability - Support to develop adequate knowledge & skills - Resources are available - Time is available - Instructor support to increase educational effectiveness - Administrative support in relation to the implementation outcomes - Support for application features related to communication, collaboration, pedagogy, assessment, content management (“collect, select, reflect”) - Integration with other campus/ commercial systems (course management, security, customization) - Training and help resources

Culture	<ul style="list-style-type: none">- Students complete portfolios as a program requirement- Students complete portfolios as requirements in a course- Portfolios carry a significant weight in determining the course grade- The student's work in the portfolio defines the student to faculty and recruiters- Multiple faculty/ supervisors/ mentors read and comment on students' portfolio work- Rewards or incentive exists for participants- Participation is expected and encouraged (engagement)- Commitment is firm by those who are involved (faculty commitment)- Leadership commitment is evident- Students' attitudes are positive- Instructional approaches are appropriate- Students' reflections are valued- Students are committed to the purpose of the use of the portfolios- Students value a learning- centred culture- Project champions are respected in the organization- Integrated curriculum is developed by teams of faculty- Electronic portfolios are accepted as authentic assessment
Infrastructure	<ul style="list-style-type: none">- Internet access- Classrooms have Internet access with computer display projection units- Electronic storage- Security- Appropriate tools for publishing- Portability (ease of use)- Tools for linking and grouping of artefacts- Technical requirements for managing the Web system and underlying database

Planning	<ul style="list-style-type: none"> - The change is well understood in the organization: <ul style="list-style-type: none"> Needs are clear The project and its goals are clear The complexity of the change is managed Quality/practicality or the change are acknowledged - Dissatisfaction with status quo will stimulate interest in the change - Environment's profile in respect to technology use is positive - Decision maker are involved in planning for (faculty, department, faculty, institute) <ul style="list-style-type: none"> Equipment Budget Flexibility Curriculum changes - Implementation milestones are set - Standards or competency based curriculum is in place - Feedback will be provided by supervisors and mentors using the electronic portfolio
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To illustrate how different combinations of these implementation factors can be realized in practice, two illustrations follow.

- Example from California Lutheran University, USA

A study by Herner, Karayan, McKean, and Love (2003) describes how webfolios are used in California Lutheran University's (CLU) education specialist credential preparation. They claim that the techniques can be applied to any teacher preparation program. The study described the benefits from using a webfolio in comparison with traditional paper portfolios. The following text is an edited quotation from their work.

“Traditional paper portfolio at the post-secondary level generally include a resume, philosophy of education, references, letters of recommendation, reflections on educational theories, personal goals, examples of lesson plans, and unit plans. However, there were major drawbacks to paper portfolios including the physical space required to store them, the difficulty of providing access to multiple readers, and delivering them to readers that are not close to the storage location. The Webfolio system in the Special Education Teacher Preparation Program at California Lutheran University

organizes all the related data for the portfolio (e.g., student produced artifacts, instructor provided assignments, artifact assessment scores, reviewer comments, programs standards, and assignment taxonomies) in an electronic database. Stakeholders in the educational institution realize from having portfolio related materials in a database gives the same benefits that the information systems discipline has recognized for having any kind of data in a database. There is much greater flexibility in presenting different users with exactly the data they want and the data are much easier to maintain.

Students entering the School of Education at CLU are trained in the use of the Webfolio during their first courses. User support, such as email, phone help, an on-site lab assistant, and exemplary artifacts, are available in order to help students and new faculty adjust to the system. The system is easy to use. Anyone with basic computer skills can add assignments and content to the Webfolio after a short training session. The Webfolio is primarily used as an authentic assessment tool to evaluate the students' knowledge of the subject matter and their mastery of the content and application of state mandated standards, which requires from students to provide examples of how they have met standards through class work and daily teaching. Participants can communicate with their instructors, field supervisors, and site support personnel, as well as with their peers.

The use of the Webfolio replaces the traditional comprehensive exams required of students at the completion of their credential coursework. This practice represents the summative evaluation use of a Webfolio. Students have a chance to look at their coursework and field experience as a whole, as an integrated body of knowledge and experience that will contribute to their success. The process of defending the Webfolio provides evidence of the candidate's overall preparation and readiness to teach. The system provides the pre-service teachers with a virtual environment that enables them to get coordinated support from different sources. In contrast, for instructors, who are the field supervisors, and the site support personnel, will be made aware of a question or issue, and they will all provide the teacher candidate with information/suggestions that are coordinated and cohesive. Generally speaking, the Webfolio, is not used as an employment tool, because most Special Education students are already employed. However, it may be used as a re-employment tool when applying for a different school position. The Webfolio encompasses a rich set of features. The system's

database and its own dedicated backup as well as the server hosted off campus allow instructors to use it outside the campus. Individual faculty members can indicate the proper standards and taxonomy classification for each of their assignments or this can be carried out by a system administrator or by another group charged with the task. The system transparently ties the selected standards and taxonomies to specific assignments and student produced artifacts by links in the database. System training is provided by face-to-face workshops as well as a course within the system. Moreover, all of the data (student produced artifacts, faculty created assignments, comment logs, and standards) will be maintained as long as needed for continuous improvement, assessment, alumni relationship enhancement, and student lifelong learning support.”

Another study was conducted in the same context by Gathercoal et al. (2002). The purpose of the study was to introduce the Webfolio instead of paper portfolio at the institution level for faculty members as well as students. They defined their webfolio as “a tightly integrated collection of Web-based multimedia documents that includes curricular standards, course assignments, student artefacts in response to assignments, and reviewer feedback to the student’s work” (p. 29). The study concluded that successful implementation depends on a culture where faculty understand their central role in the portfolio process as resource providers, mentors, conveyors of standards, and definers of quality. The researchers found that the transition was not as easy as expected. They purpose that successful implementation depends on a set of critical success factors, and in academic settings lacking them, expectations must be scaled back until they are adequately addressed. Moreover, it requires faculty appreciation of the benefits of using the webfolio. However, they found that the major obstacle of implementing webfolio is the students’ readiness.

- Example from the University of Minnesota, USA

Treuer and Jenson (2003) conducted research in the University of Minnesota (UM), which involved creating a new electronic system for portfolios. The UM system provides functionalities so that every student, faculty member, and staff member maintains lifelong ownership and control of his or her individual electronic portfolio. Therefore, the owner is able to store and selectively share information in that portfolio with anyone, anywhere, and anytime. The system is password protected, highly secure, and available online. The system has three integrated features are the researchers feel are fundamental to UM electronic portfolio in relation to students' achievements, which are:

- Information is entered not only by the portfolio owner but also by the UM administrative system database.
- Information is stored in elements.
- The portfolio owner selects one or more elements at a time to share online with one or more persons at the time.

In addition to these features, the UM electronic portfolio system supports a wide range of formative (learning) and summative (evaluative) activities. As an example "a student can enter one set of materials related to studies in an academic, another set related to a study abroad program, and a third set related to career counseling" (p. 37). As students build their portfolios throughout the four years of their undergraduate program, they are encouraged to demonstrate growth through a sequence of learning artifacts, thereby showing formative development in any learning area. The assessment of the learning outcomes based upon a portfolio checklist and occurs at many levels, because many viewers share the portfolio information and use it in many ways. For instance, the portfolio has been assessed from the advisor, who looks for the student's academic profile to assist with placement and course selection. However, if the portfolio is reviewed by the instructor, the focus is on the student's learning achievements in relation to the degree program. If the portfolio is reviewed by internship employers, they focus on the students' qualifications and job descriptions. The study comes up with three proposed standards for electronic portfolio, which are: Standards for entering information, Standards for storing information, and Standards for sharing information. Since the development of electronic portfolio systems is rapidly increasing, they suggest that the use of these standards be applied to any electronic portfolio system.

The discussion in Section 4.2 has illustrated the complexity of implementing electronic portfolios in pre-service teacher education. One particular aspect of this implementation is the “Webfolio” or Web-based support systems that instructors and students can use to integrate resources and learning activities relating to portfolio use with other course components. Specific implementation considerations for the support system are discussed in the next section.

4.3 Factors related to the design of a Web-based system to support portfolio processes

The last factor discussed by Roberts and his colleagues relates to the technical challenges which are similar to those involved with the development and implementation of any large-scale distributed database. They state that it is necessary to create functional workflows in an integrated technical infrastructure to plan such a database. In most cases an electronic portfolio is not a single tool; usually it is part of a larger technical configuration in which the required functionality may be met by the interoperation of different systems. Therefore, the IT staff must be included in and aware of the electronic portfolio projects. Conclusion, localizing the electronic portfolio systems “is necessary to reflect other major institutional systems’ look and feel and to capture relevant institutional data in its local context and “dialect”. The design of the user interface and interaction design is critical issue, which is often neglected” (p.8).

In Section 3.3, the importance of a Web-based support system to accompany portfolio use in a “productive course environment” was indicated. Such a support system is part of the technical configuration discussed by Roberts and his colleagues. Two major perspectives relating to the implementation of a Web-based support system for learning are the functionalities of the system and the usability of the system (Neilson & Levy, 1994). By functionalities is meant that the system provides what the users want and need. By usability is meant that the system is easy to use, consistent, and attractive to the users.

In terms of the functionalities needed for a Web-based electronic portfolio support system, Lorenzo and Ittelson (2005) note that such a system needs to relate to overall course processes, such as course information; provide tools for communication, collaboration and peer review; for assessment (self, peer, and instructor); for creating the portfolio itself (thus to support the ‘collect, select, reflect’ phases and also publishing); and have useful tools and resources as background for

the portfolio creation process. Table 7 in Section 2.1.3 gave an extensive overview of these possible functionalities. Not all functionalities need to be available for a particular system; formative evaluation with users of the system is necessary to see what will be particularly needed and valued in a given implementation context. However, regardless of what specific functionalities are supported, criteria such as the following should be positively validated by the end users:

- The information is accurate.
- All information relates to the overall purpose.
- The information on the topic is thorough.
- The purpose of the pages is obvious.
- The pages use correct spelling and grammar.
- The links are relevant to the subject.
- The pages are appropriate for context and vocabulary of its intended audience.
- Graphics enhance the site's message.
- The font styles and background make the pages clear and readable.
- The icons clearly represent what is intended.
- The links are logically grouped.

By usability, criteria such as the following are important:

- Information is easy to find.
- The site's presentation is eye-catching.
- The site engages the visitor to spend time there.
- The links are easy to identify.
- The layout is consistent from page to page.
- There is a link back to the home page on each supporting page.
- The site connects quickly to the page chosen.
- The user can tell from the first page how the site is organized and what options are available.
- The site loads quickly.
- Downloads and uploads are fast and efficient.

All of these considerations relate to the ease of use and perceived effectiveness of the support system, and thus, according to the 4-E Model (Collis, Peters, & Pals, 2001) are important to the likelihood of use of the system in practice.

4.4 Applying the results to the current research

The purpose of developing electronic portfolios in the current research is improving and documenting pre-service teachers in the Gulf Region in their professional & academic growth. The investigations to be described in Sections 6, 7, and 8 take place in specific courses within three pre-service teacher training programs.

The Gulf Region educational systems, generally, are centralized decision making systems. Therefore, decisions about implementing electronic portfolios will not be easily taken at the central levels since the system procedures are difficult to realize. The researcher believes that change has to start with committed from those actually carrying out the innovation. So the research will work as the primary change agent during the investigations. From there the decision process must move to the faculty members who, accordingly, will raise it to the higher level, the Head of Department, in order to approve the implementation. This process occurred to get support for the initiation phase of implementing the electronic portfolio using a Web-based electronic portfolio support system. The first steps of the implementation phase are described in Chapters 6, 7, and 8. The approval process involved unofficial approvals (orally) from PAAET and Kuwait University and official approval by Qatar University,

In Figure 9, Fullan's figure relating to decision makers and portfolio use, the original term 'principal' as the "coper" in one of the cells will be replaced by 'instructor' and the original term 'teacher' in the other "coper" cell will be replaced by 'student', because the recipients and respondents of the change effort are the instructors and students (pre-service teachers).

In connection with Fisser's (2001) approach to key steps in the implementation process (Section 4.1.1), the researcher tried to fit those phases to the research context, making the following adaptation:

- Incidental and isolated use of ICT by one or more instructors: it is noticeable that several individual trials with (paper) portfolios had occurred in the pre-service teacher education program
- Increasing awareness of ICT relevance for education, at all levels: the awareness can be noticed more on the universities' level (Kuwait University & Qatar University) than on the vocational level (PAAET). This is related to the budgets

available to enhance their outcomes by adopting new innovations.

- **Emphasis on ICT coordination and hardware:** The Gulf Region countries are considered to be one of the top income countries in terms of the average level of any citizen. Nevertheless, those countries are still considered as developing countries. Promoting standard technology usage still in the childhood stage which, from the researcher's point of view, will take decades in order to change. For instance any new innovation such as the chalkboard took years to be adopted in one or two organizations. But once those countries invest in education as much as they invest in other disciplines, the change can be remarkable. The United Arab Emirates and Qatar are now considered pioneers in ICT use.
- **Emphasis on didactic innovation and ICT support:** Only a few trials have occurred in higher education in the Gulf Region, for example, Kuwait University adopted the Blackboard course management system starting from January 2005. Nevertheless, the adoption of the Blackboard system by the faculty members is still in the optional level which consequently is still in the early adopters' stage according to Rogers' (1995) categories.
- **Use of ICT- integrated teaching and learning, independent of time and place:** Integrating ICT in teaching and learning rated as still in the early adopter stage in Rogers' (1995) categories. Even when ICT is used, often the trials are exploratory and do not have explicit objectives.

To prepare the implementation approach for the investigations in the current researcher, the researcher built an analysis using a combination of Fullan's model (1993) and Al-Najjar's (2002) model (see Figure 7). The considerations as expressed for the current research are:

- **Characteristics of change**
 - **Need:** Fullan (1993) stated that "many innovations are attempted without a careful examination of whether or not they address what are perceived to be priority needs" (p. 69). Identifying the need linked to use electronic portfolio is strongly related to successful implementation. For this research, it was concluded that the pre-service teacher

preparation program is lacking in the extent to which it stimulates academic and professional growth.

- Clarity: This related to goals and means. Therefore, finding the appropriate tool in order to solve the needs has to be defined. The research goal is improving pre-service teachers' academic and professional growth. Hence, the support system for electronic portfolio use has to make the purpose of using electronic portfolios for instructors and students clear.
 - Complexity: This relates to, as Fullan (1993) states, the "difficulty and extent of change required of the individuals responsible for implementation" (p. 71). To avoid too much complexity in this research, the researcher will provide the instructors as well as the students with several training sessions, and will provide and be available via the Web-based support system in order to surmount the implementation difficulties.
 - Quality/practicality: Since paper portfolios are already being used but without consistent specifications, the researcher emphasized five particular components of electronic portfolios (a statement of purpose, student's resume, links to the curriculum with examples of work, a statement of educational philosophy, and links to previous work and learning; see Section 3.3).
- Acceptance
 - Student's attitude: The pre-service teachers' positive attitude to developing electronic portfolios will be considered as very important.
 - Knowledge: The amount of knowledge gained relative to course objectives, which is considered in this research as academic growth, during the development of electronic portfolio should be substantial.
 - Instructional approach: A focus on constructivist, learner-centered learning, learner reflection, and active learning during the development of electronic portfolio is essential.

- Performance: Evidence of professional growth, which is one of the research objectives as well as the course objectives, should be substantial.
- External factors
 - Instructors: Must fit the use of electronic portfolio with the pedagogical and instructional perspectives. Moreover, the visions of their teaching style have to switch and so that they become guides in the learning process.
 - Technical support agent: Responsible to provide support and help the successful implementation of electronic portfolio at the organization level. Moreover, the technical support agent must provide all technical support either for students or instructors in order to attain the implementation success. In this research the technical support agent was the researcher. However, an important source of technical support was the Web-based electronic portfolio support system.

Also the researcher used the 4-E Model of Collis, Peter, and Pals (2001) (see Section 4.1.2) to assist in planning for the implementation phase of the research.

- Educational effectiveness
 - Assure that the Web-based support system fulfils the department standards, and stimulates a new form of the learning situation emphasizing learner-centered, active learning and changes the instructors' role to that of a guide in the learning process.
 - Assure that all information necessary about the new innovation is provided, and the changes that will occur on learners and instructors by using the electronic portfolio innovation are made clear:
 - Learners, by: providing them with examples of an existing electronic portfolios (which will be in Web-based support system) and electronic tutorials helping them in their creation of their electronic portfolios
 - Instructors, by: providing them with sessions or presentations to introduce how using technology will enhance the learning outcomes and how to provide a more productive course environment (see Section 3.3).

- Ease of use

The Web-based support system has to be easy to use for both learners and instructors, and this will be fulfilled by:

- Simplicity of using the support system by:
 - The clarity of the information presented.
 - Ease of navigation through the support system pages.
 - Easy to find information.
 - The availability of a back button in each page.
 - Consistent background colors and fonts.
 - Clear descriptions on how to use the site and navigate.
- The ease of use of the support system tools for the instructors by providing training sessions about the use of the support system

- Engagement

This factor will be successful if it provides those actors with the following:

- Instructors:
 - Build self confidence on their ability to manage a Web-supported learning environment as well as present their diversity in their instructional methods in order to come up with a more productive course environment.
- Learner:
 - Provide learners with more professional skills as well as academic information. Moreover, increased their engagement via communication and reflective learner through the support system activities.

- Environment

- Represents the most important environmental conditions that influence the change towards the use of ICT within a program level, such as:
 - The department should ensure that the infrastructure for new technology is available, such as up-to-date computers and a good network.

- The department should be willing to adopt electronic portfolio assessment among all of the program's courses.
- The department leaders' should show vision for the support of using this new innovation in order to achieve learning related purposes such as improve the learners' attitude toward technology, and their professional and academic growth.

Finally, the research will build on the analysis presented in Table 21 to focus on factors likely to influence the success of the electronic portfolio process. These are seen as four main sets of factors, which are support, culture, infrastructure, and planning. Therefore, these factors will be under consideration during the design and planning stages of the research (see Section 6.2) to come up with which are the most important for the specific implementation.

Given this conceptual preparation, the actual investigations for the research can begin. The following chapter, Chapter 5, describes the research methodology, research subjects, instruments and data collection, and data analysis plans for the three specific pre-service teacher education contexts and three rounds of investigations that will be described in Chapters 6, 7, and 8.

5 Research methodology for the design and investigation studies

In this chapter the research questions are reviewed and a general description of the methodology for the questions is presented (Section 5.1).. Following this, the chapter focuses on the methodology for the design and investigation studies that relate to the second of the three sets of research questions. Section 5.2 presents some general considerations about research methodology and describes the independent and dependent variables for the comparative studies in the 2nd and 3rd Investigations. The section also gives an overview of the methodology for the formative evaluations of the Electronic Portfolio Support System that took place in the 1st and 2nd Investigations. Section 5.3 describes the research subjects for the 1st, 2nd, and 3rd Investigations. Section 5.4 describes the instruments used in the 1st, 2nd, and 3rd Investigations. The chapter concludes with a summary in Section 5.5.

5.1 An overview of the methodology for addressing the research questions and hypotheses

In Section 1.5.3 three sets of research questions were presented. The first set was described as conceptual questions. These were:

1. What is an electronic portfolio?
 - What are possible components of an electronic portfolio and of an electronic support system to help students and instructors in the processes of using an electronic portfolio?
 - What are goals and ways of using an electronic portfolio in higher education and in particular in pre-service teacher education?
 - What learning theories can underlie the use of electronic portfolios and in particular how to these relate to the use of electronic portfolios for pre-service teacher education?
2. In what ways can an electronic portfolio contribute to pre-service teachers' professional and academic growth?
 - What is academic growth?
 - What is professional growth?
 - What is the role of an e-portfolio in pre-service teachers' professional and academic growth?

What are considerations for course design in pre-service teacher education so that professional and academic growth are stimulated and integrated with electronic portfolio use?

3. What are key factors for implementing an electronic portfolio in higher education?

What are key factors at the organization, curriculum, instructor and student levels that affect the change process when introducing new technologies and teaching methods?

What are specific recommendations to improve the likelihood of successful implementation of electronic portfolios in pre-service teacher education?

What should be taken into consideration in the design of a Web-based support system to accompany portfolio use to increase the likelihood of use of the system in practice?

The methodology used to address these questions at the conceptual level was the literature review reported in Chapters 2, 3 and 4. Questions 1 and 2 relate primarily to the “Why?” of using an electronic portfolio in pre-service teacher education, while Question 3 related primarily to the “How?”. In addition, preliminary explorations specific to the Gulf Region were addressed by a set of studies making use of questionnaires (see Section 1.4). A major conclusion of the conceptual research was that the implementation of electronic portfolios in a course can benefit from the use of a Web-based support system, to help students relate the portfolio to the course objectives and provide the students with appropriate resources to help them in the portfolio construction process. Tools for communication with peers and with the instructor were seen as particularly important, as well as templates to help structure the portfolios that the students are to build.

The second set of research questions focused translating the conceptual results to specific investigations in the Gulf Region. The research questions relating to the second set were:

4. What are the requirements for the design of tools to support the use of electronic portfolios in the context of pre-service teacher education in the Gulf Region?

What are the components of the electronic portfolio itself?

What are the components of a support system to help students in the development of their electronic portfolios?

What functionalities are needed for students in the support system?

What functionalities are needed for the instructor in the support system?

What are key requirements relating to usability of the support system?

While these questions had been addressed at the conceptual level in Chapters 2, 3, and 4, they were made concrete through three cycles of design work. In the first cycle, a Web-based support system was designed and developed. It became known as the Electronic Portfolio Support System. Following this, a formative evaluation took place, focusing on the functionality and usability of the system but not on its actual implementation in practice. Following the first formative evaluation, the Support System was redesigned and another formative evaluation took during an actual implementation in practice. The Support System was then redesigned for the third time, and used in a final implementation study.

Thus three different versions of the Electronic Portfolio Support System were used in the three investigations that took place in specific courses in the pre-service teacher education context in the Gulf Region. The research questions that steer these investigations were.

5. Research questions for Investigation 1:

What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic Portfolio Support System, and how are these used for improvements in the support system?

Following the 1st Investigation, the conditions will be in place to study the hypothesis:

The use of electronic portfolios with the support of the Electronic Portfolio Support System will lead to more professional and academic growth of pre-service teachers than the use of paper portfolios alone.

This hypothesis is one of the focuses of the research questions in the 2nd Investigation.

6. Research questions for Investigation 2:
What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?

What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic Portfolio Support System, and how are these used for improvements in the support system?

Following the 2nd Investigation, the conditions will be in place to study two additional hypotheses:

The use of electronic portfolios with the support of the Electronic Portfolio Support System will lead to more professional and academic growth of pre-service teachers than the use of electronic portfolios without Electronic Portfolio Support System and both of these will lead to more professional and academic growth than paper portfolios alone.

The results of the electronic portfolio process will be more positive for students using the Electronic Portfolio Support System than for students not using the Support System.

These hypotheses are the focuses of the research questions for the 3rd Investigation.

7. Research questions for Investigation 3:
What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio without the use of the Electronic Portfolio Support System compared to when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?

What are differences in the level of understanding and quality of production of electronic portfolios by pre-service teachers when the Electronic Portfolio Support System is used, compared to when it is not used?

The questions in the 2nd and 3rd Investigations involving a comparison of groups using different approaches to portfolio construction and support were addressed by an experimental design methodology. The

questions in the 1st and 2nd Investigations involving formative evaluation of the Electronic Portfolio Support System were addressed using studies focusing on the functionality and usability of the system. These two types of methodologies are discussed further in Section 5.2.

The third and final set of research questions from Section 1.5.3 was:

8. Recommendations

What are recommendations for the further implementation of electronic portfolios in pre-service education in the Gulf Region?

What are directions for further research more generally?

These questions will be addressed by a reflective synthesis of the results of the research.

5.2 Methodology for the investigation studies

In this section, the methodology for the comparative studies in the 2nd and 3rd Investigations will be discussed in further detail (Section 5.2.1), followed by the methodology for the formative evaluation studies in the 1st and 2nd Investigations (Section 5.2.2).

5.2.1 Experimental research approach

In this section, some general background to the theory of experimental research for comparing groups that represent different levels of the same independent variable is given (Section 5.2.1.1), followed by a discussion of the independent and dependent variables for the comparisons and the general research design (Section 5.2.1.2).

5.2.1.1 General background for experimental research

At the beginning of this century, the experimental method formally surfaced in educational psychology with the classic studies by Thorndike and Woodworth on transfer (Ross & Morrison, 2003). Ross and Morrison (2003) stated that experimental research methodology is based on "the experimenter's interest in the effect of environmental change, referred to as 'treatments', demanded designs using standardized procedures to hold all conditions constant except the independent (experimental) variable. This standardization ensured high internal validity (experimental control) in comparing the experimental group to the control group on the dependent or 'outcome' variable. That

is, when internal validity was high, differences between groups could be confidently attributed to the treatment, thus ruling out rival hypotheses attributing effects to extraneous factors" (p.1021). Discovering causal relationships, which it means that an independent variable, and nothing else, causes a change in a dependent variable and how much of a change is shown in the dependent variable, is the key to experimental research. The use of pre-tests or analyses of prior achievement among the different groups assigned to the levels of the independent variable is considered an important component of the experimental research to establish group equivalence prior to the experimental intervention.

There are various types of designs that can be used for comparative experimental studies, including true experimental design, repeated measures, quasi-experimental designs, and time series designs. Einstein (1997) states that "A true experimental design is a design in which subjects are randomly assigned to program and control groups. With this technique, every member of the target population has an equal chance of being selected for the sample. The fact that every member of the target population has an equal chance of being selected for the sample makes this design the strongest method for establishing equivalence between a program and control group" (p. 1). In contrast, Ross and Morrison (2003) note that "oftentimes in educational studies, it is neither practical nor feasible to assign subjects randomly to treatments. Such is especially likely to occur in school-based research, where classes are formed at the start of the year. These circumstances preclude true-experimental designs, while allowing the quasi-experiment as an option. A common application in educational technology would be to expose two similar classes of students to alternative instructional strategies and compare them on designated dependent measures (e.g., learning, attitude, classroom behavior) during the year" (p.1023).

Usually experimental research and quasi-experimental research seek out how the independent variable will affect the dependent variable. In other words, how much cause will produce how much effect. An independent variable means "A variable that is part of the situation that exists from which originates the stimulus given to a dependent variable. It can include treatment levels, or the state of variable, such as age, size, weight, etc." (Palmquist, 1997, p. 3). The term treatment is the stimulus which is given to a dependent variable. This treatment refers to either removing or adding a stimulus in order to measure an effect. The dependent variable means "A variable that receives a stimulus and is measured for the effect the treatment has had upon it" (Palmquist, 1997, p.3). Causality is the relation between cause and effect, which it means

the relation between the independent variable and the dependent variable.

A key aspect of experimental or quasi-experimental design is the randomized or matched assignment of students to levels of the independent variable. Matching means that "corresponding variables in the experimental groups are equal feature for feature" (Palmquist, 1997, p.2), and randomization means "to allocate subjects in a random fashion to experimental and control groups." (Palmquist, 1997, p.2). The processes of matching and randomization means selecting groups in such a way that the experiment and control groups are comparable in all respects except the application of the treatment. Palmquist notes that randomized assignment is preferable to matching in terms of making causal assumptions about the differential results of an intervention.

Campbell and Stanley (1963) identify a number of designs for experimental comparisons. When randomization is involved, a strong design is the Pre-Test Post-Test comparison, represented for randomized assignment into two groups as:

R	O	X	O
	O		O

This notation means that random assignment to groups occurs, then pre-tests are done to determine if indeed there is no systematic difference between the groups on the dependent variables, then one of the groups experiences the intervention, then both groups are measured again on the dependent variables. The expectation is that there will be no difference between the groups before the treatment, but after the treatment, the group experiencing the treatment will score higher on the dependent variables than the other group.

5.2.1.2 Independent and dependent variables for the experimental studies

In this research the independent variable for the 2nd and 3rd Investigations will be "Portfolio Context", where two or three levels of "richness" in the context in which a portfolio is created by pre-service teachers will be compared. In the 2nd Investigation, the two levels of Portfolio Context are: the Less-Rich level, where only a paper-based portfolio is created, and the More-Rich Level, where an electronic portfolio is created with the support of the Electronic Portfolio Support

System (see Section 7.1.2.1 for the further explanation of the independent variable). In the 3rd Investigation, the independent variable will also be “Portfolio Context” but with three levels. Level 1 is paper-based portfolio only, Level 2 is electronic portfolio but no use of the Electronic Portfolio Support System, and Level 3 is electronic portfolio and use of the Electronic Portfolio Support System. The comparisons take place within specific course settings, where the course processes already involve pre-service teachers developing paper-based portfolios of their work in the courses. The courses involve all share the same objectives relating to academic and professional growth and include a focus on learning how to use technology to support learning (see Section 7.1.1).

In this research, the dependent variables relate to the professional growth and academic growth of the pre-service teachers participating in the experiments. Other dependent variables relate to understanding of processes and reasons for an electronic portfolio and the quality of the portfolios produced by the students. The dependent variables relating to academic and professional growth will be based on the objectives for academic and professional growth of the courses in which the experiments take place (see Section 7.1.1 and 8.1.1). These course objectives can be categorized as:

- Academic growth
 - Develop critical thinking about instruction
 - Demonstrate knowledge and skills with educational technology
 - Create and maintain positive learning environments
 - Gain insight into instructional planning
- Professional growth
 - Learn from and with peers
 - Strengthen communication skills
- Both Academic and Professional growth
 - Use technology to support instruction
 - Gain insight into the roles of teachers

Therefore the dependent variables to be compared in the 2nd and 3rd experiments relate to these course objectives. They will be specified further in the discussion of the instruments for the investigations, in Section 5.4.

In this research, it assumed that the differences in the pre-service teachers’ professional and academic growth which is shown in the outcomes of the experimental comparisons occurred because of the use

of the electronic portfolio and the Electronic Portfolio Support System. Nevertheless, there might be other issues that interfere with the experiment procedures which affect the result.

Following Campbell and Stanley (1963) the comparative study in the 2nd Investigation, which involved random assignment to one of two groups, can be represented as:

R	O	X	O
	O		O

The comparative study in the 3rd Investigation, which involved random assignment to one of three groups, can be represented as:

R	O	X1	O
	O	X2	O
	O		O

5.2.2 *Formative evaluation approach*

Formative evaluation is a term to refer to the process of getting feedback from appropriate persons about their reactions to an entity under development, in order to improve the entity based on their reactions before the entity is put into regular use. The term is frequently used with respect to the design and development of electronic tools and systems. The persons giving the feedback should be representative of the target groups for the tool or system.

Formative evaluation requires criteria. Two typical sets of criteria relate to functionality and usability (Nielsen & Levy, 1994; see Section 4.4). Functionality means: Does the tool or system do what the user would like it to do? Usability means: Is the tool or system easy to use, consistent, pleasant to use, and easy to understand.

In the 1st and 2nd Investigations formative evaluations of the Electronic Portfolio Support System will take place involving both students and instructors as both of these need to be users of the system in practice. The functionality and usability criteria to be used are described in detail in Section 6.2.4.

Formative evaluation does not involve pre- and post tests, as is the case in a comparative experiment. Instead, it can be described as a one-shot case study (Campbell & Stanley, 1963) in which the participants use a system, are observed, and then are questioned about their opinions.

5.3 Subjects

In this section, the subjects for the research are described, the manner of randomly assigning them to levels of the independent variable is given, and a comment is made about the initial equivalence of the groups is made (Sections 5.3.1-5.3.3).

5.3.1 Descriptions of the participants and their settings

This research was conducted in three different contexts in the State of Kuwait and the State of Qatar. The first context was the PAAET at the College of Education in the Educational Technology Department. The second context was Kuwait University at the College of Education- the Educational Technology Center. The third context was Qatar University at the College of Education in the Faculty of Educational Science in the Educational Technology Department. The investigations involved two different categories of participants: faculty members who act as external factors (see Section 4.5), and students (pre-service teachers) who are in “coper” category (someone who copes, see Figure 9, Section 4.1). When the faculty members are also the instructors of the students in a course involving a portfolio, then the faculty members are also in the “coper” category as they are also direct users of the Electronic Portfolio Support System.

The faculty members are experiencing new issues, such as using authentic criteria to evaluate student’s professional and academic growth with electronic portfolios and the use of a Web-based support system to improve and document the students' professional and academic growth. Faculty members who are also instructors of the courses in which electronic portfolios are used must develop new skills and practices themselves. Thus the perspectives of instructors will be important input in the investigations and contribute to the results for the recommendations that relate to the third set of research questions for the overall research.

The pre-service teachers (students) are experiencing new issues, such as: (a) learner-centered learning which means a new type of involvement in his/her learning; (b) new responsibilities about his/her learning processes and pace; (c) new approaches to acquiring reflection

ability; and (d) new skills in handling computer-based tools, resources, and the Web-based support system. The students are the major focus for data collection in the investigations.

The participants from each research setting will be discussed in Section 5.3.1.1, 5.3.1.2, and 5.3.1.3.

5.3.1.1 Pre-service teachers and their instructors at the PAAET

The research was conducted in the Educational Technology Department of the College of Education (PAAET was introduced in Section 1.3). Pre-service teachers were the participants for 2nd Investigation. They were all students in a course called “Workshop in Instructional Media” (the course has a different title than the courses in the other contexts, however, it has the same objectives). They were in their fourth (last) year of their studying at the college. The participants were all females (the college is a women's college). The age of the students ranges from 21 to 23 years.

The department has about 1000 students (major and non-major) and more than 40 instructors (fulltime faculty members and assistant instructors). The department has three computer labs with PCs, which serve all of the departments of the College of Education. Out of those computer labs only one lab was equipped with high speed Internet connections and Windows XP. The others use Windows 98 with a limited set of applications. The department has its own major "Instructional Designer" and, as well as the other departments, prepares pre-service teachers in the College of Education. It provides the other departments with two compulsory courses for the pre-service teachers program. The following texts present all required information about the course.

The course that was the setting for the 1st Investigation is one of the compulsory graduation courses that the Educational Technology Department provides to students in their major ‘Educational Technology Specialist’. The course credit hours are 3 credits with 4 hours a week for a period of three months (semester). .

The course that was the setting for the 2nd Investigation is one of the two compulsory courses that the Educational Technology Department provides to the overall pre-service teacher programs. Also this course is a prerequisite for all the pre-service teachers for their last year (a graduation requirement). The course credit hours are 3 credits with 3 hours a week for a period of three months (semester).

The reasons for selecting these courses as the settings for the 1st and 2nd Investigation were:

- 1- The courses were recommended by the department and the course instructors were willing to participate in the investigation.
- 2- The course for the 1st Investigation is compulsory for all students in the Educational Technology Specialist major and thus a good choice for students who would be interested and willing to participate in the formative evaluation of a Web-based support system for learning. The course for the 2nd Investigation is compulsory for all pre-service teachers and thus not just those particularly interested in educational technology.
- 3- The courses already required a portfolio (collected on paper) from each student.
- 4- Importantly, the objectives of both courses emphasize professional and academic growth and expect documentation of this in the portfolios that the students produce.

5.3.1.2 Pre-service teachers and their instructors at the University of Kuwait

The research was conducted in the Educational Technology Center at the College of Education (Kuwait University was introduced in Section 1.3). The pre-service teachers were participants in the 3rd Investigation. They were in their third and fourth year of studying in the college. The participants were all females (the college is a women's college). The age of the students ranged from 20 to 23 years. The Center serves all the departments of the College of Education by providing certain courses in order to prepare pre-service teachers for their future careers. The Center has five computer labs with PCs, available for College of Education community as well as for other University of Kuwait members.

One of the Center's courses which are available for pre-service teachers is "Computers in Education". This course is one of the compulsory courses offered by the Educational Technology Center for the pre-service teacher education programs. The course credits are 3 credits with 3 hours a week for a period of three months.

The reasons for selecting this course as a setting for the 3rd Investigation are the same as for selecting the course from the PAAET:

- 1- The course was recommended by the Educational Technology Center and the course instructors were willing to participate in the investigation.
- 2- The course is compulsory for all pre-service teachers and thus not just those particularly interested in educational technology.
- 3- The course already required a portfolio (collected on paper) from each student.
- 4- Importantly, the course objectives emphasize professional and academic growth and expect documentation of this in the portfolios that the students produce.

5.3.1.3 Pre-service teachers and their instructors at the University of Qatar

The 3rd Investigation was also conducted in the Educational Technology Division at the Faculty of Education Science at the University of Qatar (Qatar University was introduced in Section 1.3). The pre-service teachers and their instructors were participants for the 3rd Investigation. The students were all females (the college is women's college). The age of the students ranged from 20 to 23 years. The Educational Technology Division serves the College of Education by providing two compulsory courses and two optional courses in educational technology in order to prepare pre-service teachers for their future careers. The Faculty of Education Science decided to implement a new course called "Computers in Instruction" which was offered by the Educational Technology Division. This was the setting for the research. This course is one of the compulsory courses provided by the Educational Technology Division to the pre-service teacher programs. The course credits are 3 credits with 3 hours a week for a period of three months.

The same reasons applied for choosing this course as were given for the other two settings.

5.3.2 *Assignment of students and instructors to Portfolio Context groups*

Random assignment of students to the levels of the independent variable was a key factor for the 2nd and 3rd Investigations. The assignment process at the student level as well as the course level was as follows:

At the student level, registering in any course in higher education in the Gulf Region involves early registration for all

students enrolled in the program especially and the whole university generally, two months before the semester begins. The college assigns a date for each student to register online in his/her preferred course session based on his/her schedule. Normally the date of each student registering goes by their entering dates, for instance, if the student started studying at the university in 1999, he/she has the priority to register before the students who started in the following years, such as: 2000, 2001, and so on. Moreover, it also depends on which semester he/she started as well. Hence, neither instructors nor the administration contribute to the selection of course sessions, therefore, it can be assumed that the assignment of students to the different sessions of courses is a random process.

At the course level for the 3rd Investigation, researcher had a meeting with the instructors who would be involved in the investigations. She explained the requirements of each of the research groups (the different levels of the independent variable) and gave instructors the freedom to choose which of research groups they wanted their course sessions to be involved in. Therefore, the assignment of the courses to the treatment levels was not random. The choices made by the instructors may have reflected differences in their attitudes relative to change and the use of technology. For the 2nd Investigation, the same instructor was involved with both groups; one group was randomly assigned to the Less-Rich Portfolio Context and the other group to the More-Rich context. Thus for the 2nd Investigation, random assignment did occur on both student and course levels.

5.3.3 *Supporting the initial equivalence of the Portfolio Context groups*

In order to further support the initial equivalence of the groups assigned to the two levels of the independent variable in the 2nd Investigation, Table 22 shows the common features for both groups.

Table 22. Common features of the groups for the 2nd Investigation

	Common to both groups	Less-Rich Portfolio Context group	Less-Rich Portfolio Context group
1	Same course	✓	✓
2	Same instructor	✓	✓
3	Same assignments	✓	✓

4	Same evaluation strategies	✓	✓
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A similar table could be made for the 3rd Investigation, with the exception of “Same instructor”. Six different instructors were involved from the two settings, Qatar University and Kuwait University. However, all six had many characteristics in common such as: similar levels of experience (all above 5 years’ experience), all teaching the same course, all with similar teaching styles for the course; and also the evaluation strategies for the courses are the same as well.

Moreover, since the investigations in the research are taking place in three different higher education contexts within the Gulf Region, the similarity between the three contexts needs also to be justified. Table 23 presents key equivalences.

Table 23. Initial equivalence within the research settings

	Common features	PAAET	Un. of Kuwait	Qatar Un.
1	Same cultural background	✓	✓	✓
2	Same organization field, a College of Education	✓	✓	✓
3	Same curriculum objectives	✓	✓	✓
5	Same evaluation strategies	✓	✓	✓

From Table 23 it can be noticed that all the research settings are from the GCC (Gulf Cooperation Council) in which they are joined and united in many issues, such as cultural background, language, economic situation, life style, and religion. Also many family relatives have connections between these countries, and education systems. Moreover, the GCC countries have a "Bureau of Arabian Education in the Gulf Region", which concentrates on reforming the education systems throughout the Gulf countries. Therefore, Table 23 shows the similarity in the most common aspects in relation to the research. Similarly the students in all three settings are the same ages, the same gender, the same academic level, and have had the same sort of experience with technology in their academic programs.

These common features together supports the argument that there was initial equivalence between the groups in the investigations and that differences in outcomes can be associated with the differences in levels of Portfolio Context.

5.4 Research instruments

A variety of different types of data-collection instruments were used during the three investigations. These will be described in Sections 5.4.1-5.4.13 with a final comment about the instruments in Section 5.4.14. The instruments are listed in the order in which they appeared in the three investigations. The section concludes with a comment about the multi-method approach. The instruments in general were questionnaires, interviews, observations, and coding forms. Althuwaini (2003) defines a questionnaire as “a group of questions used to elicit information from respondents by means of self-report” (p. 97). Generally speaking, questionnaires can be defined as self-report instruments used to gather information about variables of interest for investigator. The questions may be open-ended, which requires respondents to answer in their own words; or fixed choice, which requires respondents to select one or more answers from those provided, either in the form of checklists or rating scales (Althuwaini, 2003).

5.4.1 *Computer Background Skills questionnaire*

The questionnaire contains eleven items whose purpose is to explore the students' computer backgrounds and their levels of computer-related skills. The same questionnaire was used at the start of the course in all three investigations and also at the finish of the course in the 2nd and 3rd Investigations. The purpose was to support the initial equivalence of the groups in terms of computer background and skills and then to see if there is a difference among the groups by the end of the course that could be assumed to relate to the independent variable of Portfolio Context. Table 24 shows the questions.

Table 24. Computer background skills

Question	Responses	
	Yes	No
Do you own a computer at home?		
Do you have an Internet connection at home?		
Do you have an electronic mail (e-mail) account?		
Do you know how to utilize application software (word processing, spreadsheet, and presentation packages)?		

Do you know how to create, save, and manage files on your computer?				
Do you know how to download items from the Internet?				
Do you know how to upload items to the course server or your own web page?				
Do you know how to participate in a web chat?				
Have you ever received any type of computer training?				
Question	Responses			
	N*	M	W	D
How often do you use a computer?				
How often do you use the Internet?				
How often do you use your e-mail?				

* N=Never, M=Monthly, W=Weekly, D=Daily

5.4.2 Functionality & Usability Survey

The purpose of this questionnaire was to collect students' opinions for the formative evaluations of the Electronic Portfolio Support System, in particular to evaluate the functionality and usability of the Support System during the 1st and 2nd Investigations. The survey was also used by the instructors in the 1st Investigation. The survey was adopted and modified from Schrock (2003) as well as from an evaluation survey freely available for use via the Web (Survey Share, 2004). The survey items were translated to Arabic in order to be used in the research settings. The resulting survey contains 25 items, 13 items of which represent the functionality aspect and 12 of which represent the usability aspect. Underlying these functionality and usability aspects are five factors, which are: (a) Contents/Information; (b) Interface/Presentation; (c) Navigation; (d) Access; and (e) Author information. The response categories are on a five-point scale, with 1= strongly disagree, 2= disagree, 3= undecided, 4= agree, and 5= strongly agree. Table 25 shows the Functionality and Usability Survey.

Table 25. Functionality and Usability Survey instrument

Questions to measure the functionality perspective	Responses*				
	1	2	3	4	5
The information is accurate.					
All information relates to the overall purpose.					
The information on the topic is thorough.					
The purpose of the pages is obvious.					
The pages use correct spelling and grammar.					
The links are relevant to the subject.					
The pages are appropriate for context and vocabulary of its intended audience.					
Graphics enhance the site's message.					
The type styles and background make the pages clear and readable.					
The icons clearly represent what is intended.					
The links are logically grouped.					
The author is clearly identified.					
You can easily tell the domain of the system.					
Questions to measure the usability perspective					
The site is clearly identified; information is easy to find.					
The site's presentation is eye-catching.					
The site engages the visitor to spend time there.					
Links are appropriate.					
The links are easy to identify.					
The layout is consistent from page to page.					
There is a link back to the home page on each supporting page.					
The site connects quickly to the page.					
The site is available through search engines.					

There is a way to contact the author (s) via e-mail or traditional mail.					
You can tell from the first page how the site is organized and what options are available.					
The site loads quickly.					

* 1= Strongly disagree, 2=Disagree, 3= Undecided, 4= Agree, 5= Strongly agree

5.4.3 Interviews, 1st Investigation

In the 1st Investigation, two sets of interviews were carried out, one with a set of four students who are participated in the formative evaluation, and another with the three instructors who participated in the formative evaluation. The purpose of the interviews was to gain further insight into the reactions of the students and instructors to the electronic portfolio process and the use of the Electronic Portfolio Support System.

The questions for the students were:

1. What is a portfolio?
2. List three reasons why you might develop a portfolio:
 1. _____
 2. _____
 3. _____
3. How is an electronic portfolio different from a paper portfolio?
4. What types of artifacts might you include in your portfolio?
5. What does the word reflection mean?
6. What does the word rationale mean?
8. What does the term alternative assessment mean?
9. Who do you feel should determine the contents of your portfolio, you or your instructor?
10. How would you self-assess your computer ability (novice, intermediate, highly skilled, expert)
11. Do you prefer to work alone on a project or in a group? Why?

The questions for the instructors were:

- What is your opinion about the Electronic Portfolio Support System?
- Do you think there is more to be added in this system?
- What is your point of view about the electronic portfolio?
- Do you think, developing an electronic portfolio will influence students' academic growth positively?
- Can you clarify that this system is fulfilling the research objectives, which is to experiment with the effectiveness of developing electronic portfolios on students' academic growth?

5.4.4 *Field notes*

Field notes were collected throughout all three investigations. The use of field notes is a method to capture descriptions of the way activities are performed. Direct & indirect observations were used. Direct observation occurred through observing instructors as well as students during their use of the Electronic Portfolio Support System. A particular focus was on the interaction of instructors and students while they working with the Support System. Questions addressed in the field notes included:

How long does it take instructors and students to get familiar with developing electronic portfolios using the Electronic Portfolio Support System? How often do they use the Support System? To what extent do they become involved with the Support System? Are they happy, confused, serious, afraid, greatly interested, or bored? Can changes in their attitudes toward the Support System be seen during the course?

The answers to these questions will help the researcher gain insight into the students' attitudes toward and understanding of the meaning of developing electronic portfolios for their academic and professional growth.

5.4.5 *Attitudes toward Professional Growth & Technology*

A major instrument for the comparison of groups in the 2nd and 3rd Investigations was a 30-item questionnaire whose purpose is to measure different indicators of the pre-service teachers' professional growth at the start of the course and compare the Portfolio Context groups on changes in these attitudes after the course. Professional growth, as expressed in the course objectives, relates to the use of technology for communication, as well as lesson planning, collaborative learning, understanding the role of teacher, and making effective use of technology for both instruction and personal productivity. The questionnaire has been adopted from Christensen and Knezek (1998),

from the Texas Center for Educational Technology of the University of North Texas, where extensive research has occurred to support the reliability and validity of this questionnaire. The questionnaire was modified and translated to Arabic language in order to be used during the investigations. It contains 30 questions which are divided into six clusters. All items are responded to on a 5-point scale, with 1=strongly disagree, 3=undecided, and 5=strongly agree. Negatively worded items are recoded before analysis. The six clusters and samples of their items are:

- Enjoyment (2 items): Sample item: I enjoy doing things on the computer
- Vocational awareness (8 items): Sample item: I believe that I can easily have a job if I have computer skills
- Importance of technology for learning (6 items): Sample item: As a future educator I think that children will enjoy lessons that use the computer
- Personal productivity with technology (8 items): Sample item: I prefer to use technology in producing my assignments
- Use of e-mail (4 items): Sample item: I believe that using communication tools (e-mail, net chatting) will create more interaction between students enrolled in the course and students with their instructors
- Anxiety (2 items): Sample item: Computers intimidate me.

The complete questionnaire is found in Appendix 1.

5.4.6 Weekly questions

In the 2nd Investigation, students were asked a different question each week over seven weeks. This instrument measured students' perspectives about transferring theory to practice through the development of their portfolios. The questions were related to some of the course objectives such as: technology use, lesson planning, professional communication, and the role of the teacher. The instrument contained four questions answered by all students, each responded to on a four-point scale, where 1= Not affected/ Not useful at all, 2= Little affected/ Little useful, 3= Affected/ Useful, and 4= Much affected/Very useful. The questions are related to some of the course objectives (which are also among the research objectives) such as those relating to technology, planning, communication, and the role of the teacher. Thus they relate to both professional and academic growth. The first four were answered by all students. The last three were answered only by

students in the group that created electronic portfolios using the Electronic Portfolio Support System.

- To what extent do you think that technology will be used in your future career (as a teacher)? In what ways? (open-ended responses)
- To what extent did you make use of instructional design strategies in choosing the illustrations and graphic images that you included in your portfolio?
- To what extent did the use of communication positively affect your reflection ability and your assessment ability?
- To what extent did interacting with your classmates during the portfolio development and revision process affect you positively? Describe? (open-ended responses)
- To what extent has the act of developing an electronic portfolio affected your relationship with technology? How?
- To what extent does the electronic portfolio have an impact on your use of technology in your future career? Describe?
- Elements of the portfolio were designed to help you reflect on your academic growth, for example, using the rationale statement prompts you to describe your thinking about your illustration. To what extent have you become a more reflective practitioner?

5.4.7 Electronic Portfolio Survey

This survey was used in order to explore students' attitudes toward different aspects of developing electronic portfolio after they had completed their portfolios. The survey was used in the 2nd and 3rd Investigations by students in the groups who made electronic portfolios. In the 3rd Investigation, it was used to compare students in two of the Portfolio Context groups (electronic portfolios with and without the use of the Electronic Portfolio Support System). The survey was adopted from Barrett (1998), and was modified and translated to the Arabic language. The survey contained 10 questions, only the first question was an open-end question, the rest of the questions are fixed choice with various scales. Examples of the survey items are:

- What do you think are the primary purposes for the electronic portfolio that you created? (choice from different options)
- How useful did you find each of the following (9 options) listed in creating your electronic portfolio?
- How likely are you to make use of an electronic portfolio in your future careers?

See Appendix 2 for the full survey.

5.4.8 Coding of electronic portfolios

Lopez Fernández's (2003) criteria for coding electronic portfolios (see Section 2.4.2, Table 11) were modified to a set of 16, grouped in clusters relating to Artifacts produced (four criteria), Reflection evidence (two criteria), Relationship to course objectives (two items), Multimedia design (four criteria), and Instructional design (four criteria) in order to fit the experimental context as well as be embedded in the Gulf Region society. Lopez Fernández's criteria had been rated by the labels poor, average, good, excellent in the original criteria list. In this experiment the scoring was modified, reducing those categories to poor, good, and excellent which were in turn expressed as numbers, which are 1= poor, 2= good, and 3= excellent. The procedure was used in the 2nd and 3rd Investigations to examine the quality of the portfolios produced by the students and also to compare this quality when the Electronic Portfolio Support System is used or not used. Table 26 shows the scoring criteria and how they were scored and then weighted.

Table 26. Scoring procedures for electronic portfolios produced by the students

Weighting factor	Criteria Area	Indicators	Score		
	ARTIFACTS		1=Poor	2=Good	3=Excellent
0.5	Organization of artifacts	Facility to find, open and view the artifacts in the Learning e-Portfolio	Artifacts are in paper format or not, poorly organized	Artifacts have some type of organization, but is minimal	Artifacts are well organized following a classification
0.5	Appropriate content	Relationship between the content of every artifact and the objectives of the course	Content does not relate to the instruction of the student in the program	Content more or less relates to the learning goal or standard	The content of all the artifacts are appropriate for their learning goals in that moment of the program, using all resources available in the moment of creation

1.0	Creativity of the artifacts	Grade of the creativity of the artifacts in terms of design of content, form of implementation and selection	The artifacts are not unusual and do not present any creativity. There is no or poor imagination shown	The artifacts are not unusual and present some creativity. It is not much imaginative	The artifacts are unusual and present creativity in some of the specified terms. There is imagination shown
0.5	Appropriate use of multimedia (MM)	Facility to use MM technology	Not showing the use of MM or inappropriate use, distracting from the learning objectives	Some use of MM (audio/video /images may be included)	Appropriate MM use (audio/video /images included)
	REFLECTION		Poor	Good	Excellent
1.0	Connection between reflections and artifacts	Relationship between the reflective comments about every artifact (as an evidence of learning) in the e-Portfolio	Absence or poor reflection throughout the e-portfolio. It is more descriptive than reflective	Reflection about some artifacts, but still not much developed or not very well organized	Every artifact is accompanied by its reflective comment, well developed and well organized
0.5	Level of reflection	Degree of thought in the critical analysis of the artifacts and other detailed and global reflections	No evidence or poorly level of reflection. No or minimal effort shown	Some critical analysis or reflection about the e-Portfolio. Not much effort shown	Critical analysis and reflection about every artifact. Good effort shown
	STANDARDS		1=Poor	2=Good	3=Excellent
0.5	List of standards	List of the standards (course objectives) that are necessary for accomplishing every statement of the e-portfolio	There is no list of standards	There is a poor list of standards	There is a complete list of standards, with the clear description of every one

1.5	Educational philosophy	Appearance of the educational philosophy which is underlying their program objectives (Teacher Preparation Program). Incorporating current best learning practices and the acquisition of previous theories	Absence or incomplete philosophy statement (i.e. is not supported by references)	Philosophy statement is present, but not very clear, and only a little developed	Educational philosophy is present and is well developed. Most statements are adequately supported and with some references
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5.4.9 Interviews, 2nd Investigation

At the completion of the course, two students who had used the Electronic Portfolio Support System were interviewed. They responded to the following questions:

1. Is the Electronic Portfolio Support System easy to use in relation to its navigation system and the data base?
2. Did you find the templates for developing the electronic portfolio easy to use?
3. Do you think the information in the Electronic Portfolio Support System is worthwhile and meaningful in relation to increasing a pre-service teacher's knowledge about the course as well as the electronic portfolio?
4. In terms of the time factor, do you think that there was enough time to construct your e-portfolio?

In addition the instructor was interviewed in an unstructured procedure.

5.4.10 Communication skills survey

The purposes of this survey were to measure the pre-service teachers' attitudes about communication and knowledge of how to use electronic tools for communication skills before and after completing the course. The survey was used in the 3rd Investigation. The concentration was on communication as an aspect of professional growth. The survey was

designed by the researcher and revised by judges from Kuwait and Qatar (seven faculty members, one professor, and six other persons with relevant PhDs). The survey contains 10 questions, which are fixed choice with five options (for example, e-mail, online chat, online discussions, course Web site, telephone); nevertheless, the respondent may select as many of the responses that are relevant. Examples of survey items include:

- Communication between an instructor and student can take place via: (choose as many as appropriate)
- Collaborative learning can be supported by: (choose as many as appropriate).

See Appendix 3 for the full version.

5.4.11 Performance test

The performance test attempts to measure what an individual has learned from specific information presented in the course or learned via course activities. Althuwaini (2003) stated that “achievement test scores are used in evaluating the influence of course of study, teachers, teaching methods, and other factors considered to be significant in educational practice” (p.102). The survey was used in the 3rd Investigation to compare the academic growth of the different treatment groups.

The test contains 39 questions with fixed-choice answers. The test was constructed using items found in previous tests in the courses which were the setting for the 3rd Investigation as well as new items. The test was designed by the researcher and judged by seven faculty members from Qatar University and Kuwait University. Examples of test items include:

- In Word, changing between different character sets for languages is done through:
 - Alt+ right shift or Alt+ left shift
 - Ctrl+ right Alt or Ctrl+ left Alt
 - Language option at the language command
 - All the above are correct
- The Excel program is used to:
 - Create documents, such as reports, formal letter, and etc.

- Create electronic tables and deal with numeric information
- Create electronic presentations, such as: lectures and lessons
- None of the above is correct

Appendix 4 contains the full performance test.

5.4.12 Electronic Portfolio Concept test

The Electronic Portfolio Concept test measures students' understanding of the electronic portfolio concept. The test was used with the two groups who created electronic portfolios in the 3rd Investigation. The test contains 38 items with fixed-choice answers. The items related to the definition, objective, advantages, usage, contents, contents formats, and types of the electronic portfolio concept test was designed by the researcher based comprehensive online information about the electronic portfolio. This test was judged by seven faculty members from the two contexts (Kuwait University and Qatar University). Examples of test items are with the correct response highlighted are:

- 1- Developing electronic portfolio encourages:
 - a. Passive learning
 - b. Planning skills as well as technology skills
 - c. Wasting students' time
 - d. All the above are correct
- 2- Developing electronic portfolio will achieve:
 - a. Gains in students' technological skills
 - b. Gains in students' planning skills
 - c. Gains in students' knowledge of subject matter
 - d. All above are correct

See Appendix 5 for the full version.

5.4.13 Interviews, 3rd Investigation

Three sets of interviews were held during the 3rd Investigation; two with students and one with the instructors. The first student interview involved five students from each of the three Portfolio Context groups. The 15 questions included:

- In your point of view, how do you see the procedures of constructing a portfolio, is it effective method, and can it be

considered to be a mechanism to transfer learners from being passive receptors to an active learners?

- Do you think that your technology skills improved while creating your portfolio?
- Do you think the planning for your electronic portfolio has crystallized your theoretical background and helps transfer it to practice?
- One of the course objectives is "Plan an education situation". Do you think planning for your e-portfolio fulfilled this objective?

In addition, five students from each of the groups that created electronic portfolios participated in another interview. Sample questions are:

- In terms of the time factor, do you think that there was enough time to construct your electronic portfolio?
- What barriers did you encounter while you were producing your e-portfolio?

Finally, the six instructors who participated in the 3rd Investigation also participated in an interview with eight questions. Samples of these questions are:

- After your experiences with the use of electronic portfolio do you think it is an effective tool to assess students' progress (academic & professional growth)?
- How do you feel that teaching with electronic portfolios and using the Electronic Portfolio Support System compares with your previous teaching procedures in the "Computer in Education" course?

5.4.14 Comments about the different instruments

The multiple types of instruments described in Sections 5.4.1-5.4.14 demonstrate the triangulation approach to analyze the collected data outcomes. Althuwaini (2003) defined triangulation as "a combination of different research approaches, methods, data sources, evaluation instruments, types of statistical analyses, and theories to arrive at a high level of validity and reliability for study" (p. 94). Moreover,

triangulation is also defined as “the application and combination of several research methodologies in the study of the same phenomenon. The diverse methods and measurement that are combined should relate in some specified way to the theoretical constructs under examination. The purpose of the use of the multiple methods, in this research, is to overcome the weakness or biases of a single method taken by itself” (Denzin, 1970, p. 318). Triangulation reduces the chance of bias in the research and increases the validity and reliability of the data. Hence, triangulation can be used in methods, data sources, statistical analysis, or theories. In this research, the triangulation approach relates to the data collection and analysis approaches (statistical approach). An analysis triangulation approach is applied on each of the three dimensions that relate to the research questions for the 2nd and 3rd Investigations. Figure 10 shows this focus.

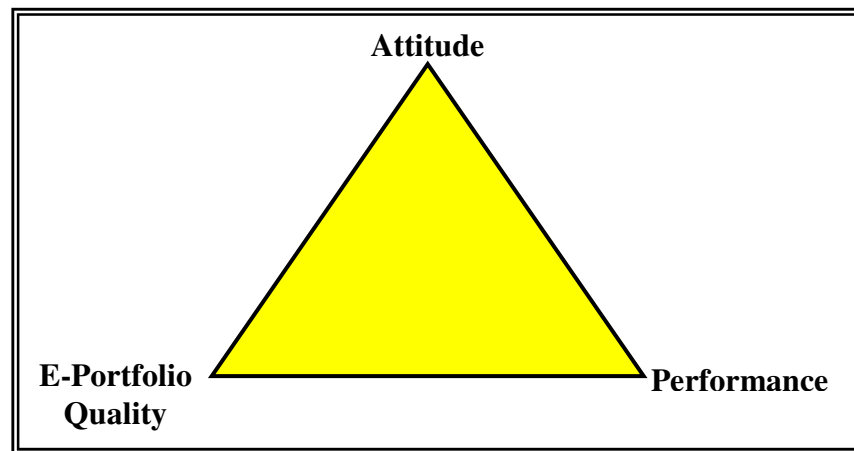


Figure 10. Focuses of the investigations

The attitude focus primarily relates to analyzing the pre-service teachers’ professional growth. The performance focus primarily relates to the pre-service teachers’ academic growth. The electronic portfolio quality focus primarily relates to processes and outcomes related to the electronic portfolio itself.

5.5 Summary of the research design

The 1st investigation took place at the PAAET during the first half of 2004. The 2nd Investigation also took place at the PAAET, during the second half of 2004. The 3rd Investigation took place at Kuwait

University and Qatar University during the first half of 2005. Table 27 summarizes the design for the investigations.

Table 27. Research design, three investigations in actual course settings

Investigation	Purpose	Evaluation instruments	Methods of analysis	Dates
1 st	Formative evaluation of the Electronic Portfolio Support System	-Computer Background Skills questionnaire -Functionality & Usability Survey , students and instructors -Interviews with students and instructors - Field notes	X O	February 2004 until May 2004
2 nd	Comparison of two types of Portfolio Contexts (paper only vs electronic portfolio with the Electronic Portfolio Support System) on professional and academic growth	-Computer Background Skills questionnaire -Attitudes toward Professional Growth and Technology questionnaire -Weekly questions -Course final grades - Field notes	R O X O O O	September 2004 until December 2004
	Formative evaluation of the Electronic Portfolio Support System	-Functionality & Usability Survey -Weekly questions -Electronic Portfolio Survey -Coding of electronic portfolios -Course final grade -Interviews with students and instructor - Field notes		

Research methodology for the design and investigation studies

3 rd Investigation	Comparison of three types of Portfolio Contexts (paper only vs electronic portfolio with and without the Electronic Portfolio Support System) on professional and academic growth	<ul style="list-style-type: none"> -Computer Background Skills questionnaire -Attitudes toward Professional Growth and Technology questionnaire -Communication Skills survey -Performance Test -Interviews with students -Course final grades - Field notes 	<div style="text-align: center;"> R O X1 O O X2 O </div>	February 2005 until May 2005
	Comparison of the two electronic portfolio groups (with and without the Electronic Portfolio Support System) on the quality of electronic portfolio understand and results	<ul style="list-style-type: none"> -Electronic Portfolio Concept test -Electronic Portfolio Survey -Coding of electronic portfolios -Interviews with students and instructor - Field notes 		

Given this overview of the methodology for the three investigations, the description of the results of the investigations can begin. Chapter 6 presents the results of the 1st Investigation.

6 Investigation 1: Design and formative evaluation of the Electronic Portfolio Support System

In Chapter 4 it was established that students creating an electronic portfolio could benefit from having a web-based support system to use as a resource and tool for the actual creation of a portfolio. This chapter deals with the design, development, and formative evaluation of such a support system. Section 6.1 gives global decisions about the design, followed by a general theoretical framework for the design process in Section 6.2. In Section 6.3 the design and development of the support system created for this research, called the Electronic Portfolio Support System, is described. Section 6.4 reports the context and methodology for a formative evaluation of the system and Sections 6.5 and 6.6 report the results from the students' and the instructors' perspectives. For the students, the focus was on the functionality and usability of the system, including the approach that was used for creating electronic portfolios. However, the students did not actually create portfolios; they only tried out the file-managing procedures. For the instructors, the focus was on the eventual implementation of the system, and of electronic portfolios in general, in their courses. Although they had navigated within the support system, they had not used its instructor functionalities and thus could only comment on the general approach. Finally, Section 6.7 presents the modifications made in the system following the formative evaluation. The research questions and sub-questions addressed in this chapter are:

What are the requirements for the design of tools to support the use of electronic portfolios in the context of pre-service teacher education in the Gulf Region?

- a What are the components of the electronic portfolio itself?
- b What are the components of a support system to help students in the development of their electronic portfolios?
- c What functionalities are needed for students in the support system?
- d What functionalities are needed for the instructor in the support system?
- e What are key requirements relating to usability of the support system?

What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic Portfolio Support System, and how are these used for improvements in the support system?

6.1 Starting points for the design

The starting points for the design reflect the implementation considerations relating to the specific context in which the system will be used and basic decisions about the functionality and technical requirements for the system. These aspects are discussed in Sections 6.1.1 and 6.1.2.

6.1.1 Implementation constraints

In Chapter 4 it was established that the implementation of any support system must reflect the realities of the contexts in which it will be used. The support system to be created for this research will be used for pre-service teacher education in three specific educational contexts, namely the PAAET and Kuwait University in Kuwait and Qatar University, all higher education institutions in the Gulf Region. Therefore, a major requirement for the support system is that it be in the Arabic language. The education systems in those countries use the Arabic language. A review was done of existing electronic portfolio systems or systems that support the electronic portfolio concept in higher education (Barrett, 2004c; Gathercoal, Love, Bryde & McKean, 2002; Purnawarman & Lynch, 2004) to see if there is any system that supports Arabic character, but the result was nil. The researcher found an electronic portfolio system that had been used in the United Arab Emirates University, but it was in English. Also, the researcher made some investigations with several existing electronic portfolio systems to see if alterations could be made in order to support Arabic characters, but it was not feasible to consider this if there were not any promises from the organization that an adapted system would be used later because an adaptation of an existing system would cost effort and money. This led to the decision that the researcher would develop the support system herself, and given the financial constraints within the project, the costs of the support system to be developed for the research had to be carried by the researcher. This led to the further decision that any additional help she would need, for example for programming, she would have to pay for herself.

6.1.2 Functionality and technical requirements

In this section, the basic functionalities required for the system will be reviewed, and the decision to build a customized system instead of using a collection of generic tools will be explained.

6.1.2.1 Key requirements

In this section, the general design decisions for the functionality and technical requirements of the support system are given, from the perspectives of support for the students in learning activities in general, support for the students in terms of tools for creating an electronic portfolio, support for the instructor to manage the system and adapt it for a particular course setting, and general requirements relating to the usability of the system.

- Functionalities for the students for general aspects of learning

The basic criteria for an electronic portfolio support system had already been studied (see Section 4.3). These emphasized support for reflection and communication as well as the provision of resources of help to the students for their assignments in the particular course.

- Functionalities for the students for creating and publishing their electronic portfolios

In addition to the more general functional requirements given in the previous lists, a particular function of the support system should be tools to help the students create their own portfolios and upload them so that the instructor and other students could view them.

- Functionalities for instructors to manage the system within their courses

Also, the support system is meant to be used within a course, and thus the instructor will play an important role in setting up and managing the system. The instructor will need a different level of access to the system than the students, in order to do tasks relating to putting resources into the system, giving students access to the system, providing them with email addresses for communication (in universities where students already have e-mail accounts this would not have to be set up within the support system itself), and manage the communication among themselves and the students including discussions and feedback on submitted work.

- Requirements relating to usability

In addition to the functionalities described above, the system should also reflect basic characteristics of usability such as being easy to use with an attractive user interface, consistent layout designs, and a clear navigation structure (Nielsen & Levy, 1994).

6.1.2.2 Use of generic tools or building a customized system?

Given these general design decisions, a next question was: Can the requirements be met by using existing generic tools or should a customized system be built? To address this question, Barrett's (2004a) comparison between available systems including commercial and non-commercial software, the use of free web server space, open source products, and other types of systems was modified for the research, in order to summarize costs, licensing agreements, hosting approaches, and storage space available (see Appendix 6). The researcher found that comparison to be a very useful source in order to make a decision about the use of generic tools or the development of a customized system.

These two options have also been studied by Barrett, 2001; Campbell, Cignetti, Melenzyer, Nettles, & Wyman, 2001; and Gathercoal, Love, Bryde & McKean, 2002. The term generic tools (GT) includes general applications such as word processing software, HTML editors, multimedia authoring tools, portable document format (PDF) editors, and other commonly used productivity tool software. With GT users will use whatever digital storage space they have available. The second type, called customized systems (CS), involves the integration of servers and a database and requires programming to link all components of the system with each other through a common interface. A simple definition of a CS is that an educational organization or a company provides an online database environment that provides a structure and server to store and organize students' portfolios. Table 28 presents Gibson and Barrett's analysis of the benefits of each approach in relation to key criteria.

Table 28. Comparison of generic tools vs customized systems approaches for the development of an electronic portfolio support system (Gibson & Barrett , 2003, pp. 4-5, 7)

Criteria	Generic tools approach (GT)	Customized systems approach (CS)
Planning and goal setting	“Expectations include the digital documentation and portfolio presence of planning and goals setting and adjustments as part of the story of growth over time	Planning processes are prompted, online dialog is documented, and goals can be flexibly linked to standards and other frames of reference determined either by the organization or the individual
Creativity	Inflexible templates or stock multimedia elements (sounds, graphics, logos) are used by students for the organization and display of their portfolios	The application allows students to customize all digital products. Students either have a CS or are expected to use GT to add creatively to their portfolios
Communications	Instructions for developing electronic portfolios do not include the use of communication tools	Application integrates asynchronous and synchronous communications into all processes and documentation is available to be used in portfolio
Collaboration	There is little evidence of collaboration in the portfolios	Application supports multiple groups and individual roles and relationships that support self, peer and expert co-creation and dialog about portfolios and their products
Reflective Processes	Written or audio reflections primarily deal with the alignment of work to course requirements or personal statements	Application prompts for and supports multimedia reflections on work and the creation of alignment between purposes and audiences for multiple portfolios
Connection Capabilities	Students are expected to extensively link their work to more than one schema, depending upon audience and purpose of the a portfolio	Application facilitates maximum use of linkages among and between work products and other representations and multiple sets of schemas. Students have flexible access to the linkage to make adjustments and create new connections
Organizational Flexibility	Students maintain more than one way to organize their work collections and utilize more than one organizational framework to represent their work	Multiple frameworks are supported and can be deployed flexibly across learner work areas and the portfolio

Extracting from Table 28, and in connection with the research objectives and hypotheses, the researcher decided to use the customized approach, as some of the pedagogical criteria, such as communications, collaborative tools, connection (interlinking) capabilities, and organizational flexibility, may not be achieved in the generic approach. Moreover, concerning the implementation factors, the “ease of use” factor is difficult to attain in the generic approach. However, the financial constraints will be considered during the development of the electronic portfolio support system, so not all the key elements of the design criteria indicated in the literature can be embedded in this system.

Summarizing this analysis, Figure 11 shows the key design decisions relating to the electronic portfolio support system to be developed for the research.

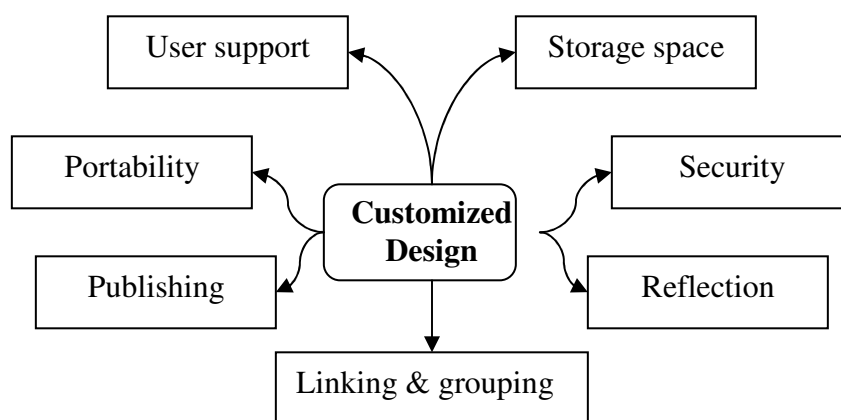


Figure 11. Key design decisions for the electronic portfolio support system

Figure 11 shows the approach “customized design”, which has to provide communication and collaborative tools in order to support students constructing their artifacts and reflection. Moreover, the system provides feedback tools as a facet of the communication and collaboration factors, to support interaction between either peers or instructor. The purpose of the feedback system is providing students with motivation for their progress during the portfolio-development processes. The system will allow portability among different sorts of files as well as supporting flexibility in access, and flexibility in the

construction as well as organization of the electronic portfolios that will be produced with support of the system. The system will provide user support, which contains tutorials, examples, interesting links, online support (online chatting), and development instructions (orientations). The system provides a platform for publishing the electronic portfolios created by the students, which involve “linking and grouping” among the items in the portfolios.

Given these criteria, the next section presents the overall design methodology for the development of the support system.

6.2 Design methodology

Generally speaking, constructing instructional materials requires a design methodology to achieve the objective of the design. Moonen (2001) stated that “depending on the background of the producer (teacher/instructor, audio-visual producer, and software developer), the specific learning material or the instructional emphasis, different specific methods and techniques are available, often with different terminology to describe the activities involved. Generally speaking, however, the design and development process of digital learning material is conceptually the same, whatever the perspectives. It is a methodology based upon a merging of instructional system development strategies and software engineering” (p.154).

In the context of the research the use of the electronic portfolio support system will take place in a course, namely Computers in Education, within a program, namely the pre-service teacher preparation program, in a College of Education within different countries in the Gulf Region. Thus the instructional system development strategies that Moonen mentions will be integrated as shown in Figure 12 for the design of the electronic portfolio support system.

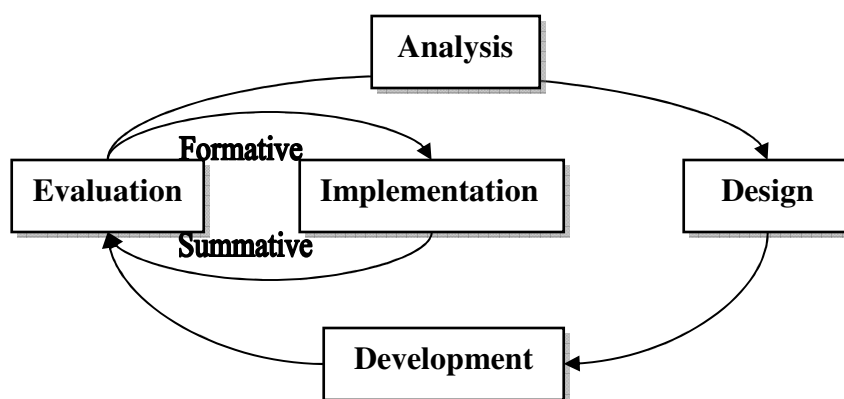


Figure 12. Design approach for the electronic portfolio support system.

As shown in Figure 12 (adopted from Althuwaini, 2003, p.64), a generic scheme of traditional design is presented which is applied to develop an educational system as a specific learning environment. This design approach contains five inter-related activities: (a) *Analysis*, which represents the stage of gathering information about what has to be taught and learned; (b) *Design*, which represents the stage of identifying the educational goals and the possible methods to teach and learn these goals; (c) *Development*, which represents the stage of designing the structure and the page layouts after selecting the method; (d) *Evaluation*, which includes tryouts and revisions (formative evaluation) or represents the stage of determining whether students do learn after using the system or understand the objective of using it (summative evaluation). Evaluation in turn requires some level of (e) *Implementation* (Gustafson, 1993; McCormack & Jones, 1999). In Sections 6.2.1-6.2.5 details of these five sets of activities as they occurred in this research will be given. For the Analysis, Design, and Development activities, a detailed described of the work leading to the first version of the Electronic Portfolio Support System is given. For the Evaluation activity, only the key evaluation questions will be given as the three investigations described in the remainder of Chapter 6 and also Chapters 7 and 8 describe the results of the evaluations in detail. The Implementation activity will be focused upon during the investigations described in Chapters 7 and 8 and not further discussed in this chapter.

6.2.1 *The analysis stage*

Althuwaini (2003) stated that this stage consists of “a feasibility-study phase that serves to identify pedagogical, organizational, technical, and economical indicators of a potential product” (p.64). Therefore, in this stage, the researcher carried out a feasibility study for the electronic portfolio support system to further consider the design factors (criteria) which leads to success implementation:

- According to the system contents, the researcher discussed with experts of educational technology (two professors and three instructors) in order to specify which knowledge is required to fulfill the course objectives as well as the electronic portfolio concept. One important conclusion was that students have to understand the reasons for developing an electronic portfolio and thus need to be provided information about these reasons.
- According to the pedagogy practiced, the researcher believes that changes in instructional approach can affect positively the students' attitudes (to become active students) as well as their performance. Originally the course pedagogy was: lecture, lab practice, and assignments. Figure 13 shows the general pedagogy of the courses that were involved in the investigations.

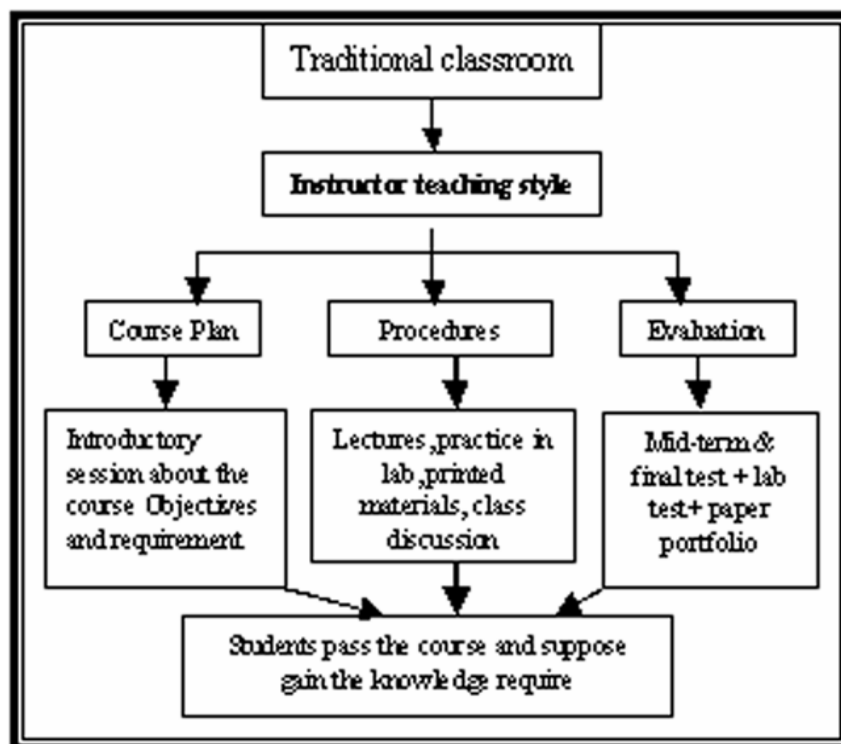


Figure 13. Existing pedagogical approach

Instead a new pedagogical approach should include, after conducting several discussions with experts of educational technology (two professors and three instructors): Discussion forum, On-line chatting, E-mails, and Weekly questions to which students submit their answers electronically and get feedback electronically. The purpose of this new pedagogy is to promote learning with and from peers, communication, and the technology use which are the course objectives as well as the research objectives. Another purpose of this new pedagogy is to increase the flexibility of learning (time and place). Moreover, another purpose of the new pedagogy is promoting active learners instead of always passive learners.

- According to technical issues, the researcher investigated the current situation in the three research contexts in relation to the computers (hardware), networks, and technical support for Web-based and database technology. The researcher found that computers (hardware) are available in good condition, with at least: three labs in the PAAET context, five labs in Kuwait

University, and one lab in Qatar University. The labs in Kuwait University and Qatar University as well as the one at the PAAET are connected with fast Internet connections (via cable). In relation to the technical support, Kuwait University has a technical support department which supervises the five labs and provides help when it is needed. However, the PAAET and Qatar University do not have a technical support department for support purposes; but lab instructors provide some assistance if possible according to their time schedules.

- According to students, the researcher investigated pre-service teachers' attitudes toward computers and how much they are involved with computers. She found that students mostly do not have that much contact with computers and have not used them for learning before this course. If it is necessary, they seek professional help from commercial agencies. However, a great number of students are interested in online chatting and downloading music and have experience in this. The course used in the research is one of the compulsory technological courses. Therefore, the students have to take this course before their final field internship credits.
- According to instructors, the researcher determined that the instructors in the target group have significant experience with computers, the Internet and the use of educational technology. Nevertheless, only one instructor out of all participants' instructors is already started embedding technology tools in his course. This is important because the instructors are in charge of the design and development of the course material and approach and will be the ones to set up a support system for their own courses as well as manage the way the students use it for communication and submitting their work.

Based on these and other analyses of the issues, the researcher collected related resources to put in the system as well as creating some if they were not available, putting all in electronic format. Moreover, draft illustrations for what kind of tools will be used in order to increase the chances of successful implementation for the electronic portfolio support system were also prepared.

All of this preparation led to the second stage which is the design stage.

6.2.2 *The design stage*

To extend the design stage beyond the general decisions reported in Section 6.1.2, the researcher set specific goals for designing the electronic portfolio support system. The design has to lead to a product that will:

- Save students time, be easy to use, and help them attain the required knowledge and skills about the course as well as the electronic portfolio.
- Assist students in their development of their electronic portfolios by providing: electronic portfolio examples; electronic tutorials; guidelines and a manual for using the electronic portfolio support system and for developing the electronic portfolios themselves; online assistance such as: online chatting, e-mail system, and discussion forums. The purpose of the electronic assistance is to enhance students' knowledge about the impact of the development of electronic portfolios on their academic and professional growth as well as encourage new attitudes (as active students) with the intention that the students will in turn use these in the future with their prospective students.
- Store the results of these activities in servers at each of the three research context locations (two institutions in Kuwait and one in Qatar).
- Document the students' abilities by providing them with an upload feature so that the students can add samples of their work to their portfolio.
- Make clear the specific criteria expected of the electronic portfolios so students know how to connect their work to the correct criteria.
- Be secure as well as provide privacy for the electronic portfolios while under construction.
- Provide sufficient tools for the instructors to set up the system for a particular course and manage student communication and submission of assignments within the system

Combining these with the general design decisions about the support system's functionality (Section 6.1.2), led to the following set of specific design decisions.

- Functionalities for the students for general aspects of learning

The basic pedagogical criteria for an electronic portfolio support system had already been studied (see Sections 4.2 and 4.3). These emphasized support for reflection, publishing, and linking and grouping to show interrelationships among items in the portfolio and standards and objectives. In addition, other important criteria related to storage space, security, and portability were discussed (Barrett, 2002). Table 19 in Section 4.2 summarized these criteria. Gibson and Barrett (2003) integrated these ideas to list the following key sets of criteria relating to the pedagogy of developing the portfolios:

- Support for planning and goal setting
- Stimulation of creativity
- Support for communications
- Provision of tools for collaboration
- Support for reflective processes
- Support for connection (linking) capabilities within the system
- Support for organizational flexibility in terms of how the user will set up a portfolio

In Section 4.2, Table 21, a summary was made of criteria that were seen as important for the success of electronic portfolios for pre-service teacher education. From this analysis it was concluded that key functionalities that should be included in such a system include:

- Being assessable via the Internet
- Demos/Tutorials
- Discussion forum
- Resources
- Support for communication, collaboration, pedagogy, assessment, content management (“collect, select, reflect”)
- Training and help resources

Comparing these analyses lead to the decision that the support system should be Web-based, password protected, allow students to download resources and upload their completed portfolios for publication, and include tools for discussion forums, email, and chat. The system must also include a variety of support resources. The system should also allow presentation of stimuli such as weekly questions.

- Functionalities for the students for creating and publishing their electronic portfolios

In addition to the more general functional requirements given in the previous lists, a particular function of the support system should be tools to help the students create their own portfolios and upload them so that the instructor and other students could view them. As the system was Web-based, the portfolios should also be Web-based and thus a simple to use html editor should be used by the students to create their portfolio pages. To help students create their own portfolios, a folder with templates of html pages should be available. The decision was made to offer five html pages for the students to fill in:

- A welcome page*: giving the goals of the electronic portfolio and an overview of its content

- Resume page*

- Course requirements page*: A page with links to finished work and reflections that show how the learner has demonstrated learning goals or standards during the course

- Educational philosophy page*: A page with statements giving a reflection on knowledge and skills developed from their learning processes

- Experience*: A page to which the students can link examples of how professional skills were demonstrated in other work done by themselves before the course.

The students can download this folder from their computer desktops, use an html editor to add the links to their work and reflective comments, save all edited pages and linked work files in the folder, and then upload the folder via an ftp server for the instructor to view. The html editor *Frontpage* was chosen to be used, as it is commonly available to students, easy to use, and a tool that students can be likely to use in their further work. Given the constraints surrounding the development of the support system (see Section 6.1.1), the decision was made to use an existing tool, an ftp server, as the medium for students to upload their eventual completed folder to the instructor. The folder was placed on the desktops of the students' computers.

- Functionalities for instructors to manage the system within their courses

Also, the support system is meant to be used within a course, and thus the instructor will play an important role in setting up and managing the system. The instructor will need a different level of access to the system than the students, in order to do tasks such as:

- Add and remove the names and emails of students with access to the system and the electronic portfolios
- Manage students' email addresses and passwords
- Manage communication through the system, such as e-mails and discussion questions as well as the use of a discussion forum and chat. Managing involves setting initial questions, reading, responding to students' responses or to messages that students initiate themselves, and sending feedback to the students on their uploaded work (including their electronic portfolios).
- Add resources to the system, including making the students' electronic portfolios available for viewing and feedback from other students.

- Requirements relating to usability

In addition to the functionalities described above, the system should also reflect basic characteristics of usability such as being easy to use with an attractive user interface, consistent layout designs, and a clear navigation structure (Nielsen & Levy, 1994).

In addition, for the purposes of the PhD research, English versions of some of the system should also be available.

Given these specific design decisions, Figure 14 presents the structure of the initial version of the Electronic Portfolio Support System designed for the research.

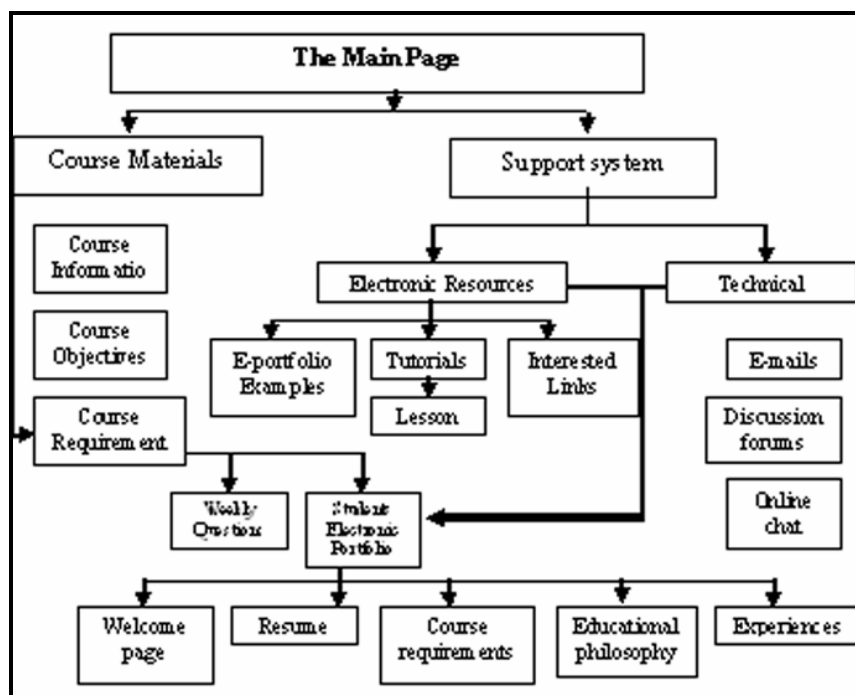


Figure 14. Structure of the Electronic Portfolio Support System

From Figure 14, the main tasks for the development stage can be identified, which are: (a) the need for programming to develop the database that underlies the system shown in, and (2) the use of authoring software in order to develop the system contents as well as the system interface. The development stage is presented in the following section in detail.

6.2.3 The development stage

In this section, an overview of the roles of the programmer and the researcher during the development is given, the opening page of the system for both students and instructors, the system as viewed by the students, followed by the system as viewed by instructors (Sections 6.2.3.1-6.2.3.4).

6.2.3.1 Roles of the researcher and programmer

Certain of the technical steps needed to realize the system required the work of a programmer in addition to the researcher. The researcher paid the programmer out of her own funds for his contribution. In the development stage, the programmer's roles as well as the researcher's roles are presented.

The researcher's roles were the following:

- Subscribe to the Yahoo web-hosting server (<http://smallbusiness.yahoo.com/webhosting/?p=1>) and obtain enough storage space online
- Design the Electronic Portfolio Support System interface
- Create a guideline manual to support:
 - The development of electronic portfolios
 - Use of the Electronic Portfolio Support System
- Create assistance lessons related to developing the course projects
- Create a page called "Interesting links" and collected links (Arabic language) that are related to learning theories, teaching style, and educational technology. Moreover, links to interesting sites in other educational institutions were also provided.

The programmer was responsible for the following:

- Programming secure access to the system.
- Programming the weekly questions system in order to enable users to submit responses and get feedback to these questions
- Programming the electronic mail system which will be used during the course
- Connecting the interface with the database that that was also built by the programmer as well as connecting the pages (which the researcher built) with the system.

6.2.3.2 Development of general pages of the system

Figure 15 presents the main page of the Electronic Portfolio Support System as seen by all users.

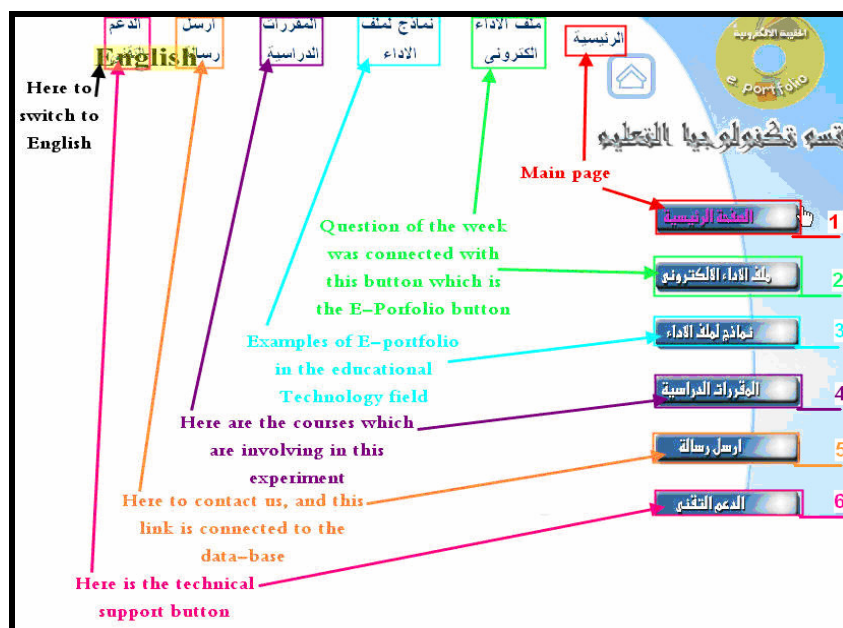


Figure 15. Interface of the main page of the Electronic Portfolio Support System

The navigation window shown in Figure 15 contains six buttons:

1. A link to (this) welcome page, which contains information about the electronic portfolio system.
2. A link to the area offering explicit support for the electronic portfolio, which is a secured area. Entering requires a username and password. Also related to this link, the students are able to participate in the weekly questions.
3. A link to a page with examples of e-portfolios, including those created by the students and also with samples from other people in order to provide students with visual insights into the electronic portfolio's contents.
4. A link to the course overview page, which contains a table of all courses that are participating in the experiment. Each course button will lead to the course page for each specific institution. This page contains course: information, description, objectives, policies, requirements, schedules, and the assessment criteria and procedures about the course.
5. A link to a page with information of how to contact the instructors or researcher, to facilitate communicating with the course instructors or the technical support person (the

researcher). Via this link, students are able to participate in the discussion forum through the e-mail.

6. A link to a page with support resources for the students, which contains tutorials in how to create the portfolio or even help with their other course assignments. Also this page contains interesting links to help the students get ideas in the fields of education or educational technology.

Choosing the second option introduces a login screen, as shown in Figure 16.

When you chlick on the E-portfolio button, this window will appear. This window for login to the weeks' question.

ادخل البيانات المطلوبة

Here the user-name اسم المستخدم

Password كلمة السر

To login Login Clear

او سجل نفسك الآن

Register with use, but this is not allowed for any one. Students have to fill the registration form and then they press on the submission button and we (as adminstrative) revise the form and either accept or reject this registration form.

الصفحة الرئيسية

ملف الاداء الالكتروني

نماذج لملف الاداء

Figure 16. Login when access to a secure area of the site is chosen

The same login screen appears if students or instructors choose to go directly to the “question of the week” via the option shown at the top of the screen in Figure 15. The login given to the prompts shown in Figure 16 lead to two different views of the associated pages: the students’ views and the instructors’ views. Before these are discussed separately, the rest of the common elements available from the initial welcome page (Figure 15) will be reviewed.

- Option 3 leads to a page with links of examples of electronic portfolios used in other institutions.
- Option 4 leads to a list of all courses participating in the investigations, along with information about the courses involved and links to the different institutions’ public Web pages.

- Option 5 is “Contact us”. This leads to a link to the e-mail of the researcher.
- Finally, Option 6 of the welcoming page seen by all users leads to a page with a selection of links to different types of support resources for students to use in their overall courses as well as when creating their portfolios.

6.2.3.3 Development of the students’ view of the secure pages of the support system

After the students login to the secure areas of the system they either go to the weekly question if they had chosen that option from the welcoming page, or the electronic portfolio section. Figure 17 shows the students’ view of the Weekly Question page.



Figure 17. Students’ view of the Weekly questions interface

Via this page, the students can see the weekly questions and are able to participate in responding to these questions. They have two options of participation: either uploading their answers to the system by uploading a Word file or writing their answers directly in the text box after choosing this method.

Figure 18 shows the students’ view of the “electronic portfolio” section of the support system. The navigation frame here was called the “students’ control panel”.



Figure 18. Entry page to the students' view of the control panel for the electronic portfolio portion of the support system

The six numbered navigation buttons (which are also available in the upper part of the page for more convenience) are:

1. Main page (shown in Figure 18)
2. Electronic portfolios (of the students)
3. Examples of electronic portfolios
4. Courses (you are enrolled in) with links to communication tools
5. Contact us
6. Technical support

The actual folder with the html templates for creating the portfolio was not available via the support system, but rather had to be downloaded and uploaded via a separate ftp server. However, in Option 2, the instructor can upload the students' finished portfolios once the instructor has downloaded them from the ftp server. Options 3 and 6 contain more support information. Option 4 is available if the student is enrolled in more than one course and the electronic portfolio system is going to be used in each of them (this feature was not activated). Also linked to Option 4 was a separate page giving students access to two kinds of communication tools: a discussion forum and online chat tools. Option 5 involves e-mail tools. Figure 19 presents the interface of the

page with the e-mail system which is represented in the students' control panel with the "Contact us" button.

Figure 19. Interface to the e-mail system

The layout contains the fields needed to conduct an e-mail process: the name of the student (which is presented automatically according to his/her sign in), the student's e-mail address (also appearing automatically), the e-mail's subject which the student fills in, and the letter body where the student writes his/her e-mail contents.

6.2.3.4 Development of functionalities available for the instructor

The functionalities available to the instructor include: registering students as users, setting up and checking students' responses to the weekly questions, and checking students' e-mails. Figure 20 shows the page which authorizes the instructor do these sorts of management tasks, called the "instructor's control panel".



Figure 20. Instructor's control panel

The six options are:

1. *First option*: add a new question
2. *Second option*: review students' responses to the question
3. *Third option*: review students' e-mails
4. *Fourth option*: add new users (students)
5. *Fifth option*: make modifications in a username
6. *Sixth option*: make modifications in a password

Figure 21 presents the page the instructor uses to manage the weekly question procedures.

Here to write the week question

Title of the question عنوان السؤال

Here the question السؤال

Submit

Reset

Here to submit the question

Here to reset the title & question field

Figure 21. Instructor's view for adding a new weekly question

To review students' weekly question responses, Figure 22, on right side, presents the two response options. The first option gives access to the uploaded response as an attached file. The second option presents the content of the response as text entered via the text field.

اضافة سؤال الاسبوع

مراجعة الاجابات

From here, to review (check) the students answers

Here are two choices

مراجعة الاجابات المرفوعة

مراجعة الاجابات المباشرة

Answer has been up-loaded (by file)

Answer has been answered through text field

Figure 22. Reviewing the weekly question responses

Once the instructor chooses the way that the student has entered a response Figure 23 appears to support managing the responses.

Here all students files that have been up-loaded

اسم الطالب Student name	التاريخ Date	استعراض الملف	الغاء الملف
sheref mohammed sharaf	2004-05-28	استعراض الملف	الغاء
sheref	2004-05-28	استعراض الملف	الغاء

Open the file
Delete file

To check the answer, click on this

Figure 23. Instructors' view of the Weekly questions review system

The tools for reviewing e-mails are also part of the instructor's control panel. Figure 24 shows the page that supports the instructor in e-mail management.

مراجعة الرسائل

Reviewing e-mails

You Have 0 New Messages How many new messages

ID	name	Message	email	Date	Check
1	amal alhammar	[SHOW MESSAGE]	aalhammar@hotmail.com	2004-05-27	<input type="checkbox"/>
2	amal alhammar	[SHOW MESSAGE]	aalhammar@hotmail.com	2004-05-27	<input type="checkbox"/>
3	amal	[SHOW MESSAGE]	aalhammar@hotmail.com	2004-05-18	<input type="checkbox"/>

Delete
1
2
3
4
5
6

Figure 24. Instructors tools for reviewing e-mails

Figure 24 shows six elements:

- *First:* show the sender's name
- *Second:* open the message
- *Third:* show the sender's e-mail address
- *Fourth:* show the date of sending the message
- *Fifth:* a checking box in order to delete an entry
- *Sixth:* the delete button.

Finally Figure 25 presents the "add user" option in the instructor's control panel.

Figure 25. Adding new users via the instructor's control panel

The six fields shown in Figure 25 are:

1. New user name
2. New user e-mail address
3. New user username
4. New user password
5. To reset and restart or quit
6. Submit button to confirm the data which was entered

The development of the first version of the Electronic Portfolio Support System took six weeks (February-March 2004).

6.2.4 *The Evaluation stage*

After the development stage comes the evaluation stage, which begins with a formative evaluation described in Sections 6.3 and 6.4 and moves on to additional formative evaluation as described in Chapter 7 and summative evaluation as described in Chapter 8. The purpose of the formative evaluations is to examine the functionality and usability of the Electronic Portfolio Support System. The purpose of the summative evaluations is to investigate the impact of the use of the Electronic Portfolio Support System on students academic and professional growth.

This section presents the criteria for the formative evaluations which occurred in Investigations 1 and 2 (Section 6.3, 6.4, and 7.4). The formative evaluation activities focus on the functionality (Section 6.2.4.1) and usability (Section 6.2.4.2) of the Electronic Portfolio Support System in order to improve the chance of its successful implementation in pre-service teacher education in the Gulf Region.

6.2.4.1 Functionality perspective:

The meaning of functionality perspective is to determine if the contents of the system are accurate according to the system's objectives (see Nielsen & Levy, 1994) which are to provide: (a) Course information; (b) Electronic portfolio information; and (c) Support system tools which contains: e-mail, discussion forum, and online chatting. Important factors for implementation success, according to the 4-E Model (Collis, Peters, & Pals, 2001; see Section 4.1.2) are "educational effectiveness" and "engagement", which are related to the functionality perspective. In particular, users will be asked to give their opinions about the educational effectiveness and engagement of

- **Course contents:** Are the course contents, objectives, procedure, requirements, and evaluation system presented clearly?
- **Electronic portfolio information:** Is the information about the meaning of electronic portfolios, their definition, objectives, types of contents, types of electronic portfolios, format of content, advantage & disadvantage, and development processes clear and helpful?

- E-mail: Is the email system useful to support the electronic portfolio development process by giving feedback, comments, and suggestions? Can communication be from instructors, the technical support specialist, or peer within the course?
- Discussion forum: Does it help to enhance the students' knowledge about the electronic portfolio concept specifically, and e-learning generally? Does it stimulate a change in the students' attitudes from passive to active by participating in these discussion and expressing their ways of thinking (reflection)?
- Weekly questions: Do they help students to construct their knowledge about the course objectives, and also their knowledge about the electronic portfolio concept?
- Online chatting: Is it used to provide vital environment (students, instructor, and peer) to exchange ideas, information, and perspectives about their electronic portfolio contents as well as the objective from developing their electronic portfolio? Is support achieved through this feature? Do the students acquire new communication skills as well as technology skills, which will improve their professional skills, considered very important to complete the course objectives?
- Instructor's and students' control panels: Are the options presented those the instructor and student most need? Do they work as expected?

6.2.4.2 Usability perspective:

The usability perspective means the ease of use of the system (Nielsen & Levy, 1994). Another of the success factors for the implementation of the system, according to the 4-E Model is "ease of use". In particular, focuses will be on:

- The ease of use of the Navigation System. How clear is the transfer among the different parts of the site? Are the navigation buttons clear enough which can predict the pages they are linked to? Do the users have the freedom to choose where they prefer to starting their navigation? Does each main topic lead to the following sub-topics in a way that guides the user to the right direction?

- Downloading time. Can the electronic material be downloaded quickly? Usually, delays whether it is measured in minutes or seconds are frustrating. Therefore, any electronic materials have to be small and simple in size, which give the advantage for downloading quickly and easily as well as conveying meaning.
- The ease of use and consistency of the user interface. Is it a rich representation of the environment? Can the user quickly and easily identify the site information based on the way that it is grouped together? Are the background, colors, and style and colors of the fonts employed well in the system?
- The consistency of the layouts. Is the design of the layouts consistent in order to not distract the students' attention?

In order to examine the functionality and usability of the Electronic Portfolio Support System, all of the components of the system will be studied according to their functionality and usability. The functionality perspective will be examined from learner's and instructor's perspectives.

6.2.5 The Implementation stage

The implementation stage involves using the innovation in real learning settings. In this research this will be the basis for Chapters 7 and 8.

The following section presents the first formative evaluation of the Electronic Portfolio Support System.

6.3 Formative evaluation

The setting and methodology for the first examination of the functionality and usability of the Electronic Portfolio Support System is described in Sections 6.3.1-6.3.7.

6.3.1 Objectives

The objective of the formative evaluation is to examine the functionality and usability of the Electronic Portfolio Support System from the students' perspective. Students have to evaluate the: (a) user support, such as tutorials, and interesting links, (b) support for learning with peers and reflection such as the discussion forum, online chat room, and

e-mails; (c) other aspects of the system as a learning environment, such as course information and weekly questions, and (d) the approach for creating an electronic portfolio (via using html templates and *FrontPage*, linking files with their own work to the template pages, via uploading the resulting folder to an ftp server). In addition, another objective was to gain insight into the instructors' perspectives about implementation of electronic portfolios via use of the Electronic Portfolio Support System within their courses.

6.3.2 *Description of the context*

The formative evaluation was conducted in the PAAET context, in the Faculty of Educational Technology of the College of Education. The students in the sample were chosen from the course called "the Project Course". The reasons for selecting that course were:

- The course objectives are similar to the course objectives of the courses where the implementation investigations (Chapters 7 and 8) will take place.
- This course is one that is required for graduation and thus taken by all students.
- A course requirement is developing a portfolio to connect the course objectives with the projects students develop in the course.
- It is a seminar course, which means that students work individually as well as in groups to achieve the course requirements.

The formative evaluation took six weeks (April-May 2004).

6.3.3 *Subjects*

The participants in the formative evaluation were instructors and students, all of whom evaluated the system. In total 18 participants were involved, three instructors from the PAAET and 15 pre-service teachers (students). The selection of the students was according to the recommendation of the head of the educational technology department as well as the course instructor. The pre-service teachers are all females according to the education system in the Gulf Region (separation between males and females in all education levels), and the average age of the participants was around 20-23 years.

Instructors were invited to participate through distributing an invitation from the researcher, which was sent to all the instructors in the department. Only three instructors agreed to participate in the evaluation. The instructor of the course in which the students were participating was not one of the participants in the formative evaluation as he was away when the instructor interviews were conducted. He had made only limited use of the instructors' functionalities in the system, as the researcher took the main role of managing the system during the formative evaluation. All instructors who participated have expertise in the educational technology field, particularly in computer and e-learning environments, with teaching experiences of a minimum of five years. The three instructors who participated in the evaluation had the opportunity to browse the support system but had not used it in practice.

6.3.4 Problems encountered

As natural, scholars usually encounter problems during their studying. In this evaluation, the researcher encountered several problems, which were:

- 1- The course and adviser had been changed without informing the researcher ahead of time in order to find another course and adviser.
- 2- Some of the students who were participating could not use the Internet at home. As a consequence, they could not participate in the on-line discussion forum or finish their work at home.
- 3- Students needed more than one workshop (with face to face communication) at the beginning of the investigation to introduce the new course procedures since using an on-line learning environment is new in the PAAET context. In this investigation there was a limitation on the available time, so that the researcher could not conduct more than one workshop, which it was not enough.

6.3.5 Instruments

The researcher used the following instruments in order to explore the students' opinions of the Electronic Portfolio Support System from the functionality and usability perspectives:

- The students' Background Computer Skills questionnaire (see Section 5.4.1), which contains 12 items related to the students'

ability to use a computer since the support system is in electronic format;

- The Functionality & Usability questionnaire (see Section 5.4.2), which explores the students' opinions in relation to the functionality and usability aspects--the questionnaire contains 25 items divided into five factors, which are: (a) Contents/Information; (b) Interface/ Presentation; (c) Navigation; (d) Access; and (e) Authoring;
- Interviews to capture the students' understanding of the electronic portfolio concept, and instructors' perspectives about the overall system after using the system (see Section 5.4.3).

In addition, an interview was used to capture the opinions of the three instructors about eventual implementation in their courses.

6.3.6 Procedure

The procedure for the formative evaluation consisted of the following steps:

- In the first week, the researcher conducted a presentation about the Electronic Portfolio Support System as well as the conceptual meaning of the electronic portfolio.
- In the same week, the researcher distributed the students' usernames and passwords so that they could start using the system and practicing with it. Also, a face-to-face session was conducted to practice using the system by downloading files, opening files, and uploading weekly question responses.
- After finishing the practice session, the researcher distributed the Computer Background Skills questionnaire in order to appreciate the level of skill that the students had with using the computer.
- The researcher posted by e-mail that she will be available for any questions in the online chat room which was placed in the discussion forum in the system.
- Each week, the researcher posted a topic in the discussion forum of the Support System in order to give students the space to participate and reflect on their own beliefs and ways of thinking according to their teaching specialisms.
- From the second week until the sixth week the researcher was available for students during the face to face class sessions and

online between the sessions in order to provide support for them. During this time, the students could use the system for e-mail.

- The students were given the task to use the folder with html templates available on their computer desktops to practice some of the technical aspects of creating a portfolio: (a) using *FrontPage* for editing, (b) embedding a link in an html page to a sample of their work, and (c) uploading the resulting folder of templates via an ftp server. The students did not provide meaningful content to the portfolios; they were only focusing on the technical issues of assembling, linking, and uploading.
- The instructor in the course browsed the Support System and tried out a few of the instructor functionalities.
- All instructors in the Department were invited to participate in the formative evaluation. Three agreed, and browsed the Support System.
- In the last week, the researcher distributed the Functionality and Usability survey as well as conducted interviews with four of the students and all three of the instructors.

6.4 Results: Students

The results of the data collection from the 15 students on the three instruments for the formative evaluation are described in Sections 6.4.1-6.4.3.

6.4.1 Computer background skills

Table 29 presents the students' responses to the Computer Background Skills questionnaire.

Table 29. Students' responses to the Computer Background Skills questionnaire

Question	Responses (N=15)	
	Yes	No
Do you own a computer at home?	12	3
Do you have an Internet connection at home?	12	3
Do you have an electronic mail (e-mail) account?	12	3

Do you know how to utilize application software (word processing, spreadsheet, and presentation packages)?	15	0		
Do you know how to create, save, and manage files on your computer?	15	0		
Do you know how to download items from the Internet?	10	5		
Do you know how to upload items to the course server or your own web page?	2	13		
Do you know how to participate in a web chat?	2	13		
Have you ever received any type of computer training?	15	0		
Question	Response			
	N *	M	W	D
How often do you use a computer?	3	2	7	3
How often do you use the Internet?	3	2	0	1 0
How often do you use your e-mail?	3	1	3	8

* N=Never, M=Monthly, W=Weekly, D=Daily

It can be seen that the students have adequate experience for using a Web-based support system but will need to be introduced to upload files to a server and participating in online chats.

6.4.2 Functionality & Usability Survey

Table 30 gives the responses of the students to questions on the survey relating the functionality of the system:

Table 30. Students' responses to the functionality perspective

Questions to measure the functionality perspective	Responses* (N=15)				
	1	2	3	4	5
The information is accurate.	0	0	2	0	13
All information relates to the overall purpose.	0	1	0	0	14
The information on the topic is thorough.	0	1	0	0	14

The purpose of the pages is obvious.	0	0	0	0	15
The pages use correct spelling and grammar.	0	0	0	0	15
The links are relevant to the subject.	0	0	0	0	15
The pages are appropriate for context and vocabulary of its intended audience.	0	0	0	0	15
Graphics enhance the site's message.	0	0	0	0	15
The type styles and background make the pages clear and readable.	2	4	2	1	6
The icons clearly represent what is intended.	3	2	1	2	7
The links are logically grouped.	0	2	2	4	7
The author is clearly identified.	0	0	0	0	15
You can easily tell the domain of the system.	0	0	0	0	15

* 1= Strongly disagree, 2=Disagree, 3= Undecided, 4= Agree, 5= Strongly agree

The students were very positive about most aspects of the functionality except for the type styles and background, the meaning of the icons, and the grouping of the links.

Table 31 presents the students' responses to the survey questions related to the usability perspective.

Table 31. Students' responses to the usability perspective

Questions to measure the usability perspective	Response*				
	1	2	3	4	5
The site is clearly identified; information is easy to find.	3	1	2	2	7
The site's presentation is eye-catching.	4	3	5	2	1
The site engages the visitor to spend time there.	7	0	4	3	1
Links are appropriate.	4	2	6	1	2
The links are easy to identify.	4	2	3	4	2
The layout is consistent from page to page.	7	3	2	3	0
There is a link back to the home page on each supporting page.	3	6	4	2	0
The site connects quickly to the page.	0	1	1	13	0

The site is available through search engines.	15	0	0	0	0
There is a way to contact the author (s) via e-mail or traditional mail.	0	0	0	15	0
You can tell from the first page how the site is organized and what options are available.	14	0	1	0	0
The site loads quickly.	14	1	0	0	0

* 1= Strongly disagree, 2=Disagree, 3= Undecided, 4= Agree, 5= Strongly agree

In contrast to the functionality, the students were much less satisfied with the usability of the system and were critical about most of the aspects mentioned in the items. The speed of accessing the system is a particular problem.

6.4.3 Interviews

After the students navigated the system, the researcher interviewed four of the students. The selection of the students was done by the course instructors. The interview questions are shown in Figure 26.

1. What is a portfolio?
2. List three reasons why you might develop a portfolio:
 1. _____
 2. _____
 3. _____
3. How is an electronic portfolio different from a paper portfolio?
4. What types of artifacts might you include in your portfolio?
5. What does the word reflection mean?
6. What does the word rationale mean?
8. What does the term alternative assessment mean?
9. Who do you feel should determine the contents of your portfolio, you or your instructor?
10. How would you self-assess your computer ability (novice, intermediate, highly skilled, expert)
11. Do you prefer to work alone on a project or in a group? Why?

Figure 26. Students' interview questions

Table 32 summarizes the students' responses to these questions:

Table 32. Students' responses to the interviews questions

Question	Student 1 Souod, A.	Student 2 Habeib, S.	Student 3 Alajmi, E	Student 4 Saalem, A.
What is a portfolio?	"It is the student's folder to collect his work in"	"It is a folder that a student uses to present her progress to the course instructor"	"It is all a student's work collected in one place called Portfolio"	"It is my showcase to the course instructor"
List three reasons why you might develop a portfolio.	"Collecting the course material, representing my work to the future employee, sharing my experiences with other peers"	"Collect all my electronic work, mandatory, saving my old work in case I might need it in the future"	"Mandatory, storing place, to document my progress within a course"	"Storing, saving, documenting, mandatory"
How is an electronic portfolio different from a paper portfolio?	"Making any changes does not need to redevelop the whole work"	"I think the most difference is the format type, one electronically and the other in paper format"	"Transfer. The electronic portfolio to print format but the opposite can't happened unless it was printed by using a word processor"	"Electronic portfolio doesn't need much space to save it in, opposite is the paper format"
What types of artifacts might you include in your portfolio?	"Presentations, video, audio, images, graphics, and documents"	"Lesson plans, brochures, documents, such as: reports and theses or essays"	"Video, music, paper, lessons, images, and presentations"	"Documents, presentations, lessons, brochures, others"

What does the word reflection mean?	"Either give opinion or criticism on some topic and the opposite"	"Receiving the others' opinions or observations on my work as well as I do"	"Giving my comments on the others' work. Also receiving the others' comments on my work"	"Commons, opinions, criticisms"
What does the word rationale mean?	"Express my understanding about topic in paragraph"	"Writing my understanding about a subject but in my own way"	"It's my thoughts written in order to provide my understanding about a subject"	"In order to prove that I accomplished an objective, I have to write it in a way I can present"
What does the term alternative assessment mean?	"It is another way of evaluating instead of examinations"	"It is a type of evaluation that measures learner progress"	"It is assessment which has flexibility in evaluating the right answer from the wrong"	"Beside the exam assessment there are projects, participation, papers, and more"
Who should determine the contents of your portfolio, you or your Instructor?	Both	Instructor	Both	Both
How would you self-assess your computer ability (novice, intermediate, highly skilled, expert)?	"Highly skilled"	"Highly skilled"	"Intermediate"	"Expert"

Do you prefer to work alone on a project or in a group? Why?	"Groups, to gain ideas and thoughts"	"Group, sharing information helped me a lot to visualize my progress"	"Alone, I prefer to work without obligation with others"	"Group, dividing work together is very nice, besides sharing information is a good experience for me"
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The interviews show that the students have a good understanding of the portfolio process and its intentions.

6.5 Results: Instructors

The three instructors completed the Functionality & Usability survey and participated in an interview. The results are given in Sections 6.5.1 and 6.5.2.

6.5.1 Functionality & Usability Survey

The instructors responded to the same instrument as the students Table 33 presents the instructors' responses for the functionality perspective.

Table 33. Instructors' responses to the functionality perspective

Questions measure the functionality perspective	Response*				
	1	2	3	4	5
The information is accurate.	0	0	0	1	2
All information relates to the overall purpose.	0	0	0	0	3
The information on the topic is thorough.	0	0	0	0	3
The purpose of the pages is obvious.	0	0	0	0	3
The pages use correct spelling and grammar.	0	0	0	0	3
The links are relevant to the subject.	0	0	0	0	3

The pages is appropriate for context and vocabulary of its intended audience.	0	0	0	0	3
Graphics enhance the site's message.	0	0	0	0	3
The type styles and background make the pages clear and readable.	0	0	0	3	0
You can tell from the first page how the site is organized and what options are available.	0	0	0	2	1
The links are logically grouped.	0	0	0	3	0
The icons clearly represent what is intended.	3	0	0	0	3
The author is clearly identified.	3	0	0	0	0
You can easily tell the domain.	3	0	0	0	0

* 1= Strongly disagree, 2=Disagree, 3= Undecided, 4= Agree, 5= Strongly agree

Other than the last two items, the instructors had the same reactions as the students.

Table 34 presents the instructors' responses to the survey questions related to the usability perspective.

Table 34. Instructors' responses to usability perspective

Questions measure the usability perspective	Response*				
	1	2	3	4	5
The site is clearly identified; easy to find.	1	2	0	0	0
The site's presentation is eye-catching.	0	3	0	0	0
The site engages the visitor to spend time there.	0	3	0	0	0
Links are appropriate.	1	2	0	0	0
The links are easy to identify.	1	2	0	0	0
The layout is consistent from page to page.	2	1	0	0	0
There is a link back to the home page on each supporting page.	0	3	0	0	0
The site connects quickly to the page.	2	1	0	0	0
The site is available through search engines.	3	0	0	0	0
There is a way to contact the author (s) via e-mail or traditional mail.	3	0	0	0	0
The site loads quickly.	1	2	0	0	0

*1= Strongly disagree, 2=Disagree, 3= Undecided, 4= Agree, 5= Strongly agree

Like the students, the instructors were critical about the usability of the system.

6.5.2 Interviews

After the instructors completed their browsing of the Electronic Portfolio Support System and filled in the Functionality & Usability questionnaire, the researcher interviewed all of them (three participants) in an open discussion interview. The objective of this interview is to explore if the Electronic Portfolio Support System attains its objectives. Figure 27 shows the interview questions.

- 1- What is your opinion about the invention prototype component?
- 2- Do you think, there are more to be adding in this prototype page?
- 3- What is your point of view about the electronic portfolio?
- 4- Do you think, developing electronic portfolio, will influence students' academic growth positively?
- 5- Can you clarify that this page is fulfilling the research objectives, which is experiment the effectiveness of developing electronic portfolio in student academic growth?

Figure 27. Instructors' interview questions

Table 35 presents the instructors' responses to the interview questions.

Table 35. Instructor's responses to the interview questions

Question	Instructor 1	Instructor 2	Instructor 3
What is your opinion about the system?	"it looks to me fine, nevertheless, it need some modifications"	" Good for you Amal, I think the prototype contained all the components that course needs, but I have my considerations on the way it is presented, for instance, the "e-portfolio" buttons led to the weekly question, and I don't what is the common between these two"	"Ya, I like the idea of providing on-line support as well as I believe that an e-portfolio can document students' achievement, But the prototype needs re-organization to the available information and adding some features which could capture students growth are needed"
Do you think there is more to be added in this system?	"Yes of course, such as: controlling students contributions to the system, the switching between the prototype and the database control panel needs modification"	"Of course, needs the buttons to be organized to the following contents so the user is not shocked if the button took him/her to another aspect different from what was presented on the button. Also if it possible transfer the discussion forum from the e-mail and create a discussion forum page. Students can participate in an on-line discussion as well as other	"Ya it needs things such as: the discussion forums, up to date on-line support providing students with all the technical support they need, also "contact us" have to be more professional, also students have to have their database control panel. Moreover, add internal e-mail in order to facilitate the communication between students"

		students can benefit from those discussions”	
What is your point of view about the electronic portfolio?	“I usually use portfolios in the paper format, and I believe in order to cope with our technology evolution I will transfer to the electronic format. Also I support the idea of using it as an assessment tool, and documenting the student’s progress within the course”	“We are familiar with the portfolio concept, in paper format; nevertheless, the electronic format as I understood will add various privileges. Examples, acquiring technology skills, and constructing some concepts by developing the e-portfolio”	“I’m familiar with the electronic portfolio concept, but my focus was on acquiring technology skills. Nevertheless, I would like to use the electronic format to support different aspects, such as: reflections, benefits from the e-communication in order to share, distribute, acquire knowledge as well as professional skills”
Do you think, developing an electronic portfolio, will influence students' academic growth positively?	Yes, of course.	Yes	Absolutely, I agree.

Can you clarify that this system is fulfilling the research objectives, which is to experiment with the effectiveness of developing electronic portfolios on students' academic growth?	"After modification, I think so"	"Ya, this page can fulfill the experiment objectives after the corrections happen"	"I think so"
--	----------------------------------	--	--------------

In addition, one of the instructors, who was also the instructor for course in which the 2nd investigation (Chapter 7) would occur, expressed his ideas about the structure of the electronic portfolio that the students were meant to fill in. He felt that the expectations were too high in terms of asking students to give their educational philosophy, and also that they would not have time to add work they had done in previous courses. He preferred the pages in the portfolio to map onto the individual projects, rather than having one page with all the project results on it.

6.6 Conclusion

Sections 6.6.1 summarizes the main results of the formative evaluation and Section 6.6.2 indicates how the Electronic Portfolio Support System was revised, based on the results.

6.6.1 Summary of the main results

From the results and conclusion, the following points of attention were identified as most important, mostly about the usability perspectives:

- The design has to be changed, to make it more easy to use.
- The design, background colors, the font size, and font style, have to change.
- The buttons have to be expanded and grouped more logically with the associated pages.
- More features need to be added to the system, such as a separate discussion forums page, internal e-mail, controlling the

login from the start, on-line technical support through an online chatting room, and more interesting links.

- A control panel should be added within the system for both instructors and students, and it has to also have “ease of use”.
- The process of constructing the portfolio has to be changed, so that it is easier for students. Now they have to download and then upload a large folder which takes much time.
- The organization of the pages of the portfolio for the students to fill in needs review.
- To anticipate research purposes, an English language version of the system should be available for the researcher.

6.6.2 System modifications

According to previous summary, modifications were made to the Electronic Portfolio Support System. Figure 28 shows the new main page for the system. Users have to choose which language they would like to proceed in. The purpose for creating the English version is to give the non-Arabic speaking members of the researcher’s supervisory committee insight into how the system is designed.



Figure 28. The entry page for the revised system

Figure 29 shows the system’s contents page which contains two important parts: (a) The control panel, and (b) The navigation system. The navigation system is the same in both the students' and instructors' views.



Figure 29. The system interface [Arabic language]

The navigation system is the same in both students' login and instructor login. It consisted of the following:

1. E-portfolio button: A link to a page that contains all the information the learner needs about the e-portfolio, such as definition, format, content types, and the development procedure. The folder for downloading the folder with the html templates for the portfolio for the students to complete is also included here.
2. Courses button: A link to a page where students can find all the courses they are enrolled in that make use of the system with all information they need, such as course information, description, contents, course materials, requirements, and course time schedule.
3. E-portfolio example button: A link to a page where students find examples of e-portfolios from previous courses or other education environments. Moreover, after students upload their own electronic portfolios, they will also show in this page.
4. Discussion forum button: A link to a page where students find the discussion forum as well as the online chatting room. They

can exchange perspectives, information, ideas, and visions between peers and technical support as well.

5. Interesting links button: A link to a page where they can find all electronic resources that can help them in developing their portfolio as well as their knowledge about the content in the course.
6. Technical support button: A page where students find all the tutorials/lessons, and instructions they need to develop their projects as well as the electronic portfolio.
7. Surveys button: A link to a page where all the research instruments are available on-line in order that students can fill them in and participate on-line.
8. Control panel button: A link to the appropriate control panel for students or instructors.
9. Language button: To choose the language they would like to proceed with.

While the navigation panel is the same for both students and instructors, the control panel is different. The contents and differences are:

- The *instructor* control panel contains:
 - Weekly question: The instructor can add questions, delete questions, review student answers, and give feedback.
 - E-mails: The instructor can check all e-mails that have been sent from the students and can reply as well.
 - Visitor: The instructor can monitor students' login daily, weekly, or even monthly.
- The *student* control panel contains:
 - Weekly question: The student can check the weekly question, and send his/her response. The student has two options to respond, which are: direct response and up-load response.

- E-mails: The student checks if his/her e-mails were received by the instructor or technical support person.
- Feedback: the student can receive his/her feedback from the instructor on their responses to the weekly question.
- Contact instructor: Students can send e-mail to the course instructor.
- Contact technical support: Students can send e-mail to the technical support person.

An important modification of the system was in the tools for creating electronic portfolios. The differences are:

- The new set of templates can be downloaded directly from the Support System itself, rather than outside of the system.
- The set of templates was changed in structure to reflect the wishes of the instructor for the implementation setting to be described in Chapter 7. The instructor had been one of the three instructors participating in the formative evaluation described in Section 6.4. He wished a change in the topics of the template pages, away from general categories such as Educational Philosophy, Resume, and Experience, toward separate pages for the different projects to be completed in the course. In this way, the reflections on the different sets of projects and the projects themselves each had their own pages. the separate template page for each group of projects (transparencies, lesson, brochures; see Section 7.1.1 for a description of the course and its projects) contains: (a) a heading where the pre-service teacher is asked to state the objective of developing the particular project in relation to the course objectives, (b) the audience for the project, (c) how to use the project materials, and (d) the evaluation processes for the project.

The new procedure that the student has to do for building the electronic portfolio begins with the following steps:

- Download the template folder from the Electronic Portfolio Support System.
- Rename the folder with her own name.
- Collect all the digital files of what she produced in her course projects in this folder.

- Open the template pages through the *FrontPage* authoring application to edit the templates.
- When the portfolio is completed, submit them by uploading their folders through any ftp software into the reserved space that is available on the server that runs the Electronic Portfolio Support System.

Screen dumps and discussions of the new set of template pages follow.

Figure 30 shows the main page template for the portfolio. It consists of two frames, the upper frame and the bottom frame (window). The upper frame contains the institution (or organization name) in the right. In the middle is the pre-service teacher's name, and the electronic portfolio logo on the left side. Under the title there are six buttons (explained in the next figure). The bottom frame is the display frame for whatever page is selected via one of the buttons.

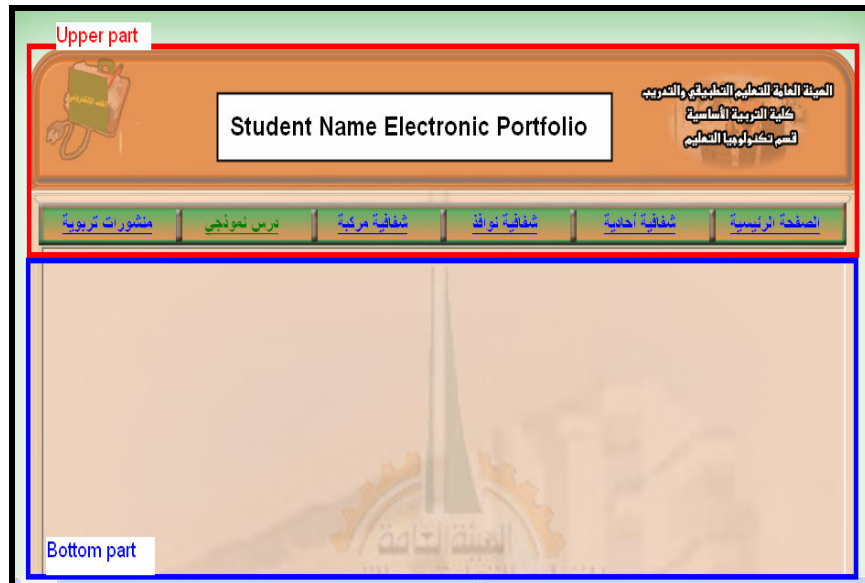


Figure 30. The main frame of pre-service teacher electronic portfolio

Figure 31 shows the option buttons in more detail.

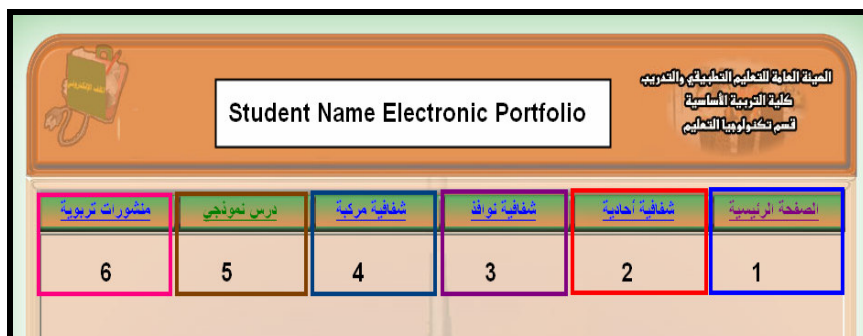


Figure 31. Pre-service teacher electronic portfolio main navigating buttons

The buttons present the pre-service teacher's work within her electronic portfolio organized around the different types of projects in the course (explained in the next chapter, in Section 7.1). These buttons are:

1. The welcoming page
2. Single transparency page
3. Windowed transparency page
4. Assembled transparency page
5. Learning environment (lesson) page
6. Brochures page

The first of the pages is the welcoming page. Figure 32 shows the button for the welcoming page.



Figure 32. Link to the welcoming page

Here the pre-service teacher writes an introduction about the electronic portfolio followed by a statement about the audience of her electronic portfolio. Then she writes a short statement about how developing an electronic portfolio affects her professional and academic growth.

The next four buttons relate to four projects that the students do in the course. Figure 33 shows the buttons in the portfolio template that link to these project pages.

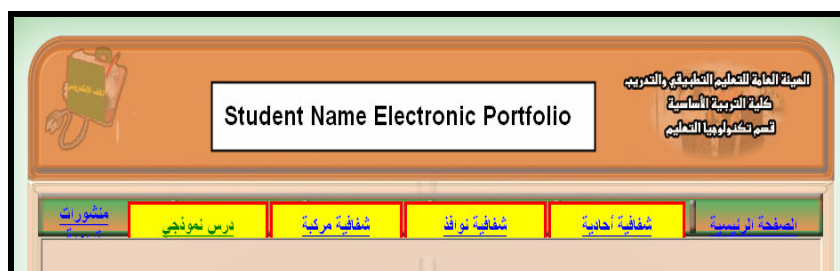


Figure 33. Buttons that link to four project pages

These buttons, which are: (a) single, windowed, and assembled transparencies, and (b) learning environment (lesson), each linked to a separate html file. In each file, the pre-service teacher has to write:

- An introduction about the topic/subject
- The intended audience
- How to use the medium (project) in the classroom
- The process they will use to evaluate their project

Moreover, she has to link her projects to these html files through the “hyperlink” command in *FrontPage*.

Finally, the left-most button presents the page that pre-service teacher uses to present and reflect on all the brochures that she created within the course. Figure 34 shows the brochures button.

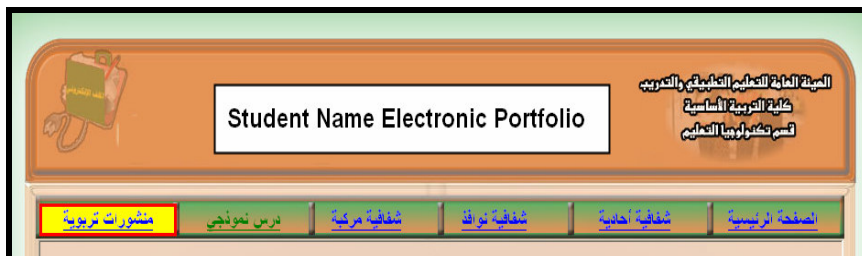


Figure 34. Brochures button

On the template for this page, the pre-service teacher lists the brochures' titles and then links, by using the “hyperlink” command in *FrontPage*, each brochure with its title.

After thus modifying the Electronic Portfolio Support System, the second investigation could begin. This is described in the next chapter.

7 Investigation 2: Less- and more-rich portfolio contexts

In Chapter 6 the first investigation of the application portion of the research was described. A Web-based support system to help pre-service teachers develop an e-portfolio was designed and developed and a sample of respondents who were representative of the target groups for the system was involved in a formative evaluation of the system. Following this, the system was revised for implementation in a specific course context. In this chapter, this implementation is described. In this phase, two different approaches to use of a portfolio in pre-service teacher education were investigated, one of them involving the development of an e-portfolio with the use of the Electronic Portfolio Support System, and the other involving the development of a paper-based portfolio with no adjacent Web-based support system. Together these two situations can be seen as two levels of a variable relating to “Portfolio Context”. One of the levels of this variable is the “Less-Rich” level, in which students produce only a paper-based portfolio and do not have a Web-based support system to help them during the production of the portfolio. The other level is the “More-Rich” level, in which students produce a more-rich type of portfolio (a hyperlinked electronic portfolio) and also are supported by the Web-based Electronic Portfolio Support System described in Section 6.6. This comparison took place within one course for pre-service teachers in the PAETT in Kuwait. In addition to the comparison between contexts the setting for the 2nd investigation provided another opportunity for formative evaluation of the Electronic Portfolio Support System and also for piloting of instruments and methodologies for relating the use of portfolios to academic and professional growth.

The overall setting for the investigations described in this chapter is discussed in Section 7.1. This second round of investigation of portfolio contexts focused on several specific research questions which are discussed in Section 7.2. Section 7.3 gives the results of the comparison between students in the Less-Rich Portfolio Context group with students in the More-Rich Portfolio Context group. The results of the parallel investigation of the group of students developing an electronic portfolio with the help of the Electronic Portfolio Support System are discussed in Section 7.4. Section 7.5 expands the investigation to include the instructor’s perspective on the implementation of the two types of portfolio contexts. Section 7.6 describes the redesign of the Electronic Portfolio Support System that occurred on the basis of the experiences in this investigation.

The research questions for the 2nd Investigation are:

- a. What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?
- b. What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic Portfolio Support System, and how are these used for improvements in the support system?

7.1 Setting for the 2nd Investigation

In this section, the setting for the 2nd Investigation is described including the institution and course in which the investigation took place (Section 7.1.1). The way in which two “Portfolio Context” groups were defined and formed (a Less-Rich Context group and a More-Rich Context group) and a description of the procedures that students in each of these groups followed is given in Section 7.1.2.

7.1.1 Institution, course, and students

The 2nd Investigation took place in the second half of 2004 in the Educational Technology Department of the College of Education at the PAAET in Kuwait. One particular course for pre-service teachers was chosen to be the setting for the investigation. This course was called “Workshop in Instructional Media”. Key objectives for this course and their relationship with the standards of the Educational Technology Department are summarized in Table 36.

Table 36. Course objectives for the setting of the 2nd Investigation:
Academic and professional growth

Categories of course objectives	Example of course objectives
<i>Academic growth</i>	
Develop critical thinking about instruction	Students use appropriate instructional design techniques and pedagogical strategies which promote and enhance the critical, creative, and evaluative thinking capabilities of their students.

Investigation 2: Less- and more-rich portfolio contexts

Demonstrate knowledge and skills with educational technology	Students demonstrate knowledge and skills with educational technology.
Create and maintain positive learning environments	Students create and maintain positive learning environments in which their students are actively engaged in learning, social interaction, cooperative learning and self motivation.
Gain insight into instructional planning	Students plan, implement, and evaluate effective instructional design models in a variety of learning environments.
<i>Professional growth</i>	
Learn from and with peers	Students interact with their peers in ways that contribute to a positive learning environment which supports the intellectual, personal, and social development of all students.
Strengthen communication skills	Students use effective communication techniques with students and other stakeholders.
<i>Both Academic and Professional growth</i>	
Use technology to support instruction	Students use technology as available in schools to collect and analyze data and interpret results, to communicate with peers and other stakeholders, and to manage, evaluate, and improve instruction in ways appropriate to the their students. Students provide their students with opportunities to actively use technology and facilitate access for their students to the use of electronic resources.
Gain insight into the roles of teachers	Students understand the roles of teachers, and are able to work with various education professionals such as teachers, administrators, and other stakeholders to accomplish the continuous improvement of their own educational experiences and those of their students.

The course is required for pre-service teachers at the PAETT. It runs for 14 weeks, with three hours of face-to-face sessions per week. The general plan for the course and its learning activities is:

- Participate in technology and communications skills lab practica (4 lessons maximum) on:
 - How to operate the computer
 - How to use several software applications such as Word, Paint, and PowerPoint.

- Perform satisfactorily on practical exams on using Word, Paint, and PowerPoint.
- Develop eight final projects, which are:
 - Creating four brochures explaining lesson ideas and the motivation for technology use in the lesson(s) by using Word
 - Creating three different types of overhead-projector transparencies (single, windowed, and assembled) for use in the lesson(s) by using PowerPoint.
 - Creating materials for an overall lesson(s) by using PowerPoint.
- Combine the results of these eight projects (printed handouts + floppy) in a paper-based portfolio by the end of the course.
- Perform satisfactorily on subject matter-oriented midterm and final exams

The specific instructions for the eight projects are as follows:

- *Four brochures*, which present four different topics. The students are free to choose these topics. Once they selected their topic, they have to write statements giving a rationale about:
 - The objective of this topic in relation to standards
 - What instructional aid fits this topic to present it in useful way
 - What this instructional aid has to contain.

These brochures will be designed by using the Word application. The purpose of these brochures is:

- Present how technology brings solutions to achieve the successful implementation of technology with instruction.
 - Provide guidelines on how technology can be embedded by producing some examples (brochures).
 - Transferring theories to practice.
- *Three different types of transparencies*. The main purpose of these transparencies is to equip pre-service teachers with technology skills involved in using the PowerPoint

application. However, with each type of transparency there are other purposes:

- *Single*, which presents one topic/subject and pre-service teacher is free to choose the topic. The purpose of this type of instructional aid is to:
 - Prepare pre-service teachers in their selection of different types of instructional aids that help and support the topic/subject.
 - Connect their theoretical background with their practice by developing different instructional aids with the use of technology.
 - Verify their instructional aids to make instruction attraction as well as meaningful.
- *Windowed*, formally it is a single transparency, however, the topic/subject is divided among a maximum of five sessions and the pre-service teachers use paper to hide different portions of the transparency during these sessions. The use of this type of transparency is to present the topic/subject sessions gradually. The purpose of this type/style:
 - Help pre-service teachers to use simple techniques in order to enhance the attractiveness of the presentation and simulate an animation in a basic way.
- *Assembled*, which means multiple layers for one topic/subject. The choice of the topic/subject is up to the pre-service teacher. The purposes of this type are to:
 - Use advanced PowerPoint techniques in order to present a high quality instructional aid using technology.
 - Practice delivering the topic/subject for their prospective students.
 - Acquire new technology skills.
- *Lesson*, which means pre-service teachers are requested to develop a complete lesson by selecting a specific topic/subject in their specialist area from the subject standards. The purpose of this:
 - Increase their ability to generate a whole lesson in their future careers.
 - Illustrate how theories (learning theories) transfer to practice (through teaching styles) to

- bring learning (objectives/standards) in a rich learning environment.
- Acquire higher technology skills.

The results of the eight final products are worth 70% of the final grade in the course; the portfolio presentation is worth an additional 10%, and the subject-matter oriented exams are worth the remaining 20% of the final grade. A final mark of an A is 90% or better, a B is 78-89%, a C is 60-77%, a D is 50-59%, and below 50% is a fail.

The development of a personal portfolio is important to the course because it is believed that connecting students' works to the standards expected in the course will provide a explicit illustration of the students' understanding of the course objectives (Campbell, Cignetti, Melenzyer, Nettles, & Wyman, 2001; Polonoli, 2000; Ring, 2002; Yancy & Weiser, 1997). Therefore, the development of a portfolio is intended for deep learning outcomes. Table 37 shows general ways in which the department standards and course objectives relate to course activities particularly the development of a portfolio.

Table 37. Relating course objectives to learning activities, particularly portfolio development

Categories of objectives	Examples of course objectives	Learning activities, particularly relating to a portfolio
<i>Academic growth</i>		
Develop critical thinking about instruction	Students use appropriate instructional design techniques and pedagogical strategies...	Give a rationale for each of the course projects and on the development of the portfolio
Demonstrate knowledge and skills with educational technology	Students demonstrate knowledge and skills with educational technology	Learn to use Word, PowerPoint and Paint
Create and maintain positive learning environments	Students create and maintain positive learning environments...	Design a lesson
Gain insight into instructional planning	Students plan, implement, and evaluate effective instructional design models ...	Select items for the portfolio Develop a portfolio

<i>Professional growth</i>		
Learn from and with peers	Students interact with their peers in ways that contribute to a positive learning environment ...	Participate in course activities Communicate with peers and the instructor in a variety of ways
Strengthen communication skills	Students use effective communication techniques ...	Discuss topics and come to conclusions as a group
<i>Both Academic and Professional growth</i>		
Use technology to support instruction	Students use technology ...to manage, evaluate, and improve instruction...	Develop instructional materials using technology
Gain insight into the roles of teachers	Students understand the roles of the teacher...	Carry out projects involving the roles of the teacher with using educational technology

The participants in the course were 48 pre-service teachers in the College of Education at the PAAET. All were females. The age of the participants was between 21-23 years. Students had different academic majors and were at the fourth year of their study. The academic majors were Islamic Education (4 students), Arabic Language (1 student), Mathematics (5 students), Art Education (7 students), Physical Education and Sport (2 students), Music (2 students), Kindergarten (9 students), Home Economics (6 students), Science (8 students), and English Language (4 students). Students could choose to develop their lessons and media products around a topic of their choice in their academic majors.

The instructor has many years of teaching experience and is also an expert in the use of educational technology in learning.

7.1.2 Portfolio Context groups

In the setting described in Section 7.1.1, the students were randomly assigned to one of two groups who would differ in terms of key aspects of the portfolio context. In this section the two Portfolio Context groups are described in general terms, followed by a description of how the 48

course participants were placed in one or the other of the Portfolio Context groups. The section concludes with a detailed description of the two contexts.

7.1.2.1 Defining the Portfolio Context groups

The experience of the development of a portfolio can vary in a number of ways within a course (see Section 2.2) but in particular two aspects were chosen as particularly important to the portfolio context for the pre-service students. One of these aspects relates to the medium of the portfolio, either a paper-based collection of items or an electronically organized and presented collection of items. As discussed in Section 2.1.2, a paper-based portfolio is less rich than an electronically based portfolio in terms of a number of key aspects, such as hyperlinking and the availability of the portfolio for study and discussion by others. Thus a portfolio context in which only a paper collection of items is assembled is a less-rich portfolio context than a context in which an electronic portfolio is produced.

Another key aspect that distinguishes the richness of a portfolio context relates to the support materials available to help students during their portfolio development. A context in which a support tool such as the Electronic Portfolio Support System (described in Chapter 6) is available for students during their work can be seen as a richer portfolio context than a setting in which only general instructions are given for how to assemble the portfolio.

Combining these two aspects leads to the two Portfolio Context groups for the 2nd Investigation (Table 38):

Table 38. Groups for the independent variable: Portfolio Context

Type of portfolio\Type of support	Instructions only	Web-based support system
Paper based	Group 1: Less-Rich Context	
Electronic		Group 2: More-Rich Context

Group 1 is a less-rich portfolio context while Group 2 is a more-rich portfolio context. In the particular class setting, Group 1 is the typical situation for the course and thus can be seen as the control setting. Group 2 is the new situation, and thus can be described as the experimental setting.

7.1.2.2 Allocation of students to Portfolio Context groups

The general format of the investigation is a one-shot case study with random assignment (R X O) according to Campbell and Stanley (1963). To accomplish the random assignments, the students were invited to subscribe to one of the two possible groups. They were not aware of the implications of the groups. An equal number of students were in each group. Initially there were 50 students so each group had 25 participants. However, two students dropped out of one of the groups early in the course for reasons non-related to the research leaving the groups with 25 and 23 students. Because of this group-assignment process, it can be argued that a random assignment of students to groups had occurred and thus an experimental comparison between the groups can be made.

7.1.2.3 Procedures for the two Portfolio Context groups

The course assignments differed in two respects between the two groups. The respects relate to the medium chosen for the portfolio and also the support given for constructing the portfolio.

The Less-Rich Context group was given the following instructions to create their paper-based portfolios:

“After producing these projects, the pre-service teachers are requested to collect these projects in printed handouts and submit the printed copies as well as a floppy disk of these projects in a paper-based portfolio and submit this by the end of the semester for evaluation.”

The More-Rich Context group was given the following instructions to create their electronic portfolios:

“After producing the components for the portfolios, the pre-service teachers are requested to collect these projects electronic portfolios by using the templates provided in the Electronic Portfolio Support System and FrontPage authoring software. The pages to be created from the templates will include a rationale statement for each project which contains:

- Introduction about the topic
- The audience (either the prospective student level or teacher level)

- How to use this medium
- The evaluation procedure.

Also other material in the Electronic Portfolio Support System can be used as references and guidelines. And regular opportunities will be provided to ask questions and discuss ideas with the researcher and with the other students, using the communication tools in the Electronic Portfolio Support System.

Link these pages describing the projects in the electronic portfolio template, saving all files in a folder on the students' own computer.

Upload their electronic portfolio folders to the Electronic Portfolio Support System. Then the electronic portfolio will be ready for evaluation.”

As indicated by the extra instructions and support for the More-Rich context group, this group also had some additional experiences during the course compared to the students in the Less-Rich Context group. These were:

- During the first session of the course the researcher presented the electronic portfolio concept and its roles in the teacher preparation program as well as how the procedure of developing an electronic portfolio can positively affect pre-service teachers' academic and professional growth in a introduction presentation (took around 20 minutes)
- In the same session, the researcher introduced the electronic portfolio using the Electronic Portfolio Support System, and displayed all the details of the system, such as: the tutorials, electronic resources and other forms of instructional guidance that are available; the e-mail component of the system, the electronic discussion forum and online chat room; and the course information which is available consisting of statements of the course objectives, contents, assignments, procedures, policies, and evaluation criteria; and special features of the system such as the weekly question and an announcement area.
- In the next session, the researcher gave the pre-service teachers in the experiment group their usernames and passwords to access the Support System. Then she worked with the students

in the computer lab to assist them in practicing to use the Electronic Portfolio Support System.

- The week after, in the second half of the lecture, the researcher continued assisting the pre-service teachers on their usage of the system in the computer lab. By this time, all the pre-service teachers in the experimental group were familiar with the Electronic Portfolio Support System and were able to login easily without problems.

Table 39 expands on Table 37, to show the additional connections between the More-Rich Portfolio Context and the course objectives.

Table 39. Additional relationships of the More-Rich Portfolio context with the course objectives (material added in italics to the third column)

Categories of course objectives	Examples of the course objectives	Learning activities, particularly relating to portfolio (more-rich activities in italics)
<i>Academic growth</i>		
Develop critical thinking about instruction	Students use appropriate instructional design techniques and pedagogical strategies	Give a rationale for each of the course projects and on the development of the portfolio <i>Express these to a target audience via the electronic portfolio</i>
Demonstrate knowledge and skills with educational technology	Students demonstrate knowledge and skills with educational technology	Learn to use Word, PowerPoint and Paint <i>and FrontPage</i>
Create and maintain positive learning environments	Students create and maintain positive learning environments	Design a lesson <i>Present the lesson and its rationale for a target audience via the electronic portfolio</i>
Gain insight into instructional planning	Students plan, implement, and evaluate effective instructional design models	Select items for the <i>electronic portfolio</i> Develop <i>an electronic portfolio</i>

<i>Professional growth</i>		
Learn from and with peers	Students interact with their peers in ways that contribute to a positive learning environment	Participate in course activities <i>Reflect on the work of peers that is available via the Electronic Portfolio Support System; give comments and feedback via chat</i>
Strengthen communication skills	Students use effective communication techniques ...	Communicate with peers and the instructor in a variety of ways, <i>including email and online chat and discussions</i> Discuss topics and come to conclusions as a group
<i>Both Academic and Professional growth</i>		
Use technology to support instruction	Students use technology to manage, evaluate, and improve instruction	Develop instructional materials using technology <i>Develop an electronic portfolio using the Electronic Portfolio Support System</i>
Gain insight into the roles of teachers	Students understand the roles of the teacher	Carry out projects involving the roles of the teacher with using educational technology

Throughout the course, the researcher participated in the experimental context in order to provide face to face support, if necessary. The support was not only technical but also involved making suggestions to the students for revising their work and giving them feedback on their products. Moreover, because of the limited time of the class sessions (three hours a week), the researcher was available daily online (via online chatting), two hours in the morning and two hours in the evening, in order to provide on-line support, revising students' work, and giving reflections.

7.2 Research questions and methodology

There were two lines of research during the 2nd Investigation: (a) a comparison between the Portfolio Context groups in terms of results

relating to academic and professional growth and other course results and (b) a study in depth of the experiences of the experimental group including an analysis of their electronic portfolios. In addition instrument validation as well as the validation of the procedures for scoring the electronic portfolios (see Section 5.4.8) also occurred. In this section each of these lines will be discussed in terms of guiding questions, instruments, and methodology.

7.2.1 Research questions

The comparison between the Portfolio Context groups focuses on two hypotheses:

H1: The More-rich approach to the design and use of a portfolio leads to more positive professional growth outcomes compared to the Less-rich approach.

Less Rich < More Rich

H2: The More-rich approach to the design and use of a portfolio leads to more positive academic growth outcomes compared to the Less-rich approach

Less Rich < More Rich

The study of the experimental (More-rich context) group relates to the questions:

What are the students' impressions concerning the functionality and usability of the Electronic Portfolio Support System and are improvements needed?

What are the experiences of the students with using the Electronic Portfolio Support System in terms of time and outcomes?

What are the attitudes of the students with using the Electronic Portfolio Support System and developing electronic portfolios?

What is the quality of the electronic portfolios that are produced using the Electronic Portfolio Support System?

In what ways should the Electronic Portfolio Support System be revised before its next implementation?

The instrument validation occurred through the use of the different instruments described in Section 5.4 in both the first and second lines of the research.

7.2.2 Instruments

Table 40 shows the instruments related to the first and second lines of the investigation.

Table 40. Instruments for the 2nd Investigation

Instrument	Purpose
<i>Comparative study:</i>	To compare the two Portfolio Context groups
11-item “Computer Background Skills” survey questionnaire (see Section 5.4.1)	Students’ access to, use of, and skills with common types of IT applications; responses to be compared before and after the course (yes/no or 4-point scale) (relates to both academic and professional growth)
30-item questionnaire, attitudes toward technology and personal orientations related to technology (the “Attitudes toward Professional Growth & Technology”, see Section 5.4.5 and Appendix 1)	Attitudes about personal enjoyment or anxiety relating to technology, about the importance of technology for instruction and for the individual’ career development, and about the use of technology for personal and academic productivity; responses to be compared before and after the course (5-point scale)) (relates to professional growth)
Weekly questions, closed and open-ended responses (see Section 5.4.6)	Four questions related directly to the course objectives (4-point scale and open-ended) (relates to both academic and professional growth)
Notes from class discussions, other field notes, on-going observations, discussions with instructor	Additional insights relating to implementation of portfolios in instruction) (relates to both academic and professional growth)
Final course grade	Relates to academic growth
<i>Study of the experimental group:</i>	To investigate in depth the Electronic Portfolio Support System and its use for electronic portfolio construction
25-item Survey questionnaire (see “Functionality and Usability survey” Section 5.4.2)	Students’ opinions about the functionality and usability of the Electronic Portfolio Support System (formative evaluation of the system)

Weekly questions, closed and open-ended responses	3 additional questions related directly to the course objectives (4-point scale and open-ended) (academic and professional growth)
10-question electronic portfolio survey (closed- and open ended, see Section 5.4.7 and Appendix 2)	Students' opinions about the value and application of the electronic portfolio (academic and professional growth)
Portfolio analysis procedure (see Section 5.4.8)	Procedure for coding the quality of the electronic portfolios (academic growth)
Final grades in the courses	Relates to overall academic growth
Interviews	Interviews with two members of the More-Rich Portfolio Context group and the instructor
Notes from class discussions, other field notes, on-going observations; analysis of entries to the online forum and chat, discussions with instructor	Additional insights relating to implementation of electronic portfolios in instruction

7.2.3 Data collection methods

In addition to the on-going observations and field notes, the data collection consisted of the following procedures:

- All students: At the end of the first class session, the “Computer Background Skills” questionnaire and the “Attitudes toward Professional Growth & Technology” were distributed to all students and collected when filled in. The researcher distributed the questionnaires to the experimental group while the instructor distributed the questionnaires to the control group.
- Experimental group only: At the end of the second class session the research distributed the “Functionality and Usability survey.”
- All students: During the course, four “Weekly Questions” were administered.

- Experimental group only: During the course, three additional “Weekly Questions” were administered.
- Experimental group: At the closing session of the course, the researcher distributed the “Electronic Portfolio” survey.
- All students: At the end of the course, the “Computer Background Skills” survey and the “Attitudes toward Professional Growth and Technology” questionnaire were distributed and collected.
- Experimental group: At the end of the semester, interviews were held with two members of the experimental group.
- Instructor: Also, course instructor was interviewed at the end of the course to explore his attitude to the use of an e-portfolio as an assessment tool as well as the use of the Electronic Portfolio Support System.
- Experimental group only: At the end of the course the researcher evaluated the electronic portfolios produced for the course according to the evaluation criteria.

The next section gives the results of the comparative study of the two Portfolio Context groups.

7.3 Comparing the two contexts of use for portfolios

To compare the impact of the two Portfolio contexts on the professional growth of the students relating to technology, the background computer access and skills of the students was accessed at the beginning and the end of the course. These results are given in Section 7.3.1. A comparison of the attitudes of the students in the two groups on the “Attitudes toward Professional Growth & Technology” is given in Section 7.3.2. A comparison of both quantitative and open-ended responses to items relating to the Weekly Questions is given in Section 7.3.3. A comparison of the final grades earned in the course is discussed in Section 7.3.4. Finally the hypotheses related to the comparison of the Portfolio Contexts are discussed (Section 7.3.5).

7.3.1 Computer background skill

There are eight questions with a “yes” & “no” answers. There were three items with responses on a four-point scale, where the lowest value related to the lowest frequency, 1= Never, 2= Monthly, 3= Weekly, & 4= Daily. Although these three items were thus categorical variables, it can be argued that they represent a linear scale of increasing frequency of use. Thus for convenience in interpretability, they will be treated here as a linear variable on the scale of 1 to 4. This section contains the pre & post results of the questionnaire. The calculations of the Computer Background Skills resulted in a Cronbach’s alpha in the pre & post situations of .864, which indicates satisfactory reliability.

Table 41 combines and compares the responses to the Computer Background Skills questionnaire for the two groups, at the start and end of the course.

Table 41. Computer Background Skills responses, pre- and post course

No.	Questions	Control Group, Start of course	Experimental Group, Start of course	Control Group, End of course	Experimental Group, End of course
		N=25	N=23	N=25	N=23
		# Yes	# Yes	# Yes	# Yes
3	Do you own a computer at home?	19	20	23	23
5	Do you have Internet connection at home?	19	20	23	23
7	Do you have electronic mail (e-mail) account?	1	2	1	23
9	Do you know how to utilize application software (word processing, spreadsheet, and presentation packages)?	4	3	25	23
10	Do you know how to create, save, and manage files on your computer?	4	3	25	23
11	Do you know how to download items from the Internet?	3	2	5	23

No.	Questions	Control Group, Start of course	Experimental Group, Start of course	Control Group, End of course	Experimental Group, End of course
		N=25	N=23	N=25	N=23
		# Yes	# Yes	# Yes	# Yes
12	Do you know how to up-load items to the course server or your own page?	0	0	0	23
13	Do you know how to participate in a web chat?	1	2	1	23
		Mean* from a 4 point scale (1=Never, 2=Monthly, 3=Weekly, 4=Daily)			
4	How often do you use a computer?	1.20	1.13	3.08	3.74
6	How often do you use the Internet?	1.20	1.22	1.20	3.61
8	How often do you use your e-mail?	1.04	1.22	1.04	3.61

*For convenience in interpretation, these responses are treated as a linear variable and thus the mean is used as a tendency score.

The data for both groups shows little difference at the start of the course. Most of the pre-service teachers (76% of the control group and 87% of the experimental) had a computer at home and had an Internet connection available, which supports the orientation of the course that working with technology is applicable (this in turn is related to the fact that the persons in the Gulf regions have generally high individual incomes). However, the pre-service teachers were not making use of the available technology at the start of the course, as shown by the low scores on Items 7, 4, 6 and 8. These results show that which the students are not familiar with using technology, or, in other words, the educational system in which the pre-service teachers have themselves been educated is not embedding technology in instruction. The low scores for items 9, 10, 11, 12, and 13 which shows that students did not start the course with computer skills.

However, there are changes both within and between the groups at the finish of the course. The data show almost the same percentages (92% control and 100% experimental) for owning a computer at home or having an Internet connection at home (92% control and 95% experimental). The comparatively few students who did not have a computer at home and did not have Internet access now had it by the end of the course. This suggests that the course stimulated the pre-

service teachers to want to make use of a computer away from the university; however, there could be other reasons including the general growth of technology use at home throughout society. The figures for Item 4 “How often do you use a computer?” now have increased to between weekly and daily for both groups. For Items 9 and 10, both groups are now skilled in the use of certain software packages and in file management on their computers; a change that reflects their experiences in the course.

However, there are differences that have emerged between the groups by the end of the course. The members of the More-Rich Portfolio Context group have now all gained e-mail accounts and use the Internet and e-mail on a near-daily basis; the Less-Rich group in contrast has not increased in these aspects of computer use. Similar results can be seen with respect to Items 11, 12 and 13. Together these results show that students in the experimental group have gained more technology skills than students in the control group, which reflects the fact that the students in the experimental group have become familiar with using an electronic communication system while the control group did not.

Thus it can be concluded that using the Electronic Portfolio Support System and developing electronic portfolios improves students’ professional skills with technology more than is the case with the Less-Rich Portfolio context. Generally speaking, the results show substantial differences between the control group and experimental group on the use of the Internet particularly for communication, which leads to the conclusion that using the Electronic Portfolio Support System to develop electronic portfolios improves students’ technology and communication skills which are part of their professional growth and that this improvement is greater than if the students use only a paper-based portfolio with limited support.

7.3.2 Attitudes toward professional growth and technology

The “Attitudes toward professional growth and technology” (Christensen & Knezek, 1998) was completed by all the students at the start of the course and then at the finish of the course. Table 42 shows the pre- and post course scores of the students, compared by group. All scores are in the range of 1 to 5, where 1 is the least-positive ranking. Negatively worded scores have been transposed. The items are grouped according to the six clusters identified by Christensen and Knezek, as modified for this research. The t-test and significance columns in Table 42 refer to comparisons between the Less-Rich and More-Rich groups

post course. When cells are empty in these columns, this means that there was no significant difference ($p < .05$).

Table 42. Comparison of scores on Attitude questionnaire, pre- and post course

No.	Clusters	Questions	Pre-course scores		Post-course scores			
			M (SD)		M (SD)		t-test	Sig. (2-tailed)
			Less-Rich (N=25)	More-Rich (N=23)	Less-Rich (N=25)	More-Rich (N=23)		
1	Enjoyment	I do enjoy doing things on the computer	2.36 (1.08)	2.22 (1.13)	3.48 (1.33)	4.13 (1.18)		
5		I feel comfortable working with computer	2.24 (1.30)	2.26 (1.18)	2.56 (1.42)	4.35 (1.11)	- 4.834	,000
2	Vocational awareness	I do think if I learn how to use computer, I will be able to get a good job	1.72 (1.10)	1.83 (1.07)	3.48 (1.33)	4.61 (0.58)	- 3.758	,000
11		If I learn to use technology in my college experiences, eventually I will implement it in my future career	3.92 (0.95)	3.78 (1.68)	3.84 (1.03)	4.26 (1.14)		
14		I do like to up-date my knowledge concerning application software	3.00 (.82)	3.65 (1.07)	2.60 (1.23)	4.04 (1.43)	- 3.766	,000
15		I like active learning processes	2.96 (1.06)	2.83 (1.47)	2.44 (1.16)	4.35 (1.19)	- 5.626	,000
17		I believe that I can easily have a job if I have computer skills or not	2.04 (1.02)	2.30 (1.60)	2.00 (1.19)	3.70 (1.40)	- 4.540	,000
26		It is not necessary that I have used technology in my college experiences in order to using technology in my future career	2.40 (1.41)	1.91 (1.20)	2.24 (1.20)	4.83 (.39)	- 9.866	,000

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29		I am not interested in updating my knowledge about application software	2.12 (0.83)	2.35 (1.72)	2.20 (1.41)	4.13 (1.29)	- 4.927	,000
30		I am ready to be a decision-maker about how to use technology in my career	2.76 (0.72)	3.43 (0.84)	2.16 (1.03)	4.30 (0.77)	- 4.946	,000
3	importance	I believe that computers give me the opportunities to learn many new things	3.16 (1.43)	3.13 (1.60)	3.48 (1.33)	4.65 (0.57)	- 3.913	,000
4		As a future educator I think that children enjoy lessons on computer	2.52 (1.12)	2.61 (1.03)	3.44 (1.36)	4.74 (0.45)	- 4.375	,000
7		I would like to have training on using computers	2.68 (1.07)	2.70 (1.11)	2.40 (1.29)	4.48 (.898)	- 6.420	,000
18		I think with computer I will not learn any new thing	2.04 (1.24)	2.70 (1.66)	4.32 (.95)	4.70 (.47)		
19		Using electronic instruction could not attract children's attention	2.20 (1.22)	2.09 (1.16)	3.72 (1.43)	4.78 (.42)	- 3.428	,000
22		I prefer having face to face training	1.92 (.70)	1.57 (.84)	1.64 (.49)	1.30 (.47)	2.417	.02
6	productivity	I prefer to use technology in producing my assignments	2.44 (1.003)	2.09 (1.08)	2.40 (1.23)	4.04 (1.07)	- 4.941	,000
8		I like to be an active learner	1.76 (1.09)	2.35 (1.43)	2.28 (1.17)	4.70 (0.47)	- 9.210	,000
12		I prefer tradition assessment by printed tests.	2.52 (.82)	2.04 (1.30)	3.80 (.96)	1.70 (1.06)	7.215	,000
13		I would like to show electronic evidence of my academic and professional growth.	2.52 (1.00)	2.70 (.97)	3.92 (1.00)	4.04 (1.43)	7.062	,000
21		I dislike using technology in producing my assignments	2.00 (1.08)	2.30 (1.46)	3.04 (1.37)	4.83 (.39)	- 6.035	,000
23		I prefer to be a passive learner	2.20 (1.26)	2.30 (1.70)	2.28 (1.37)	4.83 (.39)	- 8.596	,000

27		I prefer alternative assessment	3.20 (1.04)	2.61 (1.12)	3.96 (.98)	4.39 (1.03)		
28		I do not like the idea of having my work available electronically for assessment	2.64 (1.35)	2.43 (1.24)	2.16 (0.99)	4.30 (0.97)	-7.569	,000
9	e-mail	I do like using e-mail for communication about the course	3.12 (0.97)	2.87 (0.87)	2.24 (1.30)	4.26 (1.45)	-5.086	,000
10		I believe that using communication tools (e-mail, net chatting) will create more interaction between students enrolled in the course and students with their instructors	2.72 (1.06)	2.52 (1.04)	2.16 (1.18)	4.70 (0.47)	-9.627	,000
24		I think that receiving class information or assignments through e-mail will not be as easy as receiving them as printed material.	1.76 (1.05)	1.43 (.84)	1.60 (.87)	4.52 (1.03)	-10.616	,000
25		I believe that technology rarely makes any interaction between students enrolled in that course or student with their instructor	2.76 (.93)	2.74 (1.05)	1.96 (1.31)	4.70 (.47)	-9.486	,000
16	anxiety	Computers intimidate me.	2.40 (1.35)	2.26 (1.18)	1.96 (1.17)	4.35 (.94)	-7.760	,000
20		Working with a computer makes me uncomfortable	2.36 (.81)	2.13 (1.18)	2.92 (1.35)	4.74 (.54)	-6.023	,000

The groups were generally the same in their responses at the start of the course. T-tests comparing each pair of means showed only two with significant differences (Q14, $t=-2.39$, Sig. (2-tailed)=.02, and Q30, $t=-2.98$, Sig. (2-tailed)=.005), and it can be expected that there will be several false significances with small sample sizes and many t-tests. However, by the end of the course the More-Rich group was significantly ($p<.05$) more positive on all but four of the items. These four items come from four different clusters (see Table 38) and thus do not represent an overall difference between the groups within a cluster. The More-Rich group expresses more self-confidence about using technology (the Enjoyment and Anxiety clusters), more oriented toward technology and new ways of working for their future careers (the Vocational cluster), more positive about the importance of technology (the Importance cluster), more likely to use technology as personal productivity tools (the Productivity cluster), and more positive about electronic communication (the E-mail cluster). In general, the results show the More-Rich group to be significantly ($p<.05$):

- More-positive (in the sense of less-traditional attitudes) toward alternative assessment methods, namely via the electronic portfolio, come up after experiences with developing an electronic portfolio using the Electronic Portfolio Support System.
- More-positive in their attitudes toward professional use of technology followed the experience of using the Electronic Portfolio Support System.
- More-positive in their attitudes toward change (stages of concern, see Section 4.2) after using the Electronic Portfolio Support System, which reflects that using it is associated with pre-service teachers' professional growth.
- More-positive in their self-confidence.
- More-positive in their willingness to adapt to change (in learning style, integrating technology, and using new innovation) after using the Electronic Portfolio Support System.

7.3.3 *Weekly questions*

This instrument measured students' perspectives about transferring theory to practice through the development of their portfolios. It contains four questions answered by all students, each responded to on a four-point scale, where 1= Not affected/ Not useful at all, 2= Little affected/ Little useful, 3= Affected/ Useful, and 4= Much affected/Very useful. The questions are related to some of the course objectives (which are also among the research objectives) such as those relating to technology, planning, communication, and the role of the teacher. Thus they relate to both professional and academic growth. Table 43 shows the mean responses to the four questions answered by all students.

Table 43. Responses to portfolio-related questions, all students

Item # and course objective	Questions	Control group		Experimental group	
		Mean	SD.	Mean	SD.
2. (Technology)	To what extent do you think that technology will be used in your future career (as a teacher)? In what ways? (open-ended responses)	3.64	.70	3.91	.29
4. (Knowledge & skills, design of learning environment, role of the teacher, critical thinking)	To what extent did you make use of instructional design strategies in choosing the illustrations and graphic images that you included in your portfolio?	3.72	.54	3.87	.34
5. Communication	To what extent did the use of communication positively affect your reflection ability and your assessment ability?	2.56	.77	3.57	.59
6. Learning with peers	To what extent did interacting with your classmates during the portfolio development and revision process affect you positively? Describe? (open-ended responses)	2.20	.91	3.74	.45

Paired t-tests were used to compare the mean scores of the groups. While there is no significant difference between the groups on the first two questions, there is on Items 5 and 6 (both $p < .00$, $t = 6.14$ and $t = 3.56$ respectively). This suggests that while the course in itself stimulated both groups to high responses to questions about the general importance of technology for teachers and the value of instructional design principles, the More-Rich Portfolio Context was associated with stronger social and communication experiences than was the Less-Rich context. More insight into these responses can be seen in comments made to the open-ended questions associated with the 1-5 scales of the weekly questions. A sample of these comments is given in Table 44.

Table 44. A sample of students' comments to the weekly questions

no	Question	Less-Rich Context group comments	More-Rich Context group comments
2	To what extent do you think that technology will be used in your future career (as a teacher)? In what ways? (open-ended responses)	<p>Kholoud: I can create my lessons.</p> <p>Amthal: No more going to the commercial agency to waste money.</p> <p>Bodour: I'll create all my media products by myself.</p> <p>Maie: Acquiring technology skills made me more confident that I'm capable to create my own work.</p> <p>Shoug: It's helped a lot for my future career.</p> <p>Amaal: I can use the recent lessons in my future career.</p>	<p>Salhaa: I can present lessons in an attractive way, and embed new teaching approaches.</p> <p>Latefah: I consider acquiring technology skills as important because of career prospects. Also it will equip me with the modern-era weapon.</p> <p>Reem: It's helped me presenting my lecture in different ways, more attractive to my students, also it's reducing the time and effort spent creating the traditional lesson.</p> <p>Ebtehal: I'm ready to develop my media products without the need to go to the commercial agency to do that.</p> <p>Asmaa: It's useful for my future career as well as my personal use.</p> <p>Muneera: It's helped me in developing my lessons recently and in the future as well. I will have the confidence to apply for the ICDL license.</p>
4	To what extent did you make use of instructional design strategies in choosing the illustrations and graphic images that you included in your portfolio?	<p>Heend: I think this objective was achieved.</p> <p>Amaal: I think it is good to produce lessons through following certain procedures.</p>	<p>Fatemah a: It makes me be more organized in formatting my work and choosing colors and building contrast in between.</p> <p>Mona: I think these assignments connect the course theories with practice in understandable ways.</p> <p>Reem: Following certain theories in building my lessons makes me aware of what makes a lesson effective and I can better understand the purpose of developing these assignments.</p> <p>Ebtehal: I'm capable to design any instructional aids without worrying how to do so.</p> <p>Asmaa: It will formulate my future work.</p> <p>Muneera: I felt I'm not obligated to use it at all if it is not necessary to my projects, and that was the advantage of this objective, which is to recognize what is needed for illustrations and when.</p>

5	To what extent did the use of communication positively affect your reflection ability and your assessment ability?	<p>Amaal: It was fine, but we couldn't communicate that much because it is in the class time only.</p> <p>Shoug: The communication was only in the last four weeks when we revised our work.</p>	<p>Nawal: It is good to exchange knowledge and creativity .</p> <p>Reem: Discussion and reflection within the course refreshes students' thinking as well as brings up conflicts between students, which makes a healthy atmosphere to exchange knowledge and experiences.</p> <p>Entesaar: It is a good way to exchange experiences and ideas in order to improve learning and teaching processes.</p> <p>Ebtehal: It is a fertile field to exchange ideas, opinions, and suggestions.</p> <p>Asmaa: From these discussions, students can formulate good visions of their work and if any changes are needed.</p> <p>Latefah: It's a good tool to share ideas, perceptions, and information.</p>
6	To what extent did interacting with your classmates during the portfolio development and revision process affect you positively? Describe? (open-ended responses)	<p>Amaal: We didn't communicate or collaborate that much.</p>	<p>Mona: Sharing points of views helped me a lot in my work.</p> <p>Muneera: Finding our deficiencies or strengthens in our thinking is the important aspect of the collaboration.</p> <p>Reem: Learning from others' mistakes makes me avoid the same mistakes in the future.</p> <p>Ebtehal: The benefit that correcting my works to be better than before.</p> <p>Reham: It helps formulate our teaching and learning as well.</p>

Thus the weekly questions show the pre-service teachers' perspectives of achieving the course objectives by developing portfolios, and the students agree that the course has helped them transfer theory to practice. However, the experimental group shows a more positive reaction to the weekly questions related to social interaction and communication than the control group, which can be related to the impact of developing electronic portfolios on students' academic and professional growth.

7.3.4 Final results in the course

In order to compare the academic growth of the students in the two Portfolio context groups, their final scores in the course can be compared. These results are shown in Table 45.

Table 45. Final results in the course, Less- and More-Rich Portfolio contexts

Grades	Less-Rich context (N=25)	More-Rich context (N=23)
A: 90-100	4	7
B+: 85-89	4	7
B: 80-84	5	4
C+: 75-79	6	3
C: 70-74	1	2
D+: 65-69	0	0
D: 60-64	5	0

Table 45 shows that:

- Pre-service teachers from the More-Rich context have achieved more grades of A (7 students) than have those who are in Less-Rich context (4 students).
- More students (12 students) from the Less-Rich context did poorly in the course (ranked between C+ to D) than from the More-Rich context (5 students).

Therefore, the More-Rich context is associated with positive differences compared to the Less-Rich context in their overall academic performance in the course. It is reasonable to assume that this is associated not only with producing an electronic portfolio instead of a paper-based portfolio but also because of the use of the Electronic Portfolio Support System. The support system provides pre-service teachers, for instance, with tutorials which can help the pre-service teachers to improve their technological skills as well as improve their professional skills. According to pre-service teachers' comments made to the researcher during the on-going interactions, they mentioned that tutorials, online technical support, the guidelines handout, the discussion forum, and e-mails all helped them to fulfill the course requirements, understand the course objectives/standards, as well as build their self-confidence for presenting their skills.

7.3.5 *Discussing the hypotheses*

The comparison between the Portfolio Context groups focused on two hypotheses:

H1: The More-rich approach to the design and use of a portfolio leads to more positive professional growth outcomes compared to the Less-rich approach

Group 1 < Group 2

H2: The More-rich approach to the design and use of a portfolio leads to more positive academic growth outcomes compared to the Less-rich approach

Group 1 < Group 2

The results, both quantitative and qualitative, support the first hypothesis in a number of ways, such as in terms of the social and communicative aspects of professional growth and all the categories represented in the Attitudes survey (Table 42) such as those relating to the growth in confidence with technology use and the expectation that technology use is important in society and in careers.

The most comprehensive indicator for support of the second hypothesis is the comparison of the two groups in terms of overall grades earned in the course. Table 45 supported a relationship between Portfolio Context group and overall academic performance. Also, the increased number of ways that the More-rich group gained experience with in terms of using technology supports the hypothesis in terms of the course objectives relating to skills in technology use. The responses of the groups to the weekly questions shows that the More-Rich group gained more in terms of learning from peers and experiencing the benefits of group communication and interaction.

Thus both hypotheses are supported.

7.4 Investigating the More-Rich Portfolio Context

This section focuses only on the experimental group. The results of the Functionality and Usability survey are discussed in Section 7.4.1. This is followed by an analysis of the responses to three additional Weekly questions that were appropriate only to the experimental group (Section 7.4.2). The responses to the Electronic Portfolio survey are presented in

Section 7.4.3 and key results from the interviews with members of the experiment group appear in Section 7.4.4. Section 7.4.5 describes the results of the assessment of the quality of the electronic portfolios produced by members of the experimental group. The section concludes with a review of its research questions (Section 7.6.6).

7.4.1 Functionality and Usability Survey

This instrument was distributed to the experimental group who used the Electronic Portfolio Support System. The purpose is measuring the functionality and usability of the support system. The functionality and usability survey contains 25 items, 13 items represent the functionality aspect and the remaining 12 represent the usability aspects. Underlying both these functionality and usability aspects are five factors: (a) Contents/ Information; (b) Interface/ Presentation; (c) Navigation; (d) Access; and (e) Author qualifications (Rogers, Sharp, Banyon, Holland, Preece, & Carey, 1994; Whiteside, Bennett, & Holtzblatt, 1988;). Responses were given on five-point scales, where 1= strongly disagree, 2= disagree, 3= undecided, 4= agree, and 5= strongly agree (see Section 5.4.2). Table 46 presents the students' responses for the functionality perspectives.

Table 46. Experimental groups' responses to the functionality items (N=23)

Functionality Perspective	Mean	Std. D.
The information is accurate	4.57	0.51
All information relates to the overall purpose	4.52	0.51
The information on the topic is thorough	4.39	0.50
The purpose of the page is obvious	4.61	0.50
The page uses correct spelling and grammar	4.17	0.72
The links are relevant to the subject	4.43	0.66
The page is age appropriate for content and vocabulary for its intended audience	4.39	0.58
Graphics enhance the site's message	3.96	0.83

Functionality Perspective	Mean	Std. D.
The type styles and background make the page clear and readable	4.30	0.77
The icons clearly represent what is intended	4.35	0.57
The links are logically grouped	4.17	0.72
The author is clearly identified	4.30	0.56
You can easily tell the domain	4.13	0.82

It can be seen that all responses are between agree and strongly agree and thus the students are satisfied with the functionality of the Electronic Portfolio Support System.

Table 47 shows the responses to the questions relating to usability.

Table 47. Mean responses to the usability items

Usability Perspective	Mean	Std. D.
The site is clearly identified; easy to find	4.57	0.51
The site's presentation is eye-catching	4.52	0.51
The site engages the visitor to spend time there	4.39	0.50
Links are appropriate	4.61	0.50
The links are easy to identify	4.43	0.66
The layout is consistent from page to page	4.39	0.58
There is a link back to the home page on each supporting page	3.96	0.83
The site connects quickly to the page	4.35	0.57
The site is available through search engines	3.22	1.17
There is a way to contact the author (s) via e-mail or traditional mail	4.52	0.51
You can tell from the first page how the site is organized and what options are available	4.04	0.83
The site loads quickly	4.13	0.59

The students are also positive about the usability of the Electronic Portfolio Support System but not as consistently so as they were about its functionality.

The functionality and usability of a system are closely related to the likelihood of its implementation in practice (Section 4.4). The 4-E Model (Collis, Peters, & Pals, 2001), discussed in Section 4.1.2) can be used to discuss these implications with respect to the Electronic Portfolio Support System and its use in the PAETT.

- *Educational effectiveness*: The purpose of the site is clear, information about the course topics as well as information about the electronic portfolio concept are present, and the system presents information relating to both the specific purpose, of the system which is the electronic portfolio, as well as the course content.
- *Ease of use*: The system is easy to use through the navigation system as well as the database. Moreover, the system loads quickly. The interface of the home page, as well as the other page layouts, is readable and colors are used consistently.
- *Engagement*: The activities offered via the system as well as the course assignments are effective at keeping pre-service teachers engaged so much so that they prefer to contact the author of a particular element through the system rather than via face to face communication. These engagement tools are: e-mails, weekly questions, electronic discussion forum, and online chatting. The preferred toll was online chatting because it provides an immediate response to their needs. The students feel it is really meaningful to contact other persons to share and help during the development of their electronic portfolios.
- *Environment*: Attaining high level positive environment can be achieved through the criteria for providing a useful/effective electronic portfolio system that includes: (a) storage space, (b) security, (c) linking and grouping, (d) reflection, (e) publishing, (f) portability, and (g) user support (see Section 6.2.1). The Electronic Portfolio Support System provides these important factors which leads to a positive and productive environment.

Thus, in terms of the 4-E Model, the Electronic Portfolio Support System is likely to be associated with successful implementation, but this conclusion is only based on a few questions asked of students. Use in practice is likely to be affected by many other implementation variables not measured in this investigation (see Table 21, Section 4.3).

7.4.2 Weekly questions

Three of the weekly questions were directly addressed to the members of the experimental group. The quantitative results are shown in Table 48 and the qualitative results summarized in

Table 49.

Table 48. Quantitative responses to portfolio-related questions for members of the experimental group (4 point scale, 1=Not at all, 4=Very much)

Item # and course objective	Questions	Experimental group	
		Mean	SD.
1. Technology	To what extent has the act of developing an electronic portfolio affected your relationship with technology? How?	3.91	.29
3. Technology	To what extent does the electronic portfolio have an impact on your use of technology in your future career? Describe?	4.00	.00
7 Reflective practitioner	Elements of the portfolio were designed to help you reflect on your academic growth, for example, using the rationale statement prompts you to describe your thinking about your illustration. To what extent have you have become a more reflective practitioner?	3.74	..45

Table 49. Qualitative responses to portfolio-related questions for members of the experimental group

No.	Question	E group comments
1	To what extent has the act of developing an electronic portfolio affected your relationship with technology? How?	<p>Mona: Since I wasn't that much interested in the latest technology, I appreciate that this course provided me with a very helpful tool which is the portfolio.</p> <p>Reham: Its helped me a lot, I was hating the use of computer, it's my nightmare, but after developing my e-portfolio, and seeing what I can do and learn, I felt that this tool is lifelong learning tool.</p> <p>Sheikah: The e-portfolio is the facilitator tool between the owner and the other users (recently my peers and the course instructor), also in the future I can use it as a connection tool between me and my future employees.</p> <p>Reem: Developing e-portfolio adds a lot to my knowledge.</p> <p>Nour: It's a great experience since I enjoyed sharing knowledge with my peers; also the planning procedures increase my awareness in how to organize my works in representative way.</p> <p>Muneera: It helped me acquiring good</p>

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		technology skills, professional skills as well as working with peers.
3	To what extent does the electronic portfolio have an impact on your use of technology in your future career? Describe?	<p>Fatemah a: It has a positive impact on my future career, it provide a solution for wasting time, effort, space, and money. However, it will be a burden for someone who has difficulty using technology in the beginning.</p> <p>Latefah: The impact is knowing that I'm capable now to cope with the technology era.</p> <p>Reem: Its impact is that learning and teaching became more effective than with the traditional method, which it, in my point of view, involves saving time, and effort. Also it provides a solution to the learning processes.</p> <p>Reham: It has great impact on my productivity as well as managing my future classes in an organized way.</p> <p>Nour: Before attending this course, I was thinking that is impossible dealing with technology. But at the end, I'm able really to embed this technology in my lessons.</p>
7	Elements of the portfolio were designed to help you reflect on your academic growth, for example, using the rationale statement prompts you to describe your thinking about your illustration. To what extent have you have become a more reflective practitioner?	<p>Reham: it gave me insight on my progress and I can estimate my level.</p> <p>Mona: I was able to accomplish the course objectives through my e-portfolio, and I'm able to predict my progress for further courses.</p>

Weekly questions show the pre-service teachers' perspective of achieving the course objectives by developing the electronic portfolio, and as mentioned earlier, that the process as supported by the Electronic Portfolio Support System helps to transfer theory to practice. The responses to these questions provide more support for the benefits of the More-Rich Portfolio Context.

7.4.3 Electronic portfolio survey

This survey was used in order to explore students' attitudes toward developing electronic portfolios after completion of their portfolios. The survey was adopted from Barrett (1998, see Section 5.4.6) and was modified and translated to the Arabic language. The survey contained ten questions. The first five questions were open-ended questions, and thus the responses to them were coded to three categories by the researcher and the results confirmed by the course instructor as well as an external instructor (a specialist from educational technology field).

The rest of the questions used a five-point response scale, where 1= Do not use, 2= Used, but it wasn't useful, 3= Somewhat useful, 4= Very useful, and 5=I couldn't complete a portfolio without it. The results of this attitude survey are given by question:

- *Question 1*, which related to the time spent in developing electronic portfolio. Pre-service teachers expressed that it takes them too long to finish their electronic portfolio, around 25-50 hours.
- *Question 2*, which was about pre-service teachers feelings' about the emotional affect that the development of their electronic portfolios has had, with terms relating to a negative affect (unsatisfied, unpleasant, not proud, sad; coded as 1); no affect (coded as 2); and positive affect (satisfied, pleasant, victorious, proud, coded as 3). Only one of the 23 respondents indicated a negative affect and four indicated no affect. The majority, 18 out of 23, indicated a positive affect. Thus the pre-service teachers reacted positively (78.3%) about their feelings relating to the development of their electronic portfolios.
- *Question 3*, which was about the respondents' awareness of reasons for developing electronic portfolios, and the answers were coded as: 1=not aware, 2=aware (choosing two of the following options: compulsory requirement, assessment method, and electronic collecting tool), and 3=very aware (choosing all three of the options compulsory requirement, assessment method, and electronic collecting tool). The result of the question was in Table 50:

Table 50. Pre-service teachers' responses to purposes of the electronic portfolio (N=23)

Question	Conditions	Students' responses		Mean	Std.D
What do you think are the primary purposes for the electronic portfolio that you created?	Experimental N=23	Not aware	6	2.30	.876
		Aware	4		
		Very aware	13		

These data show that the pre-service teachers are aware of the reason for creating their electronic portfolio (56.5%). However, this percentage could be strengthened in future implementations.

- *Question 4*, which is about the electronic portfolio's use in the respondent's future, and the answers were coded to Yes, and No. Twenty of the 23 group members said yes. This shows that a high number of the pre-service teachers (87%) are willing to use their electronic portfolios after graduation.
- *Question 5*, which deals with where the respondent thinks she will use an electronic portfolio in the future. The answer was coded to: 1= in my career field, 2= in the private field & 3= in both (career and private fields). Nineteen of the 23 respondents indicated both.

Questions 4 and 5 show the effectiveness of developing electronic portfolios is supported by the pre-service teachers' responses, which represent their future plans to use electronic portfolios to document their progress. Moreover, pre-service teachers acknowledge the meaningfulness of using electronic portfolio in their professional careers.

- *Question 6* which deals with the extent to which specific support resources were useful when creating their portfolio. The questions were responded to on five-point scales, where 1= Did not use, 2= Used, but they weren't useful, 3= Somewhat useful, 4= Very useful, and 5= I couldn't complete the portfolio without it. Table 51 presents the pre-service teachers' responses:

Table 51. Pre-service teachers' responses to the usefulness of components of a support system

Question no.	Did not use	Used, but it wasn't useful	Somewhat useful	Very useful	I couldn't have completed portfolio without it	Mean	Std. D
Laptop	0	1	6	8	8	4.00	.91
Handouts	0	0	0	17	6	4.26	.45
Templates	0	0	8	8	7	3.96	.83
Open lab hours	2	10	5	6	0	2.65	.98
Assistant in lab during open lab hours	0	0	0	15	8	4.35	.49
Class sessions in lab	0	0	1	17	5	4.17	.49
One-to-one meeting with instructor	0	0	0	16	7	4.30	.47
Electronic tutorials	0	0	1	17	5	4.17	.49
Help from friend or relative	3	1	4	12	3	3.48	1.20

These responses reflect that all the components of an electronic support system are valuable during the development of the electronic portfolio to reduce the obstacles that pre-service teachers encounter when finishing their electronic portfolios. The templates however were seen as the least-useful components. Also, the students appreciate the direct help of someone associated with the course such as the instructor or a lab assistant.

- *Question 7* deals with the self-evaluation of the pre-service teachers of the technology skills that have been acquired at course completion. The responses were coded as 1= poor, 2=acceptable, 3= good, 4= very good, and 5= excellent. The students felt their skills were good to excellent on four of the seven types of technology skills (folder management, Word, PowerPoint, using a digital camera); that they were between good and very good on using discussion forums and electronic communication tools; but that they were only between

acceptable and good ($M=2.83$ (.94)) on scanning images with a desktop scanner.

- *Question 8* asked if the students think they will use their multimedia skills in their own classrooms. The results show that almost all the respondents (91%) think they definitely will use technology in their future careers
- *Questions 9 and 10* asked the extent to which the students feel their electronic portfolios give sufficient evidence to document their academic and professional growth. Again, almost all the students (91%) believe it definitely does.

It can be concluded from the survey that:

- There is further support for a positive impact of the electronic portfolio on pre-service teachers' academic and professional growth
- Pre-service teachers are likely to remain using the electronic portfolio in the future which reflects their awareness of the electronic portfolio as a lifelong learning tool as well as documentation tool.
- Pre-service teachers acquired self-confidence through the use of the Electronic Portfolio Support System. The use of the system impacts pre-service teachers' technology skills positively.

7.4.4 Student interviews

Interviews were conducted in order to further explore the functionality and usability of the Electronic Portfolio Support System. An invitation for this interview was posted for all participants; however, no one volunteered because of their busy study commitments. Therefore, the course instructor assigned two pre-service teachers in the More-Rich Context group to participate in the interview. The interviews were conducted face to face after the end of the course. There were four interview questions. The responses are discussed here.

1. Is the Electronic Portfolio Support System easy to use in relation to its navigation system and the data base?

Both students agreed that the system was easy to use from the navigation perspective. However, the data base should be easier to use.

2. Did you find the templates for developing the electronic portfolio easy to use?

Both students complained about the upload processes of the completed templates, which they felt overloaded them since the Internet connections (especially at home) are very slow. They said that they had to struggle to make it on time because of this problem, and they would prefer more simple procedures for publishing the finished portfolio.

3. Do you think the information in the Electronic Portfolio Support System is worthwhile and meaningful in relation to increasing a pre-service teacher's knowledge about the course as well as the electronic portfolio?

Both students agreed that it really was a very useful site and contains a lot of information even more than what related directly to the course objectives. They also asked if it was possible to keep using the system after finishing the course.

4. In terms of the time factor, do you think that there was enough time to construct your e-portfolio?

Both of the students agreed that there was not enough time. They insisted that either the system should be easier to use or that they could extend the time for developing the electronic portfolio (outside of the course time).

7.4.5 Students' electronic portfolios

Of the 23 students in the experimental group, only 12 completed their electronic portfolios and submitted their results in the Electronic Portfolio Support System. The other students had so much difficulty uploading files into the system because of the slow Internet connection times that the instructor told them they could just give him their digital files on a floppy disk. The researcher was only able to score the electronic portfolios that were available via the Electronic Portfolio Support System. The remainder of this section refers to the quality of these 12 electronic portfolios. As an example of what the 12 students achieved with their electronic portfolios, Appendix 7 gives printouts of the some of the different pages and elements in one of the submitted portfolios.

After the completion of the electronic portfolios, these electronic portfolios were evaluated using the procedure based on the approach of Lopez Fernández (2003) described in Section 5.5.8. Each of the 16 criteria in the coding procedure had a different weight: 0.5, 1.0, or 1.5. Table 52 shows the way that a score of 10 could be obtained.

Table 52. Scoring procedures, electronic portfolios

Grading	13 items with a weight of 0.5	2 items with a weight of 1.0	1 item with a weight of 1.5
1 - poor	1 x 0.5	1 x 1.0	1 x 1.5
2- good	2 x 0.5	2 x 1.0	2 x 1.5
3 – excellent	3 x 0.5	3 x 1.0	3 x 1.5
Highest possible score	19.5	6.00	4.5
Total score: Overall score/3 to get points out of 10			

The evaluation was done first by the researcher then revised and approved by the course instructor as well as by an external instructor from the same field. Table 53 presents the pre-service teacher scores:

Table 53. Pre-service teachers' scores on electronic portfolios (score out of 10)

Student no.	EP score	Student no.	EP score	Student no.	EP score	Student no.	EP score
S1	8	S2	10	S3	10	S4	3
S5	8	S6	10	S7	6	S8	5
S9	6	S10	4	S11	10	S12	3

The mean score for the 12 portfolios was 6.96 but there was wide variation ($SD=2.83$) for the 12 pre-service electronic portfolios. The scores show that six of the 12 students had high scores, three were satisfactory, and three were not at the passing level. Table 54 describes examples that show the difference in quality between high- and low-scoring students on the criterion categories.

Table 54. Differences in high- and low-scoring electronic portfolios

Maximal marks out of 10 in the final mark	Criteria area	Excellent example	Poor example
2.5 marks	Artifacts	The full versions of the artifacts are available. The contents of the artifacts fulfill the course standards. There is an appropriate use of the specific multimedia to serve the topic/subject. Lastly there is use of creativity in order to employ the use of technology to support the learning processes.	Not all the artifacts are in the electronic portfolio and the ones that are there are not complete.
1.5 marks	Reflections	Complete reflections on each of the electronic portfolio components as well as the general reflection of developing electronic portfolio are available. The reflections present the pre-service teacher's deep understanding and thinking about the course objectives in relation to the artifacts.	Incomplete reflections either on the electronic portfolio components or the electronic portfolio in general (for example, described in only a few words).
2 marks	Standards	Pre-service teacher presents her understanding of the standards (course objectives) by connecting these standards to her artifacts and the electronic portfolio in general.	Minimal connection appeared which reflect the student having less understanding of the course standards and the artifacts.

2 marks each	Instructional design Multimedia design	These two criteria are relating to the electronic portfolio context which has to be excellent, well operated by the navigation system, offer the flexibility for the user to choose and are all working. Moreover, the appropriate use of text as well as the communication tools should be shown.	Navigation system is not working appropriately or links are not working correctly. The multimedia are not employed well with the topic and there is no or little creativity shown in the developing of the multimedia.
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In order to get more insight into these scores and to have some basis for predicting what the scores for the other students might have been if they had submitted their portfolios through the Electronic Portfolio Support System, a comparison can be made of the portfolio scores with the scores that were awarded by the instructor for participation in class activities. The participation score was given on the basis of 1-10. Table 55 shows this comparison.

Table 55. Pre-service teachers' electronic portfolio grades compared to grades for participation in course activities

Student no.	Participation & portfolio scores	Student no.	Participation and portfolio scores	Student no.	Participation scores	Student no.	Participation scores
S1	10 (8)	S7	6 (6)	S13	10	S19	6
S2	10 (10)	S8	2 (5)	S14	2	S20	8
S3	10 (10)	S9	8 (6)	S15	5	S21	0
S4	5 (3)	S10	6 (4)	S16	8	S22	0
S5	9 (8)	S11	10 (10)	S17	9	S23	6
S6	10 (10)	S12	5 (3)	S18	5		

The course-participation grades of the 12 students who submitted electronic portfolios are positively correlated with their portfolio grades ($r=.85$, $p<.00$). Students who were active in class activities may also have been more likely to be active in using the Electronic Portfolio Support System, and thus may have gotten more benefit from it than students who were less-active users. But there also may be other factors that explain this relationship, such as overall ability of the students. Perhaps higher-ability students are likely to be more-active in class

activities than lower-ability students and may have created better electronic portfolios even without the Electronic Portfolio Support System. This is an area for further research.

7.5 Interview with the instructor

The course instructor was interviewed to get his overall impressions about the Electronic Portfolio Support System and more generally about the implementation of an electronic portfolio in his course. The interview was open-ended to allow the instructor to comment as freely as possible. Main points of the instructor's remarks included:

- The system looks better than before (the pilot version, see Chapter 6) and is easy to use; however, the uploading function has to be solved and become easier to use.
- The electronic portfolio evaluation criteria should be available early in the course in order to introduce to the pre-service teachers exactly what their evaluation criteria will be so they can work toward them.
- Concerning the impact of an electronic portfolio on changing pre-service teachers' attitudes toward technology, he agreed that there is significant positive difference between the More-Rich Context group and the other group (control group).

He concluded that he will keep using the electronic portfolio in his further courses.

7.6 Conclusions of the 2nd Investigation

Out of this overall investigation, the following conclusions can be extracted:

- Generally speaking, using an electronic portfolio is positively associated with indicators of pre-service teachers' academic and professional growth. This growth can be seen on the high-scoring examples of the electronic portfolios submitted by the More-Rich Portfolio Context group as well as by the additional technology skills they developed compared to the control group (Section 7.3.1) and the positive differences on various scores in the Attitudes questionnaire (Section 7.3.2). Based on Barrett

(2005) and others, developing an electronic portfolio is an effective method to improve pre-service teachers' professional skills as well as their academic knowledge. Barrett concluded that the development stages for the portfolio involve constructivist learning as well as the acquisition of technology skills. These were very noticeable in this experiment as well, particularly in terms of the on-going observations and field notes made by the researcher but not reported specifically in this chapter.

- The use of the Electronic Portfolio Support System has the potential to increase pre-service teachers' self-confidence, which can mean that this system can be important during the procedure of developing pre-service teachers' electronic portfolios. This was shown from the students' responses to the Electronic Portfolio Survey (Section 7.4.3) as well as the interviews (Section 7.4.4.). Previous studies (Barrett, 2005; Gathercoal, Love, Bryde, & McKean, 2002; Gibson, & Barrett, 2003) consider an electronic support system as one factor in successful implementation of the electronic portfolio in teacher education.
- Most of the instruments used appear suitable for further research but some of the instruments need modification. In addition a test to measure academic performance needs to be developed for the next experiment.
- The electronic portfolio creation process has to be simpler, particularly in terms of features which enable pre-service teachers to upload files and edit templates more directly and more easily. With this approach less time and effort will be needed and it will be more convenient with slow Internet connections. This can be done by adding additional technical functionalities to the system. Also the usability of the system should be further improved.

7.7 Modifications to the Electronic Portfolio Support System

Using the feedback from the 2nd Investigation and also recognizing the fact that the next investigation would take place in different courses and thus the organization of the electronic portfolio would need to be more

generic rather than in terms of the specific projects in the course that was the setting in the 2nd Investigation, the research redesigned the system in a number of ways. This are discussed in terms of changes to the parts of the system that are common to both instructors and students, then to changes in the pages and functionalities available to instructors, and to students (Sections 7.7.1-7.7.3). Figure 35 shows the structure diagram of the revised Support System (which can be compared with the original structure diagram in Figure 14, Section 6.2.2).

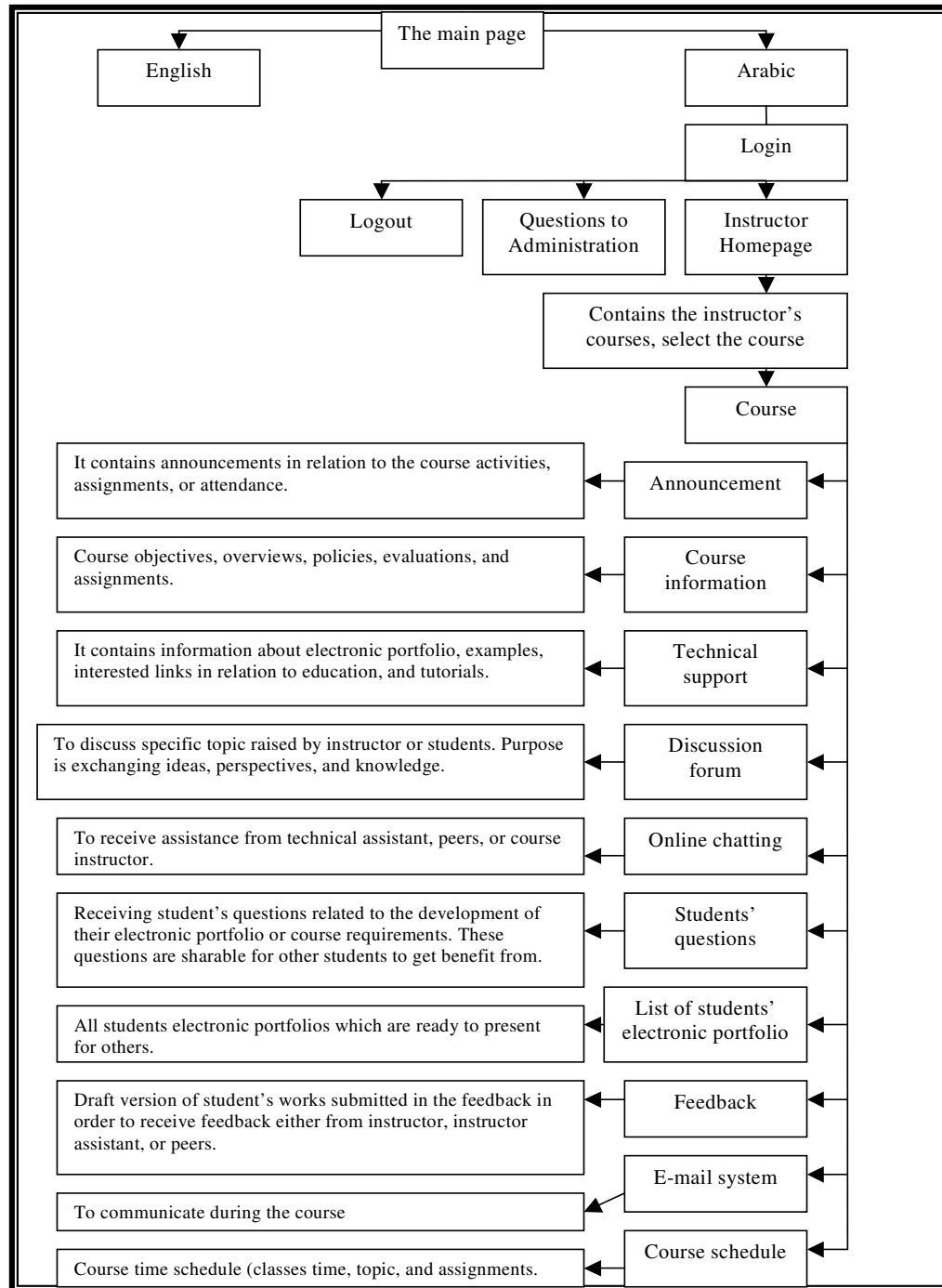


Figure 35. Structure of the revised Electronic Portfolio Support System

7.7.1 System features available to both instructors and students

The first change was in the homepage of the Support System, as shown in Figure 36.



Figure 36. The support system main page

The only changes in the main page compared to the previous version are in the layout.

Figure 37 shows the revised page where either instructor or students sign in. The login procedures require an e-mail address and password.

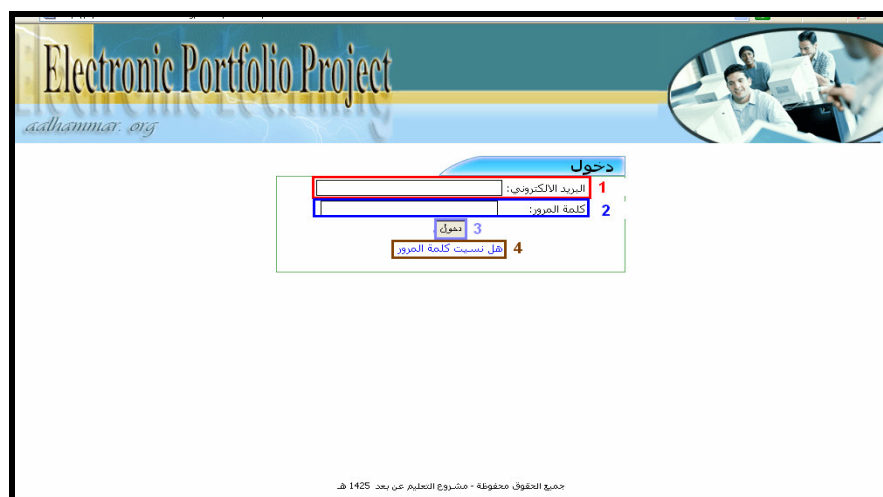


Figure 37. The login page

The feature is not optional. To avoid the e-mail address obstacle if some participants did not yet have an e-mail address, the researcher created for participants their own e-mail addresses within the support system. After that, the researcher distributed this information (e-mail address as well as password) for all participants individually in printed form.

7.7.2 Instructor's pages and functionalities

After logging in, from the new interface the instructor decides which course he/she would like to navigate within. Figure 38 shows this new interface for the instructor.



Figure 38. The first page after login for the instructor

This page is new, and the purpose is giving the instructors more clear direction and fixed options to make it easier to modify or change a course page

The numbered items shown in Figure 38 are:

1. Instructor's name appears according to the login information.
2. The instructor page, which is this page (the first page after login). The purpose that is stated in the upper part, is to give the instructor flexibility to switch between his/her courses.
3. Questions to the administrator. From here the researcher can access the administration support person. So either instructor (or students, from their interface) can send

- questions concerning the system or any other technical problems that they face.
4. Logoff option. If the instructor decides to quit he/she has to quit through here since the system is secured.
 5. General announcement. This is uploaded by the administrator (the researcher) which is displayed for everyone registered within the system (not by the course only).
 6. These are the instructor's courses. From this option he/she chooses which course to view or work on. The courses' names are hyperlinks, so what the instructor can do is choose by clicking on the course name.

After the instructor selects which course he/she would to view, Figure 39 presents the main interface of the page associated with the first option.

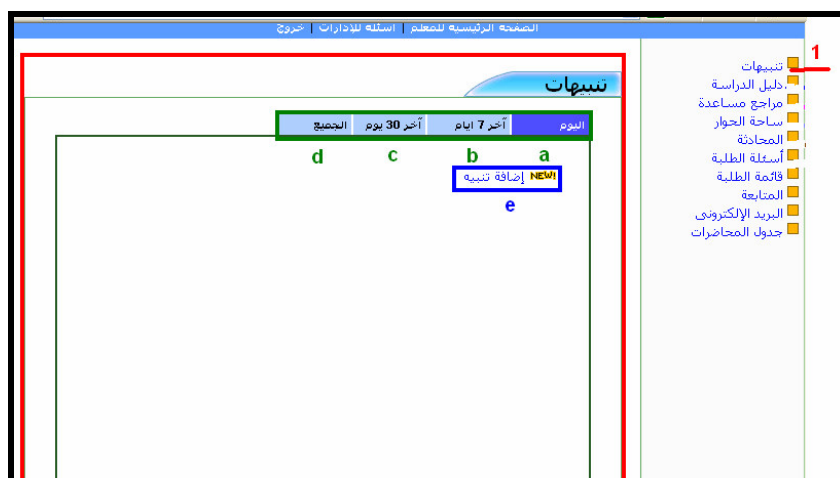


Figure 39. The announcement page as viewed by the instructor

This figure presents the first option “Announcement”, which is new. At the right side (since Arabic writing starts from right to left) are all the options that are available for instructor to navigate. However, the page mainly opens on the announcement page since this is the first option. In the previous version of the system, first the announcement was underlying the courses page – then the particular page. Moreover, since the course page was designed by an authoring editor application, the technical support person was responsible for uploading any announcement to the course page then refreshing the page in order to display the new information. Therefore, in order to make the course

more accessible as well as flexible for the instructor to add/remove what ever he/she wishes, the announcement feature become available through a template which the instructor could fill in directly and easily upload by simply submitting. The options displayed in the horizontal window in Figure 39 shows the instructor's tools for the announcements:

- a. Display all announcements for today,
- b. All announcements the last seven days,
- c. All announcements the last 30 days,
- d. All announcements for that course,
- e. Add a new announcement: The instructor selects this by clicking on the hyperlinked title.

Figure 40 shows the online template available to the instructor to insert his or her own announcements.

Figure 40 shows the online template for adding a new announcement. The form is titled "إضافة تنبيه جديد" (Add New Announcement). It includes the following elements:

- 1**: A text input field for the announcement title, labeled "عنوان التنبيه".
- 2**: A large text area for the announcement content, labeled "التنبيه".
- 3**: Date selection fields for the announcement timeline, including "من يوم" (From Day) and "إلى يوم" (To Day), with dropdown menus for year and month.
- 4**: A checkbox labeled "إظهار على الموقع" (Display on site).
- 5**: Two buttons at the bottom: "أضف" (Add) and "مسح" (Delete).
- 6**: A small icon above the buttons.

Figure 40. The announcement option for the instructor

The figure presents the structured procedure to create an announcement. The instructor has to follow these numbered steps:

1. Announcement title
2. Announcement content
3. Announcement timeline, which means from when until when

4. Would you like to display it at the system main page? (The first page after login which means Figure 49 for the instructor and a comparable page for the student). However, this option is not currently available.
5. After finalizing the announcement details, the instructor has to confirm his/her wishes by clicking on the “Add” button.
6. However, if he/she wishes to cancel, he/she can click on the “Delete” button.

The second option on the instructor’s interface, which is presented in Figure 41, is Course Information.



Figure 41. Course information, from instructor’s interface

It contains two parts, which are: (a) General information, (b) Course details. These features were also available in the previous version of the support system.

When the option general information is chosen, information about the course, such as course title, code, and credits is available. This is shown in Figure 42.

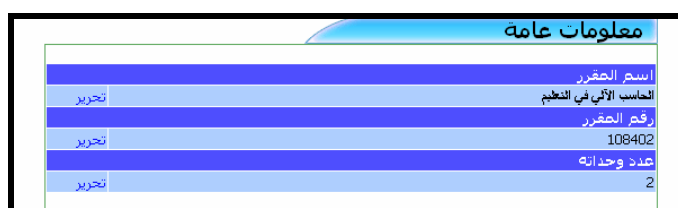


Figure 42. General course information

Figure 43 presents the page shown when the option detailed information about the course is chosen.

المقررات	
مقدمة	
تحرير	يكون هذا المقرر من شقين أساسيين: إحداهما نظري والآخر عملي، وهما جزءان متكاملان، وروعي في إعداد محتويات هذا المقرر تطور تكنولوجيا المعلومات والاتصالات، بالإضافة إلى التركيز على تطبيقات الحاسوب في التعليم وخاصة التعليم بمساعدة الحاسوب CAI ودور المعلم في اختيار وتوظيف برمجيات الحاسوب التعليمية في مجال تخصصه
أهداف المقرر	
تحرير	<p>عند الانتهاء من هذا المقرر ينبغي أن يكون الطالب قادراً على:</p> <ol style="list-style-type: none"> 1- تعريف الحاسوب ومميزاته 2- التعرف على المكونات الأساسية في الحاسوب وأوساط التخزين 3- تعريف فيروس الكمبيوتر وأعراضه وطرق الكشف عنه 4- تشغيل شبكة الإنترنت والاستفادة من خدماتها المباشرة (البريد الإلكتروني) 5- استخدام بعض البرمجيات التطبيقية الجاهزة (وورد/اكسل) 6- تشغيل برنامج العرض باوربوينت 7- التعرف على مميزات برنامج العرض باوربوينت واستخداماته 8- تصميم درس في مادة التخصص على برنامج العرض باوربوينت 9- تعريف التعليم بمساعدة الحاسوب (CAI) 10- تعريف برمجيات الوسائط المتعددة وتحديد مميزاتها 11- تعريف فو.ع.أو أوساط برمجيات التعليم بمساعدة الحاسوب

Figure 43. Detailed course information

The page includes information such as an introduction about the course, course objectives, evaluation and grading procedures, and course policy and rules.

The third option in the instructor interface is the support page. This is shown in Figure 44.



Figure 44. Support page, instructor's interface.

By using this feature the instructor is able to publish all the resources that he/she believes will help students achieve the course requirements

(which here includes creating an electronic portfolio). This page contains the following options (see boxed area in the central window in Figure 44):

- Information about the electronic portfolio concept
- Electronic portfolio examples
- Tutorials on the applications which are in use in this course
- Interesting links
- Instructional guidelines to develop electronic portfolio and its contents
- Research instruments (questionnaires available electronically).

The information in this option was available in the previous system; however, it was divided between four buttons. Based on the usability feedback from the formative evaluation in the 1st Investigation, the researcher found that combining these options is necessary since they are all relevant as support in the sense that they are all types of knowledge and skills support.

The fourth option in the instructor's interface is the discussion forum (see Figure 45).

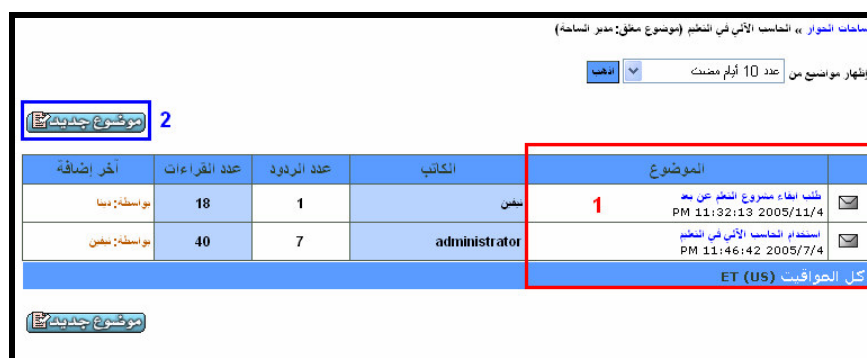


Figure 45. Discussion forum

In the previous version of the system the discussion forum was also available but combined with online-chatting. Based on the usability feedback, the two options are now available separately as they use different interfaces. In the discussion forum the instructor can post a topic and then he/she exchanges ideas with the students so as to better understand how they think about the topic from their points of view.

Figure 46 presents the fifth option in the instructor's interface, the online-chatting room.



Figure 46. The online chatting option from the instructor's interface

Figure 47 shows how the instructors (and the students) login in, in the area marked with the number 1, to go to the online chatting room.



Figure 47. Online-chatting login page

This separate login is necessary, as the online-chat system is not directly part of the Electronic Portfolio Support System, but a separately available external tool.

The sixth option available via the instructor's interface is the students' questions option. This is shown in Figure 48.



Figure 48. Entry to students' questions, from the instructor's interface

Via this interface, the instructor views the students' questions concerning the course as well as about their electronic portfolio development. This feature is new. In the previous version of the support system questions and answers only occurred through e-mails, which were not shared between students. In this feature the instructor can share students' questions as well as the answers for further use by other students.

The seventh option on the instructor's interface is the student list, which also enables the instructor to view his/her students' electronic portfolios (see Figure 49).

4	3	2	1
صلاحيات الزوار	النوع	البريد الإلكتروني	اسم الطالب
<input checked="" type="checkbox"/>	female	nora@aahammar.org	نورة
<input checked="" type="checkbox"/>	female	naglaa@aahammar.org	نخلاء
<input checked="" type="checkbox"/>	female	mariam@aahammar.org	مريم
<input checked="" type="checkbox"/>	female	amala@aahammar.org	أمان
<input checked="" type="checkbox"/>	female	terfaa@aahammar.org	طرفة
<input checked="" type="checkbox"/>	female	mariam_a@aahammar.org	مريم
<input checked="" type="checkbox"/>	female	mariam_g@aahammar.org	مريم
<input checked="" type="checkbox"/>	female	maia@aahammar.org	ميا
<input checked="" type="checkbox"/>	female	maha@aahammar.org	مها
<input checked="" type="checkbox"/>	female	shiekah@aahammar.org	شيكاه
<input checked="" type="checkbox"/>	female	nara_a@aahammar.org	نورة
<input checked="" type="checkbox"/>	female	nara_s@aahammar.org	نورة
<input checked="" type="checkbox"/>	female	forjaa@aahammar.org	فرجة
<input checked="" type="checkbox"/>	female	basaa@aahammar.org	باسم

Figure 49. The students' list, as available to the instructor

Figure 49 presents the four columns on this page, which are:

1. First column presents student name
2. Second column presents student e-mail address

3. Third column is concerning the student's gender; however, in this experiment all participants are females
4. Uploading authority, in this option the instructor enables the student uploading feature by checking the box, which means that the instructor is the authority to allow a student to upload her work to her electronic portfolio.

The eighth option on the instructor's interface is "feedback", which enables the instructor to upload the assignment requirements and receive students' draft versions of their work, so then instructor can give his/her feedback before the submission of their final versions. The interface for this feature is shown in Figure 50.



Figure 50. The feedback option for the instructor

Also in the same option is the opportunity to make all the draft versions of the portfolios accessible for peers, which is considered a way to make the support system also serve as a platform for sharing ideas and knowledge as well. Moreover, this feature is new since all the feedback in the previous system was through e-mails and the students' work-in-progress was not accessible for others registered in the course. Therefore, one of the course objectives as well as the research benefits from the feedback and reflection system which helps and improves students' academic and professional growth. Figure 50 further shows:

- a. Links to the available assignments
- b. A button to allow the instructor to enter another feedback. The instructor has to click on the hyperlink which leads to the page via which instructor is able to upload any new feedback.

The ninth option in the instructor's interface is the e-mail. The new interface is shown in Figure 51.



Figure 51. The e-mail system

An e-mail system was also available in the previous system; however new features are added to it, which are lists of registered students' and others (such as assistant instructors or technical support persons) and an archive of e-mails received from within the course. This is so that the instructor does not need to save his or her e-mails anywhere else. Figure 51 shows the two processes, which can be chosen from this interface:

1. Checking e-mails, and beside it directly indicating if there are any new messages
2. Writing new e-mail

Figure 52 shows the numbered steps the instructor has to go through if the instructor writes new e-mail.

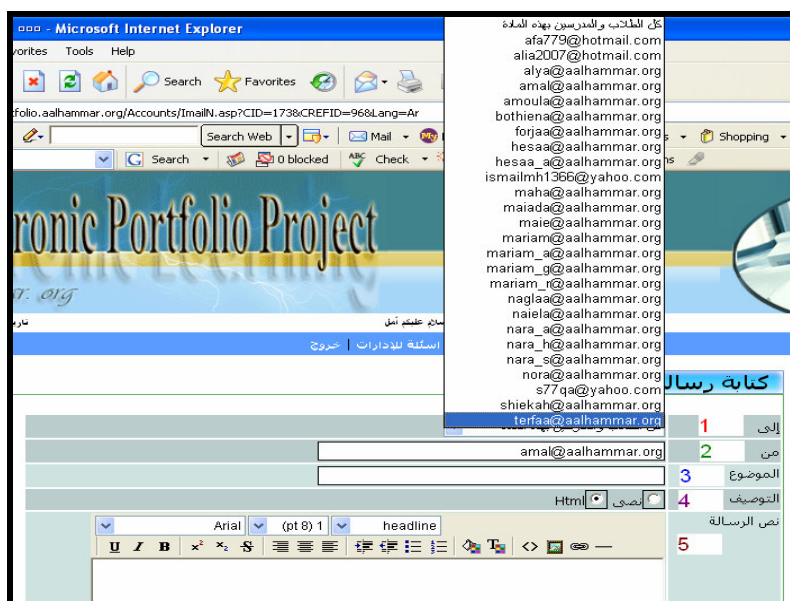


Figure 52. Writing new e-mail

These steps are:

1. Select the person who the instructors wishes to send new e-mail to
2. The e-mail address of the instructor which is inserted from the login in, so this step is ignored
3. Title of the e-mail (topic)
4. Type of the e-mail, if it is only text or html style which gives more rich text by coloring and styling and other features
5. Fill in the e-mail content

Figure 52 also shows two buttons, one to submit and see that the e-mail is sent. The other button is to clear the field if the instructor does not want to send that e-mail.

The last option for the instructor, the tenth, is the course schedule (see Figure 53). This was available in the previous system, however it was embedded within the course button.

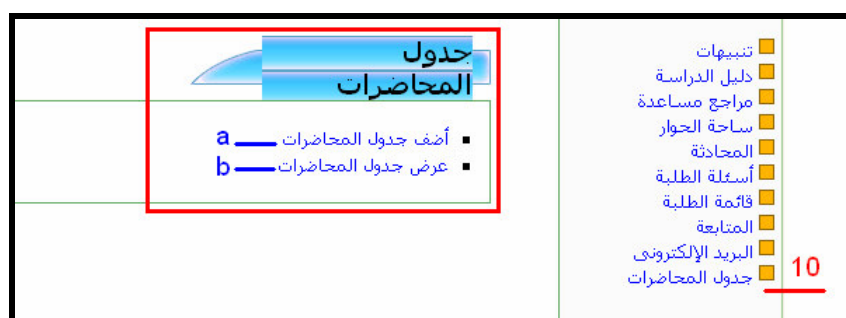


Figure 53. Course schedule, instructor's interface

This option provides instructor to upload easily and simply the course contents. There are two selections as shown in Figure 53:

- a. If the instructor wishes to add/remove/modify information in the course schedule
- b. If instructor only wants to view what the course schedule contains

7.7.3 Students' pages and functionalities

Next, the features for the students are discussed. Many of these are new and were not in the previous system. From the students' comments as

well as the instructors' in the formative evaluation, it was clear that the method of downloading a folder of templates to develop and then uploading via a ftp server takes much effort and time to deal with. The students suggested that if there is a way to save that time and effort and instead invest it in their progress it will be much more effective. Therefore, the researcher redesigned the support system for the students to include bringing the electronic portfolio templates online as fill-in forms so that students can fill them in directly through the support system.

After a student logs in, the students interface is presented, as shown in Figure 54.



Figure 54. Student's main page

As with the instructor, the student can choose among multiple courses if she is enrolled in more than one course that will make use of the Support System.

After clicking on the chosen course the interface shown in Figure 55 appears:



Figure 55. Student's main page per course

This interface is mainly the same as instructor interface, however, there is a reordering of the options. The numbered options are:

1. The announcement page, which presents all announcements that the instructor or assistant instructor has posted to that course
2. Course information, where students view all information about the course such as title, code, credits, description, objectives, policy, and evaluation system (grading)
3. Course instructors' page, which gives more information about who is teaching that course, his/her e-mail, and more if the instructor would like
4. Course technical support, where the student is able to view all the resources that the instructor has made available to help achieve the course requirements (which here includes creating the electronic portfolio)
5. Discussion forum, where students have a fruitful environment to express their ways of thinking and creativity in their specialist areas
6. Online chatting room to communication directly with course instructor as well as peers. The purpose is to provide support and direct help either from peers, the technical support person, or the instructor during the developing of their electronic portfolios
7. Questions to the course instructor from the students and these questions are displayed for every student registered in that course. The purpose is benefiting from these questions for the other participants
8. Feedback, which is also accessible for every participant registered in the course. Also student is able to upload her draft version of her work in order to receive feedback from instructor, assistant instructor, or peers. The researcher believes that sharing ideas and perspectives helps improve professional & academic growth (which is the acquisition of knowledge either new or re-constructed from previous understandings)
9. E-mail system in order to communicate with course instructor, assistant instructor, or peers
10. Course schedule, which represents the timetable during the course

11. Student list, which means access to the students' electronic portfolios. The purpose is observing peers' progression and giving reflection or feedback either face to face during the sessions, or during online chatting and feedback

Option 4 is the link to the area of the system in which the students create their electronic portfolios online. In the following paragraphs, the new version of the tools for developing the students' electronic portfolio contents is described.

Figure 56 presents the main elements of the interface of the main template of the electronic portfolio development tool that appears when Option 4 is chosen.



Figure 56. Student's electronic portfolio development interface

The elements linked to the navigation frame of the student's portfolio include five that are links to templates for the portfolio pages and one that is a support link. These are:

- Welcome page: The pre-service teacher fills in her goals for the portfolio, contents of portfolio, and overall reflection.
- Resume: The pre-service teacher provides general information about herself, such as: name, e-mail, education, experiences, training courses followed, and so on.
- Course requirements: The pre-service teacher relates each of the course projects to the course objectives, provide evidence that she

- **Course requirements:** This page contains all the course requirements in one page (see Figure 58) rather than in separate pages as was the case in the previous templates for the portfolio.

مشروع الورد
مقدمة:

الإنسان والملابس هو موضوع مشروع الورد، حيث أُنجزت منشور تربوي يستعرض فوائد الملابس للإنسان، وأنواع الملابس التي يحتاج إليها الإنسان وتنوعها، وكذلك أهمية العناية بنظافة وترتيب الملابس- كما تتطرق الوحدة إلى مصادر الحصول على الخيوط التي تصنع منها ملابس (سواء كانت من أصل حيواني أو نباتي) مع الإشارة إلى كيفية صنع خيوط القماش وكذلك نسج الخيوط إلى قماش بالإضافة أيضاً إلى عملية صنع الملابس.

جمهور المستفيد:

معلمين ومعلمات رياض الأطفال - المرحلة الابتدائية

الهدف من إنتاجه:

يُكمن الهدف من إنجاز هذا المشروع الإلمام بالآتي:

- 1- إتقان استخدام برامج الورد في المجال التربوي
- 2- اكتساب مهارة التنسيق المستند
- 3- كيفية تطوير التكنولوجيا في العملية التعليمية والمنهج
- 4- استخدام معايير تصميم الموقف التعليمي

التأمل والتفكير:

بعد استخدام برامج الورد والدراسة بمصيراته المختلفة، استطع أن أقوم بالآتي:

- إنشاء خطة درس

Figure 58. Course requirements.

For each project specific information has to be included. This information is: introduction about the work, audiences, purpose of the project according to the course objectives, and reflection on what she has acquired from creating this project.

- **Educational philosophy:** Figure 59 shows the page of the portfolio that presents the student's educational philosophy.

العلسفة التربوية

فلسفتي التربوية

تحرير الفلسفة التربوية

تتمتع فلسفتي التربوية على فكرة "نحن ندرس بما نحن نفعل وليس بما نقول"، لذا كترتوية أرى أن الفكر الانتقائي في تسهيل التعلم هو من أفضل طرق التعلم في العملية التعليمية، وأقصد بالفكر الانتقائي هو الأخطي بمعنى "التنقل بين المعلومات المعروضة وجعلها اختيارية على حسب رغبة كل متعلم" لأنني أؤمن بأنه التربوي الجيد المؤثر هو من يوفر، يسهل، ويشرف على العملية التعليمية ويترك حرية التعلم للمتعلمين.

فلسفتي الرئيسية تكمن بأن جميع المتعلمين يستطيعون التعلم ولكن على بطرق وسرعات مختلفة اعتماداً على الفروق الفردية فيما بينهم، لذا التربوي الجيد يجب أن ينوع من طرق تدريسه حتى يضمن توافر الفرص للجميع في التعلم.

اختلف الآن دور المتعلم والمعلم، حيث أصبح المعلم هو الموجه فقط، أما المتعلم فهو المسؤول الأول والأخير عن تعلمه، وساعد على ذلك التطور السريع في العصر وانتشار التكنولوجيا في جميع مجال حياتنا المختلفة الذي أثر بشكل إيجابي وجعل عملية التعليم مستمرة وممتدة إلا ما بعد الحياة الأكاديمية. وكترتوية، يجب أن أراعي أن البيئة الاجتماعية لها أثر فعال في مستوى وطرق التعلم، وبما أن مجتمعاتنا العربية تعاني من بعض العادات والتقاليد التي تعوق المتعلم من بناء الشخصية المفكرة المستقلة في اتخاذ القرارات والتعبير عن رأي (خاصة بالنسبة للمرأة)، أرى أنه يجب الاستفادة من هذه التكنولوجيا الحديثة والخصوص الحاسوب والإنترنت في مواجهة هذه الصعوبات (العزل، التردد وغيرها). نجد الآن أن باستخدام الحاسوب والإنترنت قد ساهم وبشكل مباشر وفعال في تجاوز هذه المعوقات عن طريق توفير وسائل اتصال متعددة تمنح الاتصال المباشر ما بين الجنسين ولكنه لا يمكن من التواصل فيما بينهم في مجال التعلم والحوار مما يمكن من بناء الشخصية المستقلة المعبرة عن آراءها دون الشعور بالخوف من الشخص المقابل أو غيره، مثال على هذه الاستخدامات الآتي: البريد الإلكتروني، ساحات الحوار والمناقشة، غرف التحدث المباشرة وغيرها، لذا أرى أن التربوي الجيد هو من ينوع في وسائل الاتصال المستخدمة أثناء مقرره بالإضافة متابعة ما هو مستجد في مجال تخصصي سواءً من جهة أكاديمية (ظهور نظريات جديدة) أو على مستوى المهني (الوسائل والبرامج المستجدة حديثاً في مجال التخصص).

Figure 59. Educational philosophy

The purpose of this is reflecting the student's understanding of her specialism in her own way and own words (the template shown in Figure 59 is already filled in). Students reflect their theoretical understanding to practice by describing how they will implement it in real situations, the variation of their teaching styles, and other perspectives. .

- **Experiences:** Figure 60 shows the page where students can upload examples from other courses that relate to the objectives in this course, and reflect upon their progress from course to course.

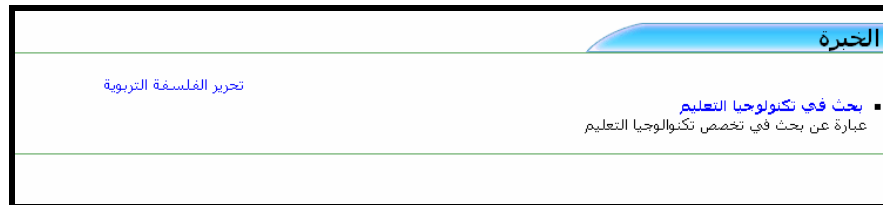


Figure 60. Experiences page

To upload their work in their electronic portfolios, there are hyperlinks on each of the pages for adding/removing/modifying any of these elements. To edit any of the pages, the student has to click on the edit hyperlink on that page. It will open another window. Figure 61 presents the general features available in the editing page for each template of the electronic portfolio.

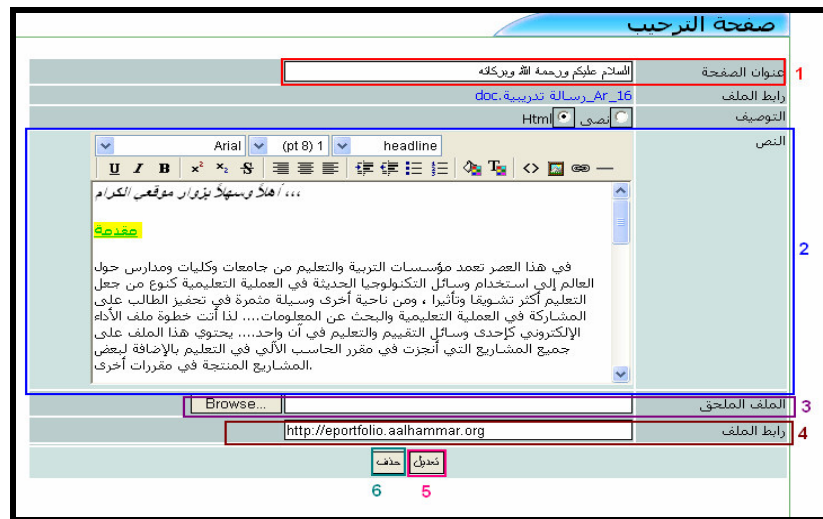


Figure 61. Editing page for the electronic portfolio contents

These editing features are:

1. Title field, which gives the title of the page.
2. The contents window which she can either copy and paste in this section or go for Choice #3.
3. Uploading file from the computer, CD-ROM, floppy, or any type of storage system. Students can benefit from this feature if they already have created files by using any application software. They can upload it directly to the electronic portfolio page.
4. If students have a web-page they would like to upload, they can write the URL address, so it will appear as a hyperlink.
5. If students decide that there is additional information they wish to have in this item, by pressing on button add/modify all information will be added or modified.
6. However, if students want to back away from the operation, they can press on the Delete button to delete the information.

The revised Electronic Portfolio Support System can be accessed at the URL: <http://eportfolio.aalhammar.org/> but requires a password.

With the electronic Portfolio Support System redesigned, the next investigation could begin. The following chapter presents the 3rd investigation which involved an experiment conducted in two different geographical contexts with two different development procedures for the electronic portfolio.

8 3rd Investigation: Comparing three portfolio contexts in two locations

This chapter deals with an experiment whose purpose was to continue to explore the effectiveness of using electronic portfolios in pre-service teacher education in the Gulf Region. As in the 2nd Investigation (Chapter 7), the outcomes or dependent variables relate to academic and professional growth, including this time a comparison of groups on electronic portfolios produced. As an extension of the 2nd Investigation, the independent variable of Portfolio Context will have a third value, representing a medium-rich Portfolio Context. In this medium-rich setting, students develop an electronic portfolio but without the support of the Electronic Portfolio Support System. As a further extension of the investigation, the studies will be carried out in two different higher education institutions, in two different Gulf Region countries. Section 8.1 describes the setting for the 3rd Investigation, Section 8.2 gives the research methodology, and Section 8.3 reports results relating to comparing the three levels of the Portfolio Context variable. Section 8.4 compares the electronic portfolios made by students in two levels of the Portfolio Context variable, both of whom created electronic portfolios but only one of which used the Electronic Portfolio Support System. Finally Section 8.5 summarizes the investigation.

8.1 Setting for the 3rd Investigation

In this section, the setting for the 3rd Investigation is described including the institutions and courses in which the investigation took place (Section 8.1.1). The way in which three “Portfolio Context” groups were defined and formed (Level 1, the least rich, with only a paper portfolio and no electronic support system; Level 2, the medium rich, with an electronic portfolio but no use of an electronic support system; and Level 3, the most-rich, with an electronic portfolio and the use of the Electronic Portfolio Support System) is given in Section 8.1.2. Section 8.1.3 describes the procedures that students in each of these groups followed. The research questions addressed in this chapter are:

- a What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio without the use of the Electronic Portfolio Support System compared to

when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?

b. What are differences in the level of understanding and quality of production of electronic portfolios by pre-service teachers when the Electronic Portfolio Support System is used compared to when it is not used?

The hypotheses related to these questions are that:

$L1 < L2 < L3$, with regard to professional and academic growth

$L2 < L3$, with regard to the quality of the electronic portfolios developed as well as understanding and attitudes related to electronic portfolios

8.1.1 Institutions, courses, and students

The 3rd Investigation took place in the first half of 2005 in two locations in the Gulf Region. One location was the College of Education at Kuwait University and the other location was Qatar University. The reason for adding these two locations was to increase the number of students and instructors involved in the experiment and also to observe if there were implementation differences in the two locations with respect to the electronic portfolio and the use of the Electronic Portfolio Support System. Both institutions run a course called “Computers in Education” with the same objectives as the course at the PAAET (with a different name) that was studied in the 2nd Investigation (see Table 37). Thus the same academic-growth objectives, professional-growth objectives, and technology-related objectives that combine both academic and professional growth are present in the courses that form the implementation settings for the 3rd Investigation. To review from Section 7.1.1, these categories of course objectives are:

- Academic growth
 - Develop critical thinking about instruction
 - Demonstrate knowledge and skills with educational technology
 - Create and maintain positive learning environments
 - Gain insight into instructional planning
- Professional growth
 - Learn from and with peers
 - Strengthen communication skills

- Both Academic and Professional growth
 - Use technology to support instruction
 - Gain insight into the roles of teachers

Both courses are required for pre-service teachers at two institutions. They run for 14 weeks, with three hours of face-to-face sessions per week. The general plan for the courses and their learning activities is generally the same as for the course described in Section 7.1.1, except that the specifics of the technology and communication skills practica and the course projects are different. These are listed in italics below to contrast them with the rest of the components that remain the same as in the 2nd Investigation.

- Participate in technology and communications skills lab practica, including
 - How to operate computer
 - *How to search & navigate on the Internet.*
 - *How to create e-mail and send a message.*
- Perform satisfactorily on practical exams on using Word, Paint, and PowerPoint.
- Develop three final projects
 - *Creating an examination (in their major) by using Word*
 - *Creating a class sheet (how a teacher can manage her class electronically) by using Excel*
 - Creating a plan for a learning environment (a lesson plan) by using PowerPoint
- Combine the results of these projects into a portfolio by the end of the course.
- Perform satisfactorily on subject matter-oriented midterm and final exams as well as practical exams in Word, Excel, and PowerPoint

The results of the three final products are worth 70% of the final grade in the course; the portfolio presentation is worth an additional 10%, and the subject-matter oriented exams are worth the remaining 20% of the final grade. A final mark of an A is 90% or better, a B is 78-89%, a C is 60-77%, a D is 50-59%, and below 50% is a fail.

The participants in the courses were a total of 283 pre-service teachers in the two institutions. The students had different academic majors and were at the third year of their study. The academic majors were Islamic Education (13 students), Arabic Language (68 students), Science/Mathematics (24 students), Mathematics (17 students), Chemistry (19 students), Geography (4 students), History (3 students), Fine Art in Education (24 students), Physical Education and Sport (19 students), Kindergarten (49 students), Physics (10 students), Biology (13 students), Social Studies (4 students), and English Language (14 students). Students could choose to develop their lessons and media products around a topic of their choice in their academic majors.

8.1.2 *Portfolio Context groups*

In this section the three levels of Portfolio Context are described in general terms, followed by a description of how the 283 course participants were placed in one of the Portfolio Context levels.

8.1.2.1 Defining the Portfolio Context groups

As in the 2nd Investigation, two dimensions of “richness” with respect to a portfolio context were considered: the richness of the medium for the portfolio and the richness of support. Richness of support was further described as using or not using the Electronic Portfolio Support System. Combining these two aspects leads to three Portfolio Context levels for the 2^{3rd} Investigation (Table 56).

Table 56. Levels for the independent variable Portfolio Context for the 3rd Investigation

Type of portfolio\Type of support	No use of the Electronic Portfolio Support System	Use of the Electronic Portfolio Support System
Paper based	Level 1: Least-Rich Context	
Electronic	Level 2: Medium-Rich Context	Level 3: Most-Rich Context

In these particular class settings, Level 1 is the typical situation for the courses and thus can be seen as the control setting. Level 2 is a new situation, not part of the 2nd Investigation. Level 3 was part of the 2nd Investigation. Level 2 and Level 3 could be seen as two types of experimental settings.

8.1.2.2 Allocation of students to Portfolio Context groups

The general format of the investigation is an experiment with pre- and post-tests with random assignment to the experimental groups, using the terminology of Campbell and Stanley (1963). To accomplish the random assignments, the students within each of the institutions were invited to subscribe to one of three possible types of groups. They were not aware of the implications of the types of groups. Each individual group was held to about 20 students. In Qatar University, five groups were formed. These were randomly assigned to the three Levels. In Kuwait University nine groups were formed that were also randomly assigned to the three Levels. Table 57 relates the groups to the three levels of the independent variable.

Table 57. Levels for the independent variable Portfolio Context for the 3rd Investigation

Type of portfolio\Type of support	No use of the Electronic Portfolio Support System	Use of the Electronic Portfolio Support System
Paper based	Level 1: Least-Rich Context Qatar-1 group, Kuwait-3 groups; Total= 70 students	
Electronic	Level 2: Medium-Rich Context Qatar-2 groups, Kuwait-2 groups; Total= 87 students	Level 3: Most-Rich Context Qatar-2 groups, Kuwait-4 groups; Total= 126 students

The reason for the division of the nine groups of Kuwaiti students into two in Level 2 and four in Level 3 was because all four of the groups assigned to Level 3 were taught by the same instructor who did not want to teach different versions of the same course. Because of this group-assignment process, it can be argued that a random assignment of students to levels had occurred and thus an experimental comparison between the levels can be made. Although each Level consisted of between 4 and 6 groups, for convenience the terms “Level 1 group”, “Level 2 group”, and “Level 3 group” will be used when speaking about all the students in a particular level.

8.1.3 Procedures for the three Portfolio Context groups

The course activities differed in two respects between the three groups. These respects relate to the medium chosen for the portfolio and also the support given for constructing the portfolio.

As in the 2nd Investigation the Level 1 group was given only the following instructions to create their paper-based portfolios:

“After producing these projects, the pre-service teachers are requested to collect the results of the three course projects in printed handouts and submit the printed copies as well as a floppy disk of the digital versions of these projects in a paper-based portfolio and submit this by the end of the semester for evaluation.”

The Level 2 and Level 3 groups were given the following instructions to create their electronic portfolios:

- Develop an electronic portfolio, which contains a:
 - *Welcoming page*: containing introduction about the portfolio, its intended audiences, the purpose of developing an electronic portfolio, and their reflections.
 - *Resume page*: containing information about the student, such as name, e-mail address, educational level, experiences, technology or other subject certificates, and hobbies.
 - *Course requirement pages*: containing the digital files for the three main course projects as attachments, and in addition, an introduction, statement of intended audience, purpose of this project according to the course objectives, and reflection for each project
 - *Educational philosophy page*: presenting the student's understanding of educational concepts by linking previous theories that they had acquired from previous courses within their specialization with present (from the course) skills and knowledge, and also presenting their teaching, learning, and decision making skills as well.
 - *Experiences page*: (optional) containing documents relating to any previous experiences either in their major or as a technology product that related to education situation in other areas.

The Level 2 groups were also given a folder with the set of html templates for the electronic portfolio from the Electronic Portfolio Support System as well as instructions for how to use the templates. They had to use *FrontPage* to edit the pages and then submitted their completed portfolios to the instructor via an ftp server. The Level 3 groups were given access to the full Electronic Portfolio Support System with all of its support resources, including the tools to chat or discuss electronically about the portfolio-construction process and also the new submit tools for filling in templates online within the system and, when their input was saved, having it directly available to all other students for feedback and peer support.

As I the 2nd Investigation, the researcher had extra interactions with the Level 2 and Level 3 groups compared to the Level 1 group, to help them understand how to use the electronic portfolio template (both levels) and to help the students in Level 3 to use the Electronic Portfolio Support System and to submit their portfolios via the system. The interactions with the researcher for Level 3 are similar to those described in Section 7.1.2 for the More-Rich Portfolio Context group in the 2nd Investigation.

8.2 Research questions and methodology

There were two lines of research during the 3rd Investigation: (a) a comparison between the three Portfolio Context levels in terms of results relating to academic and professional growth and other course results, and (b) a comparison of Level 2 and Level 3 in terms of the quality of the electronic portfolios that they developed as well as other aspects related to the electronic portfolio. In this section each of these lines will be discussed in terms of guiding questions, instruments, and methodology.

8.2.1 *Hypotheses related to the research questions*

The comparison between the three Portfolio Context groups focuses on two hypotheses:

H1: The richer the context for the development of a portfolio by pre-service teachers, the more positive the professional growth outcomes. This can be expressed as **L3 > L2 > L1** for professional growth outcomes.

H2: The richer the context for the development of a portfolio by pre-service teachers, the more positive the academic growth outcomes. This can be expressed as $L3 > L2 > L1$ for academic growth outcomes

The comparison between the two electronic portfolio context groups (Level 2 and Level 3) focuses on the hypothesis:

H3: The richer the context for the development of an electronic portfolio by pre-service teachers, the more positive the results of the portfolio development experience. This can be expressed as $L3 > L2$ for outcomes associated with the portfolios themselves.

8.2.2 Instruments

Table 58 shows the instruments related to the first and second lines of the investigation. Instruments that were not part of the 2nd Investigation are shown in italics, along with an indication of where they have been introduced in Chapter 5.

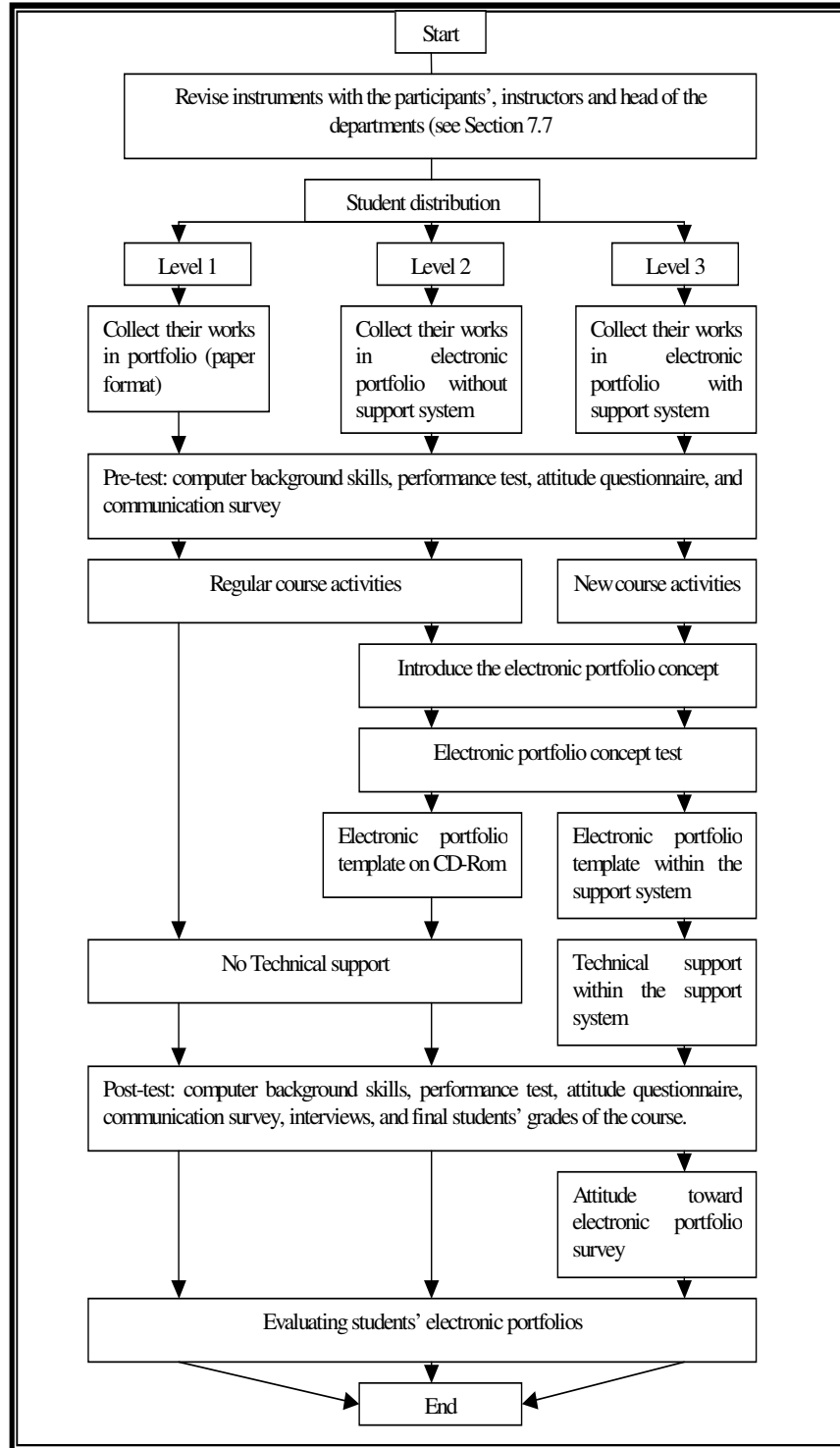
Table 58. Instruments for the 3rd Investigation

Instrument	Purpose
<i>Comparative study:</i>	To compare the three Portfolio Context groups before and after the course
11-item “Computer Background Skills” survey questionnaire	Students’ access to, use of, and skills with common types of IT applications; responses to be compared before and after the course (yes/no or 4-point scale) (relates to both academic and professional growth)
30-item questionnaire, attitudes toward technology and personal orientations related to technology (the “Attitudes toward Professional Growth & Technology”)	Attitudes about personal enjoyment or anxiety relating to technology, about the importance of technology for instruction and for the individual’ career development, and about the use of technology for personal and academic productivity; responses to be compared before and after the course (5-point scale)) (relates to professional growth)
<i>10-item “Communication Skills” survey (see Section 5.4.10 and Appendix 3)</i>	<i>Opinions about the type of electronic communication that best impacts different types of communication skills (relates to professional growth)</i>

39 items relating to the academic content of the course (the “Performance Test”, see Section 5.4.11 and Appendix 4)	Knowledge of the subject matter of the course, both technical and instructional; multiple choice questions with four responses (relates to academic growth)
Interviews with five students from each Level (see Section 5.4.13)	Opinions about the value of developing a portfolio on their academic and professional growth
Notes from class discussions, other field notes, on-going observations, discussions with instructor	Additional insights relating to implementation of portfolios in instruction) (relates to both academic and professional growth)
Study of the two experimental groups (L2 and L3) concerning the electronic portfolios they created:	To investigate in depth the experience of creating electronic portfolios and the extra benefit of the Electronic Portfolio Support System for electronic portfolio construction
38-item “Electronic Portfolio Concept Test” (closed and open ended, see Section 5.4.12 and Appendix 5)	Students’ opinions about the value and application of the electronic portfolio
10-question electronic portfolio survey (closed- and open ended)	Students’ opinions about the value and application of the electronic portfolio
Portfolio analysis procedure	Procedure for coding the quality of the electronic portfolios
Interviews, students (see Section 5.4.13)	Interviews with five students each of the Level 2 and Level 3 groups
Interviews, instructors (see Section 5.4.13)	Interviews with the six instructors
Notes from class discussions, other field notes, on-going observations; analysis of entries to the online forum and chat, discussions with instructor	Additional insights relating to implementation of electronic portfolios in instruction

8.2.3 *Data-collection methods*

As with the 2nd Investigation, the various research instruments were distributed either at the start of the course or at the end (see Section 7.2.3.). Figure 62 shows the overall methodology of the 2nd Investigation.



62. Overall view of the methodology for the 3rd Investigation.

The week-by week procedures and small variations that occurred between the Qatar and Kuwait locations are shown in Appendix 8. The researcher was present at all face-to-face class sessions of the Level 2 and Level 3 groups in both Qatar and Kuwait.

The next section gives the results of the comparative study of the three Portfolio Context groups.

8.3 Comparing the three Portfolio Contexts

To compare the impact of the two Portfolio contexts on the professional growth of the students relating to technology the background computer access and skills of the students was accessed at the beginning and end of the course. These results are given in Section 8.3.1. A comparison of the attitudes of the students in the two groups on the “Attitudes toward Professional Growth & Technology” is given in Section 8.3.2 and to the “Communication Skills Survey” is given in Section 8.3.3. A comparison of the “Performance Test” results occurs in Section 8.3.4. Interviews with the students are summarized in Section 8.3.5. Overall course grades are compared in Section 8.3.6. Combining the results of all these comparisons, the hypotheses related to the comparison of the Portfolio Contexts are discussed (Section 8.3.7).

8.3.1 Computer background skills

There were eight questions with a “yes” & “no” answers and three items with four-point scale, where the lowest value related to the lowest frequency, 1= Never, 2= Monthly, 3= Weekly, & 4= Daily. As before (Section 7.3), these categories were taken as a linear variable on a scale of 1-4, for convenience of interpretation of comparisons. This section contains the pre & post results of the questionnaire. The calculation of the computer background skills resulted in a Cronbach’s alpha in the pre & post situations of .864, which it indicates satisfactory reliability.

Table 59 combines and compares the responses to the Computer Background Skills questionnaire.

Table 59. Computer Background Skills responses, pre- and post course

No.	Questions	Level 1, Start of course	Level 2, Start of course	Level 3, Start of course	Level 1, end of course	Level 2, end of course	Level 3, end of course
		N=77	N=87	N=126	N=77	N=87	N=126
		% Yes	% Yes	% Yes	% Yes	% Yes	% Yes
3	Do you own a computer at home?	81.8%	89.7%	86.5%	93.5%	94.3 %	94.4%
5	Do you have Internet connection at home?	76.6%	78.2%	72.2%	88.3 %	85.1 %	91.3%
7	Do you have electronic mail (e-mail) account?	11.7%	17.2%	15.1%	100 %	100 %	100 %
9	Do you know how to utilize application software (word processing, spreadsheet, and presentation packages)?	18.2%	26.4%	19 %	100 %	100 %	100 %
10	Do you know how to create, save, and manage files on your computer?	10.4%	17.2%	20.6%	100 %	100 %	100 %
11	Do you know how to download items from the Internet?	7.8%	8 %	19 %	100 %	100 %	100 %
12	Do you know how to up-load items to the course server or your own page?	2.6%	4.6%	11.1%	6.5%	5.7 %	100 %
13	Do you know how to participate in a web chat?	45.5%	47.1%	47.6%	45.5%	47.1 %	100 %
4	How often do you use a computer?	2.00*	1.89*	1.80*	3.40*	3.49*	4.00*
6	How often do you use the Internet?	1.49*	1.66*	1.83*	2.55*	2.94*	4.00*
8	How often do you use your e-mail?	1.18*	1.45*	1.28*	2.40*	2.36*	3.83*

*The categories of 1= Never, 2= Monthly, 3= Weekly, & 4= Daily were taken as a linear variable on a scale of 1-4, for convenience of interpretation of comparisons.

Examining the pre-course percentages shows no meaningful differences between the students in the three levels at the start of the courses on five of the eight questions. On items 10, 11, and 12, the Level 3 students seem to have higher pre-course experience in file management, downloading of items from the Internet, and uploading items to a Web server than the other two levels. Also, the use of the Internet was higher

for the Level 3 group, but in contrast the use of e-mail was highest in frequency for the Level 2 group. Because of these differences between groups on some of the items, a comparison was made to see if there was a systematic difference based on location (Qatar and Kuwait).

In order to see if differences between Kuwait and Qatar influenced these results, all Qatar students were compared with all Kuwaiti students at the start of the courses on the Computer Background Skills instrument. The results are shown in Table 60. For closer investigation, the frequencies in Items 4, 6 and 8 are expressed in tallies and percentages instead of being treated as means on a linear scale of 1-4.

Table 60. Kuwait & Qatar responses to the Computer Background Skills survey, at the start of the courses

survey, at the start of the courses

No.	Question	Kuwait Context - Students' responses N=197		Qatar Context - Students' responses N=93					
		Yes	Yes Percentages	Yes	Yes Percentages				
3	Do you own a computer at home?	174	88,30 %	76	81,70 %				
5	Do you have Internet connection at home?	142	72,10 %	76	81,70 %				
7	Do you have an electronic mail (e-mail) account?	26	13,20 %	17	18,30 %				
9	Do you know how to use common types of application software (word processing, spreadsheet, and presentation packages)?	42	21,30 %	19	20,40 %				
10	Do you know how to create, save, and manage files on your computer?	37	18,80 %	12	12,90 %				
11	Do you know how to download items from the Internet?	30	15,20 %	7	7,50 %				
12	Do you know how to up-load items to the course server or your own page?	20	10,20 %	0	0,00 %				
13	Do you know how to participate in a web chat?	91	46,20 %	45	48,40 %				
No.	Questions	Kuwait - Students' responses (pre-course) N=197				Qatar - Students' responses (pre-course) N=93			
		Never	Monthly	Weekly	Daily	Never	Monthly	Weekly	Daily
4	How often do you use a computer?	79	67	25	26	52	27	9	25
6	How often do you use the	141	12	19	25 (12%)	46	27	13	7 (8%)

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	Internet?								
8	How often do you use your e-mail?	165	8	18	6	80	3	7	3

For the four items in Table 55 (Items 10, 11, and 12 and 6) that showed Level 3 students to have higher results on the pre-course questionnaire compared to the other levels, it can be seen that there is a systematic difference favouring the Kuwaiti students. It seems there is a small group (perhaps 20 out of 197) of Kuwaiti students who are more active computer users in terms of those four items compared to the Qatar students. However, on the other items this difference cannot be seen between the national groups. In contrast, for example, students from Qatar have somewhat more Internet access at home and use personal use of e-mail. However, an analysis of the differences in the items scored as Yes-No in Table 59 overall shows no significant difference in the Qatar and Kuwaiti groups in their computer backgrounds (Wilcoxon signed ranks comparing the “Yes” percentages, $Z = -.840$, $p = .401$). Thus it seems justified to treat the Level 1, Level 2 and Level 3 groups with the Qatar and Kuwaiti students combined, rather than compare within each group for differences between the two locations. However, the initial differences among the Levels in favour of Level 3 on four of the 11 items need to be taken into account when interpreting the results of the 3rd Investigation.

Comparing the changes at the end of the course with the beginning of the course in Table 58 shows that the experience of being in the course has a strong influence on the students’ computer skills regardless of portfolio level. Items 7, 8, 10, and 11 now moved to 100% “Yes” in each of the groups. Also, Items 3 and 5, about computer and Internet access at home, also increased across all levels. However, in the case of Items 12 and 13, it can be seen that Level 3 has had some experiences that the other two levels did not; both of these items relate to Web use skills and Item 13 in particular relates to the professional growth aspect of communication. In terms of the use of a computer (Item 4), all three groups improved but all of the students in Level 3 now use a computer daily, whereas Levels 1 and 2 are also increased but are nearly the same (3.40 and 3.49 each, showing the students to be between Weekly and Daily). With regard to Item 6, the use of the Internet, the Level 3 group all responded Daily, whereas Level 1 and Level 2 students were between Monthly and Weekly. In Item 6, the difference between the Levels at the close of the courses can be seen as $L1 < L2 < L3$. Finally, for Item 8, about the frequency of using e-mail, Level 3 is again higher

than the other two groups, with most of the students in Level 3 now saying Daily, compared to Level 1 and Level 2 which respond between Monthly and Weekly with no particular difference between the groups.

From all this, the growth of skills relating to computer use (mainly professional growth, but also academic growth because of the nature of these courses) can be seen as Level 3 showing substantially more growth than Levels 1 and 2 after the completion of the courses.

8.3.2 Attitudes toward professional growth and technology

The “Attitudes toward professional growth and technology” (Christensen & Knezek, 1998) was completed by all the students at the start of the course and then at the finish of the course. Table 61 shows the pre- and post course scores of the students, compared by Level. All scores are in the range of 1 to 5, where 1 is the least-positive ranking. Negatively worded scores have been transposed. The items are grouped according to the six clusters identified by Christensen and Knezek (1998), as modified for this research.

Table 61. Comparison of scores on Attitudes questionnaire, pre- and post course

N o.	Clusters	Questions	Pre-course scores			Post-course scores		
			M (SD)			M (SD)		
			Leve 1 1 (N=7 7)	Leve 1 2 (N=8 7)	Level 3 (N=1 26)	Level 1 (N=7 7)	Level 2 (N=87)	Level 3 (N=12 6)
1	Enjoyment	I do enjoy doing things on the computer	2.35 (1.20)	2.70 (1.22)	2.25* (1.28)	2.75* (1.26)	3.53** (1.26)	3.95** (1.23)
5		I feel comfortable working with computer	2.13 (1.12)	2.89 (1.29)	2.49 (1.29)	3.25* (1.39)	3.72 (1.32)	3.99* (1.14)
2	Vocational awareness	I do think if I learn how to use computer, I will be able to get a good job	2.45 (1.30)	2.54 (1.21)	2.26 (1.31)	3.05* (1.45)	3.78 (1.28)	3.88* (1.28)
11		If I learn to use technology in my college experiences, eventually I will implement it in my future career	2.45 (1.27)	2.64 (1.24)	2.57 (1.29)	3.09* (1.43)	3.68** (1.19)	4.30** (.97)

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14		I do like to up-date my knowledge concerning application software	2.43 (1.09)	2.62 (1.27)	2.37 (1.21)	3.09* * (1.31)	3.66** (1.23)	4.39** (.95)
15		I like active learning processes	2.64 (1.20)	2.62 (1.30)	2.32 (1.24)	3.26 (1.27)	3.46* (1.28)	4.42* (.95)
17		I believe that I can easily have a job if I have computer skills or not	2.36 (1.11)	2.28 (1.33)	2.49 (1.23)	2.65* * (1.24)	3.39** (1.43)	4.07** 91.18)
26		It is not necessary that I have used technology in my college experiences in order to using technology in my future career	2.49 (1.39)	2.34 (1.24)	2.50 (1.30)	3.18 (1.43)	3.37* (1.37)	4.04* (1.13)
29		I am not interested in updating my knowledge about application software	2.62 (1.34)	2.40 (1.40)	2.57 (1.17)	3.22 (1.37)	3.44* (1.42)	3.94* (1.21)
30		I am ready to be a decision-maker about how to use technology in my career	2.90 (1.17)	2.74 (1.21)	2.67 (1.16)	3.00* * (1.27)	3.54** (1.25)	4.39** (.89)
3	Importance	I believe that computers give me the opportunities to learn many new things	2.70 (1.28)	2.93 (1.33)	2.70 (1.27)	3.19* * (1.32)	3.87** (1.21)	4.29** (.98)
4		As a future educator I think that children enjoy lessons on computer	2.99 (1.26)	3.09 (1.27)	3.21 (1.25)	3.39* (1.13)	3.99 (1.14)	4.29* (.90)
7		I would like to have training on using computers	2.48 (1.08)	2.67 (1.26)	2.78 (1.21)	2.56 (1.19)	2.99* (1.48)	4.21* (.92)
18		I think with computer I will not learn any new thing	3.51 (1.37)	3.15* (1.25)	3.78* (1.30)	3.08* * (1.42)	3.84** (1.07)	4.40** (.82)
19		Using electronic instruction could not attract children's attention	3.60 (1.30)	3.31 (1.32)	3.64 (1.35)	3.13* (1.42)	4.06 (1.03)	4.23* (1.02)
22		I prefer having face to face training	2.69 (1.44)	3.09 (1.35)	2.71 (1.35)	2.56 (1.36)	2.67* (1.41)	3.80* (1.26)
6	Productivity	I prefer to use technology in producing my assignments	2.30* (1.04)	2.56 (1.30)	2.75* (1.17)	2.97* * (1.37)	3.72** (1.22)	4.17** (1.02)
8		I like to be an active learner	2.64 (1.30)	2.55 (1.24)	2.34 (1.27)	3.17* * (1.39)	3.76** (1.15)	4.19** (1.03)
12		I prefer tradition assessment by printed tests	2.52 (1.14)	2.63 (1.10)	2.63 (1.10)	3.08 (1.37)	3.18* (1.35)	3.69* (1.46)

13		I would like to show electronic evidence of my academic and professional growth.	2.92 (1.2 1)	3.15 (1.2 1)	3.24 (1.25)	3.35 (1.27)	3.47* (1.21)	4.10* (1.11)
21		I dislike using technology in producing my assignments	2.81 (1.5 3)	2.55 (1.4 1)	2.43 (1.31)	3.35 (1.40)	3.68* (1.18)	4.03* (1.23)
23		I prefer to be a passive learner	2.75 (1.4 3)	2.62 (1.1 7)	2.70 (1.39)	3.27 (1.42)	3.59* (1.18)	4.11* (.98)
27		I prefer alternative assessment	2.83 (1.2 7)	2.76 (1.2 9)	3.02 (1.27)	2.90* * (1.31)	3.52** (1.32)	3.99** (1.12)
28		I do not like the idea of having my work available electronically for assessment	3.12 (1.3 0)	2.85 (1.3 3)	2.72 (1.34)	3.10* (1.32)	3.61 (1.28)	3.93* (1.15)
9	E-mail	I do like using e-mail for communication about the course	2.42 (1.1 0)	2.79 (1.2 8)	2.64 (1.25)	2.64* * (1.20)	3.39** (1.29)	4.07** (1.10)
10		I believe that using communication tools (e-mail, net chatting) will create more interaction between students enrolled in the course and students with their instructors	2.94 (1.2 0)	2.90 (1.2 2)	2.81 (1.26)	3.05 (1.26)	3.45* (1.34)	4.33* (.86)
24		I think that receiving class information or assignments through e-mail will not be as easy as receiving them as printed material.	2.35 (1.2 3)	2.29 (1.3 6)	2.52 (1.25)	2.44 (1.27)	2.61* (1.23)	3.90* (1.21)
25		I believe that technology rarely makes any interaction between students enrolled in that course or student with their instructor	2.34 (1.3 6)	2.24 (1.3 4)	2.37 (1.31)	2.43* * (1.37)	3.22** (1.39)	3.91** (1.22)
16	Anxiety	Computers intimidate me.	2.68 (1.3 9)	2.36 (1.3 8)	2.34 (1.33)	2.95 (1.42)	3.16* (1.48)	3.87* (1.38)
20		Working with a computer makes me uncomfortable	2.64 (1.4 4)	2.33 (1.2 9)	2.40 (1.31)	3.18 (1.42)	3.34* (1.41)	4.06* (1.23)

**All three means are significantly different from each other, $p < .05$

*One of the means is significantly different from one of the other means

When the three Levels were compared using a series of ANOVA analyses at the start of the course on the 30 questions of the attitude

scale, there were no significant differences between the groups ($p < .05$) for 26 of the 30 items. For the remaining four items where a significant ($p < .05$) F value was found when comparing the three means, no consistent pattern could be found. For Items 5 and 6 (one from the Enjoyment cluster, one from the Productivity cluster), the Level 1 group was one time significantly ($p < .05$) lower than the Level 2 group and the other time significantly lower than the Level 3 group but in each case there was no significant difference between the Level 1 group and the remaining group. For Items 1 and 18 (from the Enjoyment cluster and the Importance cluster), Level 3 was significantly higher than Level 2 but not significantly different than the remaining group (Level 1). Thus we can say that there was no systematic pattern of difference between the groups at the start of the course on the attitude questionnaire.

However, at the close of the course, when the series of ANOVA analyses were again carried out, there were significant differences among the groups on all the questionnaire items, (for each value of the overall F in the ANOVA comparisons, $p < .05$). On 12 of the items, post hoc comparisons of the means showed all three levels to be significantly different from each other, with in every case the pattern $L1 < L2 < L3$. As indicated with a ** in Table 61, these are Items 1, 3, 6, 8, 9, 11, 14, 17, 18, 25, 27, and 30. These items represent each of the six clusters in the Attitude questionnaire, with the exception of the Anxiety cluster. Thus the strong positive difference between the Level 3 group and both Level 2 and 1, and between Level 2 and 1 can be found throughout the clusters. This result supports the hypothesis about the effect of Portfolio Context on professional growth, $L1 < L2 < L3$.

On the other items, all with a significant overall F value ($p < .05$), L3 was always significantly different than one of the other two levels. On 5 of the items (Items 2, 4, 5, 19, and 28) Level 3 was significantly different from Level 1 but not Level 2, suggesting for these items the process of producing an electronic portfolio was what contributed to the difference. On the other 13 items, Level 3 was significantly different from Level 2 but not from Level 1, which suggests that it was the use of the Support System rather than the type of portfolio produced that made the difference.

Taken together, the results of change on the attitude items supports the hypothesis regarding the effect of Portfolio Context on professional growth, $L1 < L2 < L3$. On some (five) items, it is the electronic portfolio compared to the paper version which is most associated with the difference although $L1 < L2 < L3$ in each case. On other (13) items

it is the use of the Support System that is most associated with the difference, although again $L1 < L2 < L3$ on each case.

Per cluster:

- For the two enjoyment items, there are significant differences between all levels, with $L1 < L2 < L3$, showing that using an electronic tool(s) (e-portfolio, support system) yields to stronger positive enjoyment with technology than not using the tool(s).
- For four of the eight vocational awareness items, four reflect the $L1 < L2 < L3$ pattern, while three of the four remaining items reflect the pattern that the addition of the Support System yields to the strongest differences ($L1$ and $L2 < L3$).
- For two of the six importance items, the $L1 < L2 < L3$ pattern is supported, while the other comparisons vary between $L1 < L2$ and $L3$ and $L1$ and $L2 < L3$.
- For the eight productivity items, three reflect the overall $L1 < L2 < L3$ pattern while all but one of the others reflect the pattern that the addition of the Support System yields to the strongest differences ($L1$ and $L2 < L3$).
- Of the four e-mail items two show the overall pattern of $L1 < L2 < L3$ while the other two support the pattern that the addition of the Support System yields to the strongest differences ($L1$ and $L2 < L3$).
- Of the two anxiety items it is the addition of the Support System that relates to the strongest differences ($L1$ and $L2 < L3$).

8.3.3 *Communication Skills survey*

For each of the 10 items on the survey, students had to select one or more correct responses (face to face communication, phone calls, e-mail, discussion forum, and lecture). The desired response was to realize that all communication channels can be used for all types of communication. Thus a response was scored as Poor if only one channel was chosen, Average, if two to four were chosen, and Good if all were chosen. The levels of Poor, Average, and Good were recoded as 1, 2, or 3 and treated as a linear variable for comparisons among the three Portfolio Context groups.

The survey was tested with 10 subjects for reliability. The calculation of the attitude resulted in a Cronbach's alpha in the pre-course survey of .983. The post-course survey was .988, which also indicates satisfactory reliability.

Table 62 compares the pre- and post scores on the Communication Skills survey on the ten items for the three Levels of Portfolio contexts

Table 62. Pre- and post-course scores per Level, on Communication Skills survey

	Item	Pre-course Level 1	Pre-course Level 2	Pre-course Level 3	Post-course Level 1	Pre-course Level 2	Post-course Level 3
		Means with standard deviations in parentheses*					
1	Communicating between instructor and student can be through...how many of the 5 options?	1,09 (0,29)	1,10 (0,31)	1,10 (0,31)	1,35 (0,48)	1,32 (0,47)	2,96 (0,19)
2	Collaborative learning can be achieve through...how many of the 5 options?	1,06 (0,25)	1,10 (0,31)	1,07 (0,26)	1,29 (0,45)	1,37 (0,45)	2,93 (0,26)
3	Communicating with the technical support specialist can be through...how many of the 5 options?	1,10 (0,31)	1,11 (0,32)	1,07 (0,26)	1,31 (0,47)	1,30 (0,46)	2,92 (0,27)
4	What options that available in order to finish a project?how many of the 5 options?	1,09 (0,29)	1,11 (0,32)	1,09 (0,28)	1,30 (0,46)	1,33 (0,47)	2,94 (0,23)
5	To create discussion, reflection, communicating channels with peers, instructors, future employees, and parents can be through...how many of the 5 options?	1,09 (0,29)	1,10 (0,31)	1,07 (0,26)	1,32 (0,47)	1,31 (0,47)	2,94 (0,23)
6	Receiving reflection, opinion, suggesting for your e-portfolio visitor can be through...how many of the 5 options?	1,06 (0,25)	1,15 (0,36)	1,10 (0,31)	1,31 (0,47)	1,32 (0,47)	2,91 (0,28)
7	Keeping up to date with the course changes or news can be through...how many of the 5 options?	1,13 (0,34)	1,14 (0,35)	1,09 (0,28)	1,30 (0,46)	1,34 (0,48)	2,92 (0,27)
8	After graduation and involve in the real situation in school, which of the following communication channels you would like to use...how many of the 5 options?	1,09 (0,29)	1,15 (0,36)	1,10 (0,29)	1,31 (0,47)	1,32 (0,47)	2,94 (0,24)
9	Building communication channel between you and your students, you will use...how many of the 5 options?	1,09 (0,29)	1,15 (0,36)	1,09 (0,28)	1,27 (0,45)	1,31 (0,47)	2,92 (0,27)
10	Discussion forum ?provides learners with.....how many of the 5 options?	1,13 (0,34)	1,15 (0,36)	1,12 (0,33)	1,30 (0,46)	1,33 (0,47)	2,97 (0,18)

*Scores are means, on a scale of 1-3, where 1 is poorest and 3 is strongest.

At the start of the courses, Table 62 shows the knowledge level about communication via the computer was poor in all the groups. The results after the course are impressive in support of the benefits of using the Electronic Portfolio Support System. Whereas Level 1 and Level 2 show only modest improvement in their knowledge levels, Level 3 has moved to a position of strong understanding. Thus in terms of achieving the course objectives relating to knowledge about technology as both academic and professional growth, the use of the Support System leads to a strong difference between Level 3 and the other two groups.

8.3.4 Pre & post performance test results

The 3rd Investigation used the Performance Test (see Section 5.4.11 and Appendix 4) in order to measure students' knowledge gains about technology use after course completion. The test was given pre & post course to the three different levels in order to compare the difference in students' performance gains. Each question was multiple choice, with four options, only one of which was scored as correct. Table 63 compares the pre- and post mean scores of the three portfolio contexts on these items.

Table 63. Performance Test scores, three levels, pre- and post course

	Questions	Pre-course percentage answering correctly			Post-course percentage answering correctly		
		Level 1	Level 2	Level 3	Level 1	Level 2	Level 3
1	Internet is...	84.4%	86.2%	85.7%	93.5%	97.7%	98.4%
2	Internet has lots of benefits such as...	74 %	71.3%	73.8%	97.4%	100 %	100 %
3	Internets' most popular browser is...	16.9%	16.1%	16.7%	87 %	92 %	95.2%
4	The familiar search engines are...	59.7%	59.8%	59.5%	90.9%	96.6%	97.6%
5	Using Arabic characters in e-mail usually can occur in...	55.8%	55.2%	57.1%	93.5%	95.4%	97.6%
6	The Word program is used to...	77.9%	78.2%	77.8%	96.1%	97.7%	98.4%

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7	In Word, the recognized language characters are...	84.4%	85.1%	84.9%	98.7%	98.9%	99.2%
8	In Word, key combination that are used to change between character sets are...	55.8%	56.3%	55.6%	85.7%	92 %	93.7%
9	In Word, the way to save a new document is...	41.6%	42.5%	40.5%	89.6%	90.8%	93.7%
10	In Word, to change the text format (bold, align, underline) ...	22.1%	21.8%	22.2%	92.2%	93.1%	95.2%
11	In Word, to cut, copy, and paste use the	31.2%	29.9%	31.7%	96.1%	92 %	96 %
12	In Word, to add borders and shadow to text ...	42.9%	42.5%	42.9%	85.7%	88.5%	93.7%
13	Excel programs are used for...	66.2%	66.7%	67.5%	89.6%	93.1%	95.2%
14	In Excel, deleting cell's content is done by....	31.2%	31 %	31 %	79.2%	80.5%	94.4%
15	In Excel, cutting a row or column is done by...	19.5%	18.4%	19.8%	74 %	79.3%	93.7%
16	The benefit of using Excel in education is to help instructors in...	61 %	62.1%	61.9%	90.9%	94.3%	95.2%
17	In Excel, to open existing file, use...	20.8%	20.7%	21.4%	84.4%	85.1%	93.7%
18	In Excel, presenting data in graph can be done by....	40.3%	40.2%	40.5%	85.7%	86.2%	94.4%

19	Excel and what other program share the graph feature?	33.8%	33.3%	34.1%	84.4%	88.9%	92.1%
20	In Excel, to delete selected column or rows can be done by....	36.4%	37.9%	38.1%	87 %	89.7%	92.9%
21	PowerPoint programs are used for...	59.7%	59.8%	61.9%	94.8%	95.4%	96 %
22	In PowerPoint, inserting animation schemes between slides can done by...	42.9%	42.5%	42.9%	92.2%	93.1%	95.2%
23	In PowerPoint, inserting a text box in a slide can be done by....	37.7%	36.8%	37.3%	76.6%	83.9%	96 %
24	In PowerPoint, choosing a slide layout can be done by...	9.1%	8 %	8.7%	67.5%	70.1%	88.1%
25	In PowerPoint, inserting custom animation can be through...	20.8%	20.7%	20.6%	66.2%	73.6%	88.7%
26	In PowerPoint, inserting duplicate slide can be through...	13 %	13.8%	13.5%	63.6%	71.3%	83.3%
27	In PowerPoint, inserting Clip Art can be through...	19.5%	19.5%	19.8%	72.7%	82.8%	85.7%
28	PowerPoint can be embedded in a school through...	19.5%	21.8%	19.8%	55.8%	71.3%	79.4%
29	Designing the interface of any programmed instruction involves...	24.7%	24.1%	25.7%	64.9%	89.7%	89.7%

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30	Linear programmed instruction is	18.2%	18.4%	17.5%	49.4%	59.8%	65.1%
31	Non-linear programmed instruction is characterized by...	9.1%	9.2%	9.5%	54.5%	60.9%	79.4%
32	An educational criterion for programmed instruction is...	11.7%	12.6%	12.7%	51.9%	65.5%	88.9%
33	Designing programmed instruction should follow certain guidelines, which are...	15.6%	14.9%	15.1%	46.8%	57.5%	90.5%
34	Designing good programmed instruction with high quality specifications (technically or educational) can be done through...	10.4%	10.3%	10.3%	11.7%	34.5%	84.9%
35	Good programmed instruction have an advantage over other instructional forms because...	3.9%	3.4%	4 %	13 %	10.3%	67.5%
36	Programmed instruction can be categorized as...	24.7%	25.3%	24.6%	36.4%	41.4%	87.3%
37	The main objective of using programmed instruction is...	7.8%	8 %	7.9%	29.9%	40.2%	80.2%

38	Programmed instruction is better than paper instruction when it...	11.7%	11.5%	12.7%	36.4%	46 %	81 %
39	Main feature of computer-based instruction compared to other electronic aids used in education is...	18.2%	17.2%	17.5%	46.8%	69 %	87.3%

The calculation of the reliability of the performance test resulted in a Cronbach's alpha in the pre situation of .591, which is considered low. But in the post situation it was .882, which it indicates satisfactory reliability.

Comparison between the contexts before the courses began was held in order to find any differences between the participants. Based on the results of Mann-Whitney tests ($Z = -.339$, $p = .734$) the three levels of Portfolio Context groups were not significantly different in the pre-course results.

However, there are strong patterns to be seen in the post-course results. First, on all but one of the 39 items, the percentage correct reflects the pattern $L1 < L2 < L3$ even if the actual difference between the levels is too small to be significant. When the difference between one or more of the means is substantial, the following pattern can be seen:

- Eight items (# 23, 26, 30, 32, 34, 37, and 39) where Level 1 is substantially lower than Level 2 which is in turn substantially lower than Level 3. This shows that the process of creating an electronic portfolio brings benefits compared to only a paper version, but that the additional experience of using the Support System adds substantially more.
- Four items (# 27, 28, 29, and 33) where Levels 2 and 3 make substantially more improvement than Level 1, indicating the effect of the electronic portfolio production process.
- Six items (# 24, 25, 31, 35, 36, and 38) where Level 3 has a substantially higher percentage correct than either Level 1 or Level 2, showing the extra effect of using the Support System

As the performance items reflect both academic and professional growth, both of the hypotheses are supported, $L1 < L2 < L3$.

8.3.5 Interviews

Since the experiment involves a large number of participants (pre-service teachers), the researcher had to select just a few to interview and thus interviewed five students of each Level randomly. The choice of those participants began in the beginning of the course with randomly selected names from a names-bowl. The interview procedures were as follows:

- *In the Qatar context:* the researcher had face to face interviews after the final class session for all the sample representing all three Levels.
- *In the Kuwait context:* the researcher had online interviews (using the chatting room within the Electronic Portfolio Support system) with the students in Level 3, but for the rest one instructor from the Kuwait context held those interviews and sent the transcripts electronically to the researcher.

The interview contained 15 questions (see Section 5.4.13), but not all the questions were related directly to the hypotheses. The relevant questions and summaries of answers to those questions follow:

- In your point of view, how do you see the procedures of constructing a portfolio, is it effective method, and can it be considered to be a mechanism to transfer learners from being passive receptors to an active learners?
 - *Level 1:* They don't think that developing a portfolio can affect their learning styles or that it has any other affects on their learning processes.
 - *Level 2 and Level 3:* They think it can definitely affect learning styles and processes. It gives them insight of how to become more professional in their work without being taught. The procedures build up, improve, and enhance their professional growth in managing, and embedding theories in practice and decision making. They value their work more and documenting what they had done before gave it more emphases. They regretted that their previous work that had been discarded.

- Do you think that your technology skills improved while creating your portfolio?
 - *Level 1*: They did not feel that their technology skills improved while they created their (paper) portfolios.
 - *Level 2 and Level 3*: All students agreed that their technology skills improved and were enhanced during their electronic portfolio development.
- Do you think the planning for your electronic portfolio has crystallized your theoretical background and helps transfer it to practice?
 - *Level 1*: They responded that they could not see any links between their theoretical background and the paper portfolio but they can see the link in their projects.
 - *Level 2 and Level 3*: All students agreed that planning for their electronic portfolios enhanced their previous theoretical backgrounds with what they have been learned within the course in order to bring it into practice and to illustrate their progresses.
- One of the course objectives is "Plan an education situation". Do you think planning for your e-portfolio fulfilled this objective?
 - *Level 1*: All students' responses were "No".
 - *Level 2 and Level 3*: All students responses' were "Yes" and referring to what they had said in the previous questions, they all agreed that their electronic portfolios can be considered an educational situation since they developed a presentation of their progress (either professional or academic), and presented it to their peers. Moreover, the process of applying adequate theories in order to prove their understanding can be considered as planning an educational situation as well.
- How has learning with and from your peers affected your perspective to your project (either positively or negatively)?
 - *Level 1*: All students' responded that there were only a few meetings among peers (two times only during the class

sessions) and they did not believe that these interactions affected their perspectives about their projects. Nevertheless, they preferred that more meetings would be held, at least between students, in order to get feedback from each other.

– *Level 2*: All students agreed that there were only two meetings held and these were not enough to share their perspectives in each others' work, and they wished that there was more time to emphasize sharing knowledge.

– *Level 3*: All students were delighted with and excited about these meetings, either with peers, instructors, or the researcher as an assistant, which were mostly held online, beside two times during a face to face session. They believe that exchanging ideas, reflections, and suggestions had strengthened their knowledge and helped them become more confident about their professional abilities, and that they became more polished with those reflections and arguments. They also believed that in the future they will go on with this technique with their students if it is possible to do.

- Do you agree with using the new instructional method (electronic support for learning) which makes you up-date with all the course's events as well as being able to communicate with the course instructor?

– *Level 1, Level 2, and Level 3*: All students' responded that if it is applicable they will do. All of pre-service teachers are willing to keep abreast with the 21st century, and they are hoping to work in schools equipped with all the necessary technology.

- After experiencing electronic support tools during the development of your electronic portfolio, such as e-mail, on-line chatting, on-line technical support, and the electronic discussion forum, do you think it is a good way to achieve professional growth in higher education? (Level 3 only)

– *Level 3*: All students' responded that this was their first time experiencing these electronic communication tools, which were very meaningful tools for:

- Efficiency: learning professional skills related to the course objectives is done faster with the least need of external influences (books, walk-in technical support).
 - Flexibility: in time and place of developing their electronic portfolios
 - Time saving: all required resources are available include online technical support
 - Privacy and freedom: students have a password and username in order to access their electronic portfolios or contact privately the course instructor or assistant (researcher)
- Using a "Feedback" method within the course from your instructor or peers, do you think it is effective way of building your understanding of your portfolio or your projects? Give an example? (Level 3 only)
 - *Level 3:* All students' responded that it was a useful method to gain insight into how others evaluate your work or your understanding. All agreed that it was used in previous courses but not in this way, here they experience the argument techniques in order to convey to the others what they think, which they believe enhances and improves their professional growth.
- Do you prefer using the feedback method within the course daily, weekly, or monthly? (Level 3 only)
 - *Level 3:* Students' responses varied, three responded daily, five responded weekly, and two responded monthly. Depending on the course activities and for more convenience, the weekly responses were the majority.

8.3.6 Final course grades

The final grade in the course represents an overall appraisal of academic growth. Although only 10% of the final mark directly reflected an assessment of the portfolios, the distribution of final marks shows again the $L1 < L2 < L3$ pattern. Table 64 shows the comparison.

Table 64. Final course grades, compared across portfolio levels

Grades	Least-Rich context (N=77)	Medium-Rich Context (N=87)	Most-Rich Context (N=126)
A+:	0	0	8
A: 90-100	3	14	17
A-:	3	10	16
B+: 85-89	15	12	23
B: 80-84	4	18	20
B-:	8	5	7
C+: 75-79	12	11	11
C: 70-74	14	8	7
C-:	5	1	7
D+: 65-69	6	2	2
D: 60-64	4	6	3
D-:	0	0	0
F:	4	0	5

Table 64 shows that:

- Pre-service teachers from Level 3 (the Most-Rich context) have achieved more grades of A+ (8 students) than have those who are in Less-Rich & Medium-Rich context (Levels 1 and 2, 0 students). For A and A+ combined, the results are Level 1: 4%; Level 2: 15%; Level 3: 19%.
- More students from Level 1 (the Less-Rich context, 33 students out of 77, 43%) did poorly in the course (ranked between C to D) than in Level 2 (the Medium-Rich context, 17 students out of 87, 19%) and Level 3 (the Most-Rich context, 24 students out of 126, also 19%).

In general, the results reflect the $L1 < L2 < L3$ pattern although it is the comparison of

$$L1 < (L2 \text{ and } L3)$$

which shows the strongest differences on all but the A+ scores. For the A+ scores, the fact that they only occurred in Level 3 is further support for the benefits of both an electronic portfolio and an accompanying Support System.

8.3.7 *Field notes*

During the 3rd Investigation, the researcher took many field notes relating to the hypotheses, such as the following:

- Pre-service teachers were very excited using new learning strategies, such as the electronic portfolio, and the Electronic Portfolio Support System.
- Pre-service teachers became more involved in their learning processes by suggesting to discuss some topics which been chosen by themselves within their online chatting in order to exchange their ideas and perspectives.
- Pre-service teachers suggested that the better use of electronic portfolio is to start from Year 1 in University in order to really envision their progress as well as prove and document their progress.

8.3.8 *Discussing the hypotheses*

The comparison between the three Portfolio Context groups focused on two hypotheses:

H1: The richer the context for the development of a portfolio by pre-service teachers, the more positive the professional growth outcomes. This can be expressed as $L1 < L2 < L3$ for professional growth outcomes.

H2: The richer the context for the development of a portfolio by pre-service teachers, the more positive the academic growth outcomes. This can be expressed as $L1 < L2 < L3$ for academic growth outcomes

The results support the first hypothesis in a number of ways, such as in terms of the social and communicative aspects of professional growth and all the categories represented in the Attitudes survey (Table 60) such as those relating to the growth in confidence with technology use and the expectation that technology use is important in society and in careers. The interviews also support the hypotheses in terms of professional growth.

The $L1 < L2 < L3$ pattern in growth in academic skills was seen in the Communication skills test, the Performance test and also in the final marks of the courses (Section 8.3.6), although in the case of the final marks the comparison is more substantiated from $L1 <$ than either of the other two groups, rather than for $L2 < L3$.

Thus, overall the hypotheses can be said to be supported. Using an electronic portfolio leads to better growth than not using an electronic portfolio, and in addition, combining the electronic portfolio creation process with the use of a Support System that emphasizes communication and peer support leads to the strongest growth of all.

8.4 Investigating the two electronic portfolio contexts

The results of the comparisons of the groups given in Section 8.3.8 suggest it is valuable to continue to investigate the comparison between the two groups using the electronic portfolio, but differing in having the Support System or not. Thus the next comparison focused only on the Level 2 and Level 3 groups. For these two groups, as indicated in Table 40, Section 8.2.2, there were two additional surveys, two other sets of interviews, and also the comparison of the quality of the portfolios produced. These results are reported in Sections 8.4.1-8.4.5, followed by conclusions in Section 8.4.6

8.4.1 Electronic Portfolio Concept test results

The purpose of the Electronic Portfolio Concept test (see Section 5.4.12 and Appendix 5) was to measure students' understanding of the electronic portfolio concept. The test contained of 38 questions about the definition, objectives, advantages, usage, contents, contents formats, and types of the electronic portfolio concept. Each question was graded as correct or incorrect so the total score will be out of 38. The electronic portfolio concept test was tested with 38 subjects for reliability. The calculation of the test resulted in a Cronbach's $\alpha = .958$, which indicates satisfactory reliability. The test was also given to the Level 1

students, as a control to see how many of the concepts would be common knowledge for all students in the course.

Table 65 presents the students' total scores in their Electronic Portfolio Concept tests.

Table 65. Comparisons of scores on the Electronic Portfolio Concept test

Level	Mean (out of 38)	Std. Deviation
Level 1 (n=77)	11.58	1.92
Level 2 (n=87)	30.99	3.89
Level 3 (n=126)	32.46	3.55

The comparison with Level 1 shows that working some level of understanding about electronic portfolios can occur by only working with a paper portfolio. However, the comparison of interest is that between Level 2 and 3. The difference between those means was statistically significant, $p < .05$, although in practical terms the difference in understanding is not substantial. The differences between Level 2 and Level 3 are likely to relate to the variety of resources about the electronic portfolio concept that were available in the Electronic Portfolio Support System.

8.4.2 *Electronic portfolio survey*

This survey was used in order to explore students' attitudes toward developing electronic portfolios after completion of their portfolios. It included seven of the same survey questions as those used in the 2nd Investigation (Section 5.4.7). The results of this attitude survey are given by question in order to compare the Level 2 and Level 3 groups:

- *Question 1*, which related to the time spent in developing electronic portfolio. The students in Level 3 estimated that the time spent in developing their electronic portfolios was about 6-10 hours. In contrast, the students in Level 2 estimated that the time spent was around 15-40 hours. From this result it can be concluded that the Support System was very helpful in saving time.
- *Question 2*, which was about pre-service teachers feelings' about the emotional affect that the development of their electronic portfolios has had on them, with the choices being a Negative affect (unsatisfied, unpleasant, not proud, sad) or a

Positive affect (satisfy, pleasant, victorious, proud). The difference between the Level 2 and Level 3 groups are striking. Only 16% of the Level 2 group felt that creating the electronic portfolio was a positive experience for them, compared to 91% of the Level 3 group. Clearly the use of the Support System made an important difference.

- *Question 3*, which was about the respondents awareness of reasons for developing electronic portfolios, and the answers were coded as: 1=not aware, 2=aware (two of the following options: compulsory requirement, assessment method, and electronic collecting tool), and 3=very aware (aware if all three of the options compulsory requirement, assessment method, and electronic collecting tool). The result of the question is given in Table 66.

Table 66. Pre-service teachers' response to purposes of the electronic portfolio

Question	Levels	Students' responses		Mean	Std.D	Percent	t	Sig. (2-tailed)
What do you think is the primary purpose for the electronic portfolio that you created?	Level 2 N=87	Not aware	23	2.08	.781	26,4	-5.832	.000
		Aware	34			39,1		
		Very aware	30			34,5		
	Level 3 N=126	Not aware	13	2.66	.659	10,3		
		Aware	17			13,5		
		Very aware	96			76,2		

These data show that the use of the Support System led to a significantly ($p<.01$) higher awareness of the purposes of an electronic portfolio compared to just developing the portfolio.

- *Question 4*, was about the electronic portfolio's use in the respondent's future, and the answers were coded Yes, and No. Here, as with Question 2, the difference between the groups is impressive. While only about a third (37.9%) of the students in Level 2 said they thought they would use an electronic portfolio in the future, almost all (92%) of the students in Level 3 felt this would be the case. Again, the use of the Support System explains the difference.

- *Question 5*, was similar to Question 4 but focused on the use of an electronic portfolio for professional or academic purposes. The answers were coded to: 1= in my career field, 2= in the private field & 3= in both (career and private fields). Table 67 summarizes the results.

Table 67. Use of an electronic portfolio in the future

Question	Levels	Responses		Percent
Where can you use it?	Level 2 N=87	Career field	60	69.0
		Private field	8	9.2
		Both	19	21.8
	Level 3 N=126	Career field	36	28.6
		Private field	4	3.2
		Both	86	68.3

Again, the use of the Support System increased the likelihood of the students' seeing both the academic and professional value of electronic portfolios for them in their future work. This is seen by comparing the 21.8% "Both" and 68.3% "Both" responses for the two groups.

- *Question 6* which deals with the extent to which specific support resources were useful when creating their portfolio. The questions were responded to on five-point scales, where 1= Did not use, 2= Used, but they weren't useful, 3= Somewhat useful, 4= Very useful, and 5= I couldn't complete the portfolio without it. Table 68 presents the responses of students.

Table 68. Responses to the usefulness of types of support (Level 2, N=87, Level 3, N=126)

Type of support	Did not use	Used, but it wasn't useful	Somewhat useful	Very useful	I couldn't have completed the electronic portfolio without it	Mean	Std. D
Laptop: Level 2	20	26	14	27	0	2.55	1.16
Level 3	13	36	37	40	0	2.83	1.00
Handouts: Level 2	4	8	26	49	0	3.38*	.84

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Level 3	0	5	12	34	75	4.42*	.82
Templates: Level 2	3	10	10	12	52	4.15	1.22
Level 3	0	9	11	31	75	4.37	.92
Open lab hours: Level 2	23	33	31	0	0	2.09*	.79
Level 3	24	56	46	0	0	2.17*	.73
Assistant in lab during open lab hours	0	0	0	15	8	4.35	.49
Level 3	0	0	0	0	126	5.00	.00
Class sessions in lab: Level 2	25	62	0	0	0	1.71*	.46
Level 3	0	0	0	0	126	5.00*	.00
One-to-one meeting with instructor: Level 2	10	28	49	0	0	2.45*	.70
Level 3	5	23	34	64	0	3.25*	.89
Electronic tutorials: Level 2	Not applicable						
Level 3	0	0	0	0	126	5.00	.00
Help from friend or relative: Level 2	87	0	0	0	0	1.00*	.00
Level 3	2	124	0	0	0	1.98*	.13

* Signifies a significant difference between the means, using the Mann-Whitney test ($p < .05$)

The significant difference in the means on five of the eight items are all in favour of the Level 3 group. Also, the Level 3 group is unanimous in their positive attitudes toward the value of the electronic tutorials in the Support System. What is noteworthy in the significant differences is that the use of the Support System outside of class sessions also led to a higher appreciation of the value of the class sessions in the labs and of one-on-one interactions with the instructor and of seeking help from friends and colleagues. The Support System stimulates good interpersonal communication even in face-to-face settings.

- *Question 7* deals with the self-evaluation of the pre-service teachers of the technology skills that have been acquired at course completion. These were: Word, PowerPoint, folder management, using a digital camera, using discussion forums, using electronic communication tools, and scanning images with a desktop scanner. The responses were coded as 1= poor, 2=acceptable, 3= good, 4= very good, and 5= excellent. The students in the Level 2 felt their skills were poor on all but one of the seven categories of technology skills while the students in Level 3 were unanimous that their skills were excellent in all seven categories. Again, there is a striking difference between Level 2 and Level 3.

It can be concluded from the survey that there is strong support for the hypothesis $L2 < L3$ in terms of the students' attitudes about the electronic portfolio process and its value in their future careers. This strong difference can be interpreted as relating to the use of the Electronic Portfolio Support System in Level 3.

8.4.3 *Student interviews*

In Section 8.3.5, a comparison of Levels 1, 2, and 3 on a series of interview questions identified several questions in which Level 3 students had given a more positive response than Level 2 students. Differences between the levels was further studied by interviews involving five students of each of the Level 2 and Level 3 groups. These interviews are summarized here. The same interview procedures were used as described in Section 8.3.5.

- In terms of the time factor, do you think that there was enough time to construct your electronic portfolio?

All of the students from the Level 2 group felt there was not enough time and that the stress of completing the electronic portfolio on time was loading too much pressure on the students. In contrast, all of the Level 3 students' responded that there was enough time and they enjoyed the development procedures

- What barriers did you encounter while you were producing your e-portfolio?

The Level 2 students agreed that the limited amount of resources as well as the limited amount of human support affected their work strongly. In contrast, all of the students in Level 3 agreed that they

didn't face major problems and even though they did encounter minor problems, the availability of human support online eliminated those barriers.

In addition, some questions were only asked of the five Level 3 students. These are reported next.

- Do you prefer direct communication (face to face) with the course instructor rather than electronic communication (e-mail or on-line chatting)?

The students said they were very satisfied with electronic communication and they look forward to this sort of learning style for their next courses.

- After you've been using the Support System, do you think this type of system is an effective way to participate in course activities? Or you prefer only the face to face instruction?

All the Level 3 students definitely agreed that the use of a Web-based support system is much better than only face to face instruction and they encourage that this type of learning be more available at higher education throughout the Gulf Region.

- Because of cultural issue, there are various factors that can affect the relation between the course instructor and the student, such as: shyness or confusion on the part of the student. Do you think electronic communication makes you free to express your point of view or asking questions? Describe this?

All students from the Level 3 group definitely agreed with this, and felt that these differences had really appeared in the online chatting and the long electronic discussions between the instructors and his/her students ran smoothly with no complications of cultural customs.

- What do you think about submitting the projects electronically through your e-portfolio, is it saving times and effort instead of waiting until you find the course instructor the whole day?

All the Level 3 students agreed that it was much easier than showing up at the instructor's door. Moreover, the flexibility of the time for submission, enabling students to submit any time from anywhere before the deadline date was a very appreciated action

and represented taking advantage of the technology century with its increased flexibility.

8.4.4 *Instructors' interviews*

The 3rd Investigation involved six instructors, two for each condition (Levels 1, 2 and 3), but the interviews were held only with the instructors of the Level 2 and 3 groups. The interview questions were sent by e-mail, and responses were received from all four instructors. The interview contained eight questions.

1. After experiencing the use of electronic portfolios, do you think it is an effective tool to assess students' progress (academic & professional growth)?

All instructors agreed that it is an effective tool to really track their students' progress (academically & professionally). Moreover, in the practical matter of managing their students' submissions, they thought that an electronic portfolio is an ideal method to receive their students' work on time and in one folder.

2. Do you feel teaching with electronic portfolio, with or without using the Electronic Portfolio Support System, differs from the previous teaching procedures in the "Computer in Education" course?

All instructors agreed, but to different degrees, that is different. Moreover, instructors using the Support System felt that it was exciting and they asked to continue using it.

3. Do you see any different in students' attitudes with this new method in their academic and professional growth?

All instructors agreed that there were differences in students' attitudes; nevertheless, all of them agreed that the nature of this course usually leads to a change in students' attitudes and makes them active. But with use of electronic portfolio with or without the Support System, it makes students very active learners and they became engaged in "student centered learning" which was one of the course objectives that is finally being achieved.

4. Are you willing to use the electronic portfolio and Support System for the next courses?

The instructors who used the Support System confirmed that definitely they will continue to use it, and one of the instructors had already started using it in the summer course and was really satisfied with it. The instructors of Level 2 courses expressed that they will continue to use electronic portfolios. However, the researcher sensed that these two instructors are not that much willing to do so, which may refer to the absence of the Electronic Portfolio Support System.

5. To what extent do you think the criteria for evaluating students' electronic portfolios are useful?

All instructors agreed that they are useful and referred to the time saving in not having to figuring out which criteria to use in their evaluations. Moreover, to guarantee the fairness between the students with different instructors, they consider the criteria to be authentic evaluation criteria which could be considered as a standardize tool in the College of Education.

6. Do you consider the electronic portfolio to be an authentic assessment tool?

All instructors definitely agreed.

7. How important is it to provide performance support for the students during the course generally, and for the electronic portfolio specifically?

All instructors definitely agreed that this is important and particularly noticed the effectiveness of the Electronic Portfolio Support System on the Level 3 students. Also they mentioned that the approach of using an electronic support system will be demanded by the students and thus the instructors are working to make it possible in the near future.

8. Are you willing to use the Electronic Portfolio Support System in your next courses?

All instructors definitely agreed that they will if it is available; one instructor already started using it the following summer (2005) and another asked for it for the next semester (Fall 2005/2006).

8.4.5 *Students' electronic portfolios*

After the completion of the electronic portfolios, these electronic portfolios were evaluated using a procedure based on the approach of Lopez Fernández (2003) described in Section 5.4.8 and also used in the 2nd Investigation, described in Section 7.4.5. The maximum score is 10 (see Table 51).

The mean score for the Level 2 group was 5.08 (SD=.23). The mean score for the Level 3 group was 8.62 (SD=2.85). The difference between these means is significant, ($Z = -9.491$, $p < .00$). Thus the use of the Support System led to stronger results on the final portfolios themselves. However, the standard deviation shows a wider variation among the students in Level 3 than is the case with Level 2. Appendix 9 shows an example of a portfolio created by a Level 3 student.

8.4.6 *Conclusions of the comparison of Level 2 and Level 3*

The hypothesis guiding this comparison is the $L2 < L3$. This hypothesis was supported in all of the comparisons. It was particularly strong in the responses to the Electronic Portfolio Survey (Section 8.4.2), the results of the student interviews (Section 8.4.3), and in the differences in the final marks given to the electronic portfolios produced by the students (Section 8.4.5). The desire of all the instructors who had used the Support System to continue with it is also indirect support for the hypothesis that creating electronic portfolios with the use of the Electronic Portfolio Support System is more effective than creating electronic portfolios without it.

8.5 **Conclusions of the 3rd Investigation**

The 2nd Investigation had two lines of inquiry; comparing all three Portfolio Context groups on academic and professional growth, and comparing the Level 2 and Level 3 groups on specific results relating to their electronic portfolios and its development process.

The comparison between the three Portfolio Context groups focused on two hypotheses:

H1: The richer the context for the development of a portfolio by pre-service teachers, the more positive the professional growth outcomes. This can be expressed as $L3 < L2 < L1$ for professional growth outcomes.

H2: The richer the context for the development of a portfolio by pre-service teachers, the more positive the academic growth outcomes. This can be expressed as $L3 < L2 < L1$ for academic growth outcomes

Both of these were confirmed by the various sets of results.

The comparison between the two electronic portfolio context groups (Level 2 and Level 3) focused on the hypothesis:

H3: The richer the context for the development of an electronic portfolio by pre-service teachers, the more positive the results of the portfolio development experience. This can be expressed as $L3 < L2$ for outcomes associated with the portfolios themselves.

This hypothesis was also supported by the various sets of results.

Given these results, the dissertation concludes in the next chapter with a final reflection.

9 Conclusion and recommendations

Portfolios have been used in teacher education programs for many years within different higher education settings worldwide. Similarly, the use of the Internet and Web-based tools and support systems has been introduced as well in higher education settings, making the education systems more globalized and creating shareable platforms for new forms of peer collaboration and instructor-student communication. In this dissertation, a combination of these two elements (portfolio and the Internet) has been used to help teacher education programs in the Gulf Region to solve their deficiencies in teaching and learning. The overall research questions were formulated as “(a) *In what ways can the use of an electronic portfolio lead to a more productive teaching and learning environment in higher education in the Gulf region, and (b) Under what conditions can the use of the electronic portfolio be strengthened given the context of higher education in the Gulf Region?*” Based upon these two questions and in order to answer them, three different sets of sub-research questions (*Conceptual, Design and investigation, and Recommendations*) were addressed. In this final chapter of the dissertation, conclusions related to the first and second sets of research questions are presented in Section 9.1. The third set of research questions are addressed in the following sections of this chapter. Based on the three research investigations, recommendations for pre-service education in the Gulf Region in relation to the implementation of electronic portfolios are presented in Section 9.2. Finally, in Section 9.3, general recommendations beyond the specific context of the Gulf Region for further research about electronic portfolios are made.

9.1 Conclusions related to the research questions

In this research it was argued that developing electronic portfolios improves pre-service teachers’ academic and professional growth. It was argued, based on learning theories, particularly constructivism and cognitive flexibility theory, that the development of electronic portfolios helps pre-service teachers (as learners) deepen their knowledge and skills relating to their profession as well as strengthen their reflection skills, and technology skills. Moreover, it was argued that successful implementation of electronic portfolio is based on many factors which are connected to each other. These arguments are discussed in terms of the conception research questions in Sections 9.1.1- 9.1.3. Following this, the results of the research questions relating to design and investigations in practice are discussed in Sections 9.1.4- 9.1.6.

9.1.1 Electronic portfolio (definition, characteristics, goals and general ways of use, particular use in teacher education)

In this research, the definition of electronic portfolio, goals, ways of use, and specific use in teacher education were answered from literature review to address the first conceptual research question and its associated sub-questions:

What is an electronic portfolio?

- What are possible components of an electronic portfolio and of an electronic support system to help students and instructors in the processes of using an electronic portfolio?
- What are goals and ways of using an electronic portfolio in higher education and in particular in pre-service teacher education?
- What learning theories can underlie the use of electronic portfolios and in particular how to these relate to the use of electronic portfolios for pre-service teacher education?

It was concluded from the literature that the definition of an electronic portfolio depends on the objectives (goals) of developing the electronic portfolio; however, a common definition is that it is a purposeful collection of learner artefacts which reflect his/her progress during learning processes. A distinction was made between the functionalities available in an electronic portfolio compared to a paper-based portfolio. From the perspectives of portability, storage space available, linking and grouping to strengthen deep learning, publishing tools to allow access to different sorts of audiences at different times, and of professional growth with regard to technology use and communication, electronic portfolios have many advantages compared to paper portfolios. However, the disadvantages may be hard to overcome because they relate to the difficulties involved with implementing technology for changes in teaching and learning. An analysis was made of possible components of electronic portfolios. This analysis made it clear that many types of electronic tools and resources to assist both students and teachers in the portfolio process are also needed beyond only the tools for creating a portfolio. The idea of a Web-based electronic portfolio support system was established, as a broader resource for both instructors and students. Such a support system would help integrate the portfolio processes with overall course processes and activities, provide extra resources for both the course and the portfolio

processes, and provide tools for communication, support, and collaboration (for example, peer review) during the portfolio development and publication processes. The system requires different tools and interfaces for the instructors than for the students, as the instructors must be responsible for filling the system with resources, communicating with students via the system, and using the system for feedback and assessment. For this research, the development of such a support system, with tools for both students and instructors, was taken as an important task.

Concerning the ways of using electronic portfolio in higher education in general, it was concluded that electronic portfolio have been mainly used for assessment, as tools for learning activities, or for presentation (showcase) to others, particularly prospective employers. Most often portfolios have been used as assessment tools. But with the additional functionalities available with electronic portfolios an increasing amount of focus is being put on their use also as a learning tool. The idea of the electronic portfolio as a 'deep learning pot' was presented. Specifically, for pre-service teacher education, it was noticed from the literature that the use of portfolio has been common for many years but now has a new emphasis in teacher education programs worldwide in relation to authentic assessment as well as learning. The added dimensions of gaining important technology handling skills while developing and maintaining the portfolio as well as using the portfolios are focuses for online peer discussion and review are stimulating this renewed attention.

Perspectives from learning theories that can underlie the productive use of electronic portfolios, particularly for learning, were discussed with particular attention to constructivism, cognitive flexibility theory (with relation to hyperlinking and grouping of artefacts) and collaborative learning. These perspectives stimulate a learning-oriented set of goals for developing electronic portfolios beyond presenting learner progression within a period of time and increasing technological skills, such as personal construction of knowledge and skills, increased reflective ability, better ability to connect prior knowledge with new knowledge, making use of a new form of mental workspace, engagement in authentic activities where cooperation is promoted over competition, engagement in disciplined inquiry, and becoming familiar with a new assessment method.

Following these conclusions relating to the first set of research questions, the following definition of electronic portfolios was taken for this research:

A purposeful collection of pre-service teachers' artifacts (work) hyperlinked in an electronic environment which includes reflections on their progress (academically and professionally), to accomplish course or program objectives/standards as well as document their growth.

9.1.2 Course design to integrate professional and academic growth and electronic portfolios

The second conceptual research question and its associated sub-questions are:

In what ways can an electronic portfolio contribute to pre-service teachers' professional and academic growth?

- What is academic growth?
- What is professional growth?
- What is the role of an electronic portfolio in pre-service teachers' professional and academic growth?
- What are considerations for course design in pre-service teacher education so that professional and academic growth are stimulated and integrated with electronic portfolio use?

Academic growth relates to the results of learning processes to achieve new knowledge or information in order to attain standards. Academic growth in a course in pre-service education relates specifically to the material to be learned in the course. For example, in courses in pre-service education relating to educational technology and its role in lesson planning in the Gulf Region, objectives for academic growth include developing critical thinking about instruction, demonstrate knowledge and skills with the use of educational technology, plan lessons that will create and maintain positive learning environments for their own eventual students, gain insight into instructional planning, and gain insight into the roles of teachers. Professional growth (sometimes called professional development or professional progress) is important for professionals in any field. Standards for professional growth in pre-service teachers can be defined in many ways. Examples of course objective related to professional growth in pre-service education include learning from and with peers, collaborative learning, strengthening communication skills, using technology to support instruction, and gaining insight into the roles of teachers. Some objectives can also be listed as academic growth (use technology and roles of teachers) in certain pre-service teacher education courses. That is because in pre-

service courses, sometimes the knowledge to be acquired in the course itself (i.e., for academic growth) is also the sort of knowledge needed for on-going professional growth within and beyond the course. In other words, the content of some pre-service teacher education courses is also the basis for their on-going professional growth within and beyond the course.

Evidence from the literature shows that portfolio development can contribute to professional and academic growth either through the overall processes (collect, select, link, reflect, and present) as well as the development of individual items for the electronic portfolio (decide, design, develop, and implement 'for evaluation purpose'). Miller's Pyramid of Competence (1990), which consists of four levels, can be applied to portfolio development. Three of the levels represent competence development (knows course objectives and how to present them, knows how to develop artefacts that reflect understanding for course objectives, and shows how these are related to the course objectives by writing rationale statements to reflect that understanding). The fourth level of the pyramid, which is the optimal level, is performance (does it reflect the course objectives?), which relates to the overall quality of the portfolio itself.

The constructivist approach to electronic portfolio development with its focus on professional as well as academic approach requires a review of overall course design. The course in which portfolio development occurs must be designed to include continuous follow up activities such as: discussion, the exchange of knowledge and information, collaborations among students and feedback. The course in which portfolio use occurs should therefore include:

- A constructivist environment for building knowledge and experiences
- A collaborative environment for students to exchange ideas and perspectives to build their communication skills as well their professionalism
- A flexible environment that provides freedom in place and time to gain their knowledge as well as getting support
- A support environment to facilitate help during the development of course assignments or the electronic portfolio itself.

From these, a general model for a productive course environment involving electronic portfolios for professional and academic growth

was presented. In this model, the word “environment” refers to the overall course design, not just the electronic environments that may be used within that design. This model for course design was realized in the investigations reported in Chapters 7 and 8.

9.1.3 Key factors of implementing electronic portfolios in pre-service education

The research questions relating to the conceptual aspects of implementation were:

What are key factors for implementing an electronic portfolio in higher education?

- What are key factors at the organization, curriculum, instructor and student levels that affect the change process when introducing new technologies and teaching methods?
- What are specific recommendations to improve the likelihood of successful implementation of electronic portfolios in pre-service teacher education?
- What should be taken into consideration in the design of a Web-based support system to accompany portfolio use to increase the likelihood of use of the system in practice?

Change processes within educational organizations--college, faculty, or department--pass through stages which are initiation, implementation, and institutionalisation. Change processes within a specific course involve the initiation and implementation stages, which can lead to institutionalisation if the implementation can be scaled up to change processes within the department, faculty, college, or even entire organisation. Many factors have been found that influence the change process when technology supports new course design, such will be the case when integrating electronic portfolios within a redesigned course in pre-service teacher education. Al-Najjar (2002), for example, identified a set relating to conditions, acceptance, and ways of application for the PAAET context in a previous study.

The 4-E Model (Collis, Peter, & Pals, 2001; Collis & Moonen, 2001) is a generic model for predicting the likelihood of individuals in an educational setting making use of a new technological instrument. The factors to predict this likelihood are (a) Environment (the institutional context), balanced against the individual's perception of the (b) Educational effectiveness (perceived or expected) and (c) Ease of use as well as his or her own level of (d) Engagement (the potential adopter's

personal response to technology and to change). Instructors are frequently the key actors in this decision making at the course level, but department and institutional decision makers also become involved, because the technology requires infrastructure and support beyond an individual course.

Combining the factors identified in the literature, specific factors applicable to the integration of electronic portfolios within a pre-service teacher education were identified. These involve a number of factors relating to the technology itself, some of which are general, such as the accessibility of the hardware and software and upload and download speeds. Others are specific to electronic portfolios, such as the storage space available, the security for different levels of access, and the tools available for adding reflections and hyperlinking. Gathercoal, Love, Bryde, and McKean (2002) reported on 12 critical success factors that “must to present and active in order to implement a webfolio system” (p. 34). A webfolio is a Web-based system to support electronic portfolio development. These and other observations suggest the success factors for electronic portfolio implementation within a pre-service teacher education course can be clustered into four major groups: support, culture, infrastructure and planning. An elaboration of these four clusters was given in Section 4.2, Table 21. Instructor and learner acceptance is the key element of the change processes involving electronic portfolios; these actors particularly need support, which can be partly supplied by an Web-based support system to facilitate technical support, help knowledge and skill development via provision of resources, and provide tools for communication and social interaction in order to integrate the electronic portfolio within a course.

Two major perspectives relating to the implementation of a Web-based support system for learning are the functionalities of the system and the usability of the system (Neilson & Levy, 1994). By functionalities is meant that the system provides what the users want and need. By usability is meant that the system is easy to use, consistent, and attractive to the users. Criteria for the formative evaluation of a Web-based support system based on its functionality and usability were identified.

Together this conceptual analysis led to the identification of key features for the Web-based support system as well as for the electronic portfolios themselves that were likely to lead both to academic and professional growth as well as successful implementation.

Following these conceptual analyses, the research moved to a set of design and implementation studies in specific pre-service education courses in the Gulf Region. The results of the research questions that were the focus of those investigations follows.

9.1.4 1st Investigation: Design and formative evaluation of the Electronic Portfolio Support System

Two sets of research questions were addressed in the 1st Investigation. These were:

What are the requirements for the design of tools to support the use of electronic portfolios in the context of pre-service teacher education in the Gulf Region?

- What are the components of the electronic portfolio itself?
- What are the components of a support system to help students in the development of their electronic portfolios?
- What functionalities are needed for students in the support system?
- What functionalities are needed for the instructor in the support system?
- What are key requirements relating to usability of the support system?

What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic Portfolio Support System, and how are these used for improvements in the support system?

After a summary of global decisions about the design of a Web-based support system for electronic portfolio development based on the conceptual review, a general theoretical framework for the design process was identified and used for the process of analysis, design, and development in the specific context of several pre-service education courses in the Gulf Region. The first version of the Electronic Portfolio Support System was developed, with the characteristics that the system was Web-based, password protected, allows students to download resources, and includes tools for discussion forums, email, and chat. The system included a variety of support resources, including information and resources relating to the entire course, not just for portfolio development. The system allowed presentation of stimuli such as weekly questions. The system also contained a set of functionalities for instructors, to help them to add resources, manage student accounts,

add weekly questions, and manage and contribute to communication via the system. Templates for the students to use for the actual construction of their electronic portfolios were created, but for technical reasons, were available not via the support system but downloaded from the desktops of the laboratory computers. After filling in the templates and adding appropriate resources to link to the templates to demonstrate their work, the students had to upload the folder with the completed portfolio via an ftp server to the researcher. The students only practiced with the downloading and uploading procedures, but did not actually create electronic portfolios in this investigation.

Following the development of the system, a formative evaluation involving 15 students and three instructors took place in the PAAET. The students were given the opportunity to investigate the system within a specific pre-service teacher education course where the compilation of paper portfolios was already a requirement. The instructors also interacted with the system, but did not use it in an actual course. For the students, the focus was on the functionality and usability of the system, including the approach that was used for creating electronic portfolios. However, the students did not actually create portfolios; they only tried out the file-managing procedures. For the instructors, the focus was on the eventual implementation of the system, and of electronic portfolios in general, in their courses. Following the experiences with the system and the electronic portfolios, the students completed two questionnaires and both the students and the instructors were interviewed (Section 6.3).

The results showed that students and instructors were positive about the use of electronic portfolios and about the functionalities within the Electronic Portfolio Support System, but that a number of aspects of usability were ranked as not satisfactory and also the attractiveness of the system should be improved to increase the engagement level of the students. Moreover, and very importantly, the processes of developing electronic portfolio have to be easier as well as save students' time. From the course design level, students have to be supplied with the evaluation criteria for their portfolios early in the course in order to identify what quality is expected.

Given the feedback from the formative evaluation, modifications were made in the system. These involved a new interface layout, a new structure for both students and instructors with changes in the grouping of items in the navigation, more functionalities, improvements in various ways in the usability, and a redesign of the templates which the students would use for making their electronic portfolios.

9.1.5 *2nd Investigation: Comparing less-rich and more-rich portfolio contexts on students' academic and professional growth, and further exploration of the effects and use of the Electronic Portfolio Support System*

The research questions guiding the 2nd Investigation were:

- What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?
- What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic Portfolio Support System, and how are these used for improvements in the support system?

The 2nd Investigation took place in the second half of 2004 in the Educational Technology Department of the College of Education at the PAAET in Kuwait. One particular course for pre-service teachers was chosen to be the setting for the investigation. This course was called "Workshop in Instructional Media". The course objectives were expressed in terms of academic and professional growth. The course already required the compilation of a paper-based portfolio. The participants in the course were 48 pre-service teachers in the College of Education at the PAAET. All were females. The students were randomly assigned to one of two groups: the Less-Rich Portfolio Context group and the More-Rich Portfolio Context group. All aspects of the course experience were the same except for two dimensions relating to the course requirement of a portfolio. The Less-Rich group compiled their paper portfolios as usual with no additional support. The More-Rich group developed electronic portfolios with the use of the Electronic Portfolio Support System. The two groups were compared before and after the course on their computer skills and attitudes towards technology and professional development. They were compared during the course on their responses to weekly discussion questions. They were compared after the course on their overall course grades. There was no difference between the groups at the start of the course on their background computer skills or their attitudes about technology and professional growth.

At the end of the course the results show advantages for the More-Rich Portfolio Context group on each observation measure. There were substantial differences between the control group and experimental

group on the use of the Internet particularly for communication. The More-Rich group was significantly ($p < .05$) more positive on all but four of the items on the 30-item attitude questionnaire. Student responses to the weekly questions and to interviews showed that the More-Rich Portfolio Context group was associated with stronger social and communication experiences than was the Less-Rich context. The More-Rich context group was associated with positive differences compared to the Less-Rich context in their overall academic performance in the course as measured by course grades.

Thus the hypothesis that the More-Rich Portfolio Context group would be more productive than the Less-Rich Portfolio Context group was confirmed. In particular:

- In terms of the positive indicators of pre-service teachers' academic and professional growth
- In terms of increased self-confidence, in general, and more specifically with technology use

In relation to the functionality and usability of the electronic portfolio support system, the More-Rich Portfolio Context group was studied in detail (Section 7.4). A major negative finding was that only 12 of the 23 students in the group actually completed their electronic portfolios as expected; for the others, the uploading process via the ftp server was a major reason why they did not complete the process. However, they were positive about the use of the Electronic Portfolio Support System in terms of its other functionalities. As with the 1st Investigation, they made a number of suggestions for improvement of the usability of the system. Thus the overall conclusion for the second formative evaluation of the Electronic Portfolio Support System was:

- The support system was in general easy to use, and was more engaging for the students than in the 1st Investigation; however, what was missing from the system was functionality to create a portfolio from within the system itself, rather than from having to download and upload files from outside the system. In addition to this, the usability of the system still has to improve, with respect to the grouping of the features for both students and instructors.

These findings were used for a redesign of the support system, with the important change that now students could fill in template pages to

create their portfolios as part of the support system. Submitting a form for any of the pages of the portfolio made the page directly available in the system for others to see. This allowed the students to see each others' work as it developed and for the instructor and students to give feedback on the work both during and after its development. In addition, other aspects of the system were redesigned, particularly in terms of additional functionalities for instructors, and new structuring of the navigation.

9.1.6 3rd Investigation: Comparing three Portfolio Context groups

The research questions steering the 3rd Investigation were:

- What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio without the use of the Electronic Portfolio Support System compared to when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?
- What are differences in the level of understanding and quality of production of electronic portfolios by pre-service teachers when the Electronic Portfolio Support System is used compared to when it is not used?

These research questions were addressed by an experiment whose purpose was to continue to explore the effectiveness of using electronic portfolios in pre-service teacher education in the Gulf Region. As in the 2nd Investigation, the outcomes or dependent variables relate to academic and professional growth, including this time a comparison of groups on electronic portfolios produced. As an extension of the 2nd Investigation, the independent variable of Portfolio Context had a third value, representing a medium-rich Portfolio Context. In this medium-rich setting, students developed an electronic portfolio but without the support of the Electronic Portfolio Support System. As a further extension of the investigation, the studies were carried out in two different higher education institutions, in two different Gulf Region countries. One location was the College of Education at Kuwait University and the other location was Qatar University. Level 1, the Least-Rich portfolio group (paper portfolio only) involved one group of students from Qatar and three from Kuwait, a total of 70 students. Level 2 involved two groups from Qatar and two from Kuwait, for a total of

87 students. Level 3 involved two from Qatar and four groups from Kuwait, for a total of 126 students. As in the 2nd Investigation, the students were compared before and after on a number of measures (more than in the 2nd Investigation) and in addition, Qatar and Kuwaiti students were compared to see if there was any systematic difference among the students other than the Portfolio Context Levels.

The results showed that there were no significant differences among the students in all three Levels at the start of the experiment. By the end, as in the 2nd Investigation, the hypothesis of Level 1 < Level 2 < Level 3 was supported on all measures. In particular:

- The development of an electronic portfolio with the use of the Electronic Portfolio Support System is associated with significantly more positive indicators related to academic and professional growth than the development of an electronic portfolio without the use of the Electronic Portfolio Support System. And both situations are significantly better than the results of students who developed paper portfolios.

Thus, overall the hypotheses can be said to be supported. Using an electronic portfolio leads to better growth than not using an electronic portfolio, and in addition, combining the electronic portfolio creation process with the use of a Support System that emphasizes communication and peer support leads to the strongest growth of all.

The third set of research questions extended all of these results into recommendations. These are discussed in the remaining sections of this chapter.

9.2 Recommendations for pre-service education in the Gulf Region, emphasizing implementation

Nowadays, in higher education in the Gulf Region in generally, and particularly in pre-service teacher education programs, major reforms are taking place. The new reforms respond to the need to cope with the demands of the 21st century as well as to accomplish a high quality of learning outcomes in order to provide the nations with qualified citizens who are capable to serve and build their nations. Since the education sector considers itself as the main source of building highly qualified generations, therefore, it is crucial to focus on improving pre-service teachers who are teaching these future generations to meet the demands. In this section, a general comment about the context is given (Section

9.2.1), followed by a revised model for implementation of electronic portfolios for teacher education in this context (Section 9.2.2).

9.2.1 General context for the recommendations

During the research procedures, particularly in the three contexts used for the investigations (PAAET, Kuwait University, and Qatar University) in two different countries (Kuwait and Qatar) of the Gulf region, it was found that these contexts were undergoing crucial reforms in order to emphasize the following:

- Benefit more from technology, particularly the use of electronic learning environments, such as the Web-based course management system *Blackboard* or other Web-based systems and tools.
- Transform the instructors' and students' roles by changing teaching and learning methods and embedding new approaches as well as new emphases on active and/or learner-centered approaches.
- Equip higher education graduates with the 21st century weapon, which is technological skills, which are required for their future jobs.
- Build self-confidence and competence in the graduates of higher education in the Gulf Region.

Moreover, in Qatar University, an approach to using electronic portfolios on the instructor level as well as the student level is under investigation and discussion. However, in Kuwait University, although the use of e-learning, and particularly the *Blackboard* course management system, started in December 2004, nevertheless, it is still optional for faculty members to use. Moreover, there are examples from elsewhere in the Gulf Region of implementing electronic portfolios at a higher education entity, such as in the United Arab Emirates at Zayed University.

What can be extracted from this is that higher education in the Gulf Region is involved in a change process to adopt and adapt with the 21st century demands. Therefore, any research findings that will help the successful implementation of any ICT innovation that assists in improving higher education outcomes is valuable. Therefore, the third and last set of research questions (calling for recommendations for practice and for continued research) will now be discussed. The first of these is:

- What are recommendations for the further implementation of electronic portfolios in pre-service education in the Gulf Region?

9.2.2 Recommendations for implementation in the Gulf Region context

Further implementation has to ensure specific factors are in place in order to increase the likelihood of successful implementation of electronic portfolios in pre-service teacher education. Based on this research, Figure 63 presents the recommended success factors, Figure 63 is adopted from Fullan's model (1993), Al-Najjar's model (2002), as well as the conceptual work done in this research (see Sections 4.3.1 and 4.3.2) and the results of the three investigations.

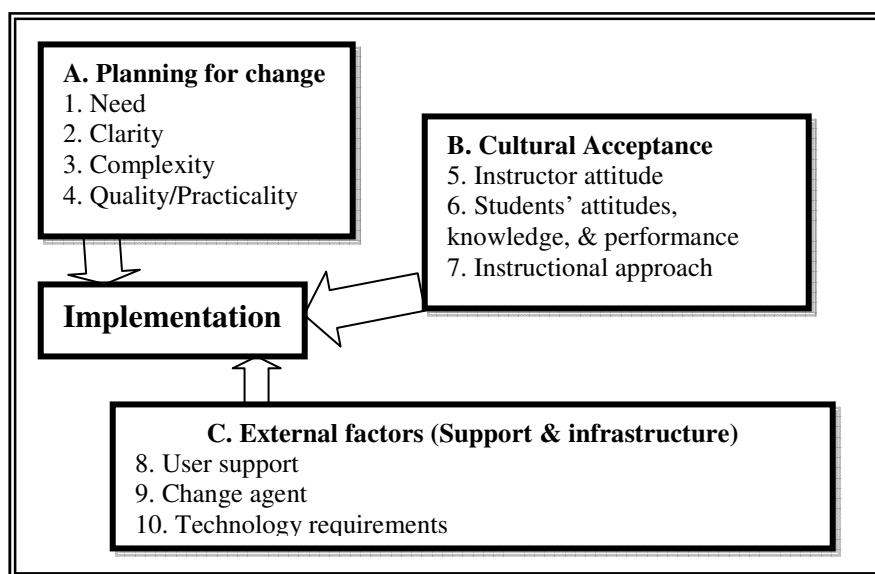


Figure 63. Interactive factors affecting implementing electronic portfolio in pre-service teacher education Gulf Region (adopted from Fullan, 1993, p. 68; Al-Najjar, 2002, p. 55)

Figure 63 extracts the important factors for implementing electronic portfolios in pre-service teacher education in the Gulf Region, based on this research. The research provides Gulf Region teacher education as well as higher education worldwide with confirmation on previously reported factors as well as re-defining factors to enhance and improve pre-service teacher education with a focus on indicators of academic and professional growth. This solution focuses on three important

factors: planning for change, cultural acceptance, and external factors. Sections 9.2.2.1-9.2.2.4 present these three factors in more detail.

9.2.2.1 Planning for change

This factor relates to the initial step of implementing any changes and especially those involved with implementing electronic portfolio. This factor consists of four elements, which are:

- **Need:** As Fullan (1993) stated, “many innovations are attempted without a careful examination of whether or not they address what are perceived to be priority needs” (p.69). Identifying the need linked to using electronic portfolios is strongly related to successful implementation. Moreover, defining the needs should be considered Step 1 of successful implementation. Briefly summarizing what was explained in Section 1.3, teacher preparation programs in the Gulf Region have deficiencies in stimulating pre-service teachers’ academic and professional growth. Thus a need for change is established.
- **Clarity:** Clarifying the purpose and the goals of the change processes which lead to implementation of the new innovations is also important. Therefore, the appropriate tool to solve the needs has to be defined. In pre-service teacher education the purpose of using electronic portfolios, to improve pre-service teachers’ academic and professional growth as well document their growth, is clear purpose for the tool. Hence, in other settings, should also be clarified for faculty through workshops (orientations) for the departmental faculty members as well as the students who will be using the electronic portfolios. Moreover, orientations are required at the college level to increase the appreciation of the usefulness of using electronic portfolios in pre-service teacher education.
- **Complexity:** Fullan (1993) defines this as the “Difficulty and extent of change required of the individuals responsible for implementation” (p. 71). Avoiding complexity in an intended innovation prior to use in practice is crucial because it will directly affect the factor ‘Cultural acceptance’ shown in Figure 63. Therefore, making the electronic portfolio as easy to use as possible as well as the engaging instructors and students through an attractive Web-based support system are

key elements to successful implementation of the electronic portfolio. Hence, training sessions for instructors and students are important, as well as the design of the electronic portfolio and of the Electronic Portfolio Support System itself.

- **Quality/practicality:** It is important to provide specific standards for academic and professional growth in order to fulfill the quality issue with respect to electronic portfolios. These standards should then be used as the criteria for assessing the quality of the portfolios as well as for authentic assessment in general in pre-service teacher education. Based on the research outcomes and previous studies, it is found that clear criteria for assessment are important for instructors as well as students to steer their progression paths.

The second factor in Figure 63 is Cultural acceptance which is presented in the following section.

9.2.2.2 Cultural acceptance

This factor is considered the most important factor. It is based on the change process and its acceptance by the actors involved. Recommendations relating to this factor consist of three elements, which are:

- **Instructor's attitude:** Based on the current research as well as previous studies, it is clear that instructors (as individuals) are the main characters involved in accepting or rejecting the implementation of any ICT innovation. Therefore, successful implementation depends essentially on them; hence, satisfying and supporting them through orientation or training sessions is necessary. More importantly, students' acceptances (see the second element following) is directly connected to instructor acceptance, because instructors are the transformer medium to the students' attitudes and acceptance.
- **Student's attitude, knowledge, and performance:** Secondly and also very important, is that students need support to build self-confidence and competence in technology use. This is essential to the successful implementation of electronic portfolios in pre-service teacher education. Therefore, an emphasis should be given to providing support in knowledge and skills for handling the technology in electronic portfolio

use as well for resources to help students to accept the new ICT innovation and benefit from it, which will lead to improved performance (academic and professional growth).

- **Instructional approach:** A focus on learner-centered, reflective, and active learning during the development of electronic portfolio is essential. Therefore, encourage different approaches to involvement, communication and peer support (such as through an e-mail system, discussion forums, and online chatting system, integrated in a Web-based support system) during the development of electronic portfolios. This in turn will require new instructional approaches.

The third factor in Figure 63 is External Factors which are presented in the following section.

9.2.2.3 External factors

Three types of external factors are the focus of recommendations:

- **Technical support for users:** Based on research investigations, it was found that technical support for the users is crucial for developing electronic portfolios, as well as to help build students' self-confidence and competence. The emphasis on technical user support is essential not only for implementing electronic portfolios but also for implementing any ICT innovation. Providing technical support for students and instructors will help to attain implementation success particularly in terms of making the technology easy to use.
- **Technological requirements:** Build the necessary technological infrastructures to successful implementation of the electronic portfolio. These infrastructures need to consist of convenient and high-speed Internet access, a high quality of hardware and software, adequate electronic storage, Web-based tools and a platform for publishing, and support for portability outside of the original electronic portfolio system. Starting up technological infrastructures has cost implications in the beginning; however, it is necessary and reduces cost over time for future adoption of new ICT tools. Without basic technological requirements being in place, the implementation will not be successful.

- **Change agent:** An effective change agent, which could be an individual, group of people (department), or committee at a higher level, is important to the successful implementation of electronic portfolios. The purpose of the change agent is to receive feedback from instructors or students (users) to evaluate the use of electronic portfolios as well the implementation processes. Also, the change agent should introduce the electronic portfolio to the educational community by arranging workshops and orientation sessions to integrate it within courses, departments, faculties, colleges, and organizations. The change agent is responsible for the management, maintenance, and facilitation of new ICT innovations through their implementation phase before they are institutionalized.

9.2.3 *Recommendations*

In summary, those involved in implementing electronic portfolios within pre-service teacher education in the Gulf Region have to focus on the critical change process actors who are learners and instructors in relation to 'Cultural Acceptance'. Normally, integrating any innovation in any educational setting has to either start from decision makers to actors or from actors to decision makers. The researcher believes that integration of any innovation, in the Gulf region, has to start from actors so that their resistance will be reduced compared to if the innovation comes from the central decision makers. Since the Gulf Region has a bureaucratic system for higher education, this is a particular issue. Resisting or refusing the adoption will be highly likely if it comes from decision makers, on the contrary, if it comes from the actors themselves, they are more likely to accept it and carry it forward to the decision makers.

However, support and facilitation are required. Therefore, a change agent, which is a department responsible for integrating any new ICT innovation based on feasibility study and analyses, is highly recommended. There also needs to be a budget for essential reforms in order to enhance and improve the teaching and learning processes

The research results demonstrate that a Web-based support system used along with electronic portfolio processes can significantly affect pre-service teachers' self-confidence as well competence, which in turn enhances and improves their professional as well as academic growth. Proceeding further with the Electronic Portfolio Support System is the

essential in order to further increase the likelihood of successful implementation of electronic portfolios in pre-service teacher education in the Gulf Region.

Finally a focus on the three groups of factors in Figure 63 is highly recommended.

The following section, Section 9.3, concludes the research with general recommendations for further research about electronic portfolios.

9.3 General recommendations for further research about electronic portfolios

The last of the research questions was:

- What are directions for further research more generally?

Although many pre-service teacher education programs are making use of electronic portfolios, many are not convinced yet with the needs of using the electronic portfolio for learning as well as an assessment tool. This requires further research on how to make instructors in teacher education more excited about using electronic portfolios in various learning activities in their courses.

Moreover it is the right time to study the potential of electronic portfolios to engage students in active participation in assessing and managing their own learning. Barrett (2005) states that “the level of available technologies makes possible an international study about the role of electronic portfolios to support student learning, engagement and collaboration” (p. 23). The researcher supports this idea and suggests further research in extracting unified standards for electronic portfolio components in relation to the assessment of pre-service teachers’ professional and academic growth to be used internationally.

It was found that awareness of electronic portfolio is worldwide available. However, resistance and refusing to standardized the use of electronic portfolios as learning and assessment across courses in a curriculum is continuing. Therefore, further research to explore the reasons for this, related to cultural issues, learner’s ability, or authentic criteria, need more investigation.

In relation to learner ability and the Web-based support system factor, in this research it was found that students who are engaged and active within the overall class as well as the with the support system also earn

higher grades in their electronic portfolios. This suggests that that learner ability (high or low) might be a key factor. Or there may be other factors that may affect the students' attitude, such as personal excitement for using technology or a new assessment method or instructional approach. These correlated factors suggest further research.

The research focused on the pre-service teacher education context, but these findings may also be relevant for other sorts of educational organizations, such as secondary schools, primary schools, and other organizations related to the professional and academic development of their learners. This, too, needs more research.

Finally this research emphasizes the importance of developing electronic portfolios with the use of an accompanying Web-based support system. As learners become more self-responsible for their progression and have to perform in increasingly efficient and effective ways and will be held accountable for good quality in their professional and academic growth, they will need to be able to use Web-based tools and systems as support to maintain as well as improve growth. The design of such systems is a major area for continued research.

Summary

Keeping its higher education systems competitive in the 21st century, the technology era, is the vital task of higher education in the Gulf Region as well as throughout the world (Abdullah, 2001; Alaasemi, 2003; Al-Nagim, 2002; Watson, 2001). The use of the Internet and Web-based tools and support systems has been introduced in higher education settings, making the education systems more globalized and creating shareable platforms for new forms of peer collaboration and instructor-student communication. Processes that were previously limited in the extent to which peer collaboration, communication, and sharing could occur are now becoming electronic to overcome these limitations. An example are the processes relating to portfolio development. Portfolios have been used in teacher education programs for many years within different higher education settings worldwide. Developing portfolios in electronic form, supported by a Web-based system that integrates the portfolio development process with tools for peer review, communication, and more flexible feedback from the instructor, is an example of how information and communication technologies can make learning processes more productive. A further benefit is that students strengthen their skills at using technology for publishing and communication, important areas of professional growth for pre-service teachers. These skills are particularly important for pre-service teachers in the Gulf Region, in that their experiences with technology for learning have been limited.

Thus although this dissertation, “Investigating electronic portfolios in pre-service teacher education in the Gulf Region,” has a specific focus on two particular countries in the Gulf Region, it reflects questions that are currently being asked at many organizations for higher education world wide, which are overall questions guiding the research:

“(a) In what ways can the use of an electronic portfolio lead to a more productive teaching and learning environment in higher education in the Gulf region, and (b) Under what conditions can the use of the electronic portfolio be strengthened given the context of higher education in the Gulf Region?”

Based upon these two questions, which are presented in Chapter 1, and in order to answer them, three different sets of sub-research questions (*Conceptual, Design and investigation, and Recommendations*) were addressed, which were answered through the dissertation chapters.

Chapter 1 presents an overview of the influence of computer technology and in particular in teacher education, and its effectiveness on changing the learning process. The advantages of using computer technology as well its disadvantages and challenges have to be considered when adopting technology in the education setting. After this general introduction, an introduction is given to the particular countries, Kuwait and Qatar, in which the investigations will take place. An overall description of the higher education systems in these two countries is presented in this chapter. Within these countries, three different higher education institutions with programs for pre-service teachers are identified and discussed in terms of their general characteristics. Based upon the overall questions guiding the research, an exploratory study was done in Kuwait to verify the conditions and deficiencies in the pre-service teacher education programs. The results of this study, reported in Chapter 1, supported the basis for the research: that there is a need for improvements in pre-service teachers' academic and professional growth, particularly their skills with using technology in a professional manner, and that the development of electronic portfolios, combined with new instructional methods and new forms of authentic assessment, could be valuable for both stimulating and documenting the pre-service teachers' academic and professional growth. This analysis led to an expanded problem statement for the research, which was how to use electronic portfolios in pre-service teacher education as:

- An effective tool to improve learner progress (professional and academic growth)
- An authentic assessment tool and that meets specific criteria in order to attain learners' professional and academic growth
- A documentation tool to document (electronic evidence) of learner's professional and academic growth
- A lifelong learning tool
- A new instructional approach (using electronic tools) in order to enhance learners' professional and academic growth.

The importance of providing instructors and students with support for electronic portfolio development led to a further aspect of the problem statement: How can such support be made available, and in what forms, with what functionalities, will the support be most effective? Based on these problem statements, three sets of research questions were formulated (Conceptual, Design and investigation, and Recommendation). The conceptual questions related to electronic portfolios and electronic support systems for portfolio development; academic and professional growth in the context of electronic portfolio

use in redesigned instructional settings; and implementation issues in realizing the potential of electronic portfolios in practice. These questions were investigated via literature reviews. The results were used to design the specific electronic portfolio tools and support system to be used in investigations in the Gulf Region. The second set of research questions relates to this design process and to experiments that were carried out to study the effects of different approaches to portfolio development and use on professional and academic growth as well as on the quality of the portfolios themselves. The third set of research questions relates to the further application of the research, both in the Gulf Region and beyond. Chapter 1 ends with an overview of the remaining chapters of the dissertation.

In this research it is argued that developing electronic portfolios can improve pre-service teachers' academic and professional growth but the extent to which this occurs will be influenced by the characteristics of the electronic portfolios themselves and of the tools and systems that support instructors and pre-service teachers in the development of the portfolios. It is also argued, based on learning theories, particularly constructivism and cognitive flexibility theory, that the development of electronic portfolios helps pre-service teachers (as learners) deepen their knowledge and skills relating to their profession as well as strengthen their reflection skills and technology skills. One particular benefit of electronic portfolios is their use in new forms of assessment, moving from traditional forms to forms that represent professional practice. These results were among the conclusions that emerged from answering the research questions in Chapter 2, which were:

What is an electronic portfolio?

- What are possible components of an electronic portfolio and of an electronic support system to help students and instructors in the processes of using an electronic portfolio?
- What are goals and ways of using an electronic portfolio in higher education and in particular in pre-service teacher education?
- What learning theories can underlie the use of electronic portfolios and in particular how to these relate to the use of electronic portfolios for pre-service teacher education?

It was concluded from the literature that the definition of an electronic portfolio depends on the objectives (goals) of developing the electronic

portfolio; however, a common definition is that it is a purposeful collection of learner artefacts which reflect his/her progress during learning processes. A distinction was made between the functionalities available in an electronic portfolio compared to a paper based portfolio. From the perspectives of portability, storage space available, linking and grouping to strengthen deep learning, publishing tools to allow access to different sorts of audiences at different times, and of professional growth with regard to technology use and communication, electronic portfolios have many advantages compared to paper portfolios. However, the disadvantages may be hard to overcome because they relate to the difficulties involved with implementing technology for changes in teaching and learning. An analysis was made of possible components of electronic portfolios. This analysis made it clear that many types of electronic tools and resources to assist both students and teachers in the portfolio process are also needed beyond only the tools for creating a portfolio. The idea of a Web-based electronic portfolio support system was established, as a broader resource for both instructors and students. Such a support system would help integrate the portfolio processes with overall course processes and activities, provide extra resources for both the course and the portfolio processes, and provide tools for communication, support, and collaboration (for example, peer review) during the portfolio development and publication processes. The system requires different tools and interfaces for the instructors than for the students, as the instructors must be responsible for filling the system with resources, communicating with students via the system, and using the system for feedback and assessment. For this research, the development of such a support system, with tools for both students and instructors, was taken as an important task.

Concerning the ways of using electronic portfolio in higher education in general, it was concluded that electronic portfolios have been mainly used for assessment, as tools for learning activities, or for presentation (showcase) to others, particularly prospective employers. Most often, portfolios have been used as assessment tools. But with the additional functionalities available with electronic portfolios an increasing amount of focus is being put on their use also as a learning tool. The idea of the electronic portfolio as a 'deep learning pot' was presented. Specifically, for pre-service teacher education, it was noticed from the literature that the use of portfolios has been common for many years but now because of the added functionalities available in electronic portfolios that there is a new emphasis their use in teacher education programs worldwide in relation to authentic assessment as well as learning. The added

dimensions of gaining important technology handling skills while developing and maintaining the portfolio as well as using the portfolios as focuses for online peer discussion and review are stimulating this renewed attention.

Perspectives from learning theories that can underlie the productive use of electronic portfolios, particularly for learning, were discussed with particular attention to constructivism, cognitive flexibility theory (with relation to hyperlinking and grouping of artefacts), and collaborative learning. These perspectives stimulate a learning-oriented set of goals for developing electronic portfolios beyond presenting learner progression and increasing technological skills. Such an orientation can involve personal construction of knowledge and skills, increased reflective ability, better ability to connect prior knowledge with new knowledge, making use of a new form of mental workspace, engagement in authentic activities where cooperation is promoted over competition, engagement in disciplined inquiry, and becoming familiar with a new assessment method.

Following these conclusions relating to the first set of research questions, the following definition of electronic portfolios was taken for this research:

A purposeful collection of pre-service teachers' artifacts (work) hyperlinked in an electronic environment which includes reflections on their progress (academically and professionally), to accomplish course or program objectives/standards as well as document their growth.

In addition to the results given in Chapter 2, another conclusion emerging from the conceptual investigations that successful implementation of electronic portfolio is based on many factors which are connected to each other in the overall course experience of which electronic portfolios are part. This result emerged when answering the research questions in Chapter 3, which relate to course design to integrate professional and academic growth and electronic portfolios.

The second conceptual research question and its associated sub-questions were answered in Chapter 3. These questions are:

In what ways can an electronic portfolio contribute to pre-service teachers' professional and academic growth?

- What is academic growth?
- What is professional growth?

- What is the role of an electronic portfolio in pre-service teachers' professional and academic growth?
- What are considerations for course design in pre-service teacher education so that professional and academic growth are stimulated and integrated with electronic portfolio use?

Academic growth relates to the results of learning processes to achieve new knowledge or information in order to attain standards. Academic growth in a course in pre-service education relates specifically to the material to be learned in the course. For example, in courses in pre-service education relating to educational technology and its role in lesson planning in the Gulf Region, objectives for academic growth include developing critical thinking about instruction, demonstrating knowledge and skills with the use of educational technology, planning lessons that will create and maintain positive learning environments for their own eventual students, gaining insight into instructional planning, and gaining insight into the roles of teachers. Professional growth (sometimes called professional development or professional progress) is important for professionals in any field. Standards for professional growth in pre-service teacher education can be defined in many ways. Example of course objective related to professional growth in pre-service education include learning from and with peers, collaborative learning, strengthening communication skills, using technology to support instruction, and gaining insight into the roles of teachers. Some objectives can also be listed as academic growth (use of technology and roles of teachers) in certain pre-service teacher education courses. That is because in pre-service courses, sometimes the knowledge to be acquired in the course itself (i.e., for academic growth) is also the sort of knowledge needed for on-going professional growth within and beyond the course. In other words, the content of some pre-service teacher education courses is also the basis for their on-going professional growth within and beyond the course.

Evidence from the literature shows that portfolio development can contribute to professional and academic growth either through the overall processes associated with portfolio development (collect, select, link, reflect, and present) as well as the development of individual items for the electronic portfolio (decide, design, develop, and implement for evaluation purposes). Miller's Pyramid of Competence (1990), which consists of four levels, can be applied to portfolio development. Three of the levels represent competence development (knows course objectives and how to present them, knows how to develop artefacts

that reflect understanding for course objectives, and shows how these are related to the course objectives by writing rationale statements to reflect that understanding). The fourth level of the pyramid, which is the optimal level, is performance (does it reflect the course objectives?), which relates to the overall quality of the portfolio itself.

The constructivist approach to electronic portfolio development with its focus on professional as well as academic approach requires a review of overall course design. The course in which portfolio development occurs must be designed to include continuous follow up activities such as: discussion, the exchange of knowledge and information, collaborations among students, and feedback. The course in which portfolio use occurs should therefore include:

- A constructivist environment for building knowledge and experiences
- A collaborative environment for students to exchange ideas and perspectives to build their communication skills as well their professionalism
- A flexible environment that provides freedom in place and time to gain knowledge as well as get support
- A support environment to facilitate help during the development of course assignments or the electronic portfolio itself.

From these, a general model for a productive course environment involving electronic portfolios for professional and academic growth was presented. In this model, the word “environment” refers to the overall course design, not just the electronic environments that may be used within that design. This model for course design, derived from the conceptual investigation reported in Chapter 3, was realized in the investigations reported in Chapters 7 and 8.

Implementation processes when innovations such as electronic portfolios and new forms of course environments are introduced into practice are described in Chapter 4, based upon previous studies in the literature. Key factors of implementing electronic portfolios in pre-service education are the main focus of Chapter 4, which answered the following research questions relating to the conceptual aspects of implementation:

What are key factors for implementing an electronic portfolio in higher education?

- What are key factors at the organization, curriculum, instructor, and student levels that affect the change process when introducing new technologies and teaching methods?
- What are specific recommendations to improve the likelihood of successful implementation of electronic portfolios in pre-service teacher education?
- What should be taken into consideration in the design of a Web-based support system to accompany portfolio use to increase the likelihood of use of the system in practice?

Change processes within educational organizations--college, faculty, or department--pass through stages which are initiation, implementation, and institutionalisation. Change processes within a specific course involve the initiation and implementation stages, which can lead to institutionalisation if the implementation can be scaled up to change processes within the department, faculty, college, or even entire organisation. Many factors have been found that influence the change process when technology supports new forms of course design, such will be the case when integrating electronic portfolios within a redesigned course in pre-service teacher education. Al-Najjar (2002), for example, identified a set relating to conditions, acceptance, and ways of application for a previous computer-based innovation in the PAAET context.

The 4-E Model (Collis, Peter, & Pals, 2001; Collis & Moonen, 2001) is a generic model for predicting the likelihood of individuals in an educational setting making use of a new technological instrument. The factors to predict this likelihood are (a) Environment (the institutional context), balanced against the individual's perception of the (b) Educational effectiveness (perceived or expected) and (c) Ease of use as well as his or her own level of (d) Engagement (the potential adopter's personal response to technology and to change). Instructors are frequently the key actors in this decision making at the course level, but department and institutional decision makers also become involved when technological infrastructure and support need to be provided.

Combining the factors identified in the literature, specific factors applicable to the integration of electronic portfolios within a pre-service teacher course environment were identified. These involve a number of factors relating to the technology itself, some of which are general, such as the accessibility of the hardware and software and upload and download speeds. Others are specific to electronic portfolios, such as the storage space available, the security for different levels of access,

and the tools available for adding reflections and hyperlinking. Gathercoal, Love, Bryde, and McKean (2002) reported on 12 critical success factors that “must to present and active in order to implement a webfolio system” (p. 34). A webfolio is a Web-based system to support electronic portfolio development. These and other observations suggest the success factors for electronic portfolio implementation within a pre-service teacher education course can be clustered into four major groups: support, culture, infrastructure and planning. An elaboration of these four clusters was given in Section 4.2, Table 21. Instructor and learner acceptance are key elements of the change processes involving electronic portfolios; these actors particularly need support, which can be partly supplied by an Web-based support system to facilitate technical support, help knowledge and skill development via provision of resources, and provide tools for communication and social interaction in order to integrate the electronic portfolio within a course.

Two major perspectives relating to the implementation of a Web-based support system for learning are the functionalities of the system and the usability of the system (Neilson & Levy, 1994). By functionalities is meant that the system provides what the users want and need. By usability is meant that the system is easy to use, consistent, and attractive to the users. Criteria for the formative evaluation of a Web-based support system based on its functionality and usability were identified.

Together this conceptual analysis in Chapter 4 led to the identification of key features for the Web-based support system as well as for the electronic portfolios themselves that were likely to lead both to academic and professional growth as well as successful implementation.

Following these conceptual analyses, the research moved to a set of design and implementation studies in specific pre-service education courses in the Gulf Region.

Chapter 5 began by a review of the research questions and then focused on a description of the methodology for the second set of research questions, relating to three cycles of design and investigations in specific Gulf Region settings. For the design processes in the 1st and 2nd Investigations, the methodology, respondents, and instruments for two rounds of formative evaluation was described. For the comparative studies in the 2nd and 3rd Investigations, the independent and dependent variables, subjects, research instruments, and data analysis processes were also described. Table 27, Section 5.5, summarized the

methodology design, purpose, and instruments used in the three cycles of investigations. The table is repeated here, as Summary Table 1.

Summary Table 1. Research design, three investigations in actual course settings

Investigation	Purpose	Evaluation instruments	Methods of analysis	Dates
1 st	Formative evaluation of the Electronic Portfolio Support System	-Computer Background Skills questionnaire -Functionality & Usability Survey , students and instructors -Interviews with students and instructors - Field notes	X O	February 2004 until May 2004
2 nd	Comparison of two types of Portfolio Contexts (paper only vs electronic portfolio with the Electronic Portfolio Support System) on professional and academic growth	-Computer Background Skills questionnaire -Attitudes toward Professional Growth and Technology questionnaire -Weekly questions -Course final grades - Field notes	R O X O O O	September 2004 until December 2004
	Formative evaluation of the Electronic Portfolio Support System	-Functionality & Usability Survey -Weekly questions -Electronic Portfolio Survey -Coding of electronic portfolios -Course final grade -Interviews with students and instructor - Field notes		

3 rd Investigation	Comparison of three types of Portfolio Contexts (paper only vs electronic portfolio with and without the Electronic Portfolio Support System) on professional and academic growth	-Computer Background Skills questionnaire -Attitudes toward Professional Growth and Technology questionnaire -Communication Skills survey -Performance Test -Interviews with students -Course final grades - Field notes	R O X1 O O X2 O	February 2005 until May 2005
	Comparison of the two electronic portfolio groups (with and without the Electronic Portfolio Support System) on the quality of electronic portfolio understand and results	-Electronic Portfolio Concept test -Electronic Portfolio Survey -Coding of electronic portfolios -Interviews with students and instructor - Field notes		

The results of the research questions that were the focus of those investigations follow.

Chapter 6 reported on the 1st Investigation. Two sets of research questions were addressed in the 1st Investigation. These were:

What are the requirements for the design of tools to support the use of electronic portfolios in the context of pre-service teacher education in the Gulf Region?

- What are the components of the electronic portfolio itself?
- What are the components of a support system to help students in the development of their electronic portfolios?
- What functionalities are needed for students in the support system?
- What functionalities are needed for the instructor in the support system?
- What are key requirements relating to usability of the support system?

What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic

Portfolio Support System, and how are these used for improvements in the support system?

After a summary of global decisions about the design of a Web-based support system for electronic portfolio development based on the conceptual review in Chapters 2, 3, and 4, a general theoretical framework for the design process was identified and used for the process of analysis, design, and development in the specific context of several pre-service education courses in the Gulf Region. The first version of the Electronic Portfolio Support System was developed, with the characteristics that the system was Web based, password protected, allowed students to download resources, and included tools for discussion forums, email, and chat. The system also included a variety of support resources, including information and resources relating to the entire course, not just for portfolio development. The system allowed presentation of stimuli for discussion and reflection, such as weekly questions. The system also contained a set of functionalities for instructors, to help them to add resources, manage student accounts, add weekly questions, and manage and contribute to communication via the system. Templates for the students to use for the actual construction of their electronic portfolios were created, but for technical reasons, were not available via the Web based support system but downloaded from the desktops of the laboratory computers. After filling in the templates and adding appropriate resources to link to the templates to demonstrate their work, the students had to upload the folder with the completed portfolio via an ftp server to the researcher. The students only practiced with the downloading and uploading procedures, but did not actually create electronic portfolios in this investigation.

Following the development of the system, a formative evaluation involving 15 students and three instructors took place in the PAAET. The students were given the opportunity to investigate the system within a specific pre-service teacher education course where the compilation of paper portfolios was already a requirement. The instructors also interacted with the system, but did not use it in an actual course. For the students, the focus was on the functionality and usability of the system, including the approach that was used for creating electronic portfolios. However, the students did not actually create portfolios; they only tried out the file-managing procedures. For the instructors, the focus was on the eventual implementation of the system, and of electronic portfolios in general, in their courses. Following the experiences with the system and the electronic portfolios, the students completed two questionnaires and both the students and the instructors were interviewed (Sections 6.3-6.5).

The results showed that students and instructors were positive about the use of electronic portfolios and about the functionalities within the Electronic Portfolio Support System, but that a number of aspects of usability were ranked as not satisfactory and also the attractiveness of the system should be improved to increase the engagement level of the students. Moreover, and very importantly, the processes of developing electronic portfolio have to be easier to do as well as save student's time. From the course design level, students have to be supplied with the evaluation criteria for their portfolios early in the course in order to identify what quality is expected.

Given the feedback from the formative evaluation, modifications were made in the Electronic Portfolio Support System. These involved a new interface layout, a new structure for both students and instructors with changes in the grouping of items in the navigation, more functionalities, improvements in various ways in the usability, and a redesign of the templates which the students would use for making their electronic portfolios. Section 6.6 describes the redesigned system.

Chapter 7 presents the 2nd investigation which compared “less-rich” and “more-rich” portfolio contexts on students’ academic and professional growth, and also included further exploration of the effects and use of the Electronic Portfolio Support System. The research questions guiding the 2nd Investigation were:

- What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?
- What are the reactions of students and instructors to a formative evaluation of the functionality and usability of the Electronic Portfolio Support System, and how are these used for improvements in the support system?

The hypothesis to be tested for the first of these research questions was that was that the Less-Rich Portfolio context would results in significantly lower academic and professional growth compared to the More-Rich context. The 2nd Investigation took place in the second half of 2004 in the Educational Technology Department of the College of Education at the PAAET in Kuwait. One particular course for pre-service teachers was chosen to be the setting for the investigation. This course was called "Workshop in Instructional Media". The course

objectives were expressed in terms of academic and professional growth. The course already required the compilation of a paper-based portfolio. The participants in the course were 48 pre-service teachers in the College of Education at the PAAET. All were females. The students were randomly assigned to one of two groups: the Less-Rich Portfolio Context group and the More-Rich Portfolio Context group. All aspects of the course experience were the same except for two dimensions relating to the course requirement of a portfolio. The Less-Rich group compiled their paper portfolios as usual with no additional support. The More-Rich group developed electronic portfolios with the use of the Electronic Portfolio Support System. The two groups were compared before and after the course on their computer skills and attitudes towards technology and professional development. They were compared during the course on their responses to weekly discussion questions. They were compared after the course on their overall course grades. These comparisons showed that there were no differences between the groups at the start of the course on their background computer skills or their attitudes about technology and professional growth.

The results at the end of the course (see Section 7.3) show advantages for the More-Rich Portfolio Context group on each observation measure. In terms of computer skills, there were substantial differences between the control group and experimental group on the use of the Internet particularly for communication. The More-Rich group was significantly ($p < .05$) more positive on all but four of the items on the 30-item attitude questionnaire. Student responses to the weekly questions and to interviews showed that the More-Rich Portfolio Context group was associated with stronger social and communication experiences than was the Less-Rich context. Finally, the More-Rich context group was associated with positive differences compared to the Less-Rich context in their overall academic performance in the course as measured by course grades.

Thus the hypothesis that the More-Rich Portfolio Context group would be more productive than the Less-Rich Portfolio Context group was confirmed. In particular, significant differences between the groups were found:

- In terms of the positive indicators of pre-service teachers' academic and professional growth, and
- In terms of increased self-confidence, in general, and more specifically with technology use.

In relation to the functionality and usability of the electronic portfolio support system, the More-Rich Portfolio Context group was studied in detail (Section 7.4). A major negative finding was that only 12 of the 23 students in the group actually completed their electronic portfolios as expected; for the others, difficulties with the uploading process via the ftp server was a major reason why they did not complete the process. However, all of the 23 students were positive about the use of the Electronic Portfolio Support System in terms of its other functionalities. But, as with the 1st Investigation, they made a number of suggestions for improvement of the usability of the system. Thus the overall conclusion for the second formative evaluation of the Electronic Portfolio Support System was:

- The support system was in general easy to use, and was more engaging for the students than in the 1st Investigation; however, what was missing from the system was the functionality to create a portfolio from within the system itself, rather than from having to download and upload files from outside the system. In addition to this, the usability of the system still has to improve, particularly with respect to the grouping of the features for both students and instructors.

These findings were used for a redesign of the support system (see Section 7.5), with the important change that now students could fill in template pages to create their portfolios as part of the support system. Filling in and submitting a form for any of the pages of the portfolio made the page directly available in the system for others to see. This allowed the students to see each others' work as it developed and for the instructor and students to give feedback on the work both during and after its development. In addition, other aspects of the system were redesigned, particularly in terms of additional functionalities for instructors, and new structuring of the navigation.

In Chapter 8, the 3rd Investigation was described. As in the 2nd Investigation, the outcomes or dependent variables related to academic and professional growth, including this time a comparison of groups on electronic portfolios produced. As an extension of the 2nd Investigation, the independent variable of Portfolio Context had a third value, representing a medium-rich Portfolio Context. In this medium-rich setting, students developed an electronic portfolio but without the support of the Electronic Portfolio Support System. Thus the three portfolio contexts were paper only, electronic portfolio without the Electronic Portfolio Support System, and electronic portfolio with the

Electronic Portfolio Support System. These three portfolio richness contexts were described as Levels 1, 2, and 3, respectively. The 3rd Investigation answered the following research questions:

- What are differences in professional and academic growth when pre-service teachers develop a paper-based portfolio compared to when they develop an electronic portfolio without the use of the Electronic Portfolio Support System compared to when they develop an electronic portfolio with the use of the Electronic Portfolio Support System?
- What are differences in the level of understanding and quality of production of electronic portfolios by pre-service teachers when the Electronic Portfolio Support System is used compared to when it is not used?

The hypothesis in relation to professional and academic growth was that:

$$L1 < L2 < L3$$

The hypothesis with regard to outcomes related to electronic portfolios was that:

$$L2 < L3$$

As a further extension of the investigation, the studies were carried out in two different higher education institutions, in two different Gulf Region countries. One location was the College of Education at Kuwait University and the other location was Qatar University. Level 1, the Least-Rich portfolio group (paper portfolio only) involved one group of students from Qatar and three from Kuwait, a total of 70 students. Level 2 involved two groups from Qatar and two from Kuwait, for a total of 87 students. Level 3 involved two from Qatar and four groups from Kuwait, for a total of 126 students. As in the 2nd Investigation, the students were compared before and after on a number of measures (more than in the 2nd Investigation) and in addition, Qatar and Kuwaiti students were compared to see if there were any systematic differences among the students other than the Portfolio Context Levels.

The results showed that there were no significant differences among the students in all three Levels at the start of the experiment. By the end, as in the 2nd Investigation, the hypothesis of Level 1 < Level 2 < Level 3 was supported on all measures. In particular:

- The development of an electronic portfolio with the use of the Electronic Portfolio Support System was associated with significantly more positive indicators related to academic and professional growth than the development of an electronic portfolio without the use of the Electronic Portfolio Support System. And the results of both of these portfolio contexts are significantly better than the results of students who only developed paper portfolios.

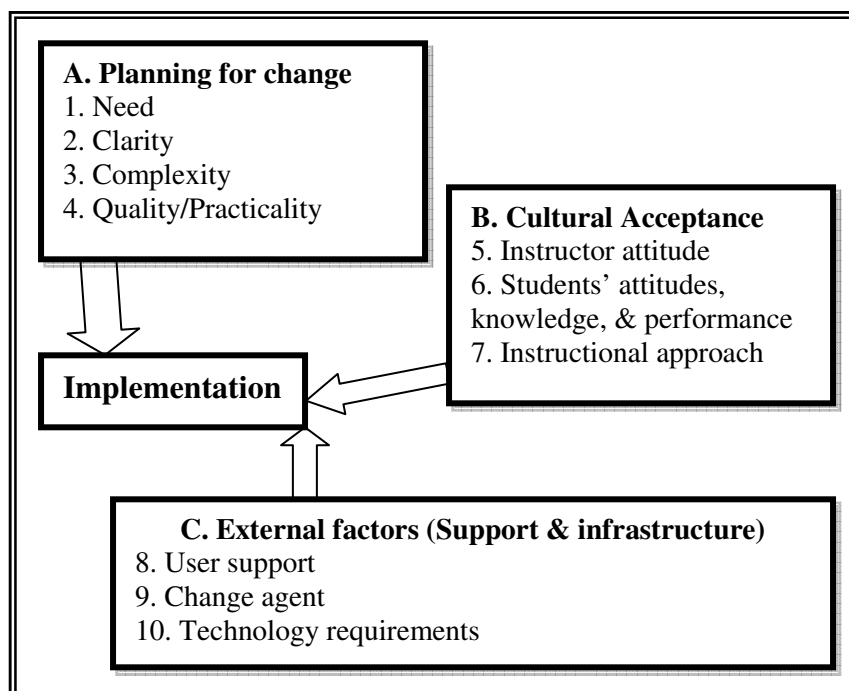
Thus, overall the hypotheses can be said to be supported. Using an electronic portfolio leads to better growth than not using an electronic portfolio, and in addition, combining the electronic portfolio creation process with the use of the Web based Electronic Portfolio Support System and a course design that emphasizes communication and peer support leads to the strongest growth of all.

In Chapter 9 started with an overview of the results of the research questions presented in the previous chapters (from Chapter 2 until Chapter 8). Moreover, the third set of research questions (calling for recommendations for practice and for continued research) was answered in this chapter. The first of these was:

- Recommendations for pre-service education in the Gulf Region, emphasizing implementation

A summary of these recommendations follows.

Further implementation has to ensure that specific factors are in place in order to increase the likelihood of successful implementation of electronic portfolios in pre-service teacher education. Based on this research, a set of factors particularly important for pre-service teacher education in the Gulf Region was identified. These were described in Section 9.2.2, Figure 63. Figure 63 was adopted from Fullan's model (1993), Al-Najjar's model (2002), as well as the conceptual work done in this research (see Sections 4.3.1 and 4.3.2) and the results of the three investigations. Figure 63 is reproduced here, as Summary Figure 1.



Summary Figure 1. Interactive factors affecting implementing electronic portfolio in pre-service teacher education Gulf Region (adopted from Fullan, 1993, p. 68; Al-Najjar, 2002, p. 55)

Figure 63 (Summary Figure 1) extracts three sets of important factors for implementing electronic portfolios in pre-service teacher education in the Gulf Region, based on this research. The research provides Gulf Region teacher education as well as higher education worldwide with confirmation on previously reported factors as well as re-defining factors to enhance and improve pre-service teacher education with a focus on indicators of academic and professional growth. This solution focuses on three important factors: planning for change, cultural acceptance, and external factors.

- **Planning for change**

This factor relates to the initial step of implementing any changes and especially those involved with implementing electronic portfolio. This factor consists of four elements, which are:

- **Need:** As discussed in Section 1.3, teacher preparation programs in the Gulf Region have deficiencies in stimulating

pre-service teachers' academic and professional growth. This need for change should be accepted by all.

- **Clarity:** An appropriate tool to solve the needs has to be defined. In pre-service teacher education the purposes of using electronic portfolios, to improve pre-service teachers' academic and professional growth as well document their growth, should be clear. These purposes should be clarified for faculty through workshops (orientations) for the departmental faculty members as well as the students who will be using the electronic portfolios. Moreover, orientations are required at the college level to increase the appreciation of the usefulness of using electronic portfolios in pre-service teacher education.
- **Complexity:** Developing electronic portfolio should be as easy as possible. This can be done by engaging instructors and students through an attractive Web-based support system. Training sessions for instructors and students are important for the development of the electronic portfolios and the use of the Electronic Portfolio Support System itself.
- **Quality/practicality:** Specific standards for academic and professional growth should be indicated, and used to assess the quality of the students' electronic portfolios. Clear criteria for assessment are important for both instructors as well as students.

The second factor in Figure 63 (Summary Figure 1) is Cultural acceptance. The recommendations for this factor are summarized next.

- **Cultural acceptance**

This factor is considered the most important factor influencing implementation in the Gulf Region. It is based on the change process and its acceptance by the actors involved. Recommendations relating to this factor focus on three elements:

- **Instructor's attitude:** Based on the current research as well as previous studies, it is clear that instructors (as individuals) are the main characters involved in accepting or rejecting the implementation of any ICT innovation. Satisfying and supporting instructors through orientation or training sessions is necessary.

- **Student's attitude, knowledge, and performance:** Students need support to build their self-confidence and competence in technology use. Therefore, an emphasis should be given to providing support in knowledge and skills for handling the technology in electronic portfolio use as well for resources to help students to accept the new ICT innovation and benefit from it, such as the Electronic Portfolio Support System.
- **Instructional approach:** A focus on learner-centered, reflective, and active learning during the development of electronic portfolio is essential. Therefore, collaboration, communication, and peer support (such as through an e-mail system, discussion forums, and online chatting system, integrated in a Web-based support system) during the development of electronic portfolios are recommended. This will require new instructional approaches.

The third factor in Figure 63 (Summary Figure 1) is External Factors

- **External factors**

Three sets of recommendations were made in terms of external factors:

- **Technical support for users:** Based on research investigations, it was found that technical support for the users is crucial for developing electronic portfolios, as well as to help build students' self-confidence and competence. Providing technical support for both students and instructors will help to attain implementation success particularly in terms of making the technology easy to use.
- **Technological requirements:** Provide the necessary technological infrastructures required for successful implementation of the electronic portfolio. These infrastructures need to include convenient access to high-speed Internet, a high quality of hardware and software, adequate electronic storage, and provision of Web-based tools and a platform for developing and publishing the electronic portfolios. Technology to enable portability or reuse of the portfolios after completing the course or program should also be supported.
- **Change agent:** A change agent should be acknowledged, who could be an individual, group of people (department), or

committee at a higher level. The change agent should introduce the electronic portfolio to the educational community by arranging workshops and orientation and is responsible for the management, maintenance, and facilitation of the electronic portfolio and its accompanying Web based support system.

In summary, those involved in implementing electronic portfolios within pre-service teacher education in the Gulf Region have to focus on the critical change process actors who are learners and instructors in relation to 'Cultural Acceptance'. Normally, integrating any innovation in any educational setting has to either start from decision makers to actors or from actors to decision makers. The researcher believes that integration of any innovation in the Gulf region has to start from instructors or students so that their resistance will be reduced compared to if the innovation comes from the central decision makers. Resisting or refusing the adoption will be highly likely if it comes from decision makers, on the contrary, if it comes from the actors themselves, they are more likely to accept it and carry it forward to the decision makers.

However, support and facilitation are required and these require commitment from decision makers. Therefore a department responsible for integrating any new ICT innovation based on feasibility studies and analyses is highly recommended. There also needs to be a budget for essential reforms in order to enhance and improve the teaching and learning processes

The research results demonstrate that a Web-based support system used along with electronic portfolio processes can significantly affect pre-service teachers' self-confidence as well competence, which in turn enhances and improves their professional as well as academic growth. Proceeding further with the Electronic Portfolio Support System is the essential in order to further increase the likelihood of successful implementation of electronic portfolios in pre-service teacher education in the Gulf Region.

Finally Chapter 9 concludes by addressing the second question of the last set of research questions:

- What are directions for further research more generally?

Although many pre-service teacher education programs are making use of electronic portfolios, many are not convinced yet about the need for using the electronic portfolio for learning as well as an assessment tool.

This requires further research on how to make instructors in teacher education more excited about using electronic portfolios in various learning activities in their courses.

Moreover it is the right time to study the potential of electronic portfolios to engage students in active participation in assessing and managing their own learning at the international level. Barrett (2005) states that “the level of available technologies makes possible an international study about the role of electronic portfolios to support student learning, engagement and collaboration” (p. 23). The researcher supports this idea and suggests further research in standards for electronic portfolio components in relation to the assessment of pre-service teachers’ professional and academic growth to be used internationally.

Also, although there is worldwide awareness of electronic portfolios, resistance to the use of electronic portfolios as learning and assessment tools across courses in a curriculum is continuing. Further research to explore how the reasons for this are related to cultural issues, learner’s ability, or other local criteria is needed. For example, in relation to learner characteristics and the use of the Web based support system, in this research it was found that students who are engaged and active within the overall class as well as the with the support system earn higher grades on their electronic portfolios than students who are less active participants. This suggests that that learner engagement (high or low) might be a key factor. Or there may be other factors that may affect the students’ attitude, such as personal excitement for using technology or a new assessment method or instructional approach. These correlated factors suggest further research.

The research focused on the pre-service teacher education context, but these findings may also be relevant for other sorts of educational organizations, such as secondary schools, primary schools, and other organizations related to the professional and academic development of their learners. This, too, needs more research.

Finally, this research emphasizes the importance of developing electronic portfolios with the use of an accompanying Web-based support system. As learners become more self-responsible for their progression and have to perform in increasingly efficient and effective ways, they will need to be able to use Web-based tools and systems as support to maintain as well as improve growth. The design of systems to facilitate student self-responsibility is a major area for continued research.

References

- Abdullah, H. (2001). Electronic schools without paper: The usefulness, and will it really will be a reality?. *Internet Horizon Magazine*, 43 (10), 6-8.
- Alaasemi, S. (March, 2003). Computerized examination system: New trend in the electronic learning. *Al-Moaalem*, v. 1335, 20-21.
- Al-Haron, M. (March, 2003). Interview with the former minister of the Ministry of Education . *Al-Moaalem*, v. 1335, p. 5.
- Ali, A. (2003). Instructional design and online instruction: Practices and perception. *TechTrends*, 47 (5), 42-45.
- Ali, B. N. (2004). Prospective e-learning teachers in Kuwait. *Al-Moaalem*, 1381, 18-20.
- Al-Nagim, S. (2002). Developing the e-learning system continuously is important for the rapid changes in technology. *Internet Horizon Magazine*, 47(2), 30-34.
- Al-Najjar, K. (2002). *The application of (blended) computer-based training (CBT) in the Public Authority for Applied Education and training (PAAET) in Kuwait*. (Doctoral dissertation, Faculty of Educational Science and Technology, University of Twente, Enschede, The Netherlands.
- Al-Nesif, G. (2001, June). The electronic learning. *Compunet Magazine*, 4, pp. 11-15.
- Althuwaini, S. E. (2003). *Visualizing abstract scientific concepts by virtual reality: Studies on using virtual reality techniques in Kuwait education*. (Doctoral dissertation, Faculty of Educational Science and Technology, University of Twente, Enschede, The Netherlands.
- Angeli, C. (2005). Transforming a teacher education methods course through technology: Effects on preservice teachers' technology competency. *Computers & Education*, 5, 383-398.
- Arter, J., & Spandel, V. (1995). NCME Instructional Module: Using portfolios of student work in instruction and assessment. *Educational Measurement: Issues and Practice*, 11(1), 36-44.

Aschbacher, P. (1994). Helping educators to develop and use alternative assessments: Barriers and facilitators. *Educational Policy*, 8(2), 202-223.

Aschbacher, P., & Herman, J. (1991). *Alternative assessments in schools: Report on the status and results of local projects*. ERIC Document Reproduction Service No. ED342799.

Ause, C., & Nicastrò, G. (1997). Establishing sound portfolio practice: Reflections on faculty development. In K. Yancey & I. Weiser (Eds.), *Situating portfolio: Four perspectives* (pp. 333-344). Logan, UT: Utah State University Press.

Baron, C. (1996). *Creating a digital portfolio*. Indianapolis, IN: Hayden Books.

Barrett, H. (2005). *Researching electronic portfolios and learner engagement*. [Online]. Available: <http://www.taskstream.com/reflect/whitepaper.pdf>

Barrett, H. (2004a). *Conflicting paradigms in electronic portfolio approaches: Choosing an electronic portfolio strategy that matches your conceptual framework*. [Online]. Available: <http://electronicportfolios.com/systems/paradigms.html>

Barrett, H. (2004b). *Electronic portfolios as digital stories of deep learning*. [Online]. Available: <http://electronicportfolios.org/digistory/epstory.html>

Barrett, H. (2004c). *My "online portfolio adventure"*. [Online]. Available: <http://electronicportfolios.com/myportfolio/versions.html>

Barrett, H. (2002). *Pedagogical issues in electronic portfolio implementation*. [Online]. Available: <http://electronicportfolios.com/EPpedissues.pdf>

Barrett, H. (2001). Electronic portfolios. In *educational technology: An encyclopedia*. [Online]. Available: <http://electronicportfolios.com/portfolios/encyclopediaentry.htm>

Barrett, H. (2000). Create your own electronic portfolio: using off-the-shelf software to showcase your own or student work. *Learning and Leading with Technology*, 27 (7), 14-21.

- Barrett, H. (1998). Strategic questions. *Learning & Learning with Technology*, 26 (2), 15-17. [Online] Available: <http://electronicportfolios.org/portfolios/LLTOct98.html>.
- Barrett, H., & Carney, J. (2005). *Conflicting paradigms and competing purposes in electronic portfolio development*. [Online]. Available: <http://electronicportfolios.org/portfolios/LEAJournal-BarrettCarney.pdf>
- Barton, J., & Collins, A. (1993). Portfolios in teacher education. *Journal of Teacher Education*, 44(3), 200-211.
- Bastist, C., & Banerjee, R. (2004). *Electronic portfolio system development: From pilot testing to implementation*. [Online] Available: <http://www.uh.edu/hti/cu/2004/v08/01.pdf>
- Becker, H. (1990). Curriculum and instruction in middle-grade schools. *Phi Delta Kappan*, 71(6), 450-457.
- Bird, T. (1990). The schoolteacher's portfolio: An essay on possibilities. In J. Millman & L. Darling-Hammond (Eds.), *The new handbook of teacher evaluation: Assessing elementary and secondary school teachers* (pp. 241-256.). Newbury, CA: Sage.
- Boon, H. (2001). E-learning: Challenges and inhibitors. In *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2001* (pp. 162-163). Norfolk, VA: AACE.
- Boulware, Z., Bratina, T., Holt, D., & Johnson, A. (1997). *Developing professional teaching portfolios using CD-ROM technology as a teaching-Learning tool*. Presentation at the 8th Annual Conference of the Society for Information Technology and Teacher Education (SITE), Orlando, FL. [Online] Available: <http://www.unf.edu/~tbratina/cdrom.htm>
- Bracewell, R., Laferrière, T., & Gregoire, R. (1998). *The contribution of new technologies to learning and teaching in elementary and secondary school*. Laval University. [Online] Available: <http://www.tact.fse.ulaval.ca/fr/html/apport/impact96.html>
- Britton, J. (1990). Research currents: Second thoughts on learning. In M. Brubacher, R. Payne, & K. Richett, (Eds.), *Perspectives on small group learning: Theory and practice* (pp. 3–11). Oakville, Ontario: Rubicon.

- Brooks, J., & Brooks, M. (1993). *In search of understanding. The case for constructivist classrooms* [Revised]. ERIC Document Reproduction Service No. ED431762.
- Brown, C. A. (2002). *Electronic portfolios in pre-service education-Distinguishing between process and product*. [Online] Available: http://www.aace.org/conf/site/pt3/paper_3008_1028.pdf
- Brown, J., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Bruner, J. (1986). *El habla del niño: Aprendiendo a usar el lenguaje*. Paidós, Barcelona: University of Barcelona.
- California State University (CSU). (2004). *Education specialist credential Level I: Portfolio guidelines for mild/moderate, moderate/severe, and visual impairments and blindness programs*. Division of Special Education, Charter College of Education, California State University, Sacramento.
- Cambridge, B. (2004) *EDUCAUSE live teleconference on eportfolios with Barbara Cambridge, February 11, 2004*. [Online] Available: <http://www.educause.edu/ir/library/powerpoint/LIVE042.pps>
- Cameron, B. (2003). The effectiveness of simulation in a hybrid and online networking course. *TechTrends*, 47 (5), 18-21.
- Campbell, D., Cignetti, P., Melenzyer, B., Nettles, D., & Wyman, R. (2001). *How to develop a professional portfolio: A manual for teachers*. Boston: Allyn and Bacon.
- Campbell, D., Cignetti, P., Melenzyer, B., Nettles, D., & Wyman, R. (1997). *How to develop a professional portfolio: A manual for teachers*. Pittsburgh: California University of Pennsylvania.
- Campbell, D.T., & Stanley, J. C. (1963). *Experimental and quasi-experimental design for research*. New York: Rand McNally.
- Carr-Chellman, A., & Duchastel, P. (2000). The ideal online course. *British Journal of Educational Technology*, 31(3), 229-241.
- Chen, L., Benton, B., Cicatelli, E., & Yee, L. (2004). Designing and implementing technology collaboration projects: Lessons learned. *TechTrends*, 48 (3), 46-51.

- Christensen, R., & Knezek, G. (1998). Parallel forms for measuring teacher's attitudes toward computers. In *Proceedings of SITE 98* (pp. 831-832.). Charlottesville, VA: Association for the Advancement of Computing in Education. [Online] Available: <http://www.tcet.unt.edu/pubs/studies/survey/tacdesc.htm>
- Cicchelli, T., & Baecher, R. (1989). Microcomputers in the classroom: Focusing on teacher concerns. *Educational Research Quarterly*, 13(1), 37-46.
- Cifuentes, L., Murphy, K. L., Segur, R., & Kodali, S. (1997). Design considerations for computer conferences. *Journal of Research on Computing in Education*, 30(2), 172-195.
- Cifuentes, L., & Shih, Y. D. (2001). Teaching and learning online: A collaboration between U.S. and Taiwanese students. *Journal of Research on Technology in Education*, 33(4), 456-474.
- Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: Experiences and expectations*. London: Kogan Page.
- Collis, B., & Moonen, J. (2005). *An on-going journey: Technology as a learning workbench*. Public address, University of Twente, Enschede, The Netherlands. [Online] Available: <http://www.BettyCollisJefMoonen.nl/rb.htm>
- Collis, B., Peters, O., & Pals, N. (2001). A model for predicting the educational use of information and communication technologies. *Instructional Science*, 29, 95-125.
- Corwin, T. (2003). Electronic portfolio. *Campus Wide Information Systems*, 20(1), 32-38.
- Courts, P., & McInerney, K. (1993). *Assessment in higher education. Politics, pedagogy, and portfolio*. ERIC Document Reproduction Service No. ED364174.
- Cushman, K. (1999). Educators making portfolios: First results from the National School Reform Faculty. *Phi Delta Kappan*, 80(10), 744-750.
- Czech, B., & Amber, V. (2002). What is the perceived value of creating electronic portfolios to teacher credential candidates? In *Proceedings of Society for Information Technology and Teacher Education International Conference 2002* (pp. 524-527). Chesapeake, VA: AACE.

- Danielson, C., & Abrutyn, L. (1997). *An introduction to using portfolios in the classroom*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Deming, M. (1986). *Peer tutoring and teaching of writing*. ERIC Document Reproduction Service No. ED276019.
- Denzin, N. K. (1970). *The research act in sociology*. London: Butterworth.
- Department for Education and Skills (DfES) (2005). *Harnessing technology: Transforming learning and children's services*. [Online] Available: <http://www.dfes.gov.uk/publications/e-strategy/docs/e-strategy.pdf>
- Dewey, J. (1915). *The school and society*. Chicago: The University of Chicago Press.
- Dimock, K., & Boethel, M. (1999). *Constructing knowledge with technology*. Austin, TX: University of Texas Southwest Educational Development Lab.
- Duffy, T., & Cunningham, D. (1996). Constructivism: Implications for the design and delivery of instruction. In D. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 170-198). New York: Simon Schuster Macmillan.
- Duke, C. (2002). *Teachers and new ICT in teaching and learning*. Working Paper, Sectoral Activities Programme, International Labour Office, Geneva.
- Einstein, A. (1997). *Introduction to research design: It is the theory that decides what can be observed*. [Online] Available: <http://www.socialresearchmethods.net/tutorial/Abrahams/sbk16.htm>
- Ely, D.P. (1990). Protocols and processes for promoting interactive cross-cultural media transfer. *Educational Media International*, 26(1), 7-12.
- Fischer, K. (1997). Down the yellow chip road: Hypertext portfolios. In K. Yancy & I. Weiser (Eds.), *Situating portfolios: Four perspectives* (pp. 338-356). Logan, UT: Utah State University Press.

- Fisher, M. (2002-2003). Online collaborative learning: Relating theory to practice. *Journal of Educational Technology Systems*, 31(3), 227-249.
- Fisser, P. (2001). *Using information and communication technology: A process of change in education*. Doctoral dissertation, Faculty of Educational Science and Technology, University of Twente, Enschede, The Netherlands.
- Fosnot, C. T. (1996). Constructivism: A psychological theory of learning, In C. T. Fosnot (Ed.), *Constructivism: Theory, perspectives, and practice* (pp. 27-49). New York: Teachers College Press.
- Fullan, M.G. (2001). *The new meaning of educational change* (3 Ed.). New York: Teachers College Press.
- Fullan, M.G. (1993). *Change forces*. London: The Falmer Press.
- Fullan, M. G. (1991). *The new meaning of educational change*. London: Cassel Educational Limited.
- Fuller, F. F., Hall, G., & Rutherford, W. (1969). Concerns of teachers: A developmental conceptualization. *American Education Research Journal*, 6(2), 207-226.
- Galloway, J. (no date). *Electronic portfolio (EP): A "how to" guide*. Indiana University Northwest. ERIC Document Reproduction Service No. ED457820.
- Gathercoal, P.; Love, D.; Bryde, B. & McKean, G (2002). On implementing web-based electronic portfolios. *EDUCAUSE Quarterly* 2. [Online] Available: <http://www.educause.edu/ir/library/pdf/eqm0224.pdf>
- Geer, C. H., & Hamill, L.B. (2003). Using technology to enhance collaboration between special education and general education majors. *TechTrends*, 47 (3), 26-29.
- Gibson, D., & Barrett, H. (2003). Directions in electronic portfolio development. *Contemporary Issues in Technology and Teacher Education*, 2(4), 559-576. [Online] Available: <http://www.citejournal.org/vol2/iss4/general/article3.cfm>

- Grant, G., & Huebner, T. (1998). The portfolio questions: A powerful synthesis of the personal and professional. *Teacher Education Quarterly*, 25(1), 33-42.
- Gustafson, K. (1993). Instructional design fundamentals: Clouds on the horizon. *Educational Technology*, 33(2), 27-32.
- Hall, G. (1980). *Evaluation of the delivery of services: A concerns-based perspective for the design of evaluations*. ERIC Document Reproduction Service No. ED223728.
- Hall, G., & Hord, S. (2001). *Implementing change: Patterns, principles, and potholes*. Boston: Allyn and Bacon.
- Hall, G., & Hord, S. (1987). *Change in school: Facilitating the process*. SUNY series in educational leadership. ERIC Document Reproduction Service No. ED223728.
- Hall, G., & Rutherford, W. (1976). Concerns of teachers about implementing team teaching. *Educational Leadership*, 34(3), 227-233.
- Hall, G., Wallace, R., & Dossett, W. (1973). *A developmental conceptualization of the adoption process within educational institutions*. Austin, TX: Research and development Center for Teacher Education, the University of Texas. ERIC Document Reproduction Service No. ED095126.
- Harris M & Curran CM (1998). Knowledge, attitudes, and concerns about portfolio assessment: An exploratory study. *Teacher Education and Special Education*, 2(21), 83-94.
- Hartnell-Young, E., & Morriss, M. (1999). *Digital professional portfolios for change*. Arlington Heights, VA: Skylight Professional Development.
- Heinrich, R., Molenda, M., Russell, J., & Smaldino, S. (1996). *Instructional media and technologies for learning*. 5th Edition. New York: Prentice-Hall.
- Herman, L.P., & Morrell, M. (1999). Educational progressions: Electronic portfolios in a virtual classroom. *T.H.E. Journal*, 26(11), 86-89. [Online] Available: <http://www.thejournal.com/magazine/vault/A2091.cfm>

- Herner, L., Karayan, S., McKean, G., & Love, D. (2003). Special education teacher preparation and the electronic portfolio. *JSET Ejournal*, 18(1). [Online] Available: <http://jset.unlv.edu/18.1/asseds/smith.html>
- Hill, J., & Land, S. (1998). Open-ended learning environments: A theoretical framework and model for design. In M. Simonsen (Ed.), *Proceedings of Selected Research and Development Presentations at the National Convention of the Association for Educational Communications and Technology*. St Louis, MO: AECT. ERIC Document Reproduction Service No. ED423839.
- Huebner, T. (1996). *Engendering reflective practice in teacher candidates with the assistance of teaching portfolios*. UMI Dissertation Service. Doctoral Dissertation, Stanford University, Palo Alto, CA..
- Ingram, A. L., & Hawthorn, L. G. (2003). Designing your Web site for instructional effectiveness and completeness: First steps. *TechTrends*, 47 (2), 50-55.
- Janicki, T. N., Schell, G. P., & Weinroth, J. (2002). Development of a model for computer supported learning systems. *International Journal of Educational Technology*, 3(1), 1-16.
- Johnson, D.W., & Johnson, R.T. (1996). Cooperation and the use of technology. In D. H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 785-811). New York: Simon and Schuster.
- Johnson, D., & Lui, L. (2000). First steps towards a statistically generated information technology integration model. In D. L. Johnson, C. D. Maddux, & L. Liu (Eds.), *Integration of technology into the classroom: Case studies* (pp. 3-12). Hillsdale, NJ: Lawrence Erlbaum Publishers.
- Jonassen, D. H. (1996). *Computer in the classroom: Mindtools for critical thinking*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Jonassen, D., Peck, K., & Wilson, B. (1999). *Learning with technology: A constructivist perspective*. Upper Saddle River, NJ: Prentice Hall, Inc.
- Kamhi-Stein, L. (1997). Promoting EFL teacher development through e-mail instruction. *Computer-Assisted English Language Learning Journal*, 7(4), 14-19.

- Khvilon, E., & Patru, M. (2002). *Information and communication technologies in teacher education: A planning guide*. UNESCO Division of Higher Education. Paris: UNESCO.
- Kimeldorf, M. (1996). Using job search portfolios in an uncertain labour market. *Career Development international*, 1(5), 51-55.
- Koschmann, T. (1996). *CSCL, Theory and practice of an emerging paradigm*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Krause, S. (1996). Portfolios in teacher education: Effects of instruction on preservice teachers' early comprehension of the portfolio process. *Journal of Teacher Education*, 47(2), 130-138.
- Leh, A. (2002). Action research on the changing roles of instructors and learners. *TechTrends*, 46(5), 44-47.
- Leh, A. S. (1997). *Electronic mail in foreign language learning: Communication and culture*. Paper presented at the 1997 National Convention of the Association for Educational Communications and Technology, Albuquerque, NM. (ERIC Document Reproduction Service No. ED 409 851).
- LeMahieu, P., Gitomer, D., & Eresch, J. (1995). Portfolios in large-scale assessment: Difficult but not impossible. *Educational Measurement: Issues and Practice*, 19(1), 11-35.
- Lopez Fernandez, O. (2003). *Digital portfolio: An innovative pedagogical tool for learner autonomy?* Universitat de Barcelona, Spain. [Online] Available: <http://www.utc.fr>
- Lorenzo, G., & Ittelson, J. (2005). *An overview of e-portfolios*. EDUCAUSE Resource Center. [Online] Available: <http://www.educause.edu/LibraryDetailPage/666?ID=ELI3001>
- Martin-Kniep, G. (1998). *Why am I doing this? Purposeful teaching through portfolio assessment*. Portsmouth, NH: Heinemann.
- McCormack, C., & Jones, D. (1999). *Building a web-based educational system*. [Online] Available: <http://webclass.cqu.edu.au/>
- Mckimm, J. (2001). *Using portfolios in medical education*. Imperial College School of Medicine. [Online] Available: http://www.ltsn-01.ac.uk/ltsn_images/pdfs/portfolios.pdf

- Miller, G. E. (1990). The assessment of clinical skills/competence/performance. *Academic Medicine*, 65, S63-S67.
- Ministry of Education Kuwait (no date). *Computing sector*. [Online] Available: <http://www.moe.edu.kw/>
- Mokhtari, K., Yellin, D., Bull, K., & Montgomery, D. (1996). Portfolio assessment in teacher education: Impact on preservice teachers' knowledge and attitudes. *Journal of Teacher Education*, 47(4), 245-252.
- Montgomery, L. A. (2002). *Digital portfolios in teacher education: Blending professional standards, assessment, technology, and reflective practice*. [Online] Available: <http://www.suu.edu/ed/portfolio/lee/CISarticle.pdf>.
- Moon, T. (1997). Review of the book 'Implementing performance assessment: Promises, problems, and challenges'. *Journal of Educational Measurement*, 34(4), 373-376.
- Moonen, J. (2001). Design methodology. In H. Adelsberger, B. Collis, & J. Pawlowski (Eds.). *Handbook of information technologies for education and training* (154-180). Berlin: Springer-Verlag.
- Moonen, J., Collis, B., & Anderson, J. (2005). Standards and assessment of e-learning. In P. Resta (Ed.). *Teacher development in an e-learning age: A policy and planning guide* (pp. 202-230). Paris: UNESCO.
- Moonen, J., & Kommers, P. (1995). *Implementation of communication and information technologies in education*. Report to the Advisory Committee for Educational Research, Dutch Organisation for Scientific Research, The Netherlands.
- Murphy, K. L., Cifuentes, L., & Shih, Y. D. (2004). Online collaborative documents for research and coursework. *TechTrends*, 48 (3), 40-44.
- National Council for Accreditation of Teacher Education (NCATE), (1997-2005). *NCATE 2000 Standards*. [Online] Available: <http://www.ncate.org/public/CurrentFutureTeacher.asp?ch=2>
- Nickerson, R. (1989). New directions in educational assessment. *Educational Researcher*, 18 (9), 3-7.

- Nielsen, J., & Levy, J. (1994). Measuring usability: Preference vs. performance. *Communications of the ACM*, 37(4), 66-75.
- Palmquist, M. (1997). *Overview: Experimental and quasi-experimental research*. Colorado State University. [Online] Available: <http://writing.colostate.edu/references/research/experiment/printFormat.cfm?printformat=yes>.
- Parson, E. A. (1995) Integrated assessment and environmental policy making, in pursuit of usefulness. *Energy Policy*, 23(4/5), 463–476.
- Paulson, F. L., & Paulson, P. R. (1994). *Assessing portfolios Using the constructivist paradigm*. Paper presented at the Annual Meeting of the American Educational Research Association New Orleans, LA. (ERIC Document Reproduction Service (ED376209).
- Paulson, L., Paulson, P., & Meyer, C. (1991). What makes a portfolio a portfolio?. *Educational Leadership*, 48 (5), 60-63.
- Piaget, J. (1974). *To understand is to invent: The future of education*. New York: Grossman.
- Pierson, M., & Rapp, M. (2001). *Implementing Web-based portfolio assessment in a graduate instructional technology program*. ERIC Document Reproduction Service No. ED457834.
- Polonoli, K. E. (2000). *Defining the role of the digital portfolio in teacher education*. Paper presented at the Annual Meeting of the West Virginia Network, Morgantown, WV. (ERIC Document No. ED 447 806).
- Purnawarman, P., & Lynch L., (2004). Electronic portfolio assessments in U.S. educational and instructional technology programs: Are they supporting teacher education? *Techtrends*, 48(1), 50-56.
- Reisetter, M., & Fager, J. (1995). *Assessing the effectiveness of the beginning teacher from a constructivist perspective*. Paper presented at the Annual Meeting of the American Educational Research Association. ERIC Document Service No. ED387498.
- Resta, P. (Ed.) (2005). *Teacher development in an e-learning age: A policy and planning guide*. Paris: UNESCO.

- Ring, G. (2002). *Diffusion of an innovation: The Electronic Portfolio Project in the College of Education*. Doctoral dissertation, University of Florida, Gainesville, FL.
- Roberts, G., Aalderink, W., Cook, J., Feijen, M., Harvey, J., Lee, S., & Wade, V. (2005). *Reflective learning, future thinking: Digital repositories, e-portfolios, informal learning and ubiquitous computing*. Paper presented at the Spring Conference Research Seminar, Trinity College, Dublin. [Online] Available: http://www.alt.ac.uk/docs/ALT_SURF_ILTA_white_paper_2005.pdf
- Roberts, S., Conn, C., Lohr, L., Hunt, E., & Duffy, A. (2003). Not another ID model. *TechTrends*, 47 (4), 15-20.
- Rogers, E. M. (1995). *Diffusion of innovation* (4 Ed.). New York, NY: Free Press.
- Rogers, Y., Sharp, H., Banyon, .D., Holland, S., Preece, J., & Carey, T. (1994). *Human-computer interaction*. Edinburgh: Addison Wesley Longman Limited.
- Ross, S., & Morrison, G. (2003). Experimental research methods. In D. H. Jonassen (Ed). *Handbook of research on educational communications and technology* (pp. 1021-1043). Bloomington, IN: AECT.
- Saleh, M. (2005). *Optimizing grouping practices in elementary classrooms*. Masters thesis, Faculty of Behavioural Sciences, University of Twente, Enschede, The Netherlands.
- Schrock, K. (1995-2003). *Critical evaluation of a Website*. [Online] Available: <http://school.discovery.com/schrockguide/evalhigh.html>
- Siemens, G. (2004). *ePortfolios*. [Online] Available: <http://www.elearnspace.org/Articles/eportfolios.htm>
- Spiro, R., Feltovich, P., Jacobson, M., & Coulson, R. (1991). Cognitive flexibility, constructivism, and hypertext: Random access instruction for advanced knowledge in ill-structured domains. *Educational Technology*, 31(9), 24-32.
- Standards Council of the Teaching Profession (1997). *Preparing a professional portfolio*. Melbourne, Victoria: Department of Education.

- Stone, B. A. (1998). Problems, pitfalls, and benefits of portfolios. *Teacher Education Quarterly*. 25 (1), 105-114.
- Summerville, J.B. (2002). Taking ID Online: Developing an Online Instructional Design Course. *TechTrends*, vol.(46)4, pp. 29-32.
- Survey Share (2004). *Internal Website evaluation questionnaire*. [Online] Available: <http://www.surveymshare.com/templates/internalwebsiteevaluation.html>
- Tierney, R. (1991). *Portfolio assessment in the reading-writing classroom*. ERIC Document Reproduction Service No. ED331055.
- Treuer, P., & Jenson, J. (2003). Electronic portfolios need standards to thrive. *EDUCAUSE Quarterly*, No.2. [online] Available: <http://www.educause.edu/ir/library/pdf/eqm0324.pdf>
- Van Sickle, R., & Hoge, J. (1991). Higher cognitive thinking skills in social studies: Concepts and critiques. *Theory and Research in Education*, 19(2), 152-172
- Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Watson, D. (2001). Pedagogy before technology: Re-thinking the relationship between ICT and teaching. *Education and Information Technologies*. 6(4), 251-266.
- Way, D. (2003). *Evaluating teaching portfolios: Moving from a competitive to a collaborative culture*. [Online] Available: http://www.usask.ca/tlc/pdf/David_Way.pdf.
- Whiteside, J., Bennett, J., & Holtzblatt, K. (1988). Usability engineering: Our experience and evolution. In M. Helander, (Ed.), *Handbook of human-computer interaction* (pp. 791-817). Amsterdam: Elsevier.
- Wieseman, K. (2004, 13 April). *Mandated standards-based electronic portfolio assessment for measuring preservice teacher quality*. Paper presented at the Annual Conference of the American Education Research Association, San Diego, CA.
- Wickliff, G. (1997). A hypertext authoring course: Portfolio assessment, and diversity. In K Yancy & I. Weister (Eds.), *Situating portfolios:*

Four perspectives (pp. 322-337). Logan, UT: Utah State University Press.

Wilkerson, J.R., & Lang, W.S. (2003). Portfolios, the Pied Piper of teacher certification assessments: Legal and psychometric issues. *Education Policy Analysis Archives*, 11(45). [Online] Available: <http://epaa.asu.edu/epaa/v11n45/>

Winsor, P., & Ellefson, B. (1995). Professional portfolios in teacher education: An exploration of their value and potential. *The Teacher Educator*, 31(1), 68-91.

Wolf, D. P. (1998). Portfolio assessment: Sampling student work. *Educational Leadership*, 46 (7), 35-39.

Wolf, K. (1991). *Teaching portfolios: Synthesis of research and annotated bibliography*. ERIC Document Reproduction Service No. ED343890.

Yancy, K., & Weiser, I. (1997). Situating portfolios: An introduction. In K. Yancy & I. Weiser (Eds), *Situating portfolios: Four perspectives* (pp. 225-243). Logan, UT: Utah State University Press.

Zemba-Sual, C., & Severs, M. (1999, March). *Web-based portfolios: A vehicle for examining pre-service elementary teachers' emerging ideas about teaching science*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Boston, MA..

Appendices

1. Questionnaire, Attitudes toward Professional Growth and Technology
2. Electronic Portfolio Survey
3. Students' Attitudes toward Communication Skills
4. Performance Test
5. Electronic Portfolio Concept test
6. Electronic portfolio specification comparisons
7. Example of an electronic portfolio submitted by a student, 2nd Investigation
8. Weekly procedures, researcher and students, 3rd Investigation
9. Example of an electronic portfolio submitted by a student, 3rd Investigation

Appendix 1 Questionnaire, Attitudes toward Professional Growth and Technology

(adapted from Christensen & Knezek, 1998)

Instructions: Please read each statement and then choose the number 1-5 which best shows how you feel. 1=strongly disagree, 2=disagree, 3=neutral, 4= agree, 5=strongly agree.

No.	Clusters	Questions
1	Enjoyment	I do enjoy doing things on the computer
5		I feel comfortable working with computer
2	Vocational awareness	I do think if I learn how to use computer, I will be able to get a good job
11		If I learn to use technology in my college experiences, eventually I will implement it in my future career
14		I do like to up-date my knowledge concerning application software
15		I like active learning processes
17		I believe that I can easily have a job if I have computer skills or not
26		It is not necessary that I have used technology in my college experiences in order to using technology in my future career
29		I am not interested in updating my knowledge about application software
30		I am ready to be a decision-maker about how to use technology in my career
3	Importance	I believe that computers give me the opportunities to learn many new things
4		As a future educator I think that children enjoy lessons on computer
7		I would like to have training on using computers
18		I think with computer I will not learn any new thing
19		Using electronic instruction could not attract children's attention
22		I prefer having face to face training

Appendix 1: Attitude Questionnaire

6	Productivity	I prefer to use technology in producing my assignments
8		I like to be an active learner
12		I prefer tradition assessment by printed tests.
13		I would like to show electronic evidence of my academic and professional growth.
21		I dislike using technology in producing my assignments
23		I prefer to be a passive learner
27		I prefer alternative assessment
28		I do not like the idea of having my work available electronically for assessment
9	E-mail	I do like using e-mail for communication about the course
10		I believe that using communication tools (e-mail, net chatting) will create more interaction between students enrolled in the course and students with their instructors
24		I think that receiving class information or assignments through e-mail will not be as easy as receiving them as printed material.
25		I believe that technology rarely makes any interaction between students enrolled in that course or student with their instructor
16	Anxiety	Computers intimidate me.
20		Working with a computer makes me uncomfortable

Appendix 2 Electronic Portfolio Survey

Course:

Lecture time:

Date:

Adopted from: Dr. Helen Barrett - University of Alaska Anchorage School of Education, 1998.

This survey is part of my research on the effectiveness of electronic portfolio development on student's academic growth. The comments are voluntary and not required for the completion of your portfolio, but your responses will help us improve the process for future cohorts. If you need more space, use an additional page, or send me an e-mail (e-portfolioproject@aalhammar.org).

1. Estimate how many hours you spent working on your electronic portfolio: _____hrs

2. Now that you are finished, how do you currently feel about your electronic portfolio or the process of developing it? (you can choose more than one answer):

- Satisfied
- Pleasant
- Victorious
- Proud
- No affected at all
- Unsatisfied
- Unpleasant
- Not proud
- Sad

3. What do you think is the primary purpose for the electronic portfolio that you create? (You can choose more than one answer):

- Compulsory requirement
- Assessment methods
- Electronic collecting tool
- Entertainment

4. In the future, how do you think you will use or adapt the electronic portfolio that you created?

- Yes
- No

5. Where can you use it?

- In career field
- In private field

6. Which support resources were useful when creating your electronic portfolio?	Did not use	Used, but it wasn't useful	Somewhat useful	Very useful	I could not have completed portfolio without it!
a. Full time use of laptop computer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Handouts provided by instructor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Templates provided by instructor (in PowerPoint and Excel)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Open lab hours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Lab aide assistance in lab	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Class sessions in lab	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. One-on-one meetings with instructor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Internet-based tutorials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Help from a friend or relative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Other (specify) _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. Using Computer Skills, Internet Skill, Multimedia Technology Skill: Level of Skills that have been acquired:	Poor	Acceptable	Good	Very Good	Excellent
a. Set up folders to organize files on computer hard drive					
b. Use advanced features of Microsoft Word (Document Map, Hyperlinks, etc.)					
c. Use advanced features of Microsoft PowerPoint.					
d. Use a digital camera to take pictures					
e. Scan images with a desktop scanner					
f. Edit a digital video (using iMovie or other software)					
g. Develop a web page.					
h. Up load pages on-line though Web Hosting Server.					
i. Using discussion forums					
j. Using electronic communication tools such as: electronic mail (e-mail)					

8. Do you think you will use these multimedia skills with your students when you get your own classroom?

☐ Definitely Will Not ☐ Probably Will Not ☐ Probably Will ☐ Definitely Will

9. Do you think the development of your electronic portfolio can be considered to be significant evidence to document your academic growth?

☐ Definitely Will Not ☐ Probably Will Not ☐ Probably Will ☐ Definitely Will

10. Do you think the development of your electronic portfolio can be considered significant evidence of your professional growth?

☐ Definitely Will Not ☐ Probably Will Not ☐ Probably Will ☐ Definitely Will

Appendix 3 Students' Attitudes toward Communication Skills

Students' name:

Group:

This test is to measure the student's acquisition to communication skills within the "Computer in Education" course in the Gulf region higher education. Your responses are not required for the completion of your course, but your responses will help us improve the process for future cohorts.

Choice the correct answers (one or more) in the following:

- 1- Communicating between instructor and student can be through:**
 - a. Face to face
 - b. Phone call
 - c. E-mail
 - d. Discussion forum
 - e. Lecture
- 2- Collaborative learning can be achieved through:**
 - a. Face to face
 - b. Phone call
 - c. E-mail
 - d. Discussion forum
 - e. Lecture
- 3- Communicating with the technical support specialist can be through:**
 - a. Face to face
 - b. Phone call
 - c. E-mail
 - d. Discussion forum
 - e. Lecture
- 4- What options that available in order to finish a project?**
 - a. On-line tutorials
 - b. Technical support specialist
 - c. Lecture only
 - d. Handouts notes
 - e. Other sources (tutorial books)

- 5- To create discussion, reflection, and communication channels with peers, instructors, future employees, and parents can be through:**
- Face to face
 - Phone call
 - E-mail
 - Discussion forum
 - Lecture
- 6- Receiving reflection, opinions, and suggestions from visitors to your e-portfolio can be through:**
- Face to face
 - Phone call
 - E-mail
 - Discussion forum
 - Lecture
- 7- Keeping up to date with the course changes or news can be through:**
- Handouts notes
 - Lecture only
 - E-mail
 - Course web-page
 - Announcement bulletin
- 8- After graduation and involvement in the real situation in school, which of the following communication channels would you like to use?**
- Face to face
 - Formal mail
 - E-mail
 - Discussion forum
 - Phone call
- 9- Building communication channels between you and your students, you will use:**
- Face to face
 - Discussion forum
 - E-mail
 - Electronic chatting
 - Announcement bulletin
- 10- Discussion forum provides learners with:**
- Reflection
 - New knowledge
 - Feedback
 - Suggestion
 - Entertainment

Appendix 4 Performance Test

Course no.:

Student's name:

Session no.:

Choice the correct answer:

- 1- Internet is:
 - a. A communication tool between computers network either locally or internationally.
 - b. A tool for sharing information between people
 - c. Trading (commercial) tool such as: for selling books, sending gifts, etc.
 - d. All above are correct
- 2- Internet has lots of benefits such as:
 - a. Sharing knowledge and cultural perspectives
 - b. Communication tool between people with less cost, such as: e-mail
 - c. Provide direct communication tool, such as: online chat
 - d. All above are correct
- 3- Internets' browser utilization most popular:
 - a. Internet explorer
 - b. Netscape communicator
 - c. Opera
 - d. a, b
- 4- The familiar searching engines are:
 - a. Yahoo
 - b. MSN
 - c. Google
 - d. All above are correct
- 5- Using Arabic characters in e-mail usually can be in:
 - a. E-mail address
 - b. E-mail title
 - c. E-mail message body
 - d. b, c

- 6- Word program is used to:
 - a. Create documents, such as: reports, formal letter, and etc.
 - b. Create electronic tables and deal with number information
 - c. Create electronic presentation, such as: lectures, and lessons
 - d. Nothing from above is correct

- 7- In Word, the recognize language character are:
 - a. English character
 - b. Arabic character
 - c. Numerical character
 - d. All above are correct

- 8- In Word, changing between languages' characters through:
 - a. Alt+ right shift or Alt+ left shift
 - b. Ctrl+ right Alt or Ctrl+ left Alt
 - c. Language option at the language command
 - d. All above are correct

- 9- In Word, save new document through:
 - a. Save option at file command
 - b. Ctrl+ S
 - c. Save button at the tool panel in the upper part
 - d. All above are correct

- 10- In Word, text format (bold, align, underline) through:
 - a. Font option at the format command
 - b. Bold, align, underline buttons at the tool panel in the upper part
 - c. Key board
 - d. All above are correct

- 11- In Word, cut, copy, and paste can be through:
 - a. Edit command
 - b. Cut, copy, and paste buttons at the tool panel in the upper part
 - c. Key board
 - d. All above are correct

- 12- In Word, adding boarder and shadow to text through:
 - a. Format command
 - b. Boarder and shadow buttons at the tool panel in the upper part
 - c. Key board
 - d. Nothing from above is correct

- 13- Excel program are used for:
- a. Create documents, such as: reports, formal letter, and etc.
 - b. Create electronic tables and deal with number information
 - c. Create electronic presentation, such as: lectures, and lessons
 - d. Nothing from above is correct
- 14- In Excel, deleting cell contain can be through:
- a. Edit command
 - b. Highlight the cell then click Del button
 - c. Del button at the tool panel in the upper part
 - d. a, b
- 15- In Excel, cut row or column can be through:
- a. Edit command
 - b. Cut button at the tool panel in the upper part
 - c. Highlight the area + key board
 - d. All above are correct
- 16- The benefit of using Excel in education is to help instructors in:
- a. Create reports and their formal letters to parents
 - b. Create attendance tables and set students' grades in electronic version
 - c. Develop electronic lessons
 - d. Nothing from above is correct
- 17- In Excel, to open existing file can be through:
- a. File command
 - b. Open button at the tool panel in the upper part
 - c. Key board
 - d. All above are correct
- 18- In Excel, presenting data in graph can be through:
- a. Graph option at the Insert command
 - b. Graph option at the Format command
 - c. Graph option at the Tool command
 - d. Nothing above is correct
- 19- Graph feature, excel and other program are sharing this feature which is:
- a. Windows
 - b. PowerPoint
 - c. Publisher
 - d. Dos

- 20- In Excel, delete selected column or row can be through:
- Delete option at the Edit command
 - Delete option at the Format command
 - Delete option at the Table command
 - All above are correct
- 21- PowerPoint program are used for:
- Create documents, such as: reports, formal letter, and etc.
 - Create electronic tables and deal with number information
 - Create electronic presentation, such as: lectures, and lessons
 - Nothing from above is correct
- 22- In PowerPoint, inserting animation schemes between slides can be through:
- Insert command
 - Format command
 - Show Slide command
 - Nothing from above is correct
- 23- In PowerPoint, inserting text box in the slide can be through:
- Insert command
 - Show Slide command
 - Format command
 - Tool command
- 24- In PowerPoint, choosing slide layout can be through:
- Show Slide command
 - Insert command
 - Tool command
 - Format command
- 25- In PowerPoint, inserting custom animation can be through:
- Custom animation option at the Insert command
 - Custom animation option at the Format command
 - Custom animation option at the Show Slide command
 - Custom animation option at the Tool command
- 26- In PowerPoint, inserting duplicate slide can be through:
- Duplicate slide option at the Show Slide command
 - Duplicate slide option at the Tool command
 - Duplicate slide option at the Insert command
 - Duplicate slide option at the Format command
- 27- In PowerPoint, inserting Clip Art can be through:
- Picture option at the Insert command
 - Picture option at the Format command
 - Picture option at the Show Slide command
 - Picture option at the Tool command

- 28- PowerPoint can be embedded in school through:
- School management
 - Teaching in big class
 - Design transparencies
 - All above are correct
- 29- Criteria of designing the interface of any programmed instruction are:
- Flexibility and well organize of the contains, such as: font, graphics, and information
 - Availability of attraction elements in the instruction, such as: animation, flashing, and etc.
 - Contrast between contains and the background.
 - All above are correct
- 30 Linear programmed instruction is:
- Moving through the linear instructional steps at the learner's own pace
 - Based on behaviorism theory
 - Based on branching
 - All of the above are correct
- 30- Non-linear programmed instruction marked by:
- User can manipulate in some of the instruction
 - User flexibility to surpass or back in the instruction options
 - a , b
 - nothing from above is correct
- 31- Educational criterion in programmed instruction is:
- Clarity and diversity of the programmed instruction
 - Variety and diversity of patterns or examples
 - Consistency between the contains and learner level
 - All above are correct
- 32- Designing programmed instruction undergo certain criterion, which are:
- Provide interactive environment between the instruction and the learner
 - Clear instructions and adequate with user level
 - Flexibility and usability of using the programmed instruction
 - All above are correct
- 33- Designing good programmed instruction with high quality specifications (technically or educational) can be through:
- Word program
 - PowerPoint program
 - Excel program
 - Authoring System program

- 34- Good programmed instruction have an advantage over others by:
 - a. Cultivate learners' differences
 - b. Attend to learners' previous skills
 - c. Emphasis on learning motivation
 - d. All above are correct

- 35- Programmed instruction categorized to:
 - a. Comprehension learning
 - b. Drill and practice
 - c. Simulation/ imitation
 - d. All above are correct

- 36- The main objective of using programmed instruction is:
 - a. Renovation and alteration
 - b. Utilizing computer's potentiality
 - c. Learning mastery
 - d. All above are correct

- 37- Programmed instruction is better than paper instruction by:
 - a. Provide immediate feedback
 - b. Provide contains in stages
 - c. Consider individual differences
 - d. All above are correct

- 38- Main feature of computer instruction than other electronic aids used in education that:
 - a. Provide contains in colorful presentation
 - b. Provide interactive environment
 - c. Present contains in linear pattern
 - d. Provide printed material

Appendix 5 Electronic Portfolio Concept test

Students name:

Group:

This test is to measure the student's understanding of the electronic portfolio concept, and it is directed to the student of the Gulf region higher education.

Your responses are not required for the completion of your course, but your responses will help us improve the process for future cohorts.

Put (T) in front the correct answer, and (F) in front the wrong answer:

- 1- Students' electronic portfolio is defined as a collective of personal photographs only. (F)
- 2- The educational philosophy is considered one of the main elements of the teachers' electronic portfolio. (T)
- 3- Assessment Portfolios presents person competence and skill for well-defined areas. (T)
- 4- Lesson plans are not considered as an element of the teacher electronic portfolio. (F)
- 5- One of the elements that differentiates between the electronic portfolio and the paper portfolio is that the electronic portfolio can be stored in electronic format such as on floppy discs, CD, etc. (T)
- 6- One of the electronic portfolio features is that you can not duplicate the portfolio. (F)
- 7- Multimedia is considered one of the electronic portfolio contents' formats. (T)
- 8- Feedback is considered to be one of the electronic portfolio advantages. (T)
- 9- Design/plan is one of the electronic portfolio development procedures. (T)

- 10- Electronic portfolio is one of the assessment methods in higher education system worldwide. (T)
- 11- One of the differences between the electronic portfolio and the paper portfolio is that electronic portfolio contents can be connected through hyperlinks. (T)
- 12- Showcase Portfolio demonstrates exemplary works, resume, objectives, and personal skills to potential employers to gain employment. (T)
- 13- Starting the electronic portfolio developing can be covered under the Design/Plan stage. (F)
- 14- Video clips related to the electronic portfolio objectives can be included. (T)
- 15- Report/thesis can not be considered one of the teacher electronic portfolio contents. (F)
- 16- Integrating technology into curriculum can be through the use of the electronic portfolio. (T)
- 17- One of the electronic portfolio contents' formats is text file. (T)
- 18- Audience for the portfolio can not considered as one of the "selection stage" criterion of electronic portfolio development processes. (F)
- 19- Interactive learning is one of the electronic portfolio advantages. (T)

Choice the correct answer:

- 1- Electronic portfolio is defined as:**
 - a. A portfolio is a purposeful collection of student work that exhibits the student's efforts, progress and achievements in one or more areas
 - b. Containers of documents that provide evidence of someone's knowledge, skills, and/or dispositions
 - c. A learning environment in which the learner constructs meaning
 - d. All above are correct
- 2- The objectives of developing electronic portfolio are:**
 - a. It is an assessment tool
 - b. It is entertainment tool
 - c. It is learning tool
 - d. a , c

- 3- **The advantages of using electronic portfolio instead of using the paper portfolio are:**
 - a. Easy to modify by adding or deleting
 - b. Encourage feedback between peers
 - c. a , b
 - d. Do not achieve collaborative learning between students
- 4- **Electronic portfolio contents can be stored in deferent formats which are:**
 - a. Audio files, and video clips
 - b. Text files, and hyperlinks
 - c. Multimedia files, and digital images
 - d. All above are correct
- 5- **Electronic portfolio contains:**
 - a. Projects (previous or resent)
 - b. Educational philosophy, resume
 - c. a , b
 - d. Medical records
- 6- **The objective of using "Reflection" between peers during the electronic portfolio development processes is:**
 - a. Benefit from peers ideas and comments
 - b. To chat and enjoy talking with peers
 - c. To improve communication skills and critical thinking
 - d. a , c
- 7- **The portfolio's purpose, audience and future use of artifacts are the criterion of:**
 - a. Implement Stage
 - b. Evaluate Stage
 - c. Decide/Select Stage
 - d. Design/plan Stage
- 8- **Storage/ Size considers:**
 - a. Advantage of electronic portfolio
 - b. Electronic portfolio content's format
 - c. Types of electronic portfolio
 - d. Nothing above is correct
- 9- **Electronic portfolio benefits is:**
 - a. Improve planning skills
 - b. Improve memorising skills
 - c. Improve technology skills
 - d. a , c
- 10- **Electronic portfolio of job seeker has to contain:**
 - a. Academic/Professional Skills
 - b. Objectives/ hobbies
 - c. a , b
 - d. criminal record
- 11- **Developing electronic portfolio encourages:**
 - a. Passive learning
 - b. Planning skills as well as technology skills
 - c. Wasting students' time

- d. All above are correct
- 12- Developing electronic portfolio will achieve:**
 - a. Gaining in students' technological skills
 - b. Gaining in students' planning skills
 - c. Gaining in students' knowledge of subject matter
 - d. All above are correct
- 13- Electronic portfolio is considered as:**
 - a. New e-learning assessment tool
 - b. New phenomena
 - c. Achievement test
 - d. Nothing above is correct
- 14- The benefit of using electronic portfolio than other e-learning assessment tools is hat:**
 - a. It presents students' progress
 - b. It presents less concerns for the students than other e-learning assessment
 - c. It improves learners' experiences as well as their knowledge
 - d. All above are correct
- 15- The objective of developing electronic portfolio within a course is:**
 - a. Presents his/her colours chosen
 - b. Presents the course objectives
 - c. Presents his/her ability to develop transparencies
 - d. All above are correct
- 16- Through the electronic portfolio development, we can emphasis:**
 - a. Active learner within the learning processes
 - b. Attendance records
 - c. Instructor's role within the learning processes
 - d. Nothing above is correct
- 17- The responsible person for choosing the electronic portfolio's contents is:**
 - a. Learner
 - b. Instructor
 - c. Lab assistant
 - d. Nothing above is correct
- 18- One of the best tools to collect students' works electronically is:**
 - a. The electronic book
 - b. The electronic record
 - c. The electronic portfolio
 - d. Nothing above is correct
- 19- Evaluating the electronic portfolio is considered one of the development stages and is called:**
 - a. Decide/select Stage
 - b. Evaluate Stage
 - c. Develop Stage
 - d. Design/plan Stage

Appendix 6 Electronic Portfolio Specification Comparisons

(Adopted from Barrett, 2001)

Design approach	software	Cost	License agreement with:	Hosting	Storage
custom-designed electronic portfolio	MyEport (Maricopa CC system)	N/A	N/A	hosted	(server limit)
	PLP (program adoption only)	Free to programs \$15/semester per person	institution	hosted	100 MB
	MNSCU (Minnesota residents only)	Free	individual	hosted	3 MB
	FolioLive (McGraw-Hill)	\$35/year	individual	hosted	25 MB
	TaskStream	\$20/semester	either	hosted	100 MB
	Blackboard Content System	\$10K/year	institution	server	20 MB
	College LiveText	\$79/3 years	individual	hosted	unlimited?
	FolioTek	\$30/year	institution	hosted	50 MB
	Nuventive's iWebfolio	\$45-\$50	?	hosted	50-100 MB
	ePortaro	\$10/user/year for 1,000 users - lower for more users	institution	either	20 MB or server limit on self-hosted server
	Geocities	Free	individual	hosted	15 MB
	PLP (program adoption only)	Free to programs \$15/semester per person	institution	hosted	100 MB
free online server space	Tripod SiteBuilder (Trellix)	Free	individual	hosted	20 MB
	Open Source Portfolio	Free	either	server	(server limit)
	Mozilla Composer	Free	individual	either	(server limit)
	WordPress	Free	individual	server	(server limit)
	Plone CMS (published on objectis.net)	Free	either	either	10 MB (or server limit)
open source software					

Appendix 6: Electronic Portfolio Specification

Commercial Software & Market	Manila	\$499/server/year	institution	server	(server limit)
	TypePad (based on Movable Type - MT)	\$5-\$15/month	Individual/ (MT-either)	Hosted/ (server-MT)	50-200MB
	BlogWave Studio (requires .Mac account)	\$20+ .Mac account	individual	hosted .Mac account	250 MB
	FolioLive (McGraw-Hill)	\$35/year	individual	hosted	25 MB
	TaskStream	\$20/semester	either	hosted	100 MB
	Blackboard Content System	\$10K/year	institution	server	20 MB
	College LiveText	\$79/3 years	individual	hosted	unlimited?
	FolioTek	\$30/year	institution	hosted	50 MB
	Nuventive's iWebfolio	\$45-\$50	?	hosted	50-100 MB
	ePortaro	\$10/user/year for 1,000 users - lower for more users	institution	either	20 MB or server limit on self-hosted server
Content Management System (CMS)	Blackboard Content System	\$10K/year	institution	server	20 MB
	Plone CMS (published on objectis.net)	Free	either	either	10 MB/ (or server limit)
	Manila	\$499/server/year	institution	server	(server limit)
Web Log Software or Journal	MyEport (Maricopa CC system)	N/A	N/A	hosted	(server limit)
	FolioTek	\$30/year	institution	hosted	50 MB
	ePortaro	\$10/user/year for 1,000 users - lower for more users	institution	either	20 MB or server limit on self-hosted server
	Tripod SiteBuilder (Trellix)	Free	individual	hosted	20 MB
	WordPress	Free	individual	server	(server limit)
	Plone CMS (published on objectis.net)	Free	either	either	10 MB/ (or server limit)
	Manila	\$499/server/year	institution	server	(server limit)
	TypePad (based on Movable Type - MT)	\$5-\$15/month	Individual/ (MT-either)	Hosted/ (server-MT)	50-200MB
	BlogWave Studio (requires .Mac account)	\$20+ .Mac account	individual	hosted .Mac account	250 MB
	Plone CMS (published on objectis.net)	Free	either	either	10 MB (or server limit)

Appendix 7 Example of an electronic portfolio submitted by a student, 2nd Investigation

The students' electronic portfolios for the 2nd investigation consists of a welcome page, and separate buttons for single transparency, windowed transparency, assembled transparency, and the lesson plan called 'learning environment'. Each of these related to one of the course requirements as is shows in Appendix 7-Figure 1. The index page, which is labeled in red on the right-hand side of the navigation bar, is the particular example of a student's work shown in Appendix 7-Figure 1. This page is the welcoming page. In this page the pre-service teacher writes an introduction about the electronic portfolio, its audience, and the purpose of developing electronic portfolio.



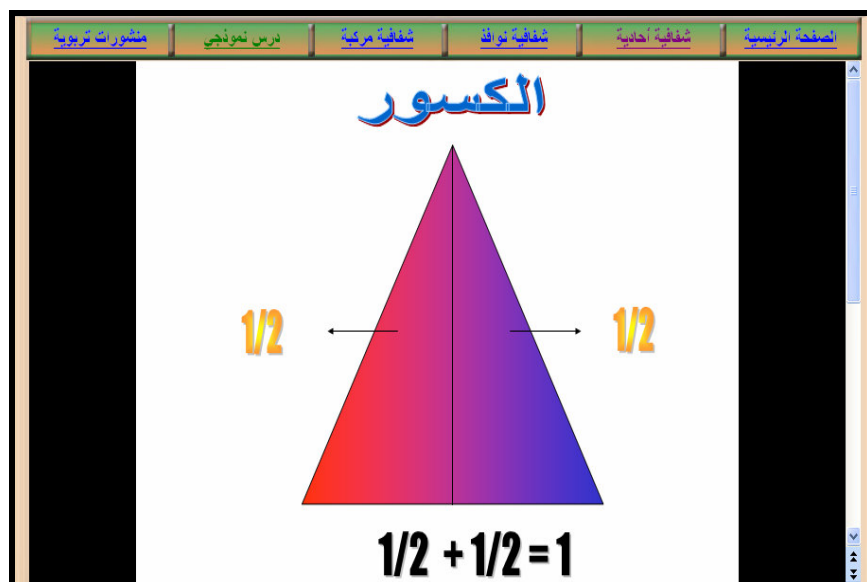
Appendix 7-Figure 1: the index page (welcoming page)

The second button in the pre-service teacher's electronic portfolio is the single transparency, which is first project in the course. This page is presented in Appendix 7-Figure 2. This page contains, as is labeled (2) in the figure, an introduction, statement of the intended audiences for the transparency and how to use the transparency. The link labeled (1) Appendix 7-Figure 2 is the hyperlink to display the results of the project.



Appendix 7-Figure 2: Single transparency

Appendix 7-Figure 3 shows the result of the student for the project of the single transparency created by PowerPoint software, using basic techniques.



Appendix 7-Figure 3: the Single transparency project

Also to accompany the results of that project, the pre-service teacher has to create a brochure to show the objectives of the single transparency, its audience, a description of its contents, and a reflection

on why the single transparency is a suitable medium to create this lesson resource in. These comments presented in Appendix 7-Figure 4.



Appendix 7-Figure 4: Brochure related to the single transparency

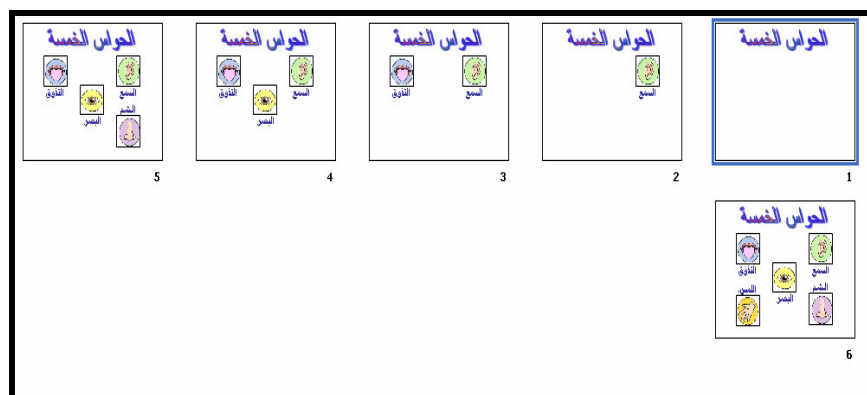
The windowed transparency has the same topic and the same design. Notice also that, some brochures can be used for more than one project.

Appendix 7-Figure 5 presents the third project which is the assembled transparency. The page also contains an introduction, statement of the intended audiences, and a description of how to use the transparency in the classroom. To display the project, click on the hyperlink.



Appendix 7-Figure 5: the assembled transparency page

The project was created by PowerPoint software, and it used additional techniques beyond those which were used in the single as well as the windowed transparency. Appendix 7-Figure 6 presents the project slides.



Appendix 7-Figure 6: the assembled transparency project

Notice that this project shares the same brochure, about fractions, with the single transparency as well as the windowed transparency.

Appendix 7-Figure 7 shows the lesson (description of the learning environment), which contains a complete lesson description with its objectives, activities, and evaluation. The lesson page contains an introduction, statement of the intended audiences, and an explanation of how to use the transparency in the lesson. To display the project, click on the hyperlink.



Appendix 7-Figure 7: the lesson project page

Lastly, Appendix 7-Figure 8 presents the brochure button, which links to extra brochures made by the student that are not related to the projects:



Appendix 7-Figure 8: the brochures page

As is shown in Appendix 7-Figure 8, titles which are labeled with blue and the number (1) are the titles of the brochures. To display the brochures, click on the pink ovals, labeled (2). Appendix 7-Figure 9, Appendix 7-Figure 10, & Appendix 7-Figure 11 show these brochure projects.



Appendix 7-Figure 9: Brochure about multiplication



Appendix 7-Figure 10: Brochure about multiplication concepts



Appendix 7-Figure 11: Additional brochure about multiplication concepts

Appendix 8 Weekly procedures, researcher and students, 3rd Investigation

APPENDIX 8-TABLE 1. RESEARCHER'S ACTIVITIES DURING INVESTIGATION 3, QATAR (SS= ELECTRONIC PORTFOLIO SUPPORT SYSTEM)

Groups	February		March				April				May			
	3 rd W	4 th W 3 days	1 st W 4 days	2 nd W 6-8/3	3 rd W 13-17/3	4 th W 20-22/3	1 st W	2 nd W	3 rd W	4 th W	1 st W	2 nd W	3 rd W	4 th W
2a + 2b	Building new instruments (a+b) Modified instruments (b, d, e, f, g, h) Get the approval to implement these instruments				Presentation of SS then available the whole week two hours day for any assistance in using the SS Assistance students to develop the course assignments (Word) Provide lessons to assist students in their projects	Presentation of the electronic portfolio concepts. Instrument (c) was embedded starting from this week Online assistance started which is two hours in the afternoon time Ask students to prepare a draft of their electronic portfolio information Work with students assignments (Excel)	Work with students assignments (PowerPoint)	Review the e-portfolio draft for students		Supervise students in their building to their portfolio which is started this week, and that was online beside in class	Supervise students in their building to their portfolio			
1a + 1b						Provide students with the require contents of their e-portfolio				Interview students				
C														

APPENDIX 8-TABLE 2. RESEARCHER'S ACTIVITIES DURING INVESTIGATION 3, KUWAIT (SS= ELECTRONIC PORTFOLIO SUPPORT SYSTEM)

Groups	February		March				April				May			
	3 rd W	4 th W 3 days	1 st W 4 days	2 nd W 5-6/3	3 rd W 13-17/3	4 th W 26-27/3	1 st W	2 nd W	3 rd W	4 th W	1 st W	2 nd W	3 rd W	4 th W
2a + 2b + 2c + 2d	Building new instruments (a+b) Modified instruments (b, d, e, f, g, h) Get the approval to implement these instruments			Presentation of SS and available these two days for any assistance in using the SS Provide with a lesson in how to use the SS electronic version	Instrument (c) started to be used Online assistance started which is two hours in the afternoon time Provide lessons to assist students in their projects	Presentation of the electronic portfolio concepts. Ask students to prepare a draft of their electronic portfolio information Develop an example of e-portfolio of students and uploaded to be available online.	Review the e-portfolio draft for students online through submitting electronic assignments or e-mail.	Teaching the FrontPage section	Review the e-portfolio draft for students online through submitting electronic assignments or e-mail.	Supervise students in their building to their portfolio which is started this week.	Supervise students in their building to their portfolio Interviewing students sample.			
1a + 1b						Provide students with the require contents of their e-portfolio								
C+a C+b C+c														

Appendix 8: Weekly Procedures

APPENDIX 8-TABLE 3. STUDENTS' ACTIVITIES DURING INVESTIGATION 3, QATAR (SS= ELECTRONIC PORTFOLIO SUPPORT SYSTEM)

Groups		March				April				May				J u n e
		1 st W	2 nd W 6-8/3	3 rd W 13-15/3	4 th W 20-22/3	1 st W	2 nd W	3 rd W	4 th W	1 st W	2 nd W	3 rd W	4 th W	1 st W
C	1a + 1b	lecture	filling the research instrument a-e-f 1.5hrs lecture then 1.5hrs practice on WWW and e-mail.	1.5hrs lecture then 1.5hrs continue practicing on WWW and e-mail. Start new software application Word with practicing in 4 exercises.	1.5hrs lecture then 1.5hrs continue practicing on WWW and e-mail. Start new software application Word with practicing in 4 exercises.	lecture and practice in the Excel program (create 3 exercises)	lecture and started practice in the PowerPoint program (create 1 exercise) + start to develop a excel project.	Practice in using PowerPoint + Submitting the final version of Excel project	Working in the labs to finish their works	Instrument (b) 5 + Instrument (i) started to be built by students	Instrument (g) (sample of each group selected by instructor (five students) + Instrument (i) started to be built by students	Instrument (i) started to be built by students	Instrument (b) 6 Instrument (b) 7 + Instrument (i) started to be built by students	Instrument (a) distributed Instrument e-f-k Last week to submit instrument (i) Instrument (g) with the course instructors
	2a + 2b			Practicing in SS.	- lecture - last week in Word and student have to submit a project through the paper or electronic portfolio - Write a rationale statement showing their demonstrating (understanding) to the course objectives - Start to build the draft of electronic portfolio contents	- Electronic portfolio test - Participating in the SS (e-mails, discussion forum topic, online chatting, follow up course requirements and submitting assignments) activities	lecture and started practice in the PowerPoint program (create 1 exercise) + start to develop a excel project.	Practice in using PowerPoint + Submitting the final version of Excel project	Working in the labs to finish their works	Instrument (b) 5 + Instrument (i) started to be built by students	Instrument (g) (sample of each group selected by instructor (five students) + Instrument (i) started to be built by students	Instrument (i) started to be built by students	Instrument (b) 6 Instrument (b) 7 + Instrument (i) started to be built by students	Instrument (a) distributed Instrument e-f-k Last week to submit instrument (i) Instrument (g) with the course instructors

APPENDIX 8-TABLE 4. STUDENTS' ACTIVITIES DURING INVESTIGATION 3, KUWAIT (SS= ELECTRONIC PORTFOLIO SUPPORT SYSTEM)

Groups		March				April				May				J u n e
		1 st W	2 nd W 6-8/3	3 rd W 13-15/3	4 th W 20-22/3	1 st W	2 nd W	3 rd W	4 th W	1 st W	2 nd W	3 rd W	4 th W	1 st W
Ca+ Cb+ Cc	1a + 1b	lecture	filling the research instrument a-e-f 1.5hrs lecture then 1.5hrs practice on WWW and e-mail.	1.5hrs lecture then 1.5hrs continue practicing on WWW and e-mail. Start new software application Word with practicing in 4 exercises.	1.5hrs lecture then 1.5hrs continue practicing on WWW and e-mail. Start new software application Word with practicing in 4 exercises.	lecture and practice in the Excel program (create 3 exercises)	lecture and started practice in the PowerPoint program (create 1 exercise) + start to develop a excel project.	Practice in using PowerPoint + Submitting the final version of Excel project	Working in the labs to finish their works	Instrument (b) 5 + Instrument (i) started to be built by students	Instrument (g) (sample of each group selected by instructor (five students) + Instrument (i) started to be built by students	Instrument (i) started to be built by students	Instrument (b) 6 Instrument (b) 7 + Instrument (i) started to be built by students	Instrument (a) distributed Instrument e-f-k Last week to submit instrument (i) Instrument (g) with the course instructors
	2a + 2b + 2c + 2d			Practicing in SS.	- lecture - last week in Word and student have to submit a project through the paper or electronic portfolio - Write a rationale statement showing their demonstrating (understanding) to the course objectives - Start to build the draft of electronic portfolio contents	- Electronic portfolio test - Participating in the SS (e-mails, discussion forum topic, online chatting, follow up course requirements and submitting assignments) activities	lecture and started practice in the PowerPoint program (create 1 exercise) + start to develop a excel project.	Practice in using PowerPoint + Submitting the final version of Excel project	Working in the labs to finish their works	Instrument (b) 5 + Instrument (i) started to be built by students	Instrument (g) (sample of each group selected by instructor (five students) + Instrument (i) started to be built by students	Instrument (i) started to be built by students	Instrument (b) 6 Instrument (b) 7 + Instrument (i) started to be built by students	Instrument (a) distributed Instrument e-f-k Last week to submit instrument (i) Instrument (g) with the course instructors

Appendix 9 Example of an electronic portfolio submitted by a student, 3rd Investigation

The students' electronic portfolios from the 3rd investigation consist of a welcoming page, a resume, a page relating to course requirements, a page about the students' educational philosophy, and a page about previous experiences of the students (the work archive). This appendix shows an example of how one student completed the portfolio.

Appendix 9-Figure 1 shows the index page, whose button in the navigation frame is labeled with a red button. This page contains the welcoming page. In this page the pre-service teacher wrote an introduction about the electronic portfolio, its intended audience, the purpose of developing electronic portfolio, and her reflections after experiencing the development.



Appendix 9-Figure 1: Welcoming page

Appendix 9-Figure 2 presents the resume page. In this page the pre-service teacher was requested to write general information about

herself, such as her name, level of education, e-mail address, technological skills, special training sessions, and hobbies.



Appendix 9-Figure 2: Resume page

The course requirements page is presented in Appendix 9-Figure 3. The page consists of three hyperlinked buttons related to the three projects created as course requirements.



Appendix 9-Figure 3: Course requirements page

The three buttons, as labeled with numbers in the figure, are:

- 1- Word project
- 2- Excel project
- 3- PowerPoint project

Each of these projects has a page which consists of an introduction, statement of the intended audience, statement of the purpose of development, and a reflection on the benefits acquired while doing the project. Also there is hyperlink to display the results of the project. For example, when clicking on the Word project button, a new window opens with the page for the Word project as presented in Appendix 9-Figure 4.



Appendix 9-Figure 4: Word project's page

As shown in Appendix 9-Figure 4, the Word project page consists of an introduction, statement of the intended audience, purpose of the project (according to the course objectives), and a reflection on the benefits from the development of the project. All these are in the area labeled with the number 1 in Appendix 9-Figure 4. Appendix 9-Figure 5 presents the Word project itself that is displayed after clicking on the hyperlink which is shown in Appendix 9-Figure 4 with the number 2.

(1) بعض أعراض الأمراض النفسية:-
 تتمثل أعراض الأمراض النفسية بحسب المرض الذي يصيب الشخص، فهناك الأمراض الذهنية حيث يحصل اضطراب واضح في عملية التفكير فيشعر أن من حوله يضطهدونه ويعتقد أن لديه قدرات خاصة تؤهله للتواصل مع العالم الغير المنموس وكل ذلك بالرغم من عدم وجود أي أدلة وعواهد على ما يعتقد.
 وعن أعراض الحالات الذهنية يسمع المريض أصوات لا يسميها غيره وكذلك يرى أشكالاً وصوراً لا تمت للواقع بصلة.

(2) العلاقة بين الصحة النفسية وصحة العقل:-
 تجلي لنا ذلك في الكافح المستمر في سبيل السعادة والهدوء جانيلاً أو وجهاً الإيجابي والسلمي فمن ناحية أن الإنسان يفضل لإقصاء الألم وتحقيق الشفاء ومن ناحية أخرى لتلويح الأرباب من مآجيك الحياة ولكل هذه من الشفاء فإنه ذلك لنا أهم العناصر التي تصد الهدوء وأهمها:

(3) المعرفة الموصلة إلى الحكمة والسعادة:
 المعرفة هي التي تجمع بين المظهر النفسي والفني في أسلوب من الحياة يؤدي إلى تجرع أسماء الفرح حتى آخر قطره من يتورع الحياة ولا مرية من أن الأخلاق الإنسانية المبتدعة عن الفرح والحب والثراء والسلام هي تلك نجم في أصنافها يدعى نجم.

توضيحي لبعض الأمراض النفسية وأعراضها جدول:

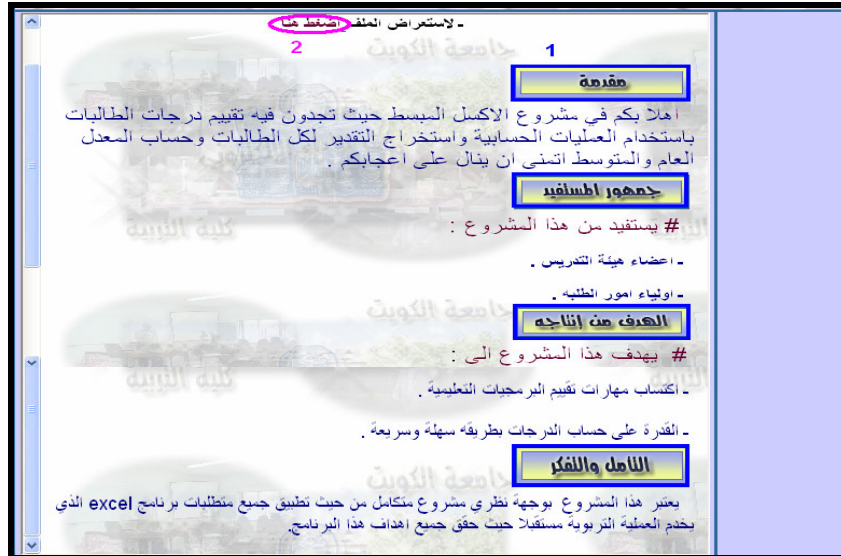
اسم المرض	نبذة توضيحية
فقدان الذاكرة	السيان التلي أو الجزئي وأخطر مراحلها التسيان الرجعي وهذا ما يجعل المصاب ينسى كل ما حصل في السابق والعجيب أنه قد يتذكر أمور معينة كما أنه قد ينسى حدثاً كان قد وقع قريباً.
مرض الجلاش	هو مرض محوره الهوس بحيث يشعر المصاب بالفرور فيقال له أنه جميل وسيم لا يقدر أحد على مقومة إغرائه.
لايقظة المشاعر	هي خلل عقلي يشعر معه المريض بالحب والبغض في آن واحد وكذلك بالرغبة والرغبة.
الغاية	وهو هبوط نفسي شديد يخيل إلى المرء متى أصيب به أنه قاتل مخبٍ فيأهمه اليأس ويسلبه نشاطه ويقتل همته ومن أخطار الغاية ما قد ينجم عنها من حس جنوني أو مقدم ما قد يعمد إليه المكتب من محاولات الانتحار.

الوقاية من الأمراض النفسية:-
 معرفة الإنسان نفسه وقدراته وصفاته على ما هي عليه والسعي لوضعها في مكانها الصحيح وبالإضافة إلى ذلك تنمية طرق التفكير والبعد عن التفكير المنمر والوساوس خاصة أن بعض الأمراض النفسية المتعلقة بالمزاج تكون نتائج

التفكير بما ينتهجه الشخص المصاب ونظرته لنفسه للآخرين.

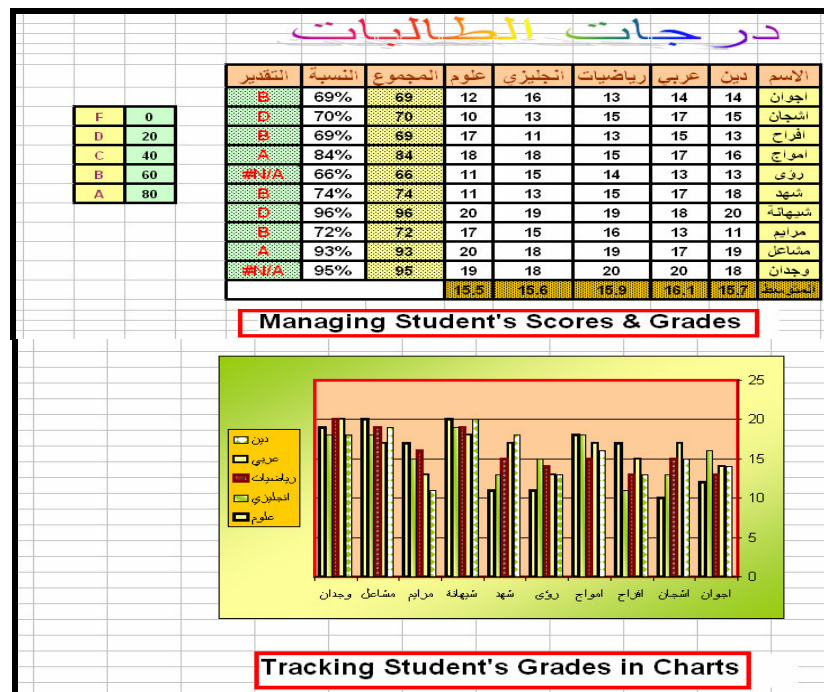
Appendix 9-Figure 5: Word project

The second project is the Excel project whose introductory page is presented in Appendix 9-Figure 6. As the previous project page, this page consists of an introduction, statement of the intended audience, purpose of the project (according to the course objectives), and a reflection on the benefits obtained by the pre-service teacher from the development.



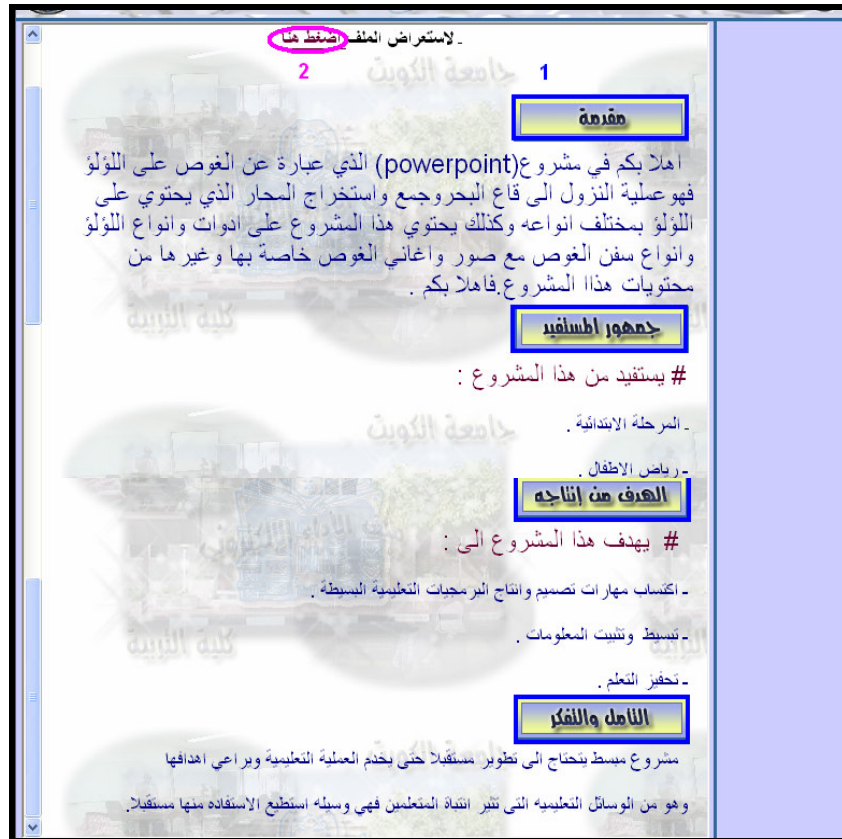
Appendix 9-Figure 6: Excel project page

Also in the same page, there is a hyperlink which leads to the original version of the project, which is presented in Appendix 9-Figure 7.



Appendix 9-Figure 7: Excel project

The last project, which was created by using PowerPoint software, is presented in Appendix 9-Figure 8. As it shown in previous project pages, this project page consists of an introduction, statement of the intended audience, purpose of the project (according to the course objectives), and a reflection on the benefits obtained from the development.



Appendix 9-Figure 8: PowerPoint project page

Also in the same page, there is a hyperlink that leads to the original version of the project, which is presented in Appendix 9-Figure 9.



Appendix 9-Figure 9: PowerPoint project

In Appendix 9-Figure 10, the educational philosophy of the pre-service teacher appears. It was required that it be based on previous knowledge and theories that the student has studied in other courses. In addition, she has to present her approach to her future employers.

ان المعلم هو محور ارتكاز العملية التعليمية وكل ساحوله وسائل مساعدة وعناصر مساندة اذا غابت فربما تآثر دوره لكنه لا ينعدم على العكس ما اذا توفرت كل العوامل والوسائل والعناصر وغاب هو فلا عمل بدونه .

الهدف من التعليم :

ما من أمة تسعى لأن تحتل مكاناً مرموقاً بين الأمم ، إلا وأولت العملية التربوية اهتماماً بالغاً تستطيع من خلالها بناء جيل واع مثقلاً في ثقافته أولاً ثم قادراً على التكيف مع معطيات التكنولوجيا الحديثة ثانياً . وحيث أن مهنة التدريس بإعدادها المختلفة ذات أهمية بالغة في الوصول بالعملية التربوية إلى الهدف المنشود فقد أولت الدول قديماً وحديثاً مهنة التعليم العناية الفائقة ؛ فهي رسالة مقدسة لا مهنة عادية ، وهي تتميز عن غيرها من المهن الأخرى ؛ ذلك بأن المهن تعد الأفراد للقيام بمهام محددة في نطاق مهنة بذاتها ، بينما تسعى مهنة التعليم المهن الأخرى في تكوين شخصية هؤلاء الأفراد قبل أن يصلوا إلى سن التخصص في أي مهنة ، ونعل هذا ، ما دفع الكثيرين إلى أن يصنفوا مهنة التعليم بأنها المهنة الأم فهي مهنة الانبياء ، ومن هنا فإن نجاح هذه المهنة أو فشلها إنما ينعكس على المهن الأخرى في المجتمع ؛ ذلك لأن المعلم هو أداة التغيير في المجتمع .

دور المعلم في المجتمع :

مفهوم مهنة التعليم لا يقتصر على نقل المعلومات بواسطة المعلمين إلى الأجيال القادمة من حيث تلقفها للعقول وتهذيبها وتمهينها للاستعدادات وصفاتها لها ، فهي ليست مجرد أداء إلى يقوم به أي فرد ، ولكنها مهنة لها أصولها وعلم لها مقوماتها وخصائصها .

وحيث إن المعلم هو المسئول الأول عن أداؤها على أسس قلبية وعظمية ، وهو المسئول الأول عن نجاحها أو فشلها فهو يلعب دوراً خطيراً في حياة الفرد والأمة ، فهو يحمل رسالة مقدسة وأمانة عظيمة ، وحيث إن "الرسالة هي البوابة التي يحتاج لنجاحها وتوصيلها إلى أصحابها أمانة ، وبدون هذه الأمانة تضل الرسالة طريقها وتفقد جوهرها ومضمونها ، فالمعلم الحق هو من اجتمعت فيه خصلتان ، حفظ الأمانة وأداء الرسالة ، فهو يهاتين الخصلتين معاً ومرباً " ونظراً لأهمية مهنة التعليم ، فإنه ينتظر من المعلم (صاحب المهنة) أن يكون له أدوار ذات خطر عظيم يؤديها .

فالمعلم هو عصب العملية التربوية ، والعامل الذي يحتل مكان الصدارة في نجاح التربية وبلوغها غايتها ، وتحقيق دورها في التقدم الاجتماعي والاقتصادي . ومن هنا فلا يمكن الفصل بين مسؤوليات المعلم والتغيرات الأساسية التي تحدث في المجتمع .

دور المتعلم في التعليم:

ان يكون له القدرة على اكتساب المعلومات والمهارات التي تمكنه من قدراته التعليمية

Appendix 9-Figure 10: Educational philosophy page

Finally Appendix 9-Figure 11 presents work from previous projects that she has saved from previous courses. For each of these it was required that she write about the topic and the intended audiences, and discuss the choice of medium that was used to create the project.

مشاريع من مقررات سابقة :

عمل برنامج سليات و بور بوييت عن ((الاعراس في الكويت قديماً و حديثاً)) .م

تختلف عادات اهالي الكويت قديماً وحديثاً من حيث الاعراس وما يوجد بها من الامور التي تغيرت وقد اختفت في وقتنا الحاضر مثل الحلوه وغيرها من الامور .

الجمهور المستفيد :

طلبة الرابع الابتدائي .

الهدف :

معرفة التلميذات عن عادات الكويت في القديم ومدى اختفاء بعضها في وقتنا الحاضر

Appendix 9-Figure 11: Previous experiences page