

## Development and design of an undergraduate radiology teaching e-portfolio for clinical practice and professional development

Mohamed M Abuzaid, Wiam Elshami, Leena David, Zarmeena Noorjan, Asma Abdi

Medical Diagnostic Imaging Department, College of Health Sciences, University of Sharjah, Sharjah, United Arab Emirates

### ABSTRACT

**Introduction:** In recent years, there have been significant efforts to optimize radiology curricula in medical education. The use of online teaching, learning, and assessment tools such as e-portfolios have been popularized in both undergraduate and postgraduate programs. E-portfolios can offer a platform to facilitate academic and practice skill development in radiology education. This study discusses the development and integration of a Blackboard Learning Management System e-portfolio targeting radiology education.

**Methods and materials:** Following a need assessment, framework, system components, and a tailored portfolio system designed, developed, and integrated at Blackboard. Technological arrangements for supporting portfolio education and assessment include calendar; announcement; guidelines and facility of “collect,” “select,” and “reflect” on evidence of development/experience; the ability to link the student’s uploaded material with reflective writing; and the ability to accommodate a range of contents.

**Results:** The system has been implemented for one semester and will be evaluated in terms of functionality, design, interface operation, user-friendly, and impacts on learning. The results expected from the e-portfolio implementation to be highly accepted by students, instructors, and improve learning and accomplishing clinical practice competency.

**Conclusion:** E-portfolios can be used to monitor students’ progress and professional competence. The new e-portfolio will replace the paper-based portfolio currently used in the Medical Diagnostic Imaging program at the University of Sharjah. There are many drawbacks related to the paper-based portfolio such as the lack of immediate feedback, interaction, and communication between faculty and students.

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### Introduction

Many universities use e-portfolios to gather student work and help in assessment. It helps to ensure that the students meet the course objectives and competencies. Students that develop an e-portfolio will learn from the process by discovering their ability to self-assessment and control their learning through the reflection process. Their ability is to develop their own learning goal and begin practice planning for lifelong learning and professional development.

Instructors who supervise e-portfolio development will be able to guide students as they create,

find, or request their own evidence. Improve by their experience while writing a reflective statement. They will have the opportunity to understand the student’s capabilities and what they know and can do.

Clinical practice is an essential component of the radiography curriculum [1–3]. It starts with the observation of radiographic examination procedures and gradually the student learns to assist in the patient examination. After laboratory sessions and observing a specific number of cases, the student will start performing radiographic examinations unassisted [4–8]. A competency evaluation will

**Contact** Mohamed M Abuzaid ✉ mabdelfatah@Sharjah.ac.ae 📧 Medical Diagnostic Imaging Department, College of Health Sciences, University of Sharjah, Sharjah, United Arab Emirates.

be conducted after a determined number of exams have been completed. Upon successful completion of the rotation, the student may fill out the exam with indirect supervision. Throughout the curriculum and study plan, students gradually gain proficiency in more complicated procedures, until all competency categories are completed. During the clinical practice, students should collect evidence to demonstrate their competency and to ensure fulfilling the course objectives and outcomes. This evidence range from attendance, logbook, reflective journal, patient's cases, evaluations, and assignments [9,10].

Competency assessment in any given objective should be carried out under the direct supervision of a qualified radiographer "preceptors" or clinical instructor. Regular feedback is required from the supervisors for the student to take full advantage of the clinical practice. Feedback should provide the student with information on current practice and offer advice to improve performance [10]. The benefits of feedback include increased student confidence, motivation, and self-esteem as well as improved clinical practice. Benefits such as enhanced interpersonal skills and a sense of personal satisfaction also accrue from the supervisor. Communication medium and expertise are important for both parties to focus on the learning process and to achieve the clinical practice objectives. Competency assessment does not just entail the execution of individual formative and summative assessments but also the aggregation of the various assessments in a way that both the student and assessor can obtain a comprehensive and objective impression of the trainee's professional development over time. The objective of this study was to design a clinical practice electronic portfolio on Blackboard Learning Management System (LMS) to monitor learning, assessment process, monitor the progress of students academic and professional competence throughout a radiography program.

### **Education portfolio**

In recent years, the use of portfolios as learning and assessment tools in undergraduate medical education has become widespread as it useful tool in competency-based medical education [10,11]. A portfolio might be depicted as an accumulation of material united for a particular reason and represent student growth and learning over time. Portfolios fill both instructor and understudy teaching and learning needs by providing students with opportunities to document and reflect on their learning. At the same time, they afford teachers a means to evaluate

students' growth and achievement. Portfolios deliver possibilities for the student to show proof of self-reflection. Students analyze their work and consider it to set further objectives. They can glance back at early efforts and compare with later pieces with perceiving how they have changed.

Portfolios have been utilized for performance appraisal and employment purposes for many years. As a learning instrument, portfolios have an established place in guaranteeing the owner of the portfolio flexibility while remaining in control of their learning. Portfolios can be a useful tool for obtaining feedback and formative assessment [12–15].

There is enduring debate regarding the relative learning impacts of electronic portfolios versus paper-based portfolios. Electronic portfolios can give timely immediate feedback and can utilize hyperlinks to organize material and connection to relevant content and objectives [10,16,17]. They can improve learning by giving organizational flexibility, adaptability in the presentation of contents and thoughts, and connections to different sources and different types of representation.

Electronic portfolios can also collect and display evidence of learning from numerous sources; e.g., writings, presentations, pictures, photos, and videos, which student can upload and access using devices such as smartphones, tablets, and laptops [10,18,19]. Most of the currently used portfolios are designed mainly for formative assessment and focused on the learning process. They provide students with information about their strengths and weaknesses and help to formulate plans for improvement [20].

## **Materials and Methods**

### **Electronic portfolio**

In this paper, the process of development and design of the e-portfolio at the Blackboard system, it falls into five steps as follows:

1. Study the need, define the vision, and analyze related work.
2. Design consideration and architecture.
3. Environmental architecture of the e-portfolio.
4. Functional description.
5. Development and testing.

### **Study the need, define the vision, and analyze related work**

Internationally, most universities use LMS as a web-based application software as a part of the

educational technology to deliver, administer, document, track, and report teaching and learning progress. LMS are available as an open source such as Moodle, Software as a service, Cloud such as cornerstone OnDemands, and Google Classroom or Proprietary such as Blackboard [19,21,22]. Some of these LMS developed their portfolio, and some integrate external portfolio sources as an add-on. The web-based portfolio allows real-time data such as capturing, enhancing communication, feedback, and the relationship between faculty and students. It made the portfolio living document to organize, collect, and share the education enables. The concept of integrating e-portfolio in LMS “Blackboard” used at the University provides us with an interface utilized by the students and faculty, so it will be able to reduce confusion, training time, ease the moving for one system to another system, and overall it will help to increase the acceptance [19,21,23,24].

### Design consideration and architecture

The e-portfolio design should offer services for the creation, management, presentation, and sharing of learning artifacts. E-portfolio is expected to prepare the students for lifelong learning, professional development, and empower their ability to select, collect, and reflect the learning outcomes and other professional accomplishments [16,25]. For faculty and clinical instructors, the e-portfolio should have a various functional requirement such as the ability to assess student learning and thus to map teaching and learning outcomes by each institution has established principles of learning Profession considers e-portfolio as a valuable resource to support students in their future professional development and planning. For the academic degree, e-portfolio considered as an important document when they are applying for accreditations and academic auditing [26].

### Environmental architecture of the e-portfolio

The e-portfolio was constructed using Blackboard (LMS). Users are divided into students and faculties.

**Table 1.** User identification (ID) and verification module.

Function	Description
Sign up Module	Users will be able to sign up for the portfolio through the website or the mobile.
Log in/Log Out Module	Users will be able to log in to the system by using secure ID and password.
Forgot password & Reset password module	Users will be able to reset the password using the registered email address, or through the admin assistance.

By default, all the users have an identification (ID) used to log to the system. Faculty possesses the ability to upload materials, and it can be archived at the end of the semester. All other submitted material deleted from the system or saved at the system database as requested. The design of this e-portfolio at the blackboard portfolio database allows access to all clinical practice courses at undergraduate radiography program as well as permits the students to archive the portfolio contents and access it after graduation to be used for their professional development.

### Functional description

Users will be able to access the portfolio through the university website, either online or through the mobile application (Table 1), utilizing the university provided ID and password. Material and artifacts upload under relevant category can be in different formats such as word, PDF, or images. The evaluation forms are designed utilizing Blackboard assignments and survey tools. Faculty will be able to provide instant feedback, correct or request more details and information about the submitted materials (Table 2). Students and faculty can communicate through the website and mobile either directly or by emails.

Administrator “faculty, clinical tutors, and system administrators” will be able to manage the content of the portfolio, user’s profile, manage static

**Table 2.** Course artifact module.

Function	Description
Attendance Module	The student will be able to send their attendance.
Announcement Rules and Regulation	Users will be able to browse different announcement, rules, and regulation posted by faculty and admin.
Case Study Reflective Journal	Students will be able to create the case study and reflective journal using word template and upload images. Faculty will be able to view, comment, feedback, and assign marks for a case study.
Logbook Competency Evaluation	The student will be able to submit the electronic logbook and competency evaluation forms according to the clinical practice guidelines and receive the faculty feedback.
Achievement and Noticeboard	This section will allow the students to see their achievement, grades, and performance Distinguish student name and profile photo will be posted on the notice board
Grade Center	Faculty will be able to grade the portfolio contents through the Blackboard grade center.
Support and FAQ	From Support Page and FAQ users will be able to get answers to their query and save time when facing any technical issues.

content like privacy policy, emails, and content backup. The administrator will be able to create reports and statics section over the admin panel, track down the users and their activities (Table 3).

**Development and testing**

The e-portfolio project has started its pilot phase in February 2017. Both the staff and students will take part in a year-long process of development and testing of e-portfolio processes that will provide significant information. This important pilot process will allow us to gather important information and prepare for broader implementation in coming academic years. It will be implemented for the clinical practice course which started at year two to year four. The clinical practice course at the undergraduate radiography program is composed of five clinical practice courses. In each course, the students should achieve specific objectives and competency. A collection of the clinical practice evidence is considered as part of the learning process. In the pilot phase, the faculty will be testing the use of e-portfolios with a particular emphasis on the second year course comprising 25 students.

The platform will provide a facility for the users to upload course material under relevant category in the format of the word document, PDF, or images, and after submission, faculty will be able to comment, correct, and give feedback to the students. On Server Application with three modes: student, faculty, and admin mode.

**Conclusion**

Currently, we are using paper portfolios, literature recommended moving toward e-portfolio. This e-portfolio system will be implemented from Year 2 of the clinical practice course until the final year. The clinical practice course in undergraduate radiography program is composed of five clinical practice courses. In each course, the students should achieve specific objectives and competency. A collection of the clinical practice evidence is considered as part of the learning process. The paper portfolio lacks in creativity, flexibility, and most importantly, the communication between the students and the clinical instructors. The e-portfolio project will move to its pilot phase in February 2017. Both the staff and students will take part in a year-long process of development and testing of e-portfolio processes that will provide significant information. E-portfolio can provide an evidence of the students learning and educational progress over time. It will facilitate evaluation through using a variety of artifacts – graphics, pictures, multimedia, stories, journals, or projects. It can empower the student’s capabilities and enhance the teaching and learning environment. E-portfolio is not only about collection it gives an in-depth understanding of the student’s growth, progress, and continuity over time but it also enables them to collect, select, and reflect on their experiences and accomplishment based on evidence.

**Table 3.** Administrator panel module.

Function	Description
User Management	-The administrator will be able to manage all users on the database. -Add/Edit/Delete: Administrator will be able to update the user’s profiles as well can delete or add new users to the portal.
Content management	-The administrator will be able to manage the content. -Admin can manage all of the images and static content on the website and mobile application.
Manage Educational material	The administrator will be able to add and upload new educational material.
Reports and Statics Section	The administrator will be able to manage and review the reports and statics on the admin panel.
Updating General announcements	This module will facilitate the admin user to update the general announcements for the students and teachers.
Sending notifications or newsletter	The administrator will be able to notify the selective or all users. Like they can send important notifications or messages specific to student or teachers.
User Management	-The administrator will be able to manage all users on the database. -Add/Edit/Delete: Administrator will be able to update the user’s profiles as well can delete or add new users to the portal.

**Conflict of Interest**

All authors declare no conflict of outcomes or interest.

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