Assignment # 1

Market Research

An analysis of ePortfolio software market for supporting medical education

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Abstract

Medical schools are increasingly adopting Jerome Bruner's philosophy of a spiral curriculum in medical teaching (Masters & Gibbs, 2007). Also referred to as the "spiral of learning", the spiral curriculum involves iterative revision of topics, subjects or themes achieving more sophisticated level each time (Harden & Stamper, 1999). A course-based learning management system (LMS) such as Blackboard or Moodle interferes with the needs of a spiral curriculum (Masters & Gibbs, 2007) where students needs to go back to the previous material, reflect on it and then construct deeper learning on top as they progress into later years of the MD undergraduate program. In addition, medical schools are developing assessment strategies that integrate experiential and basic scientific knowledge (Cohen et al., 2011). Medical schools are in need of a portfolio-based system (ePortfolio) that can be used both as:

- Record of experiential learning and professional development for the students

- Assessment tool for formative and summative evaluation of conformance to competency requirements

A market research of ePortfolio applications shows that homegrown software is slightly more prevalent over vendor based options. Among vendor based options, the LMS specific ePortfolio software is quite popular although some medical schools use other, less popular software. Some medical schools that use Blackboard ePortfolio are not satisfied with the limited functionality of the software. Medical schools that use open source software prefer to use Mahara over other options and seem satisfied with its superior reflection, collaboration and assessment capabilities. PebblePad, a UK based vendor provides a powerful ePortfolio tool that is being used in various European medical schools. Medbiquitous, an organization that develops information technology standards for healthcare education and competence assessment is

working on AAMC eFolio Connector or Lifelong Learning Briefcase specification and is targeted to release a version1 pilot in spring of 2013.

The research reinforces that the market for ePortfolio software is bit immature at this time and there are limited vendor based options available which is why medical schools are investing in developing a homegrown solution. Moreover, a matured, widely adopted industry standard for ePortfolio software does not exist at this time. One-on-one discussions with some medical schools show difference in educational and assessment needs that ePortfolios need to accommodate which can be part of the reason why a specific technology does not work for everyone.

It is suggested that medical schools "think big and start small" such that the initial implementation is simple with increased sophistication only after a clear requirement has emerged from use and evaluation. Further technical investigation of Mahara, PebblePad and eFolio Connector applications is proposed in future phase of work.

Background

North American medical schools are increasingly adopting Jerome Bruner's philosophy of a spiral curriculum model. Bruner, an influential twentieth century psychologist proposed a constructivist process of education where a learner builds new ideas based on past knowledge. Also referred to as the "spiral of learning", the spiral curriculum involves iterative revision of topics, subjects or themes achieving more sophisticated level each time. The progression in student learning is built on previously learnt knowledge and therefore carries an assumption that previously learnt material is retained and built throughout the continuum of education.

Problem Statement

Medical schools including the Faculty of Medicine, University of British Columbia is planning to implement a spiral curriculum in the next couple of years within its MD undergraduate program. It is currently using WebCT Vista, a 'course-based' learning management system (LMS) to store, manage and deliver curriculum contents. The course contents are dynamic and frequently need to be updated each year such that medical students always receive latest version of the study material including cases, handouts and lecture notes.

The course-based learning system interferes with the needs of the spiral curriculum where students needs to go back to the previous material, reflect on it and then construct deeper learning on top as they progress into later years of the MD undergraduate program. Therefore, medical schools are in need of a portfolio-based system (ePortfolio) that can be used both as:

- Record of student learning and professional development
- Assessment tool for formative and summative evaluation of conformance to competency requirements

How ePortfolio can be a potential solution to this problem?

An electronic portfolio or ePortfolio can be defined as a collection of information and digital artifacts that demonstrates development or evidences learning outcomes, skills or competencies. Studies on portfolio based learning suggest that ePortfolios promote experiential learning through reflection and self-awareness thereby encouraging integration of theory with practice (Miller & Tuekam, 2009). In addition, the need for ePortfolios is also driven by accreditation requirements such as self-assessment on learning needs; identification, analysis, synthesis of relevant information and assessment of credibility of resources; evaluation of

student experiences and performance feedback. The Accreditation Council for Graduate Medical Education (ACGME) endorses resident portfolios as a method for assessing competence in practice-based learning (Frgneto et al., 2010). These findings suggest that ePorfolios are valuable both for experiential learning as well as competency based assessment tool for accreditation purposes. Finally, medical schools need to carefully examine their portfolio learning needs and define the intended purpose of their portfolio system in order to integrate it appropriately within the curriculum (Skrabal et al., 2012).

<div align="center">Market Research</div>

There are 18 medical schools in Canada, around 170 in the US and around 100 combined in Mexico, Central America. This section provides a high level overview of the preferred ePortfolio software used in North American medical schools based on quantitative analysis of 2011 AAMC GIR IT survey of medical schools (see Appendix A).

Types of ePortfolio Software

The AAMC 2011 GIR Information Technology Survey (refer Appendix A) shows 60 medical schools which have either implemented or are in the process of implementing an ePortfolio technology (medical schools that were in the planning phase were excluded). The survey reveals that 30 schools (50%) use homegrown software, 26 schools (43%) use a vendor provided software and 4 schools (7%) use an Open Source software solution.
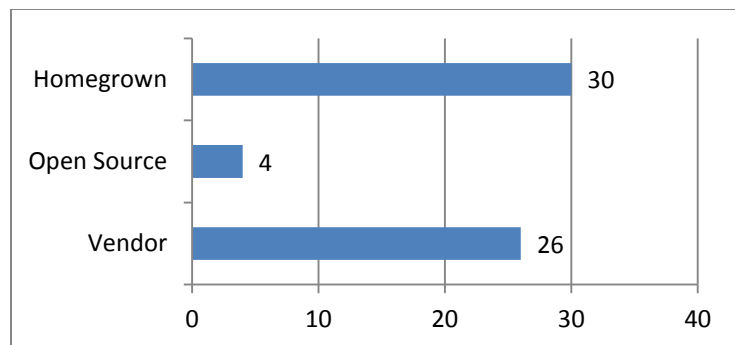
Figure 1: Types of ePortfolio software used in medical schools

Majority of medical schools that use a vendor based product prefer the ePortfolio tool provided by their respective Learning Management System (LMS). Although an LMS integrated ePortfolio software would be preferable, in one-on-one discussions with some schools, it was found that the ePortfolio features that come bundled with an LMS such as Blackboard are quite limited.

Vendor Market Share

The report reveals that out of the 26 medical schools that use a vendor based product, 9 use the ePortfolio tool that comes bundled with their campus-wide Learning Management System (LMS). LMS product vendors like Blackboard, Angel (Blackboard), Desire2Learn and Moodle provide an ePortfolio tool that could potentially address portfolio learning needs of certain institutions. Other popular vendor supported products include e-Value (n=4) and Microsoft SharePoint (n=2). The "Others" include 11 different ePortfolio products like Digication, New Innovation, One45, Epsilen, etc.
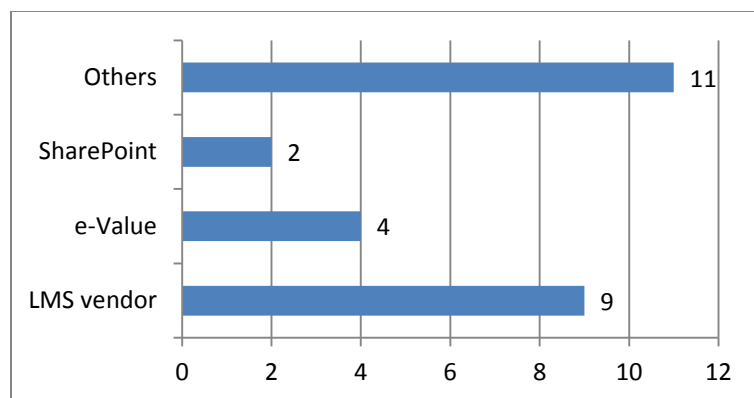
Figure 2: ePortfolio vendor market share

Open Source Market Share

From the 4 schools that use Open Source ePortfolio software, 3 use Mahara and found that it had superior options for reflection, collaboration and assessment. Mahara is flexible, customizable learner centric ePortfolio software that gives the learner 'full control' on their portfolio content. This presents some challenges for faculty who would like to use the ePortfolio software for competency assessment and tracking as faculty may have limited control on student portfolio depending on what and when certain information is shared by the students.

Standards and Specifications

The scan revealed that a matured, widely adopted industry standard for ePortfolio software does not exist at this time. There are a few organizations that are actively developing specifications to allow interoperability (import and export of portfolio data) among various systems. Conformance to a standard specification would potentially allow learners to export their ePortfolio data from one application to another if they were to change an educational institution, software provider and continue to build their educational trajectory without any fragmentation or loss of information.

Currently, Leap2A and IMS ePortfolio v1.0 are the two interoperability specifications that are getting some serious attention from ePortfolio vendors. Refer Appendix B for more information regarding ePortfolio interoperability specifications.

Following table shows the popular ePortfolio software along with the industry specifications they comply with:

Product	Leap2A	IMS ePortfolio Spec v1.0
Blackboard	No	No
e-Value	Yes	No
SharePoint	No	No
Mahara	Yes	No
*Pebble Pad	Yes	Yes

*Pebble Pad is the only software that complies with both interoperability specifications. PebblePad is based in UK and none of the North American medical schools in the survey used this software.

Summary of Notable Findings

The findings show that custom, homegrown software is slightly more prevalent over vendor based options. Among vendor options, the LMS specific ePortfolio software is quite popular although some medical schools use other, less popular ePortfolio software. Some medical schools that use Blackboard ePortfolio are not satisfied with the limited functionality of the software. Schools that use open source software prefer to use Mahara over other options.

Large numbers of K-12 and Higher-ed institutions that use open source software prefer Mahara as it offers lot of in-built features along with flexibility for customization as per requirements. Technical investigation of Mahara shows that it has strong reflection, group management, collaboration and social media tools which can be used for portfolio learning. However, due to functional limitations in software and lack of technical integration with other systems (i.e., LMS and One45), there isn't significant uptake from students and faculty.

The market for ePortfolio is evolving and there are limited vendor based options which could address the needs of health professions. One-on-one discussions with some medical schools show difference in educational and assessment needs that ePortfolios need to accommodate which can be part of the reason why a specific technology does not work for everyone. For instance, Faculty of Dentistry at UBC introduced ePortfolios as a learning tool for students to record their reflections and have positive learning experience (Gardner & Aleksejuniene, 2008). As students found it labor intensive and at times technically challenged to develop and maintain a portfolio, the Faculty decided to offer it as an option along with other choices such as essay or group project. On the other hand, School of Nursing at UBC has developed and integrated portfolio learning as a mandatory part of their curriculum (Garrett & Jackson, 2006). Their custom designed practice ePortfolio is integrated with the curriculum objectives and allows students to develop learning plan under the guidance from instructors, log their clinical skills and reflections which are then used for clinical competency assessment.

Vendor products can provide basic ePortfolio functionality and medical schools may have to invest in custom development if they need enhanced functionality like competency based assessment and integration with curriculum objectives. Please refer Appendix C for detailed ePortfolio software analysis.

Conclusion

The environmental scan revealed that there are limited vendor and open source options that could address the portfolio learning needs of medical schools. Three types of ePortfolio software are currently being used by various medical schools – vendor, open source and homegrown. Vendor specific ePortfolio software, especially those that integrated with LMS are quite popular among North American medical schools. On the other hand, it is interesting to find that majority of schools are using homegrown software to address their specific needs. This shows that the *market for ePortfolio software is bit immature* and there aren't many options available which is why institutions are investing in developing their own product.

The decision regarding selection of appropriate technology for ePortfolios should be based on academic, accreditation, assessment requirements of the program and professional development needs of students. It is suggested that medical schools "think big and start small" such that the initial implementation is simple with increased sophistication only after a clear requirement has emerged from use and evaluation. A prototype/pilot approach for ePortfolio implementation would be preferable to inform the wider implementation. Further technical investigation of Mahara, PebblePad and eFolio Connector applications is proposed in future phase of work.

Reflection based learning requires significant change management (both in teaching and learning philosophy) which is pivotal for a successful ePortfolio implementation. Medical schools should supplement the technology implementation with appropriate training and faculty development activities so that the faculty and students can appreciate the benefits of this educational technology tool and use it for teaching and learning through the continuum of education.

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Appendix A: AAMC2011 GIR Information Technology Survey of Medical schools

Medical School	Application Type	Vendor/Product Name	Status
Source: AAMC 2011 GIR Information Technology Survey of Medical Schools			
Report Date: 4/23/2012			
Educational Technology - E-portfolios Applications			
Albany Medical College	Homegrown	Deans Letter Writing System	Implemented
Baylor College of Medicine	Vendor	PubMed	Implemented
Boston University School of Medicine	Vendor	Digication	Implemented
Case Western Reserve University School of Medicine	Homegrown	ePortfolio	Implemented
Chicago Medical School at Rosalind Franklin University of Medicine & Science	Unknown		
Creighton University School of Medicine	Vendor	Angel Learning	In Process
Dalhousie University Faculty of Medicine	Unknown		
Drexel University College of Medicine	Unknown		
East Tennessee State University James H. Quillen College of Medicine	Unknown		
Eastern Virginia Medical School	Vendor	New Innovations	Implemented
Eastern Virginia Medical School	Vendor	Acuity Star	Replacing
Emory University School of Medicine	Unknown		
FIU Herbert Wertheim College of Medicine	Unknown		
Florida State University College of Medicine	Homegrown	SharePoint	Implemented
George Washington University School of Medicine and Health Sciences	Vendor	BlackBoard	Implemented
George Washington University School of	Vendor	E-Value	Implemented

Medicine and Health Sciences			
Georgetown University School of Medicine	Open Source	OSPI	Planned
Hofstra North Shore - LIJ School of Medicine	Vendor	New Innovations	Replacing
Howard University College of Medicine	Unknown		
Indiana University School of Medicine	Homegrown		In Process
Jefferson Medical College of Thomas Jefferson University	Vendor	Blackboard	Implemented
Johns Hopkins University School of Medicine	Vendor	e-Value	Implemented
Keck School of Medicine of the University of Southern California	Unknown		
Laval University Faculty of Medicine	Homegrown	Clinifolio	Implemented
	Homegrown	Medfolio	Implemented
Loma Linda University School of Medicine	Unknown		
Loyola University Chicago Stritch School of Medicine	Homegrown	ColdFusion	Implemented
McMaster University Michael G. DeGroote School of Medicine	Homegrown	medportal - Reflective Portfolio	Implemented
Medical College of Wisconsin	Unknown		
Medical University of South Carolina College of Medicine	Vendor	E*Value	Implemented
Meharry Medical College	Unknown		
Memorial University of Newfoundland Faculty of Medicine	Vendor	E-Portfolio	In Process
Michigan State University College of Human Medicine	Unknown		
Morehouse School of Medicine	Vendor	SharePoint	In Process
Mount Sinai School of Medicine	Homegrown	Homegrown with access through Blackboard	Implemented
New York Medical College	Vendor	Moodle	Implemented
New York Medical College	Vendor	Central Desktop	In Process

New York Medical College	Vendor	SharePoint	Planned
New York University School of Medicine	Homegrown	Eportfolio	Implemented
Northeast Ohio Medical University	Unknown		
Northern Ontario School of Medicine	Open Source	Mahara	Implemented
Northwestern University The Feinberg School of Medicine	Homegrown	Portfolio System	Implemented
Oakland University William Beaumont School of Medicine	Unknown		
Ohio State University College of Medicine	Vendor	Desire 2 Learn	In Process
Pennsylvania State University College of Medicine	Unknown		
Ponce School of Medicine	Unknown		
Queen's University Faculty of Health Sciences	Homegrown	MEdTech Central	In Process
Rush Medical College of Rush University Medical Center	Unknown		
Southern Illinois University School of Medicine	Unknown		
Stanford University School of Medicine	Unknown		
State University of New York Upstate Medical University	Vendor	Blackboard	Planned
	Vendor	Google	Planned
Stony Brook University Health Sciences Center School of Medicine	Homegrown	CBase	Implemented
Temple University School of Medicine	Vendor	Blackboard	Planned
Texas A&M Health Science Center College of Medicine	Unknown		
Texas Tech University Health Sciences Center School of Medicine	Homegrown	Student eportfolio	Implemented
The Brody School of Medicine at East Carolina University	Unknown		

The Commonwealth Medical College	Homegrown	Student Portfolio System	Implemented
The University of Oklahoma College of Medicine	Vendor	Desire2Learn ePortfolio	Implemented
The University of Toledo College of Medicine	Vendor	Epsilen	Implemented
The University of Western Ontario - Schulich School of Medicine & Dentistry	Unknown		
The Warren Alpert Medical School of Brown University	Homegrown	Electronic Student Record	Implemented
Tufts University School of Medicine	Homegrown	TUSK	Implemented
Tulane University School of Medicine	Unknown		
UMDNJ--New Jersey Medical School	Unknown		
USF Health Morsani College of Medicine	Vendor	E*Value	Planned
Universite de Montreal Faculty of Medicine	Unknown		
Universite de Sherbrooke Faculty of Medicine	Unknown		
University at Buffalo State University of New York School of Medicine & Biomedical Sciences	Unknown		
University of Alabama School of Medicine	Homegrown	Learning Portfolio	Implemented
University of Alberta Faculty of Medicine and Dentistry	Open Source	Mahara	Implemented
University of Arizona College of Medicine	Vendor	E*Value	
University of Arkansas for Medical Sciences College of Medicine	Unknown		
University of British Columbia Faculty of Medicine	Unknown		
University of Calgary Faculty of Medicine	Unknown		

University of California Los Angeles David Geffen SOM	Unknown		
University of California, Davis, School of Medicine	Unknown		
University of California, Irvine, School of Medicine	Unknown		
University of California, San Francisco, School of Medicine	Open Source	Mahara ePortfolio	Implemented
University of Central Florida College of Medicine	Vendor	OASIS	Planned
University of Cincinnati College of Medicine	Unknown		
University of Colorado School of Medicine	Vendor	Sharepoint	In Process
University of Connecticut School of Medicine	Vendor	Blackboard	Implemented
University of Florida College of Medicine	Homegrown	Portfolio	Implemented
	Vendor	TBA	Planned
University of Hawaii John A. Burns School of Medicine	Unknown		
University of Iowa Roy J. and Lucille A. Carver College of Medicine	Homegrown	iFolio	Implemented
University of Kansas School of Medicine	Unknown		
University of Manitoba Faculty of Medicine	Vendor	OPAL	Implemented
University of Maryland School of Medicine	Homegrown	Medscope	Implemented
University of Massachusetts Medical School	Vendor	eValue	In Process
University of Michigan Medical School	Homegrown	Global Health Disparity	In Process
	Open Source	Portfolio implemented in CTools	Implemented
University of Minnesota Medical School	Homegrown	U of MN	Implemented
University of Nebraska College of Medicine	Homegrown		Implemented
University of New Mexico School of Medicine	Unknown		

University of North Carolina at Chapel Hill School of Medicine	Vendor	One45	Implemented
University of North Dakota School of Medicine and Health Sciences	Unknown		
University of Ottawa Faculty of Medicine	Homegrown	ePortfolio	Implemented
University of Pittsburgh School of Medicine	Homegrown	Sharepoint based web application	Implemented
University of Puerto Rico School of Medicine	Unknown		
University of Saskatchewan College of Medicine	Unknown		
University of Tennessee Health Science Center College of Medicine	Homegrown	Student Portolio	Replacing
University of Texas Medical Branch School of Medicine	Homegrown	ePortfolio	Implemented
University of Texas Medical School at Houston	Unknown		
University of Texas Southwestern Medical Center at Dallas Southwestern Medical School	Unknown		
University of Toronto Faculty of Medicine	Vendor	Blackboard	Implemented
	Homegrown	OASES	In Process
University of Utah School of Medicine	Unknown		
University of Vermont College of Medicine	Vendor	Learning Objects	Implemented
University of Virginia School of Medicine	Unknown		
University of Washington School of Medicine	Vendor	Google Apps	Implemented
	Homegrown	Colleges Portfolio	Implemented
Vanderbilt University School of Medicine	Homegrown	KnowledgeMap	Implemented
Virginia Commonwealth University School of Medicine	Homegrown	Portfolio	Implemented
Virginia Tech Carilion School of Medicine	Unknown		
Wake Forest University	Unknown		

School of Medicine			
Washington University in St. Louis School of Medicine	Unknown		
Wayne State University School of Medicine	Vendor	E*Value	Planned
Weill Cornell Medical College	Vendor	angel	Implemented
West Virginia University School of Medicine	Vendor	Nuventive iWebfolio	Implemented
Wright State University Boonshoft School of Medicine	Unknown		
Yale University School of Medicine	Unknown		

Appendix B: ePortfolio Interoperability Specifications

Although there isn't a matured interoperability standard for ePortfolio software, following industry specifications are being adopted by software providers to allow users to move their content from one system to another.

Leap2A
Leap2A is an open specification for transferring learner-owned information between different systems. The Centre for Educational Technology Interoperability Standards (CETIS) at JISC, UK have been supporting group of ePortfolio software vendors to develop an interoperability specification that would allow learner information to be transferred to other applications. Leap2A is designed to work well with other specifications and resuses specifications like Atom and Dublin Core.

ePortfolio vendors that conform to Leap2A specification at this time include:

- Mahara
- PebblePad
- MyProgressFile
- ePet

IMS ePortfolio Specification
The IMS Global Learning Consortium created an ePortfolio Specification to ensure ePortfolios are interoperable across different systems and institutions. In addition, the specification supports advancement of lifelong learning and allows educators and institutions to track competencies. ePortfolio vendors that conform to IMS ePortfolio specification at this time include:

- eFolioWorld
- PebblePad

eFolio Framework
A shared vision of an open source electronic portfolio framework (eFolio) emerged in 2007 at a colloquium attended by Association of American Medical Colleges (AAMC), Accreditation Council for Graduate Medical Education (ACGME), National Board of Medical Examiners (NBME) and Federation of State Medical Boards (FMB).

Medbiquitous, an organization that developes information technology standards for healthcare education and competence assessment has set up an Educational Trajectory Working Group to realize the vision and develop a AAMC eFolio Connector or 'Lifelong Learning Briefcase' specification to meet the portfolio learning requirements of health professions. This is currently a work in progress and the version 1 pilot release of the framework is scheduled for March 2013

with full product launch targeted for summer 2013. The product roadmap is not very clear and project is facing significant technical and scope management issues.

Appendix C: ePortfolio Software Analysis

The following table provides a high level overview of the strengths and weaknesses of the popular ePortfolio software used in various medical schools. In addition, the list includes products being used and developed within various health professions at UBC.

Product	Type	School	Satisfaction	Strengths	Weaknesses
Blackboard (LMS product)	Vendor	University of Toronto	Low	1. Comes out of the box with Blackboard	1. Features are limited, counter-intuitive for university level system Note: Users are now using **Wordpress,** an open source blogging tool which has far more features and flexibility.
*PebblePad (not included in AAMC survey)	Vendor	Imperial College, London	High	1. Helped develop culture of reflection in early medical education 2. Flexible and easy to customize 3. Easily accommodated clinical log book 4. Standards compliant – LEAP2A, HRXML, IMS ePortfolio 1.0 5. API integration	1. Navigation could be made simpler 2. Add notification on home page regarding the activities to be completed 3. Training issues were encountered

				with Blackboard LMS	
Mahara	Open Source	Dalhousie University	Low (no longer used)	1. Built on strong educational objectives 2. Designed for reflective writing 3. Group discussion forums 4. Facebook like social networking 5. Flexible, easy to customize	1. No integration with LMS and One45 2. Lack of use as there is no curriculum integration 3. Students control the access to reflections and faculty/ mentor cannot retain ownership of feedback/ comments 4. No facility to link reflections to learning objectives 5. No support for assessments
Practice ePortfolio	Homegrown	UBC, School of Nursing	High	1. Convenient and easily accessible 2. Pedagogical model matches the needs 3. Inter-connection between learning plan, reflections, competencies and assessments. 3. Support for formative and summative assessment	1. Navigation needs simplification

Diastemas (under dev.)	Homegrown	UBC, Faculty of Dentistry	NA	NA	NA

*PebblePad, a UK based software vendor provides an ePortfolio software that meets industry specifications and is quite popular among European medical schools. None of the North American schools used it at the time of the GIR survey.

Appendix D: ePortfolio Software Comparison

High Level Requirement	Blackboard	Mahara	PebblePad
Functional			
Web based application that can be accessed via Learning Management System (MEDICOL)	Yes	Yes, with custom integration	Yes, with custom integration
Includes self-reflection and critical thinking capability	Yes	Yes	Yes
Provide linkages to program objectives such as CanMED roles, etc.	No	Yes	Yes
Support for formative learning and summative assessment	No	Yes	Yes
Ability to provide feedback/ coaching on journals and artifacts	No	Yes	Yes
Flexibility to accommodate various media formats and learning styles	Yes	Yes	Yes
Easy and standardized export	No	Yes	Yes
Mobile Compatibility	No	Yes (limited functionality)	Yes, iphone app exists
Business			
The ePortfolio technology should be easily supported by UBC IT and/or MedIT (preferably comes out of the box	Yes	No	No

within Blackboard suite or a service currently offered by CTLT)			
The application should not require custom development and maintenance apart from minor custom integration (one time) to integrate with Blackboard	No, will require significant custom development	Yes	Yes
The application should be hosted in Canada, preferably within UBC campus	Yes	Yes	Yes, licencing fee applies
Technical			
Conformance to interoperability standards and specification like LEAP2A, IMS, etc.	No	Yes	Yes
Provide standard API that allows easy integration with Blackboard LMS (LTI)	Not required	No	Yes
Support authentication technologies supported by UBC IT (Shibboleth)	Yes	Yes	Yes