

ePortfolio: Expanding the Information Technology Vision to Serve as a Capstone in an Outcome-Based University

Abdallah Tubaishat

College of Information Technology, Zayed University, United Arab Emirates

ABSTRACT

An eportfolio can be defined as a collection of student work accomplished throughout a student's time in an academic program [1, 2, 3, 4, 5]. Therefore, an eportfolio can serve as a capstone to demonstrate growth of achieving learning outcomes to measure what students have learned and are able to do when they complete their degree. Ideally, this has to be done at the conclusion of the program of study. An Eportfolio Assessment Management System (EAMS) is being developed and used in an outcome-based university to create, reflect, revise, and structure students' work. The EAMS is a web-based eportfolios which was developed in-house. The rationale of the EAMS is to allow students to present a collection of items that represent their accomplishments in courses towards the satisfaction pre-determined courses learning outcomes using a pedagogical web-based environment model. The system assesses students learning outcomes and evaluates how courses and colleges programs are meeting institutional goals. It is a repository management system that facilitates collecting, sharing, and presenting artifacts of student learning outcomes via a digital medium. The EAMS was built around two defined set of learning outcomes: institutionally agreed upon set of learning outcomes, and learning objectives that are related to major requirements. Therefore, there are two major benefits of the system: (a) eportfolios can serve as a capstone; and (b) eportfolios can serve as an institutional documentation of accreditation requirements. To evaluate students' eportfolios, a committee is assigned to review eportfolios for key courses across the curriculum. Judgment of eportfolios is then based on student performance on achieving specific learning outcomes according to three predefined achievement levels (beginning, developing, and accomplished). At the end, the committee prepares a set of questions for the face-to-face conversation with each student after he/she do a presentation of how learning outcomes are achieved.

Keywords: *Eportfolio, Assessments, Learning Curriculum, Evaluation*

1. INTRODUCTION AND LITERATURE REVIEW

In recent years, higher institutions around the world are implementing new strategies that are supported by technology for teaching to make student assessment more learner-centered [6] Likewise, the interest and use of student eportfolios for assessing student learning outcomes has grown considerably [7]. What is ePortfolio? and what are the purposes and benefits of eportfolios to students?

Wheeler [1] defined an eportfolio as "a collection of purposefully-organized artifacts that support backward and forward reflection to augment and assess growth over time. Paulson and Meyer [2] described a portfolio as a meaningful collection of student work that demonstrates progress and/or mastery guided by standards and includes evidence of student self-reflection. Buzzetto [3] indicated that electronic portfolios are a unique way to document student progress, encourage improvement and motivate involvement in learning. Buzzetto and Wright and Wright [3, 8] defined Portfolios as an effective form of alternative assessment that encourages students and educators to examine skills that may not be otherwise accessed using traditional means such as higher order thinking, communications, and collaborative abilities. In this paper, we will follow the definition given by the National Learning Infrastructure Initiative [4] which defined an eportfolio 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".

Several researchers [5, 9, 10, 11, 12] have addressed the purposes and benefits of eportfolios to students. A complete list is outside the scope of this paper. Here a summarized list is presented: - eportfolios are formative in nature and focus on personal development through the use of self evaluation and reflection.

- eportfolios allow for reflections on artifacts as well as how they match goals and standards
- eportfolios are tools to communicate with stakeholders (students, faculty, administrators, and employers)
- eportfolios increase learning effectiveness
- eportfolios identify students' strengths and weaknesses
- eportfolios review, assess, and improve the effectiveness of curricular programs
- eportfolios provide useful administrative data that will expedite decision making
- eportfolios model professionalism, and enhances information technology skills
- eportfolios allow for academic credit for learning beyond the classroom



- eportfolios can be used as a tool of assessment where students are required to show through selection and reflection on their learning activities how skills and knowledge development have been demonstrated

2. THE INSTITUTION UNDER STUDY

Zayed University (ZU) is an academic public institution in United Arab Emirates (UAE). It offers an academic program that prepares students for success in education, arts, business, media and IT. ZU is concerned with “outcome assessments”, how learning and growth are measured, evaluated, and demonstrated over years of study. Today, the University is educating more than 6,000 male and female students from 19 countries. The university endeavors to provide students learning opportunities using the American style of education and learning to ensure high quality education. The University is accredited by the Middle States Commission on Higher Education in 2008. Majority of the faculty members are from North America, Europe, and Australia, or have a terminal degree from universities among those countries (Zayed University, 2011).

ZU has an excellent technology infrastructure; its campuses are fully networked and allow students to connect to various university networks and the Internet from anywhere on campus. All the university has wired and wireless connections (classrooms, library, offices, student hubs, cafeteria, etc). Each student is required to purchase a laptop and each faculty member receives a laptop with a three-year replacement schedule.

Students have easy access to technology in order to facilitate the learning process. Actually, ZU is known as the laptop university in this region. In the College of Information Technology (CIT), students have their own laptop loaded with the necessary software for their courses. This helps them complete their work independently without having to be on campus all the time. The IT College has an independent network infrastructure for teaching and research, in addition to the university’s main network. This infrastructure allows students to login remotely into Linux servers to use tools needed for programming languages, databases, and web development courses. Students can also use Linux-based communication tools to collaborate with each other and with instructors. All ZU courses are implemented on Blackboard Learn⁺, a learning management system. ZU students can access Blackboard Learn⁺ from anywhere at any time using a web client.

ZU has adopted an outcome based learning framework to provide a strong focus to the students’ learning outcomes and to improve both curriculum and learning practices. The Academic Program Model (APM) was developed by faculty and emphasizes a commitment to a learner-based education and to shift the teaching paradigm to a student learning model. This model focuses on what students can actually do after they graduate. More details about this model can be found in the ZU internal

report on “Self-Assessment Based on Accreditation Standards of the Middle States Commission on Higher Education” [22], and the ZU Academic Program Model [23]. The purpose of the outcome-based model is to provide students with a focused and coherent academic program and to prepare graduates for a rapidly changing and unpredictable future. It is outcome driven and uses the traditional Grade Point Average (GPA) system. The framework that constitutes the academic program model is composed of three components:

- Readiness program to ensure that students are competent in English language
- General Education
- Degree Major

A major objective of the undergraduate experience at ZU is the development of the skills necessary for continuous lifelong learning. The APM is designed to help achieve this objective by providing students with a foundation and framework for all university studies. Every ZU course focuses on one or more of the six university-specified learning outcomes. The learning outcomes are incorporated into normal course work and, therefore, are an integral part of disciplinary content and evaluation of the course. Threaded throughout the baccalaureate curriculum, the learning outcomes help students achieve a higher order of intellectual development. ZU has six graduation requirements, called Zayed University Learning Outcomes (ZULOs), for all students regardless of their major. These requirements are depicted in Table 1, [22]:

Table 1 Zayed University Learning Outcomes

Learning Outcome	Description
Information Literacy and Communication	ZU graduates will be able to recognize information needs, access and evaluate appropriate information to answer those needs, and communicate effectively to a variety of audiences in both English and Arabic.
Information Technology	ZU graduates will be critically aware of the implications of information technology on the individual and on society and be able to use IT to communicate and solve problems in an ethical way.
Critical Thinking and Quantitative Reasoning	ZU graduates will be able to use information, reasoning, and creative processes to achieve goals and make responsible decisions.



Global Awareness	ZU graduates will be able to relate to communities beyond the local, perceive and react to differences from an informal and reasoned point of view, and be critically aware of the implications and benefits of cultural interaction.
Teamwork and leadership	ZU graduates will be able to work efficiently and effectively in a group. ZU graduates will be able to assume leadership roles and responsibilities in a variety of life situations and accept accountability for the results.
Bilingual	ZU graduates will be able to communicate effectively (orally and in writing) in both English and Arabic.

3. OUTCOME-BASED COMPUTING CURRICULUM

Student learning outcomes have become the focus of many universities as a way to measure and document student learning [13]. Chambers and Wickersham indicated that “these outcomes measure how a student's university experience has supported their development as individuals and describes the knowledge, skills, abilities and attitudes students are able to demonstrate upon completion of a program”. Furthermore, the methods by which these learning outcomes are assessed to determine student success of learning expectations vary and may be dependent upon the course, program, and/or assessment practices and beliefs of the faculty.

The Information Technology program under study strives to meet the demands of government and industry in the UAE technology market. This cooperative process usually includes advisory boards, called National Advisory Council (NAC), where industry leaders communicate the technical needs to faculty and administrators. Currently, the CIT College offers three tracks: Security and Networking, Enterprise Computing, and Multimedia Design. All core courses in each sequence include specific university learning outcomes (ZULOs) and specific major learning outcomes (MALOs) that are applicable to the courses contents.

The CIT College has established six learning outcomes that complement the learning outcomes of the ZU APM (see Table 2). These major learning outcomes form the basis for analysis and assessment that play an essential role in the continuous process of improvement.

Table 2 Major Learning Outcomes for IT College

Learning Outcome	Description
Critical Thinking and Quantitative Reasoning in IT	IT College graduates will be able to use critical thinking and quantitative processes to identify, analyze and solve problems, and evaluate solutions in an IT context.
Information Technology Application	IT College graduates will be able to select existing and cutting-edge IT tools and procedures to develop modules and systems.
Information Technology Management	IT College graduates will be able to assess and determine information resource requirements to develop solutions suitable for IT and business managers operating in a multi-national and multi-cultural environment.
Information Technology Professional Practice	IT College graduates will be able to work effectively in individual and group situations, understand how groups interact, be able to assume a leadership role when required, and understand the fundamentals of professional and ethical conduct.
Information Technology Systems Theory and Practice	IT College graduates will be able to understand and communicate the fundamentals of systems theory in the development of appropriate systems that function in a global environment.
Technical Communication (Bilingual)	IT College graduates will be able to express themselves effectively and efficiently in both English and Arabic while using the correct IT terms for each language.

4. EPORTFOLIO ASSESSMENT MANAGEMENT SYSTEM

An ePortfolio Assessment Management Systems (EAMS) was piloted in 2007 to assess students learning outcomes and evaluate how courses and colleges programs are meeting institutional goals. The system is described in detail in a previous journal paper [14]. The system is an e-learning system that focuses on knowledge representation and learning by reflection. It is a repository management system that facilitates collecting, sharing, and presenting artifacts of student learning outcomes via a digital medium. The system is introduced to students early in the curricula courses, so they have good understanding of how to upload, and reflect on artifacts. It consists of artifacts selected by the student to showcase his/her best work to

show development, and to give an opportunity for reflection upon their learning process.

The system was built around two defined set of learning outcomes:

- Institutionally agreed upon set of students' outcomes, ZULOs presented in Table 1.
- Learning objectives that are related to majors requirements, MALOs presented in Table 2.

The EAMS is a web-based eportfolios which was developed in-house. The rationale of the EAMS is to allow students to present a collection of items that represent their accomplishments in courses towards the satisfaction pre-determined courses learning outcomes using a pedagogical web-based environment model. The hope is, students become more learner-centered and focused on promoting self-responsibility in the learning process, as lifelong learners. The drive for the implementation of EAMS came from two arenas within our institution: the first is the University's commitment to the learning outcomes that they should be filtered down to all levels of the achievement levels (Beginning, Developing, and Accomplished). The second driving force is the ABET accreditation body to showcase evidences of learning achievements against their complex set of professional skills criteria.

The EAMS allows students to store and reflect on assignments, relate them to MALOs and ZULOs. At the end of their study, students showcase their best work in the Capstone course to a committee of faculty members (see below section *ePortfolio as a Capstone*). The EAMS content could be copied easily to other storage media.

The purposes of EAMS can be summarized as follows:

- To show student growth of change over time
- To improve students' input into the learning process
- To track the development of learning outcomes (MALOs, ZULOs)
- To measure how students accomplish their MALOs
- To provide an opportunity for students and faculty members to discuss learning outcomes and the progress toward achieving institutional goals (ZULOs)
- To measure students' performance based on samples of their work
- To help students develop self evaluation

5. HOW EAMS WORKS?

The EAMS is an important resource used in the colleges for various assessment activities. The system is a searchable, electronic storage tool into which specific examples of student work are uploaded from various courses across the curriculum. Students regardless of their major start using EAMS in semester three of their degree programs and therefore, they begin the development of a

working eportfolio by archiving assignments, instructors' feedback and reflections during early courses.

In each course in the Information Technology concentrations, faculty members are required to assign assignments designed to assess at most two of the six MALOs presented in Table 2. Because the eportfolio assignments are the key to the success of the outcome assessment process, faculty members are encouraged to design assignments that provide students with an opportunity to demonstrate their most distinguished performance and scholarly accomplishments. Examples of appropriate eportfolio assignments include a term paper, a project work, a programming assignment, or a network design. Faculty members are required to provide a criteria sheet for each portfolio assignment that explains the purposes and the learning objectives assessed. After reviewing student work, the faculty comments on the student's work and posts their feedback in a designated area of the EAMS. Moreover, the faculty evaluates both the assignment's general effectiveness and its level of accomplishment with respect to the desired outcome(s). Students are able to access the faculty comments from the EAMS, as well as any other work posted on the system. This process enables students to update their work and reflect on their learning. The EAMS was designed to function as an archive for research on the effectiveness of various courses in achieving learning outcomes. Because all major student work is uploaded to the system, research into student achievement of learning outcomes in courses or sequences of courses can be easily carried out. Furthermore, student work can be sorted and studied either by course or by outcome.

Figure 1 shows the EAMS interface. The interface shows for a particular faculty member the courses being taught as well as the assessment criteria posted by the instructor. It allows him/her to select term code and the courses in that semester through accessing e-portfolio systems via the Intranet or extranet.

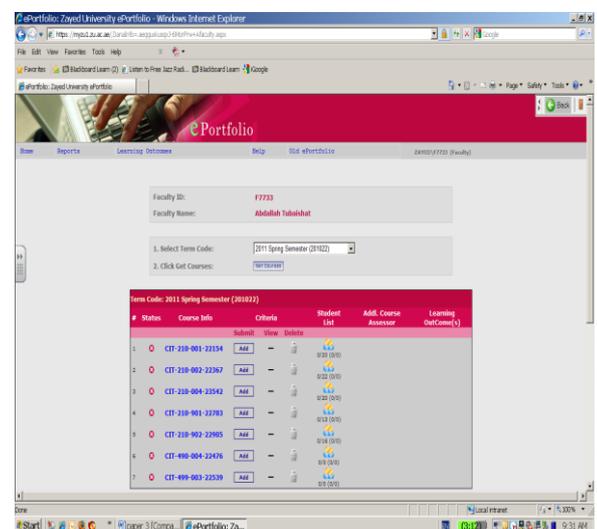
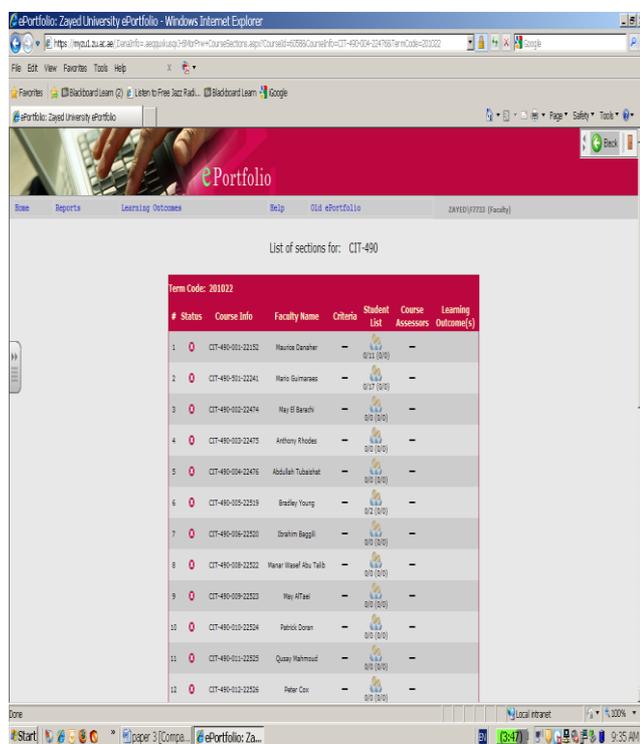


Figure 1: E-portfolio Assessment Management System Interface

After matching courses with learning outcomes, faculty members develop key assignments for the courses to optimize targeted learning. The assignments include a term paper, a lab exercise, a design for building a network, or a case study. Figure 2 shows another snapshot of the EAMS for an eportfolio course (CIT490) with committee member names, learning outcomes, and assessment criteria used in this course. After grading the piece of evidence, the instructor posts the assessment feedback. The students can then access the instructor's assessment/feedback and modify their work. Finally, the students have the option to include that piece of evidence as an artifact in their eportfolio.

The IT College has accumulated a significant amount of data from the EAMS to evaluate students' achievements.



#	Status	Course Info	Faculty Name	Criteria	Student List	Course Assessors	Learning Outcome(s)
1	0	CIT-490-010-22152	Haytham Gendier	-	0/11 (0%)	0/11 (0%)	
2	0	CIT-490-010-22141	Hani Gurnames	-	0/17 (0%)	0/17 (0%)	
3	0	CIT-490-010-22474	Hay El Barachi	-	0/0 (0%)	0/0 (0%)	
4	0	CIT-490-010-22473	Anthony Rhodes	-	0/0 (0%)	0/0 (0%)	
5	0	CIT-490-010-22476	Abdullah Tahaat	-	0/0 (0%)	0/0 (0%)	
6	0	CIT-490-010-22519	Bradley Young	-	0/2 (0%)	0/2 (0%)	
7	0	CIT-490-010-22520	Israhim Baggi	-	0/0 (0%)	0/0 (0%)	
8	0	CIT-490-010-22522	Wahid Wasef Abu Talib	-	0/0 (0%)	0/0 (0%)	
9	0	CIT-490-010-22523	Hay Al-Tai	-	0/0 (0%)	0/0 (0%)	
10	0	CIT-490-010-22524	Patrick Doran	-	0/0 (0%)	0/0 (0%)	
11	0	CIT-490-010-22525	Quana Mahmoud	-	0/0 (0%)	0/0 (0%)	
12	0	CIT-490-010-22526	Patric Cox	-	0/0 (0%)	0/0 (0%)	

Figure 2 ePortfolio Course Info, Committee Members, Learning Outcomes and Assessment Criteria

6. ePORTFOLIO AS CAPSTONE

Some researchers argue that grades are no longer proof enough of learning and multiple stakeholders in education want documentation that demonstrates the entire process of learning [15, 16, 17]. Ruhland and Brewer [18] asserted to the increased demands for accountability that emphasize assessment of student learning. Wickersham and Chambers [19] stated that eportfolios could be evaluated (judged) or graded (assigning grades to the judgment). In either case, the purpose of eportfolios is to demonstrate growth of achieving learning outcomes through the curriculum. They recommended the later, because they believed that without grades there would not

be sufficient incentive for some students to complete the portfolio through the years of their study. They concluded by saying "in setting standards, however, for judging student performance, the theoretical rationale behind portfolio development should be kept in mind". However, this is not an easy task, as they indicated that "tracking and assessing student learning outcomes within one course can be accomplished with relative ease. However, the true challenge lies within providing data for student learning outcomes for an entire program".

In our assessment system, a summative eportfolio containing artifacts and reflections representing the six MALOs and six ZULOs are mandatory in IT major. Therefore, at the conclusion of the IT degree program of study (CIT490 ePortfolio course), students are required to submit for review their eportfolio of works that consists of the following materials:

- A typewritten document that includes a brief description of key assignments in key courses that are chosen by CIT490 committee.
- A portfolio self-evaluation essay.

The evaluation process of students' eportfolios work as follows: A student does a presentation by explaining to the committee his/her eportfolio and how he/she achieved the different MALOs and ZULOs. Then, the committee reviews the eportfolio for key courses across the curricula, and prepares a set of questions for the face-to-face conversation with each student.

Judgment of eportfolios evidences is based on student performance on specific learning outcome(s) according to the agreed on three learning levels (Beginning, Developing, and Accomplished). As an example, assume the committee would like to judge the ability to write a client-server database software. The three possible objectives related to this goal would be:

- The ability to define the problem and break it into manageable components (Beginning Level)
- The ability to write an algorithm for this problem (Developing Level),
- The coding techniques and correctness of the solution (Accomplished Level).

Possessing of the above three objectives (i.e. the program goal) might be defined as a successful completion of three adequate artifacts for each stage of developing the code. When students fulfill these requirements, they have master the criteria.

The committee grades the quality of the entire eportfolio across key courses by:

- Checking samples of student work within the eportfolio and whether these samples demonstrate the different MALOs and ZULOs
- Reflections of student's upon their learning process
- Organization of the eportfolio



- Final presentation of the student

Student eportfolios contain a variety of information (evidences) that at the beginning appear difficult to examine. In our system, evidences might be program coding, term projects, term papers, or observations. We use an assessment form for each MALO (see figure 3). This assessment form is based on one of the assessment forms that was reported in the literature [20]. First, objectives corresponding to the learning outcomes are placed in the left hand column of the analysis sheet. Then all evidences from the eportfolio are examined. When an evidence of student progress related to learning outcome is found in the eportfolio contents, the example is noted next to the corresponding learning outcome on the appropriate column. The process continues until all examples have been noted. This analysis procedure is repeated for each learning outcome in the degree program. The committee assigns grade at the end of this process.

Moya and O'Malley noted that "some of the information in a portfolio might include quantitative measures such as test results, while other measures such as program coding and observations have the potential for inconsistency in interpretation and scoring. In the later case, a committee member may find an evidence to support a positive judgment, but another may find that same evidence support a negative conclusion". The resolution of this difficulty is for the portfolio committee to decide on the specific criteria for reaching judgments concerning student progress. To dispute the different opinions, the committee might agree to use a criteria such as how many line of Code (LOC) is implemented in this assignment.

Furthermore, Moya and O'Malley pointed out another important fact about using portfolios for assessment "Portfolio assessment, like other innovations, must be undertaken with caution and thoughtfulness for it to fulfill its promise. To approach portfolio assessment with anything less than a total dedication to developing a quality alternative assessment procedure is to relegate this potentially powerful approach to the realms of other educational fads.

ST Number:		ST Name:
EPortfolio Committee Member:		Date:
Learning Outcome (e.g. MALO1: Critical Thinking and Quantitative Reasoning in IT)	Example illustrated student progress related to the learning g outcome	Grade

Figure 3: ePortfolio Assessment Form

7. ePORTFOLIO ASSESSMENT FOR LEARNING

Our method of assessment to eportfolios is a summative in nature. It provides students with the ability to document, reflect, revise, and structure their work. On the other hand the use of EAMS requires faculty members to generate specific competencies to MALOs and ZULOs that students need to fulfill in a course. The process of eportfolio assessment for learning is shown in Figure 4.

Another major benefit of eportfolios is to serve as an institutional documentation of accreditation requirements. The eportfolios repository and assessment criteria are easily used to meet program and unit assessment needs. This is done through a study of specific learning outcomes on key courses across the curriculum (Junior, Sophomore, Senior) to show students achievements levels (beginning, Developing, Accomplished).

Although EAMS has accumulated a good deal of data, the analysis of this data has not been fully developed at the program or the institutional level. It is anticipated that ZU and the college of IT will use much of the data that has been and will be collected in its accreditation Board for Engineering and Technology (ABET) that is already underway as ABET have made it compulsory for graduating students in Information Technology major to show evidence of learning outcomes against complex set of 14 professional skills criteria [21].

8. CONCLUSIONS

An Eportfolio Assessment Management System (EAMS) is being developed and used in an outcome-based university to document, reflect, revise, and structure students' work. The system is a repository management system that facilitates collecting, sharing, and presenting artifacts of student learning outcomes via a digital medium. It was built around two defined set of learning outcomes: institutionally agreed upon set of learning outcomes, and learning objectives that are related to major requirements. To evaluate students' eportfolios, a committee is assigned to review eportfolios for key courses across the curriculum. Judgment of eportfolios is then based on student performance on achieving specific learning outcomes according to three predefined achievement levels (beginning, developing, and accomplished). At the end, the committee prepares a set of questions for the face-to-face conversation with each student after he/she do a presentation of how learning outcomes are achieved. Two major benefits of EAMS are: (a) eportfolios can serve as a capstone to demonstrate growth of achieving learning outcomes to measure what students have learned and are able to do when they complete their degree; and (b) eportfolios can serve as an institutional documentation of accreditation requirements. Evidently, eportfolios require time and work to create, manage, and assess. Therefore, stakeholders (students,

faculty, and administrators) need to believe that the process is worth doing it.

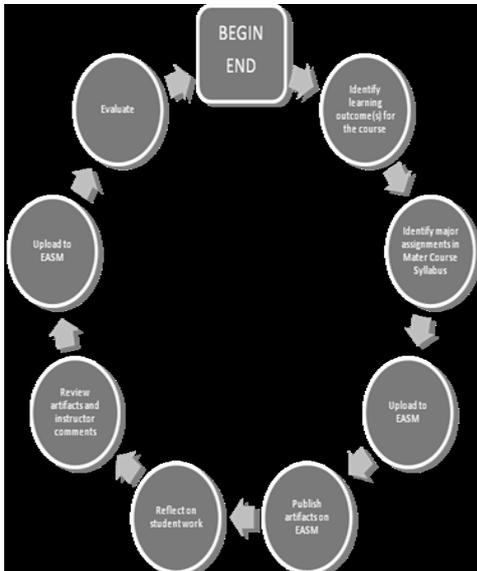


Figure 1 The process of ePortfolio assessment for learning

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