E-portfolios: Using Technology to Enhance and Assess Educational Technology Outcomes

Zuhrieh Shana

Ajman University of Science and Technology

Abstract

The shift from paper portfolios to e-portfolios has arrived in educational institutions worldwide. This study investigates e-portfolio systems as a means of improving performance-centered assessment, enriching students' learning experiences and documenting the students' progress and achievements. The current study reveals the experience of implementing a course-level framework for e-portfolios and an approach taken in initiating student electronic portfolios in the Department of Educational Technology (DET) at Ajman University of Science and Technology, UAE. Data was obtained in several ways, including Likert scale responses and interviews with the participants; students' journals and final reports; notes from the Practicum site supervisor and the DET lab technician; and analysis of the electronic portfolio product. The work and responses of the Practicum students were compared for three consecutive Practicum classes. Analysis of the results showed that developing formative and summative portfolios fluctuated extensively between the three Practicum classes of DET graduates, as did the outcomes. In spite of this fact, the findings suggested that the use of e-portfolios could serve as an influential learning and assessment tool when driven by a clear understanding of the desired outcome and the specific skills to be assessed, and when sufficiently mentored, peer-reviewed, and based on sensible principles.

Introduction

The American National Learning Infrastructure Initiative (2003) defines an e-portfolio as:

> "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." (as cited in Barrett, 2005: 5)

Portfolios in various forms have been linked to curricular activity since before the digital technology revolution. Schools and others have long used boxes or the paper-based portfolio to document student achievements; Hebert (2001) traces the idea back more than 50 years:

> "Those of us who grew up in the 1950s or earlier recognize portfolios as reincarnations of the large memory boxes or drawers where our parents collected starred spelling tests, lacy valentines, science fair posters, early attempts at poetry, and (of course) the obligatory set of plaster hands. Each item was selected by our parents because it represented our acquisition of a new skill or our feelings of accomplishment. Perhaps an entry was accompanied by a special notation of praise from a teacher or maybe it was placed in the box just because we did it." (p.ix)

Such 'showcase collections' developed into course learning portfolios: a collection of products such as documents, pictures or audio-visuals to show that students had reached course objectives. Over time the portfolio has developed with the innovation of technology. The traditional paper-based portfolio is moving towards an electronic format: the three-ring, loose-leaf binder is becoming an e-ring binder. The e-ring binder allows for the portability of academic achievement. A simple web address or CD-ROM

substitutes for the physical inconvenience of bulky binders. Therefore, e-portfolios can be considered electronic versions of classic print portfolios. They can be posted on the Internet or burned onto a CD and thus can promote quick sharing of information across the academic community. Consequently, regardless of the form, portfolios can serve a wide range of purposes such as collection of and reflection on students' best work to show progress and achievements.

A primary advantage which an e-portfolio has over traditional three-ring binder portfolios is in its physical storage. A portfolio in a traditional print binder has little protection from rough, improper handling and environmental fluctuations, and thus is more easily damaged or likely to deteriorate over time. An e-portfolio, on the other hand, offers continuous running records using CD-RW (CD-Rewritable) discs to store, update and revise data. They also allow for mixing different types of media formats such as text, graphics and still images, as well as digital video and movies with sound.

Based on the above facts, this study was intended to explore the effectiveness of the e-portfolio as a way to learn and asses learning outcomes. The credibility and dependability of the e-portfolio as a learning and assessment tool was to be determined from the perspective of faculty, staff and students.

This study was designed to provide a definite, explicit answer to the following questions:

- Do Educational Technology Practicum (ETP) students see e-portfolio as an effective learning and assessment tool?

- Does their experience with the e-portfolio change their perception of its effectiveness?

- Does their experience with the e-portfolio impact their overall e-portfolio development score?

Objectives of Study:

1. To promote the development of the reflective competencies of ETP students and give learners greater responsibility for their learning.

2. To develop strategies to facilitate non-traditional assessment of curriculum outcomes.

Importance of Study:

To share results from program-level portfolio research that has provided insight into:

- Student quality at the outset of the Education program

- Growth of students' reflective practice

- Program effectiveness.

- Students' learning and changes during the program

Literature review

Education in the Arab World

Today more than ever, it is crucial that the educational experience promote meaningful learning that fosters critical thinking based on integrated, structural knowledge, rather than rote learning of scattered facts. Although all people are meaningful learners before they begin school, most school practices encourage rote learning and many learners become used to it, especially in the Arab world where the emphasis of teaching is on theoretical education and often neglects practical "hands-on" training and "real-life" experience.

To "know" does not necessarily mean to comprehend. Selecting the correct answers on true/false or multiple-choice questions may show that a student is familiar with or "knows" the material; however it does not necessarily guarantee that the student understands the concepts. Learning is a product of comprehension and understanding, not just a separate activity that can be turned on and off. Consequently, students must use technology to acquire tools and techniques for meaningful learning. So instead technology being used as a mere delivery media, it should offer learners an intellectual partnership that transcends the limitation of human cognition, such as limitations to memory, thinking, and problem solving (Hoyles et al., 1994).

Educational institution in the Arab region needs to be more directly linked to workplaces of employers (Bubtana, 1998). Consequently, many businesses across the region have "…called for educational reform because of an overemphasis on rote learning and memorization pedagogy common throughout all levels of education in the region" (Gillespie and Riddle, 2003), and Cassidy (2005) affirmed that "Practice based on the individual pursuit of rote learning and memorization must give way to practices that encourage teamwork, critical thinking and problem-solving" (P. 6); he also recommended that " Internship programs are one example of a learning feedback loop to institutions providing an evaluation and communication about how well an institution is doing in training its students for the real demands of work"

So students and graduates must be able to undertake problem-solving projects, evaluate the appropriateness, accuracy and usefulness of information from a variety of resources, develop inquiry strategies, think critically, but constructively and develop and communicate results and solutions. (Badran, 1999)

A significant problem is that students, being used to rote learning, may not grasp the concept of meaningful learning. However, studies have shown that tools such as e-portfolios can help students learn meaningfully, help them learn how to learn, and prepare them for lifelong learning (Barrett, 2000; Love & Cooper, 2004; Wall et al, 2006).

E-portfolios for Learning and Assessment

The benefits of e-portfolios in learning include speedy access, easy storage and enhanced multimedia technology skills (Abrami & Barrett, 2005; Barrett, 2000; Heath, 2002, 2005; Wade et al, 2005; Wall et al., 2006). E-portfolios have the capability of putting theory into practice (Hauge, 2006). Also, the use of e-portfolios can encourage students to document their progress and achievements and to reflect and keep in touch with their self-development and track changes over time (Aitken, 1993; Di Challis, 2005).

On the other hand Shepard (2000) and Brookhart (2004) point out that traditional assessments were aligned with the traditional instructional practices of a previous century and have become prevalent in education. This is especially obvious in the developing countries including the Arab countries; "the most widely used instruments are school-books, notes, sheets or summaries. Communication in education is didactic, supported by set books containing indisputable texts in which knowledge is objectified so as to hold incontestable facts and by an examination process that only tests memorization and factual recall." (Gonzales, n.d.). Such an approach is inconsistent with current cognitive and constructivist theories. To better align with the current theories and instructional objectives, authentic, performance-based assessments and projects need to be encouraged and adopted.

Gerstner et al. (1994) confirmed that "the problem with education isn't that schools aren't what they used to be, the problem is that schools are what they used to be. Schools have not gotten worse; they have simply not changed for the better." Therefore, there is an enormous need for change and the introduction of authentic strategies of assessment. An analogy stated by Dr. Judith Liskin-Gasparro

(1997), to compare traditional and authentic assessment, testified that: "an authentic assessment is like a videotape of student learning, while a traditional test is more like a single snapshot" (P. 2). One of the most remarkable types of authentic assessment is the use of e-portfolios. E-portfolios engage students in the evaluation and assessment process (Wade et al., 2005), as they frequently re-examine and refine their e-portfolios. Students acquire a better comprehension of the assessment they are undertaking (Wall et al., 2006), and can use that assessment to continually improve their learning (Cambridge, 2001). Other researchers such as http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VD8-4MVDVH9-2&_user=1790654&_coverDate=05%2F31%2F2007&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000054312&_version=1&_urlVersion=0&_userid=1790654&md5=4dceca36711b31ee947ee150cac8b77b - bib31#bib31Zeichner & Wray (2000) suggested that a portfolio can provide learning experience during both the formative and summative assessment as illustrated in the Portfolio Assessment System (Dannefer and Henson**,** n.d.), Figure 1.
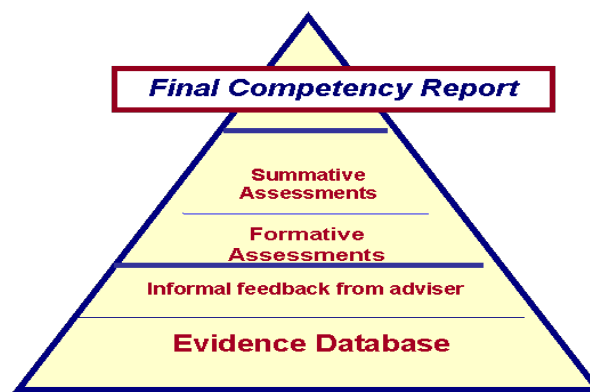

Figure 1: Portfolio Assessment System

Although recent literature related to e-portfolios and their application has grown considerably, more empirical work is needed in order to cover all aspects of e-portfolios and to increase their potential as a means to enhance learning. (Klenowski et al., 2006; Pinsky and Fryer-Edwards, 2004; Wetzel and Strudler, 2005; Abrami and Barrett, 2005)

Methods

The Course

The teaching Practicum (580421) is a three-credit hour compulsory core course, which offers students a supervised field practice component in the Department of Educational Technology (DET) program. The current DET program at AUST is only offered for females. The official course description is: "On-site experience relates closely theory and practice, under supervision of qualified person(s). Students under the supervision of a Practicum supervisor and a faculty coordinator are responsible for planning and carrying out a 'Plan of Work'. Students maintain and submit logs, journals, and other documentation of the experience."

The student workload for the Practicum is as follows: a total of 9 hours every week over a period of 16 weeks for a total of 144 hours. Students are expected to attend a seminar during the 8th week of the course. The purpose of this seminar is to provide students with the opportunity to share their teaching Practicum experience with their colleagues and coordinator. Students should record their weekly Practicum activities and present the result in the form of a time log and journal to be submitted to the faculty coordinator on every third Sunday throughout an overall period of sixteen weeks.

During the semester students were expected to show appropriate evidence to demonstrate what they have learned and how it fits with their short- and long-term educational and career objectives. Practicum students should produce at least one project in each of the major Educational Technology domains of competence:

- Website
- Database
- Multimedia production
- Computer-based Training (CBT) program in computer and technology literacy

The above requirements should be presented in the form of an e-portfolio, which is expected to be a comprehensive document that will provide evidence of accomplishments. Therefore, the Portfolio should have a professional appearance and must meet the following criteria:

1. Students must carefully choose the material and artifacts to be included. Portfolio presentation must be well-organized, unmistakably produced, thus it is strongly suggested that students have another individual proof-read the documents.

2. The cover page should include the student's name, phone number(s) and e-mail address.

3. Table of contents must be included.

4. The portfolio must be divided into sections. The sections must correspond to the competencies required for the Educational Technology Department at AUST.

5. All components of the portfolio should be clearly labeled, where each section contains: a brief introduction, appropriate supporting material, self-reflection (journal), summary, and final report.

6. Appendices should include a course syllabus, student's CV, work plan, time log and other documents related to the Practicum experience.

The Participants

The Educational Technology major is offered to female students only; hence, the sample used in this study consisted of 38 female students enrolled in Practicum classes during the spring of 2004-2006. A total of 4 students were excluded from the class of 2004 (see below), primarily because they were absent, for personal reasons, on the days of the meeting workshops or interviews. Thus a total of 34 female students completed e-portfolios for their final semester course of the Bachelors Degree in the Educational Technology Program at AUST, Fujairah Campus, UAE. They had to successfully complete at least 123 (out of 132) credit hours with an accumulative grade point average (AGPA) of 2.00 (out of 4.00) or higher.

The samples used in this study were all chosen in early 2004. The samples consisted of three groups which were observed and mentored over one year, two years, and three years respectively as a way of preparing them for their Practicum course e-portfolio. Hence, the samples were grouped based on their final graduation year.

The three groups chosen in 2004 were as follows:

- Group 1: 4th year students that took part in this study over the duration of one year, 2004. This group consisted of 18 students and will be referred to as *"the class of 2004"*.

- Group 2: 3rd year students that took part in this study over the duration of two years starting from 2004 until 2005. This group consisted of 12 students and will be referred to as *"the class of 2005".*

- Group 3: 2nd year students that took part in the study over the duration of three years starting from 2004 until 2006. This group consisted of 8 students and will be referred to as *"the class of 2006".*

Since it was important to determine whether there was a statistically significant difference between the 2004, 2005 and 2006 classes of Practicum course students in their overall accumulative grade point average score (AGPA), the students' AGPA were collected for analysis at the beginning of their Practicum course. The purpose of this analysis was to eliminate their AGPA from being a factor contributing to their overall e-portfolio development scores. A one-way analysis of variance was used to analyze the AGPA score of the students before enrolling them in the Practicum course. Since the p-value (0.572) turns out to be more than 0.05 ($P > 0.05$), the test accepts the hypotheses that the treatment means are equal and comparable as shown in Table 1.

This proves that there were **no** significant differences at the starting point of the study as shown in Table 1 below:

Table 1:   Results of the One-way ANOVA: the AGPA score of the three classes of students where DF = degrees of freedom, SS = sum of squares, MS = mean squares, F = test statistic and P = probability value, N = number of samples, StDev = standard deviation, CIs = confidence intervals

Analysis of Mean Scores

Results for: MINITAB F test.MTW / One-way ANOVA: 2004; 2005; 2006

One-way ANOVA: C1; C2; C3

Source	DF	SS	MS	F	P
Factor	2	0.302	0.151	0.57	0.572
Error	31	8.247	0.266		
Total	33	8.549			

S = 0.5158   R-Sq = 3.54%   R-Sq(adj) = 0.00%

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev
C1	14	2.6679	0.5297
C2	12	2.6058	0.4821
C3	8	2.4263	0.5401

Pooled StDev = 0.5158

The treatment levels did vary over the duration of this study. According to Barrett (2000), technology skills needed for developing e-portfolios have to be gradually introduced and integrated. Therefore, though e-portfolio development started in 2004, each year the technology skills taught were more advanced than the previous as shown in Table 2.

Table 2: Summary of duration of e-portfolio experience, the technology introduced and expected outcomes.

Class	IT Skills in curriculum	Portfolio requirements
2004 (1 year)	Databases, hypermedia or slide shows (e.g., PowerPoint), stored on a hard drive, Zip, floppy diskette or LAN server.	Portfolio data is entered into a databases, hypermedia or PowerPoint template, stored on a hard drive, Zip, floppy diskette or LAN server.
2005 (2 years)	Portable Document Format (Adobe Acrobat PDF files), stored on a hard drive, Zip, CD-R/W, or LAN server.	E-portfolio's documents are translated into Portable Document Format (Adobe Acrobat PDF files) with hyperlinks between domains, artifacts, and reflections stored on a hard drive, Zip, CD-R/W, or LAN server.
2006 (3 years)	HTML-based web pages created with a web authoring program and posted to a WWW server. Multimedia authoring program, such as Authorware or Director, pressed to CD-R/W or posted to the Web.	E-portfolio's documents are translated into HTML, complete with "hyper-links" between domains, artifacts, and reflections, using a web authoring program and posted to a WWW server. Portfolio is organized with a multimedia authoring program, incorporating digital sound and video is converted to digital format and pressed to CD-R/W or posted to WWW in streaming format.

Study Design

Both qualitative and quantitative approaches have been employed in conducting the study. The framework for gathering the research data was varied: questionnaires, interviews, journals and reports from students and supervisors were used to support and explain the quantitative data, as well as simple qualitative data in the form of comments.

The independent variable was the integration of e-portfolio into the 4th year of DET instruction for the Practicum course. The dependent variable of the study was the impact of the duration of exposure to e-portfolio on the students' perception experience and of the students' overall e-portfolio development scores.

The evaluation strategy used in this study consisted of five instruments: students' e-portfolio evaluation, three-point Likert scale questions, open-ended interview questions, student journals, student reports, and lastly: researcher, practicum site and DET lab supervisors' notes.

Research instruments

Questionnaire

In order to assess their perceptions on the e-portfolio process, students from three different classes were asked to respond to a questionnaire consisting of 6 Likert-scale items, combined with open-ended

questions. The options for answering each question were: (1) Agree, (2) Undecided, and (3) Disagree. Using this scale, students were asked to respond to six statements: the first three dealt with their perception of e-portfolio development as a learning tool, and the latter three with their perception of e-portfolios as a performance assessment tool that enables them to demonstrate their learning and reflections over the course of their DET program.

The Likert scale component comprised the following six items:

> *Portfolio creation helped me to:*
>
> 1. *look for and find information from different resources.*
> 2. *enhance my skills (multimedia, communicating and problem-solving).*
> 3. *increase awareness of my ability and to better grasp concepts.*
> 4. *be responsible for my own learning and monitor my progress.*
> 5. *reflect on my ability, knowledge and learning.*
> 6. *increase awareness of where I was, where I am and where I am heading to.*

The questionnaires were distributed at the last meeting of each practicum course for the period of 2004-2006. A total of 34 completed questionnaires were received, the class of 2004 (14), the class of 2005 (12), and the class of 2006 (8). The results of the Likert scale questions are summarized in Table 3*:*

Table 3: The percentage of students of the three classes who agreed on statements regarding eportfolios as a learning & assessment tool.

Classes	First Three Statements (Learning)	Latter Three Statements (Assessment)
2004	57%	43%
2005	75%	83%
2006	88%	100%

To elaborate on the previous students' responses, the researcher developed an interview based around the following open-ended questions:

> *Please comment on the value of the portfolio creation process as a learning and assessment experience and whether or not, and **why**, you believe that…*
>
> 1. *… portfolio assessment is a fair judgment of your effort, ability, and understanding of the content. It should replace part of traditional pencil-and-paper format tests for the overall assessment of a course.*
> 2. *… portfolio creation and assessment will contribute to your learning experiences and how it alters the focus from input/lecturing to feedback/learning.*

Several students were interviewed in the development of these questions in order to assure that the questions and responses were interpreted as intended. Questioning students on the e-portfolio development process gave helpful insight into how students think and interpret questions. Students used different reasoning that led to their various answers; therefore the questioning could result in something other than intended. Interviews led to some interesting findings in terms of misconceptions held by these students and accordingly the necessary modifications were made to improve reliability and reduce the danger of misinterpreting the questions.

The average length of time for the interviews was approximately 20-30 minutes per student. The questionnaire consisted of the above two main questions with two or three sub-questions for each main question. The questions were in English but to reduce the language "barrier", English questions were translated into Arabic and students had the choice of answering the questions in English or Arabic. To summarize the findings of these interviews, 20% of the class of 2004, 75% of the class of 2005 and 100% of the class of 2006 supported the idea of the e-portfolio, considering it an effective way to learn, to assess technology skills and to understand their major.

Student journals and final report

Student journals and final reports could provide the instructor with valuable insight into the progress of individual students toward achieving the learning objectives of the course. Because students have varying abilities to express themselves orally, not all will contribute equally to interviews or class discussions. Thus, those students will often comment more openly in their personal journal or final reports. Students were encouraged to express their feelings and thoughts and then to try to understand both the content and emotion of the message they tried to express. To trigger students' reflection, participants were provided with **instructor/researcher** designed focus questions, in the form of a reflection cycle, as shown in Figure 2:
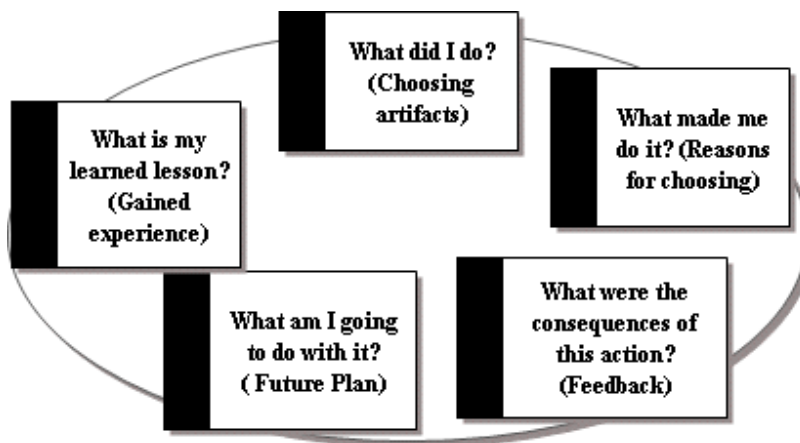
The Five What(s) Reflection Cycle

Figure 2: Instructor/researcher designed Five what(s) reflection cycle.

Data obtained from student journals and reports were collected and analyzed. In summary, the percentages of positive comments regarding the e-portfolio experience were: 36% from the class of 2004, 75% from the class of 2005 and 87.5% from the class of 2006.

Students' e-portfolios

At the very beginning of the semester, students were asked to prepare an e-portfolio. The e-portfolio should be viewed as the capstone of the students' education in their major and has to be aligned with DET core plans and program-learning outcomes. Students should ensure that elements of the e-portfolio reflect evidence of proficiency in the DET major content and main domains. Two things have to be emphasized in each section:

1. A selection of evidence of student practice/competency in these domains which demonstrates understanding of main concepts and skills in Educational Technology supported by reasons for picking these pieces or projects as evidence.

2. A written reflection on own growth and development in each area. This is considered as proof of self-awareness of one's own learning path, including where the student started from, and where she is now and where she is heading to.

E-portfolios provide evidence of meeting criteria, or making progress toward goals. Thus, concurrent with the development of the three-point Likert scale, open-ended interview questionnaire, student journal and final report, a rubric (Appendix A) including a list of DET domains and indicators of their application were developed to assess students' e-portfolios.

Evaluation of the completed e-portfolio

Five domains and 15 indicators were identified. For each indicator, a positive score of (3-5) was given if the accepted indicators were linked accurately to the correct domain, and a score of (0-2) to unaccepted indicators that were not linked to the correct domain. If one of the indicators was missing, a score of 0 was indicated. Based on the above scores, the full e-portfolio will be assigned one of the following designations:

A: Outstanding (Score of 65-75)

B: Very good (Score of 60-64)

C: Acceptable (Score of 52.5-59)

D: Unacceptable (Score below 52)

See Table 4 (p. 18 below) for differences in the mean scores of the three classes.

Site and DET labs supervisors' notes

The site and DET lab supervisors reported positively on their involvement with e-portfolios. This experience appears to add greater depth to their relationship with students. Many students benefited from this and therefore asked for greater formative feedback from site and DET labs supervisors. Although the amount of help that could be provided might be debated, their assistance to students should definitely balance students' comfort with their sense of control over the use and content of their portfolios. Technical problems and recommendations that were reported by site and DET labs supervisor included the following:

- Due to failure to back-up the work to a second personal disk a possible disk crash, unusable files and other problems can cause the loss of valuable data at very inconvenient times.

- Students change the names of files that are already on the template. Hyperlinks will not work properly; their advice to students is not to change the files names.

- Some students spend more time making their portfolios look fascinating rather than working on the content and the ideas behind it. Therefore many students spent more time struggling with the technology trying to tailor their e-portfolios than actually using it for its anticipated aim.

- Some portfolios are jammed with projects and artifacts. Their advice to students is to select what best represents their skills and matches the required goals.

Overall, the site and lab supervisor concluded that the technical problems decrease as the exposure to e-portfolio creation experience increases. Thus, although e-portfolios place additional demands on them as well as on school resources, portfolios have been characterized by site and lab supervisors as a worthwhile burden with concrete results in students' motivation, learning and assessment.

Procedures

Data Collection

In 2004, developing a portfolio was a new requirement for students completing the Educational Technology major. To enable the students to develop an e-portfolio, an e-portfolio template was produced. Based on a needs assessment survey, a series of multimedia program workshops were offered. Additional help sessions were conducted by the DET lab supervisor to help students get individual assistance when needed. Also the lab technicians were available on a regular basis to provide technical support to the instructor and students.

Covey (1989) states that, "to begin with the end in mind means to start with a clear understanding of our destination. It means to know where you're going so that you better understand where you are now so that the steps you take are always in the right direction." In line with this view, the course and program's goals were discussed with students, and students were asked to link these goals with their work samples and artifacts.

Although participants in the three classes of the study may have had no significant difference in mean GPA, they were different in their levels of pre-requisite skills and knowledge of e-portfolios. For the class of 2004, this was their first experience in developing and using e-portfolios: they had just begun to receive instruction on how to produce and use portfolios in their practicum course. Throughout the semester, the students in this class, like all other DET students including students of the first semester of the DET study plan, were asked to use the e-portfolios by selecting and uploading specific assignments for evaluation onto a server. Next, gradually, depending on their technological skills, students of this class were expected to enter portfolio data into a ready-made format, such as a slideshow (PowerPoint) or a Dreamweaver template, and to store it on a hard drive, floppy diskette or CD. See example in Figure 3.

Figure 3: A sample e- portfolio from the class of 2004

Since the e-portfolio was a new requirement for students, examples of students' portfolios from previous semesters were not available as models for students. Therefore, examples of web based

portfolios created by students from other institutions were presented. In addition, the instructor/researcher developed a "model" portfolio to display to the students. To supplement this, examples of artifacts that could provide evidence of attainment of the course goals were described to students during the first two weeks of the semester.

For the class of 2005, an e-portfolio template had also been created to support students in developing their e-portfolios. Their job was to add their work to this template and redesign it to make it suit their personal style and to match their own study plan. Students of this class were expected, in addition to previous requirements, to add hyperlinks between domain goals, artifacts, and reflection.

Templates and all related material of students that choose to create a web-based e-portfolio are housed on the DET server and the finished product can later be transferred to web space. Candidates choosing to complete a portable e-portfolio were encouraged to use CD, DVD, Flash or zipped disc devices to work on and store the finished product. The final e-portfolio must be copied onto a CD. It must include all files that were created and technology projects that had been completed. See example in Figure 4.

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Figure 4: A sample e portfolio from the class of 2005.

Since the concept of e-portfolios was introduced at an earlier stage to the class of 2006, they had a more advanced understanding and knowledge of e-portfolios than other classes by the time of this study. Students of this class had more opportunities for viewing samples, attending courses during which they received information on portfolios and thus better chance to work on developing their own portfolios. Accordingly, they had a higher set of requirements to achieve. E-portfolio for this class was expected to be structured with a multimedia authoring program, converted to digital format, pressed to CD-R/W and then finally uploaded to the WWW (See example in Figure 5). One student from this class created an e-portfolio template as an alternative to the official one shown in Figure 6.

Figure 5: A sample portfolio from the class of 2006.

Figure 6: A student from the class of 2006 created an alternative e portfolio template.

Procedure and Data Analysis

Quantitative and qualitative data was collected during the three academic years 2004, 2005 and 2006. After the students had completed their portfolios as a partial fulfillment of the practicum course requirements, they left their portfolios for a more in-depth analysis by the instructor/researchers. According to Radnor (2002) in interpretive research, "the researcher is the research instrument…" The researcher was the primary human instrument of data collection and interpretation in this study.

Qualitative data was gathered through open-ended questionnaires, interviews, students' journals and reports. The analysis of data, using the interpretive technique, was accomplished by hermeneutical data analysis techniques (Klein and Meyers, 1999). A hermeneutical mode of analysis suggests a way of understanding textual data:

> "Interpretation, in the sense relevant to hermeneutics, is an attempt to make clear, to make sense of an object of study. This object must, therefore, be a text, or a text-analogue, which in some way is confused, incomplete, cloudy, seemingly contradictory - in one way or another, unclear. The interpretation aims to bring to light an underlying coherence or sense." (Taylor 1976, p.153)

The idea of hermeneutic analysis is that the "whole" consists of common meanings that are formed by interactions between specific points of view (Klein and Myers, 1999).

The qualitative data collected was recorded and stored electronically. Raw data were placed initially into categories and organized around the issues of the study. Written interpretations of the data were made available to be reviewed to check the facts and interpretations made by the researcher and to confirm the correctness of quotes and descriptions. Conclusions were also verified with other researchers/research participants. Then efforts were directed towards generalizations through understanding a whole from the joined meanings of its parts and their interrelationship. For this purpose, subjects must have access to shared linguistic and interpretative resources. (Marshall and Brady, 2001)

Confidentiality of respondents was maintained throughout the process. Data was tabulated and analyzed using Microsoft EXCEL and Minitab Statistical Software. Minitab procudes a table labeled "ONE-WAY ANALYSIS OF VARIANCE" which resembles the independent sample t-test. The only new feature is that the independent variable comprises more than two groups. An alpha level of 0.05 was used for the tests.

ANOVA (see Table 4 below) compares means by analyzing the variances of our samples, partitioning the variances (SOURCE) into categories: FACTOR (between-group effects), ERROR (within-group effects), and TOTAL (the overall variance). Other descriptive statistics for the ANOVA include DF = degrees of freedom, SS = sum of squares, MS = mean squares, F = test statistic, P = probability value, N = number of samples, StDev = standard deviation and CIs = confidence intervals.

ANOVA produces an F-statistic (F ratio = MS for FACTOR / MS for ERROR) accompanied with a p-value representing the probability of obtaining an F-value as large as or larger than the calculated value under a users specified confidence interval (95% confidence interval was used in this study). A p-value > 0.05 means that we accept that the treatment means are equal and are comparable at the 95% confidence interval. If p<0.05, then we generally reject the null hypothesis, and accept the alternative hypothesis of statistically significant differences between means.

Summary of Results

The data were analyzed for each research question separately in an effort to find confirming and disconfirming evidence.

Do DET Practicum students see e-portfolio as an effective learning and assessment tool?

The 6 items of the three-point Likert scale and open ended questionnaire data were intended to gather supporting information and evidence to answer this question. The data confirms that students see e-portfolio as an effective learning and assessment tool and that the positive perception of the e-portfolio as a learning and assessment tool increases with exposure to and experience with e-portfolio as illustrated in Figure 7.
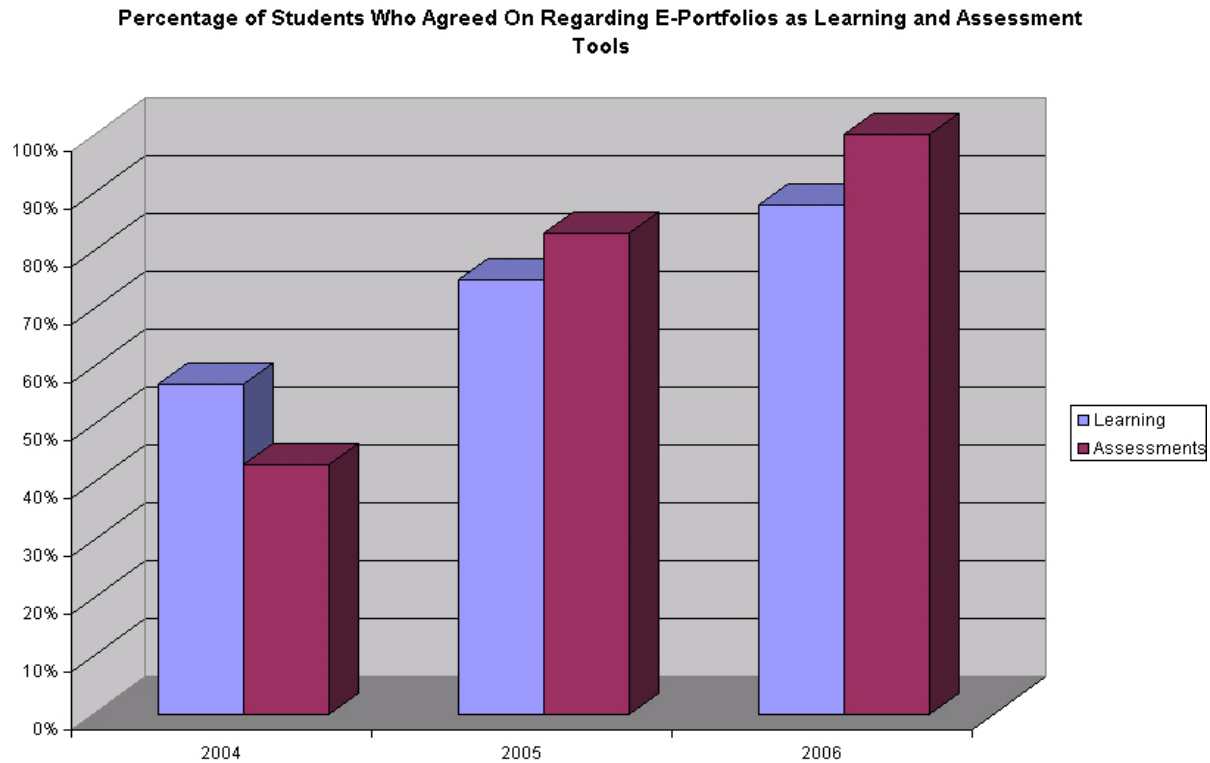
Percentage of Students Who Agreed On Regarding E-Portfolios as Learning and Assessment Tools

Figure 7: Percentage of "yes" responses to the statements provided by class of 2004, 2005 and 2006 for the Three-Point Likert Scale.

Other data for this study was collected through the *open-ended questionnaire,* which explored students' perceptions of the e-portfolio as a learning and assessment tool. Conclusions drawn by the open-ended questionnaire are illustrated in Figure 8.
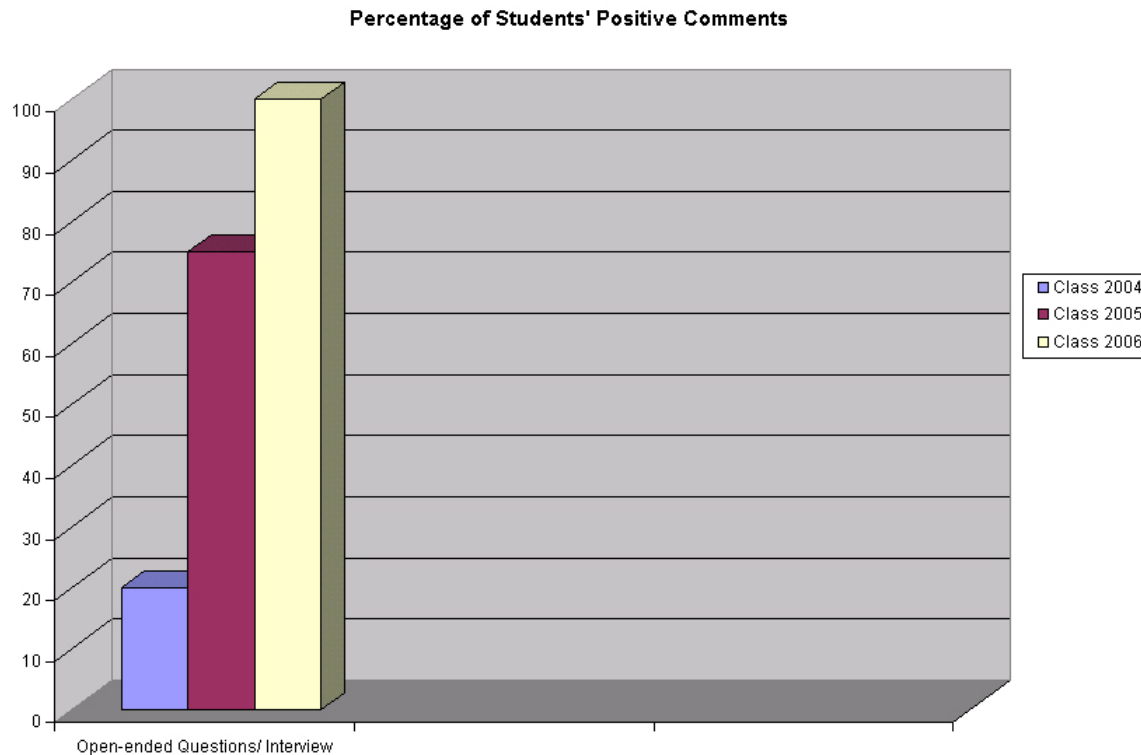
Percentage of Students' Positive Comments

Figure 8: An illustration of the increase in positive responses obtained from students' Open-Ended Questions/Interview.

Samples of Students' Interview Comments:

Positive Indicators:

> "Gaining at least one new important insight into the various aspects of Educational Technology practice and its professional and personal requirements. Feeling more confident, as though they were professionals."

Negative indicators:

> "Opposing resentfully to having to do the e-portfolio."

Does students' experience with the e-portfolio change their perception of its effectiveness?

Conclusions from the review and analysis of participants' journals and final report data were formulated and warranted through a search of confirming and disconfirming evidence. The general conclusions were:

- Learners with one year of e-portfolio experience (class of 2004) were unaware of e-portfolio development and use. They mostly had negative perception of the e-portfolio experience as a learning and assessment tool.

- Many learners with two years' e-portfolio experience (class of 2005) are positive and enthusiastic, but do not see e-portfolio as vital, important or integral to personal learning and assessment.

- Most students with three years' e-portfolio experience (class of 2006) value e-portfolios as a tool for learning and recording aspects of achievement and identity.

These conclusions support our assumption that the duration of e-portfolio experience and exposure affect students' perception of the e-portfolio process as a learning and assessment tool. The student journals and final report data that provide relevant instances to support the claims are illustrated in Figure 9:
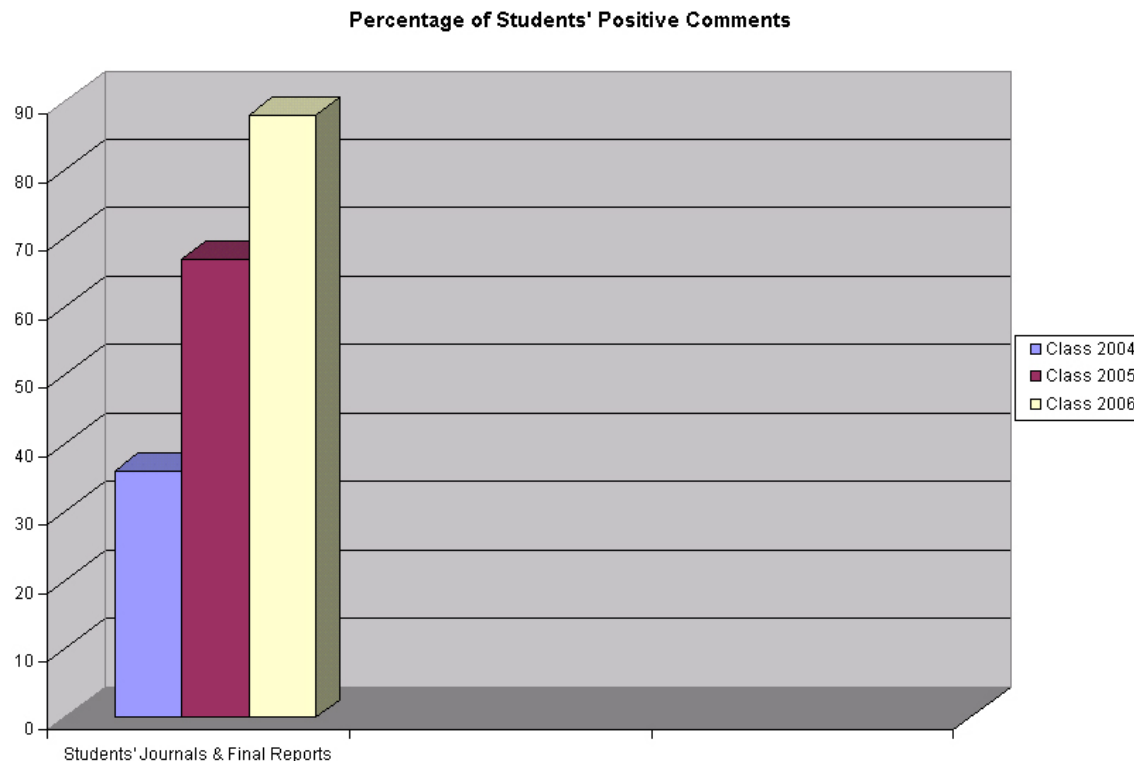
Percentage of Students' Positive Comments

Figure 9: An illustration of the increase in positive comments obtained from students' Journals & Final Reports.

Samples of Students' Journal Comments:

Positive Experience:

"The e-portfolio experience made me realize how much the DET Graduate is capable of doing. In fact, creating my e-portfolio showed me that I was capable of doing a lot more than I, personally, had thought I could."

Negative Experience:

"I was so stressed through out the semester, too much work and I wasn't able to make the right decisions and finish on time."

Does students' experience with the e-portfolio impact their overall e-portfolio development score?

Through the creation of e-portfolios, DET students explored and enhanced their knowledge about the application of educational technology. For instance, these future teachers learned to use multimedia design tools, a web site development program such as Dreamweaver, authoring tools/programs such as Director, image editing programs such as Illustrator or Adobe Photoshop, as well as how to integrate multiple software programs in creating their DET domain-based portfolios.

During the e-portfolio development process, students critically analyzed and reflected on their practice. Reflection also resulted in students gaining a greater appreciation for and understanding of their major domains and competencies. The students' score for e-portfolio rubric data that provides relevant instances to support the claims are illustrated in Table 4:

Table 4: Analysis of mean score for e-portfolio rubric.

One-way ANOVA: C4; C5; C6

Source	DF	SS	MS	F	P
Factor	2	1252.8	626.4	60.59	0.000
Error	31	320.5	10.3		
Total	33	1573.2			

S = 3.215   R-Sq = 79.63%   R-Sq(adj) = 78.32%

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev
C4	14	53.536	1.966
C5	12	61.292	2.340
C6	8	69.000	5.477

Pooled StDev = 3.215

The study showed that improvement in the quality of students' e-portfolios as a result of experience is statistically significant at the 95% level of confidence or higher. Since the p-value(0.000) turns out to be less than 0.05 ($P<0.05$), the test rejects the hypothesis that the treatment means are equal and comparable.

The comments of the sites and lab supervisors supported the other research findings in that e-portfolio experience decreases the technical problems/difficulties practicum students encounter. In addition, e-portfolio experience is considered a worthwhile burden with concrete results in students' motivation, learning and assessment.

Study Assumptions and Limitations

An assumption in this study was that all participants answered interview questions about their perceptions and actions honestly, truthfully, and openly. The study has certain limitations which may have affected the results. These limitations include the small size of the samples (total number of each class), the gender of the participants being limited to females, and varied students' experience with paper-based portfolios.

Conclusions and recommendations

The challenge of the 21st Century is that we must do a better job of teaching our students to be truly educated citizens. Today, we already see that new technology offers a set of tools at our disposal to move students away from rote learning and towards the use of alternative assessment. Unlike memorizing facts, technologies such as e-portfolio help engage students with more complex problem-solving techniques and approaches to knowledge discovery. A United Nations Arab Human Development Report concluded that

> "…a mismatch between educational output on one hand and labor-market and development needs on the other could lead to Arab countries' isolation from global knowledge, information and technology at a time when accelerated acquisition of knowledge and formation of human skills are becoming prerequisites for progress" (United Nations Development Program, 2002: 51)

The creation of educational experience that will lead to a more effective, productive and meaningful learning will require a major shift in teaching and learning processes.

Having more than 20 years of teaching experience in the Gulf region, of which seven years were in the UAE, I have usually encountered the rote way of student learning. Many of my students have depended on their memory rather than their understanding of the subject. This produced a comparatively *inaccurate* perception of their skills and capabilities. Consequently, many of the students' are only concerned with achieving *perfect grades* on their examinations at the expense of *true learning* gains.

Introducing such a concept of e-portfolios as a learning and assessment tool in the region has great importance. Based on Diez's (1994: 23) metaphor of the portfolio as a **mirror**, "The process of looking at one's development through a portfolio process functions like a literal mirror – when one sees one's own image or performance – the *literal* reflection sparks *internal* reflection", e-portfolios can give a fuller and more accurate picture of learners' development. E-portfolio makes the learner find himself/herself in both the position of evaluator (peer- and self-assessment) and evaluated (by teachers and peers) which helps to make him/her more thoughtful about the requirements and needs of each position. Therefore, e-portfolios provide ideal support for an ongoing and lifelong learning journey.

The results of this study suggest that the earlier we introduce our students to the e-portfolio experience, the better and the more beneficial it is. For this reason, through faculty requirement or a first-year orientation course, university students have to be introduced to e-portfolios and how they could be used to shape, guide, document, and assess their academic and personal development.

E-portfolio is also recommended for teaching internship supervisors and mentor teachers to evaluate pre-service teachers at other educational departments. In addition, results of this study will provide a foundation for further development of the DET Academic Program.

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Author

Dr. Zuhrieh Shana has been the Deputy Chair of the Educational Technology Department at Ajman University of Science and Technology, UAE since 2002. She graduated with a Ph.D. in Educational Media from University of Missouri, USA, and has over 20 years of teaching, training, research and consulting experience in academic institutions in the USA, Saudi Arabia, Canada and the UAE. Dr. Shana conducted this research as a part of a Research Agenda for Student Success, in order to contribute to further success and efficiency of Higher Education in UAE in general and to AUST in particular.

Appendix A: Evaluation Rubric for Students' Practicum Portfolios

DOMAINS	Goals	Indicators Artifact should demonstrate:
I. DESIGN	To enable students to design conditions for learning by applying principles of instructional system design, message design, instructional strategies and learner characteristics.	▪ Principles instructional systems design such as ADDIE ▪ Employ instructional plan for specific learners. ▪ Application of learning theory, recognize objectives and analyze tasks. ▪ Proper use of visual and message design techniques ▪ Accurate use of assessment measures. ▪ Skillful selection of instructional and motivational strategies. ▪ Exhibit knowledge of learner characteristics and learning situations
II. DEVELOPMENT	To enable students to select and use productivity technologies for the development of instructional and professional production to assess effectiveness of the products, and to revise and update them using the results of the evaluation.	▪ Usage of design theories to the development of the portfolio. ▪ Employ evaluation techniques for increased quality of the product and entire portfolio. ▪ Covers a variety of electronic and print based media including web pages, audio wav files, video files, and digital images. ▪ Accurate hyperlinked pages. ▪ Development techniques of storyboarding. ▪ Portfolio that demonstrates range of skills.
III. UTILIZATION	To enable students to apply principles, strategies, and model of media utilization, diffusion, implementation, and policy-making for using technologies, processes and resources in learning and training contexts.	▪ Ethical standards regarding copyright, fair use, accessibility. ▪ Artifact related to distance delivery technologies

IV. MANAGEMENT	To enable students to use principles and techniques of management to plan, organize, coordinate and supervise instructional technology including instructional design projects, resource support systems and services, delivery systems and information sources.	▪ Ability to apply management techniques ▪ Team work involving interpersonal skills and team building.
V. EVALUATION	To enable students to apply problem solving skills in the educational technology context, to evaluate the effectiveness of instructional product and systems as well as to evaluate educational technology projects	▪ Capability to apply problem analysis and solving skill and explanation to discuss results and limitations. ▪ evaluation criteria to evaluate educational technology projects