Curriculum Management & Educational Delivery (CMED) Program: Phase I

Systems Analysis and Recommendations

FINAL

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Executive Summary

The Curriculum Management and Educational Delivery (CMED) Program aims to enable enhancement of teaching and learning within the UBC Faculty of Medicine by implementing technologies that support three investment recommendations identified in the Educational Technology Strategy report: *Curriculum Management, Learning Objects, and Online Health Education Platform*. The anticipated benefits of this include improved learning outcomes through more accessible curriculum information, increased efficiency and collaboration in learning material development, and unified user experience for accessing online educational resources.

The goal of Phase I of the CMED Program was to determine and validate stakeholder requirements, leading to the recommendation of specific technologies to fulfill these requirements. This report outlines work to date and is designed to enable TEL Alignment Committee (TAC) to provide direction for future phases.

Starting with ten solutions discovered during an environmental scan of 32 medical education institutions, the project team eliminated six based on readily apparent risk factors or misaligned functionality. The remaining four solutions were evaluated against twelve decision criteria, defined based on stakeholder requirements and CMED Program goals. The solutions were also assessed against overall organizational and technical risk. The four options evaluated were Entrada, Homer, OpalQM, and a modular solution (separate, industry proven systems that would be integrated).

Based on the evaluation, Entrada did not meet the needs of the Faculty. Two of the four solutions, Homer and OpalQM, offered strong functional performance; however, each presented risks to the organization.

Homer was developed at the University of Alberta and is currently only used by their Faculty of Medicine and Dentistry. Adopting this solution would introduce organizational risks related to internalizing product support, development, and maintenance.

OpalQM is a commercial product developed in partnership between Online Business Systems (OBS) and the University of Manitoba (UofM) Faculty of Medicine. UofM is currently the only institution using it. The lack of customer base presents the risk that the vendor could discontinue support and development if the product is not profitable.

The fourth solution is a modular solution which would integrate three separate systems and a portal to provide required functionality. For the purposes of this investigation, the sample modular solution was made up of One45, Moodle, and Equella. The modular solution presents less risk as the FOM would diversify investment in multiple, stable systems used at many Higher Education institutions. However, this solution provides less functionality that the other options explored, and the FOM would need to invest in some integration and customization work in order to meet the desired future state.

Based on the risk and functionality profile of these potential solutions, TAC was not in favour of accepting the risks associated with Entrada, Homer, and OpalQM. TAC provided direction for the CMED Program to proceed with more detailed investigation into a modular solution in order to validate functional performance and plan for implementation.

1 Program Background & Objectives

In 2009 the Technology Enabled Learning (TEL) Alignment Committee (TAC) championed the development of an Educational Technology (Ed Tech) Strategy on behalf of the Faculty of Medicine (FOM) to enable enhanced teaching and learning through technology. This strategy supports curriculum renewal and outlines four enabling and five investment recommendations for educational technologies in the FOM. Three of the investment recommendations with significant interdependencies – Curriculum Management, Learning Objects, Online Health Education Platform – have been drawn together to form the **Curriculum Management and Educational Delivery (CMED) Program**[1]. These three investment recommendations were chartered with the following goals:

- **Curriculum Management**: Increase educational effectiveness and facilitate the accreditation process for undergraduate medical education by: increasing consistency in educational delivery; improving the integration among interdependent courses; and increasing teaching focus in areas where more learning is required.
- **Learning Objects**: Increase the quality of and ease of access to existing and emerging learning content for medical education and to improve the efficiency of instructional design for faculty members by providing mechanisms to share, annotate, and access reusable learning objects.
- **Online Health Education Platform**: Create the conditions for an enhanced learning experience by improving coherence, delivery, and access to web-based learning resources and tools for the undergraduate medical education program and UBC health professions education.

The goal of **Phase I of the CMED Program** was to recommend technology solutions that can advance the above investment recommendations. Specifically, CMED Program Phase I objectives were to:

- Conduct an environmental scan of 32 medical education institutions in Canada, the US, Australia, and the UK;
- Gather and validate high-level requirements from stakeholders across the Faculty;
- Screen available solutions to identify those that warrant further investigation;
- Design and conduct a proof-of-concept to validate stakeholder requirements;
- Conduct mid-level functional, technical, and organizational analysis of solutions; and
- Frame decision criteria and tradeoffs to enable TAC to decide on technologies to fulfill stakeholder requirements. One critical driver includes the need to accelerate MEDICOL replacement, given that MEDICOL (WebCT Vista) is reaching end of life as of June 2012.

Over the course of the project, resources were shifted from conducting a full proof-of-concept towards the mid-level evaluation of additional technologies. This allowed the project team to collect more complete information about the state of the market, and to more fully understand what stakeholder requirements could be met by existing technologies. A full proof-of-concept and additional requirements validation will therefore be required in upcoming phases of the CMED Program. This will help to enable final validation of the preferred technologies selected as an outcome of the current phase.

[1] Formerly known as the Asynchronous Communication Platform (ACP) Program

1.1 Purpose of this Report

This report is the final deliverable of CMED Program Phase I. It summarizes the work performed to date and recommends technology solutions that will advance the Ed Tech Strategy investment recommendations and warrant more detailed investigation in Phase II. This report:

- Defines decision criteria related to functional, technical, and organizational factors;
- Presents technology options that best meet our requirements as outlined in the investment recommendations and evaluate the viability of each against decision criteria;
- Frames advantages and disadvantages of viable solutions;
- Recommends technology options, allows sponsors to make decisions regarding the next phase of work.

1.2 Status Quo

In the autumn of 2009, the FOM recognized the functional inadequacy of the status quo, which spurred the creation of formal Educational Technology Strategy investment recommendations and the subsequent CMED Program. The status quo nevertheless provides a useful baseline to compare against desired functional outcomes of the CMED Program.

Status quo involves continuing to use One45 for curriculum management needs in its current form and replacing learning management functionality contained in MEDICOL. There would be no integration among systems and no dedicated learning objects repository. Users would access various tools via the existing MEd Portal.

Figure 1 shows a comparison of the current state and desired future state as outlined by the three relevant Ed Tech Strategy investment recommendations. Given the significance of these functional gaps, this report assumes that maintaining the status quo is not a feasible solution.

Figure 1: Current State vs. Desired State

2 Summary of Process

An environmental scan in summer 2010 provided visibility into software systems used by 32 other medical education institutions in Canada, the US, Australia, and the UK used in functional areas related to the UBC FoM investment recommendations (see Appendix A: Methodology for more detail). Of these, 10 solutions were identified as most likely to meet the UBC FOM's needs based on reported functionality and user satisfaction. Subsequently, six of those 10 were eliminated based on early warning signs discovered through follow up conversations and product demonstrations with other medical education institutions. See Appendix E: Eliminated Systems for additional detail on rational for elimination.

The project team gathered functional requirements by consulting approximately 30 stakeholders representing key stakeholder groups (see Appendix A: Methodology, for a list of those consulted). Technical requirements and organizational requirements were compiled based on targeted consultations with key stakeholders and technical subject matter experts within MedIT and the project team. These requirements formed the basis for defining relevant decision criteria, which are listed and defined in Section 3.

Using stakeholder requirements, the project team evaluated the four short-listed solutions to determine suitability for use in the UBC FoM. Where possible, each solution was set up with real FoM data to increase the realism of evaluations. Approximately two business weeks were spent evaluating each solution, providing sufficient data to identify major strengths and weaknesses. This data is the basis for recommendations made in this report.

3 Decision Model

Software selection best practices require solutions to be evaluated against clearly articulated decision criteria. Based on stakeholder requirements and CMED Program goals, the project team defined 12 decision criteria listed below. These criteria are grouped into functional, technical, organizational, and cost categories. Each criterion was developed based upon stakeholder requirements, with 10 to 15 discreet requirements forming the basis for each criterion.

3.1 Decision Criteria

3.1.1 Functional

Decision criteria related to functional performance are:

1. **Curriculum management**: the degree to which solutions increase educational effectiveness, enable faculty and learners self-serve access, and facilitate the accreditation process for undergraduate medical education by increasing consistency of educational delivery, improving integration among independent courses, and increasing teaching focus in areas where more learning is required.
2. **Learning Object Management**: the degree to which solutions improve the efficiency of instructional design for the FOM by providing mechanisms to share, categorize, and access reusable learning objects.
3. **Portal**: (a) the degree to which solutions provide easy and consolidated access to web-based learning resources for UBC health professions education and affiliated medical

education programs; (b) the degree to which solutions provide integrated searching and reporting for related information such as schedule and learning objectives; and (c) the degree to which solutions provide a personalized user experience.

4. **Learning Management**: quality of MEDICOL replacement functionality such as collaborative spaces, quizzing, scheduling, selective release, and notifications.

3.1.2 Technical

Decision criteria related to the technical feasibility of solutions are:

5. **Interoperability & Data Exchange Standards**: the degree to which solutions are designed to enable data flow among systems via industry standards.
6. **Scalability & Maintainability**: the ease with which systems can be maintained over anticipated lifecycle, enabling problem resolution and the modular addition of functionality.
7. **Access & Security**: the degree to which access can be controlled and private information can be protected.
8. **Adherence to User Interface Best Practices**: the degree to which solutions adhere to user interface industry standards, affecting usability and training requirements.

3.1.3 Organizational

Decision criteria related to organizational feasibility and implications of solutions are:

9. **Sustainability**: the level of confidence that solutions will be available for intended lifecycle considering vendor/community profile and commitment to the product.
10. **Support Availability**: the degree to which user and technical support is available to assist with training, documentation, and issue resolution.
11. **Strategic Alignment**: the desirability of potential relationship with vendor/community and the degree to which adoption aligns with the way MedIT's current organizational structure.

3.1.4 Cost

Decision criterion related to anticipated cost of solutions is:

12. **Cost Range**: rough order of magnitude cost ranges for a 6 year period which includes the cost of operational support staff, custom development, integration, software licensing, hosting and technical support. Each solution was rated using a scale of High, Medium, and Low with High equating to over $1.5M, Medium as between $1M and $1.5M, and Low as under $1M. Cost estimates will need to be validated before final solution selection.

3.2 Out-of-Scope Considerations

Considerations beyond the investment recommendations relevant to the CMED Program include a solution's ability to integrate with other systems currently deemed out of program scope, such as:

- Student assessment of knowledge and skill;
- Student, course, faculty, and curriculum evaluation surveys;
- Patient encounter and procedure logging; and
- Remuneration and teaching hours tracking.

While some solutions examined contain various portions of out-of-scope functionality, these functional areas were not investigated in detail in order to maintain project focus on core functional components. Nevertheless, the potential for future technical integration with such systems was considered.

4 Options Definition & Analysis

The project team evaluated the four remaining solutions against the 12 decision criteria as defined in Section 3. Scores of excellent, good, fair, needs improvement, and poor (defined in Appendix C: Evaluation Approach for Shortlisted Solutions) were assigned based on the results of this evaluation, with the score of each of the 12 decision criteria based on the results of 10 to 15 related requirements (the exact number of requirements varies by criteria, see Appendix D: Evaluation Results).

The evaluations were then further simplified to provide a single summary rating for each category of decision criteria (functional, technical, and organizational). These simplified ratings, along with the primary factors that affected the ratings for each system, are provided in Section 4. The primary factors articulated represent those findings that most strongly affected the rating (either positively or negatively) and that differentiate the solution from others. Also, each evaluation table is prefaced with a description of each solution.

4.1 Modular Solution

The modular solution option involves integration of multiple products to together fulfill stakeholder requirements. It allows the FOM to select different solutions for different functional areas, which lowers the FOM's dependence on any one system. However, this approach requires effort to make multiple independent systems interoperate which can present technical challenges to achieve seamless integration. A sample modular solution has been defined for this report to provide a tangible example. It includes One45 for curriculum management, Moodle for learning management, Equella as a learning objects repository, and an unnamed Portal.

One45 is currently used for curriculum mapping in the UBC FOM Medical Undergraduate Program. It is a commercial product containing a suite of tools designed to meet the needs of healthcare education institutions. In addition to curriculum mapping functionality, One45 provides other separate functions that are out-of-scope for the current evaluation, such as course and session evaluation surveys, student assessment by instructors and preceptors, course selection, and logging for patient encounters and clinical procedures. The system is used by approximately 44 other institutions across North America.

Moodle is one of two learning management systems under consideration for UBC-wide deployment (along with Blackboard). Moodle was selected to be evaluated in this report over Blackboard because a majority of medical schools interviewed in the environmental scan indicated that Moodle was better able to meet the specialized functional requirements of a medical school. Moodle is an open source learning management system designed for online education. According to the official Moodle website, it is in use by approximately 50,000 educational institutions around the world.

Equella is an industry-leading learning objects repository product provided by the Learning Edge Inc, which has recently been acquired by Pearson Publishing. Equella is the repository that has been selected and recommended by BC Campus[2]. It is a mature product designed to provide content management functionality to the education industry. Equella is the learning objects repository with the strongest functionality in this relatively niche market.

Portal systems were not evaluated in this phase due to time and resource constraints. The market for portal systems is mature and the project team does not anticipate there being major barriers to implement a portal within a modular solution.

Due to cost and schedule constraints, these systems have not been integrated into a functioning modular solution, or proof of concept, so they have been evaluated separately. A final modular solution could substitute any of these products for alternatives that were found to be more appropriate.

Figure 2 summarizes the Modular Solution's performance against groups of decision criteria.

Figure 2: Modular Solution Performance Evaluation

Functional	Technical	Organizational
Fair	**Fair**	**Good**
‣ Provides fair to good functionality across most areas. ‣ Integration between systems likely cannot provide as seamless a user experience as comprehensive systems. ‣ Industry standard learning management systems like Moodle aren't structured for medical curriculum.	‣ Integration and enhancements complicated by one45's lack of adherence to best practices for data exchange and design. ‣ Excellent technical performance from "best in class" system such as Moodle and Equella.	‣ Aligns with FoM organizational structure and focus ‣ Stable products and vendors with good support and/or accountability. ‣ Retaining current curriculum mapping system is a sensible precaution in an immature market.

4.2 Entrada

Entrada is an open source, web-based platform designed to enable management of and access to curricular information. It was originally developed by Queen's University, starting in approximately 2005. Queen's subsequently offered the product as open source and the University of Calgary joined the community in 2009. Of the five Faculties using the product (Faculties of Medicine, Nursing, and Rehabilitation at Queen's and the Faculties of Medicine and Veterinary Medicine at the University of Calgary), only two are active contributors to the development community. If the UBC FOM were to adopt Entrada, it would need to either hire development staff to maintain, support, and contribute to

[2] "BCcampus is a publicly-funded organization that uses information technology to connect the expertise, programs, and resources of all BC post-secondary institutions under a collaborative service delivery framework." (BCCampus website: http://www.bccampus.ca/)

development of the system, financially contribute to the development costs at Queen's, or sacrifice functionality by using the product as is.

Figure 3 summarizes Entrada's performance against groups of decision criteria.

Figure 3: Entrada Performance Evaluation

Functional	Technical	Organizational
Fair	**Needs Improvement**	**Needs Improvement**
‣ Good program administration functionality and user interface. ‣ Weak portal and searching functionality. ‣ Allows educators and learners to easily access learning/curricular resources from a single interface.	‣ Integration with future scope complicated by lack of adherence to data exchange standards. ‣ Maintainability compromised by lack of technical documentation.	‣ Requires change to staffing model and organizational focus. ‣ Internalizes risk for performing development and maintenance. ‣ Sustainability in question because product vision not bounded. ‣ Open source model compromised by low adoption, and the need for many customizations.

4.3 OpalQM

OpalQM is a commercial system designed to be a comprehensive solution. The history of OpalQM involves some initial development at the University of Calgary, a transfer to the University of Manitoba, and an engagement of Online Business Systems (OBS) to rebuild the system for UofM's needs. OBS, a business and IT consulting firm with approximately 250 staff, commercialized the product in 2009. Other than the UofM, no other institutions are using OpalQM.

Figure 4 summarizes OpalQM's performance against groups of decision criteria.

Figure 4: OpalQM Performance Evaluation

Functional	Technical	Organizational
Good	**Good**	**Needs Improvement**
‣ Provides good functionality tailored for medical education. ‣ Provides ability to easily navigate among curriculum map components, search, and manage schedule and program. ‣ Integrated with other tools to provide peripheral functionality. ‣ Has some limitations to curriculum map browsing, learning tracking.	‣ Strong demonstrated ability to interoperate with other functionality. ‣ Theoretically meets high scalability and security standards. ‣ Uses customized versions of certain modules, negatively impacting product sustainability. ‣ Insufficient ability for "hands-on" testing leaves higher margin of error for technical testing results.	‣ High level of uncertainty regarding future product offering (currently only one institution is using it). ‣ Stable vendor with large customer base (for other products/services) and reported to provide very good service.

4.4 Homer

Homer is an online learning community developed by the University of Alberta (UofA) Faculty of Medicine and Dentistry beginning in 2005. It is designed to be a comprehensive solution to most medical education requirements. Homer is currently only used by the UofA Faculty of Medicine and Dentistry. To adopt this solution, the UBC FOM would be required to either hire development staff to maintain, support, and contribute to development of the system, financially contribute to the development costs at UofA, or sacrifice functionality by using the product as is. UofA has indicated that, should UBC select Homer, both parties would need to develop and sign a Memorandum of Understanding outlining the nature of the relationship and the expectations, such as relative levels of contribution.

Figure 5 summarizes Homer's performance against groups of decision criteria.

Figure 5: Homer Performance Evaluation

Functional	Technical	Organizational
Excellent	**Good**	**Needs Improvement**
‣ Provides excellent functionality tailored for medical education. ‣ Allows educators and learners to easily access curriculum mapping, learning resources and administrative features from a single, personalized, interface. ‣ Excels at making the relationships between objectives, learning resources and events transparent.	‣ Pre-existing integration mitigates lack of adherence to data exchange standards. ‣ Risk of older technology platform mitigated by new release in spring 2011. ‣ Strong design and documentation. ‣ Insufficient ability for "hands-on" testing leaves higher margin of error for technical testing results.	‣ Requires change to staffing model and organizational focus. ‣ Internalizes risk for development and maintenance outcomes. ‣ Good relationship with UofA, but no other partners in development. ‣ Unsure whether HOMER will be flexible enough to meet FoM current and future curricular needs

5 Decision Analysis

This section provides a high-level summary of evaluation results. The purpose is to enable management decision making by comparing solutions and framing tradeoffs.

5.1 Summary of Performance

The Comparative Performance Evaluation Summary table strips away detail to show how each solution performed against the categories of functional, technical, organizational, and cost decision criteria. The ratings in this summary are based on the aggregated scores for applicable decision criteria within each category.

Figure 6: Comparative Performance Evaluation Summary

Solution	Functional	Technical[3]	Organizational	Cost
Modular	Fair	Fair	Good	Med
Entrada	Fair	Needs Improvement	Needs Improvement	High
OpalQM	Good	Good	Needs Improvement	High
Homer	Excellent	Good	Needs Improvement	High

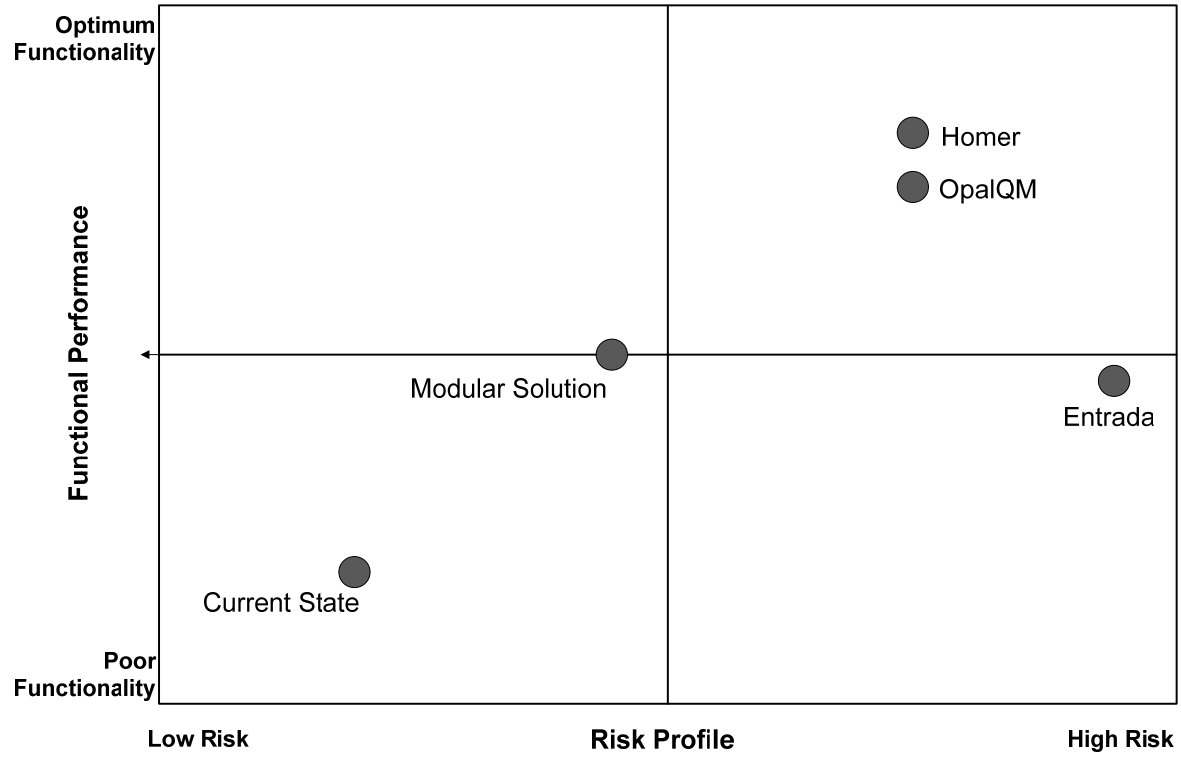
Based on these results, Entrada is a clear target for elimination with fair functionality and weak technical and organizational performance. OpalQM and Homer have similar functional and technical performance with weak organizational performance for very different reasons. The primary concern with OpalQM is that it is a commercial product with a customer base of one. The primary concern with Homer is that the FOM would internalize significant operational risk by assuming maintenance, development, support, and hosting responsibilities. Finally, the modular solution is attractive based on the best performance against organizational decision criteria, but presents less functionality.

5.2 Risk vs. Functionality Profile

The Risk vs. Functionality Profile graph below presents data in a different way by comparing technical and organizational performance as indicators of risk against functional performance. The positioning of points on this graph is not based on concrete data; it is meant to present findings in a way that enables conceptual understanding of how each potential solution rates against these two axes.

[3] Technical ratings for Homer and OpalQM have higher levels of uncertainty due to reliance on documentation and anecdotal data.

Figure 7: Comparative Risk vs. Functionality Profiles



These profiles assert that the most likely possibilities are Homer, OpalQM, and the Modular Solution. Homer displays the highest functional performance. However, selecting it would entail assuming relatively high risk based primarily on the fact that the FOM would accept responsibility for development, maintenance, and support by hiring a team of developers which changes organizational focus and structure.

Similarly, OpalQM presents very good functional performance, but brings relatively high risk of a different nature. OpalQM is a commercial product with a sole client and no booked sales which brings the risk that the vendor could deem the product no longer profitable and discontinue supporting it on short notice. The technical risks of OpalQM are also moderately uncertain.

The Modular Solution presents the possibility of moderate to good functional performance with lower risk. This solution enables the FOM to diversify investment in multiple systems which can be integrated to form a more cohesive user experience. However, this solution accepts that optimal functionality may not be achieved initially, which may prevent the FOM from realizing the full vision of the Ed Tech Strategy in the short and medium term.

6 Conclusions and Recommendations

The FOM must focus its efforts for the next phase of work based on the relative priority it assigns to functional performance and risks associated with technical and organizational considerations.

Due to the immature state of the market for medical education technologies such as curriculum mapping software, no perfect solution exists to meet UBC FOM requirements. Adopting one of the solutions with

the best functionality would guarantee good functional performance, but requires the FOM to accept potentially non-trivial organizational risk in the form of changes to its operational focus and organizational structure or investment in a solution with that may not be operationally sustainable. Conversely, adopting a modular approach provides better management control over organizational risk by diversifying its investment into multiple leading products and planning incremental improvements, but requires the FOM to accept non-trivial functional limitations, with the possibility that the full vision of the Ed Tech Strategy may not be realized in the short and medium term.

The following two options were presented to TAC as the most likely based on evaluation results:

1. **If the desire to manage organizational risk dominates, optimize the modular solution design and present an implementation plan.**

   If the FOM prioritizes predictable service and costs over desired functionality, further investigation of Entrada, OpalQM, and Homer should be ruled out. The project team should work to optimize the functionality available from the modular solution. The end result is expected to be a marked improvement over current state, with moderate system integration and a portal to help direct users. The team would then present a final implementation plan, including preferred design and hosting options, budget projections, and schedule. In selecting this choice, the FOM would:

   a) Accept functional limitations in meeting the vision laid out in the Ed Tech Strategy**,** likely leading to:
      - Less faculty and student interaction with certain functions such as curriculum mapping, leading to some lower utility from these areas.
      - The potential for short-term and medium-term confusion about the purpose and use of multiple systems than would occur in a comprehensive approach, especially where stakeholders must navigate among systems for different tasks.

   b) Reduce organizational risk by primarily using systems that are maintained by third parties.

   c) Retain long-term management flexibility to optimize each functional area (system) independently of the others. This flexibility would allow the FOM to take a “wait and see” approach in the immature curriculum mapping market and would reduce the organizational impact as individual systems reach their end of life.

   d) Flexibility: would allow the FOM to better adapt to the varying requirements of its user groups and to changes in curriculums.

2. **If the desire to fully realize the functional performance envisioned by the Ed Tech Strategy dominates, weigh the risks associated with Homer and OpalQM to determine which is more acceptable. Validate the functional benefit of the more acceptable solution over an optimized modular solution and confirm choice based on the final outcome.**

   If the FOM prefers to optimize functionality and is willing to accept additional organizational risk, it should select either Homer or OpalQM (whichever brings more acceptable risks) for further investigation to confirm viability. In this circumstance, it would be prudent to continue investigating a modular solution to confirm the best functional outcome available using that approach. A more detailed and accurate comparison of these two solutions would then be presented to TAC for a final decision. In selecting this choice, the FOM would:

   a) Guarantee strong initial functional performance, potentially leading to better learning outcomes by improving staff and student access to curriculum information and learning materials.

   b) Accept organizational risks associated with either:

- Altering MedIT's organizational focus by hiring staff to develop, support, and maintain Homer. This major change in MedIT's staffing model also carries cost implications.
- Selecting a system whose development roadmap and overall flexibility is unclear. Purchasing a commercial product with only one other customer. This accepts the risk that the product vendor could, at any time, determine that the product was no longer profitable.

c) Accept organizational risk associated with the possibility of encountering a problem that cannot be resolved by available expertise and support personnel.

6.1 Outcome

These options were presented at a TAC meeting on March 25. The group determined that the organizational risks associated with Homer and OpalQM are untenable. Therefore, TAC recommended that the CMED Program proceed with the Modular solution, recognizing some short to medium term functional limitations as acceptable given the lower risk profile.

7 Next Steps

The following next steps are recommended to proceed with validation of the Modular Solution:

1. Create a short, medium, and long term CMED Program plan which defines the roadmap for implementation. A key schedule driver and milestone in this plan is the fact that WebCT Vista (MEDICOL) is reaching end of life in June 2012.
2. Finalize selection of the products that will comprise the modular solution.
3. Create a conceptual design of the modular system.
4. Finalize order of magnitude cost estimates; determine detailed cost estimates for the next phase.
5. Initiate significant change management effort starting with stakeholders already consulted to socialize the direction and rationale. Plan change management activities for the wider stakeholder group (those not already consulted).
6. Engage stakeholders to define business processes and validate the solution.
7. Define and agree on solution architecture to enable system integration planning.
8. Conduct detailed testing of the integrated modular solution (consider the potential value of a pilot or proof-of-concept to achieve this).
9. Create a proof of concept and validate end user requirements.

Appendix A: Methodology

Environmental Scan

As a first step towards achieving program objectives, an environmental scan was conducted to obtain qualitative information on educational technology used by other medical education institutions to meet similar strategic objectives as those outlined in the Ed Tech Strategy.

Through summer 2010, the project team conducted semi-structured interviews with 32 targeted institutions (a 57% response rate). The output of this scan was a notable findings report that identified key areas for detailed investigation and narrowed the list of possible systems. Most notably, the scan found that 13% of respondents use only commercial systems and 16% of respondents use comprehensive, custom developed systems. The remaining 71% use integrated combinations of in-house developed and/or open source products with commercial products. Scan respondents that developed or adopted integrated or comprehensive systems or solutions reported the highest levels of satisfaction. The low percentage of schools use only commercial systems is indicative of how niche the medical school market is. Medical schools have unique requirements that out of the box systems may not satisfy.

The systems discovered through the environmental scan represent the initial list of potential options, the most promising of which were selected for follow up interviews and investigation.

Requirements Gathering and Analysis

The project team gathered functional requirements to understand stakeholders' needs at a high level and determine if the findings from the environmental scan would be suitable for the FOM. Detailed business process analysis will occur in a later phase to enable systematic testing of preferred solutions and to prioritize the order in which functional deficits are addressed.

Although it was not feasible to consult with all stakeholders, attempts were made to ensure that representatives from affected stakeholder groups were included. The project team gathered functional requirements through a series of focus group sessions attended by approximately 30 stakeholders, including:

- Faculty members from the MD undergraduate program including a Clerkship Director, an Integrated Clerkship Director, Foundations of Medicine Course Directors, Doctor Patient and Society Course Directors, Family Practice Course Directors, an Assistant Dean, and a Theme Director;
- Problem-based learning tutors;
- MD undergraduate program staff;
- MD undergraduate students (one from each year); and
- Faculty from other health professions programs including Audiology and Speech Sciences, Physical Therapy, and Occupational Science and Occupational Therapy.

The sessions included open discussion prompted by specific questions designed to understand the most important functional requirements needed for participants to teach, learn, or administer programs more effectively. Based on discussion results, the project team compiled a list of functional requirements, removing redundancy, and documenting those requirements that participants raised

repeatedly as higher priority. The project team then grouped these requirements into functional areas: curriculum management (includes program administration), learning object management, portal (includes searching and reporting), learning management tools, and those that will be addressed by future projects.

The project team gathered technical requirements and organizational evaluation criteria through targeted consultations with key individuals from MedIT and subject matter experts within the project team. Similar to the functional requirements, the project team grouped these into categories and evaluated each system against those requirements.

Systems Analysis and Shortlisting

The project team conducted follow up meetings with selected institutions which reported moderate to high levels of satisfaction with their systems in the environmental scan. Using this additional information and the requirements, the project team engaged in a system elimination process in order to arrive at a list of solutions with the highest probability of success for detailed evaluation. Through consensus, the project team eliminated systems based on highly visible functional, technical, or organizational deficiencies. This effort resulted in a reduction of the number of potential solutions from ten to four. See Appendix E: Eliminated Systems for a list and rationale for each.

Evaluation of Shortlisted Systems

To distribute evaluation efforts, the project team divided into functional, technical, and organizational evaluation groups and obtained access to each shortlisted system either through demonstration accounts or local test environments. For test environments, a mock curriculum was created to evaluate curriculum mapping and management functionality.

After the initial round of evaluation against requirements and evaluation criteria, the evaluation groups created a mid-level summary of the most important differentiating findings (whether positive or negative). This mid-level evaluation summary can be found in Appendix D: Evaluation Results of this report. Based on group discussion of the mid-level evaluations, the evaluation groups surfaced the most important differentiating findings for each system. These findings were used to frame tradeoffs among the various possible solutions which can be found in sections 4 and 5 of this report.

Appendix B: Results of Systems Analysis & Shortlisting

Update on State of Market since Environmental Scan

Through further interviews with medical institutions and software vendors, the project team discovered that the markets for Curriculum Management Systems, Learning Management Systems, and Learning Object Repositories vary in terms of maturity. Among these, the Curriculum Management System market is most immature. There are very few products available within this market, with only a small percentage commercially available. Many of the systems within this market were deemed unsuitable from a functional, technical, or organizational perspective. No product is a clear market leader in terms of market share or trajectory. Although not the only functional priority for the program, the curriculum mapping functional area provides the structure for learning delivery and

learning object taxonomy, and is integrated into many of the products considered. Therefore, the immaturity in this market must be considered before deciding to adopt any individual solution.

Conversely, the markets for Learning Management Systems and Learning Object Repositories are more mature and stable with a larger selection of products, both commercial and otherwise.

Results of Shortlisting Process

Through a consensus building process, the project team eliminated a group of systems based on discussion of apparent positive and negative characteristics discovered through high-level investigation including discussions with product representatives and demonstrations of product functionality.

The following systems remained after the elimination process and underwent more detailed functional, technical, and organizational evaluation:

- Entrada
- Homer
- One45 (considered as part of an example solution with Moodle and Equella)
- OpalQM

Results of these evaluations are the focus of the remainder of this report.

Appendix C: Evaluation Approach for Shortlisted Solutions

System Categorization

The products shortlisted through the Systems Analysis and Shortlisting phase are diverse in terms of design approach and ownership structure. Design approach affects the cohesiveness of the user experience and an organization's flexibility for making long-term changes. Ownership structure determines the level of control a medical school has over product direction, and the degree of risk a medical school bears for maintaining a product's stability and effectiveness. Ownership structure is especially relevant for the UBC FOM as it could lead to a change in business model by building internal expertise in software development.

Two major design approaches are discussed in this report:

1. **Comprehensive** approaches use a single product to fulfill most or all priority functional requirements. This design approach typically provides the most cohesive user experience because users do not have to navigate among different systems to access related information. However, effort is required to maintain optimum quality across all functional areas, and risk is increased because the delivery of education is reliant on a single overarching product. The three comprehensive solutions discussed in this report are:
    - **Homer**
    - **Entrada**
    - **OpalQM**

2. **Modular** solutions integrate multiple products to provide priority functional requirements. They are more likely to optimize each individual functional area by allowing the Faculty to adopt “best in class” products for each. This modular approach also requires less commitment as it allows flexibility for the Faculty to replace the system(s) that provide(s) certain functions but not the entire solution. However, this approach requires effort to make multiple independent systems interoperate, is less likely to present a unified user experience, and carries the risk of maintaining multiple systems. The sample modular solution defined for this report includes:
    - **One45** which acts as the current curriculum mapping system for the UBC FOM and a modest number of other medical schools. It is widely adopted among other North American medical schools and higher education institutions for other functional purposes (evaluation, assessment, logging, course selection, etc.).
    - **Moodle** which, along with Blackboard, is one of two learning management systems under consideration for UBC-wide deployment. Moodle was selected to be evaluated in this report over Blackboard because a majority of medical schools interviewed for the environmental scan report indicated that Moodle was better able to meet the specialized functional requirements of a medical school.
    - **Equella**: which is an industry-leading learning objects repository that has been highly recommended by BC Campus.

    Due to cost and schedule constraints, these systems have not been integrated into a functioning modular solution and so have been evaluated separately. A final modular solution could substitute any of these products for alternatives that were found to be more appropriate.

Three major ownership structures are discussed in this report:

1. **Commercial** products are owned and maintained by an external vendor who licenses their use to institutions or users. Commercial relationships provide a mechanism to spread the cost of developing and maintaining a product across multiple license holders. The vendor ideally holds deep expertise in its field, and is held contractually accountable to provide pre-defined levels of service and support. However, because license holders do not own their software, they do not have full control over future product development timelines, functional priorities, and ongoing development quality.

2. **Open Source** products are maintained by a community of volunteer contributors, all of whom can use the product free of charge and have access to the product’s source code. Like commercial relationships, an open source model provides a mechanism to spread the cost of developing and maintaining a product across multiple parties, assuming the open source community has multiple members with overlapping development priorities. Users of open source products have the additional flexibility to modify the product on demand. However, the use of open source products can transfer significant risk to the user because no external body is obligated to provide support, and because the outlay of expenses to build in-house development expertise does not guarantee satisfactory results.

3. **Proprietary** products are defined for the purposes of this report as products developed and owned by the same institution that uses them. The owners of proprietary products have complete control over product development and direction. However, proprietary products do

not have pre-existing rules to allow multiple institutions to cooperate on development and maintenance, and the user internally bears most risks and responsibilities. When entering a collaborative partnership with an institution for the purpose of adopting their propriety product, both institutions need to consider and document contractual agreements that will outline the development, support, and collaboration expectations.

Detailed functional, technical, and organizational evaluation results for each of the above products are provided in Appendix D: Evaluation Results. The advantages and disadvantages of each solution are presented for high level comparison in Sections 4 and 5.

Presentation of Evaluation Findings

Evaluation findings are presented at three levels of detail in this report. The most detail is presented in Appendix D: Evaluation Results which shows the performance of each system against each decision criterion. This is represented by a rating and notes which summarize findings and guide the rating. The following ratings were used as short-hand for each solution's performance in each area of investigation:

- **Excellent**: high priority organizational objectives are achieved in an optimal manner such that a significant return on investment would be possible.
- **Good**: high priority organizational objectives are largely addressed such that a moderate return on investment would be possible.
- **Fair**: high priority organizational objectives are partially satisfied, such that a partial return on investment would be possible.
- **Needs improvement**: high priority organizational objectives are threatened such that potential for return on investment is questionable.
- **Poor**: high priority organizational objectives would be compromised such that return on investment would not be possible.

It is important to note that only a moderate level of confidence exists in the use cases, ratings, and priorities applied to each system. The purpose of the ratings is primarily to inform next steps by indicating approximate severity of gaps.

The second level of detail is presented in section 4. The purpose of this level is to highlight the most important information about each specific product and provide a rating for three categories of decision criteria. This section focuses on the most significant differentiating positive and negative findings. For the functional investigation, scores were weighted based on requirement priority estimated by the project team and averaged within each of the six functional categories. Scores were not further abstracted to avoid losing sight of major variations in performance among categories.

The final level of detail is presented in section 5. This section distils the ratings per solution per decision criteria category. The purpose of this section is to frame trade-offs among the three areas of investigation (functional, technical, organizational), to support recommendations, and to encourage decisions.

Appendix D: Evaluation Results

Sample Modular Architecture Notable Findings

This section presents the evaluation results of several systems that together could deliver the CMED Program's functional objectives as a modular solution:

- **One45**: Currently used for curriculum management and program administration functionality
- **Moodle**: One of two learning management systems shortlisted for potential UBC-wide deployment.
- **Equella**: An industry leading learning object management system.
- **Portal**: No specific portal system was evaluated for this report due to resource constraints. The project team does not anticipate problems integrating a portal with a modular solution.

The above systems are intended to fulfill complimentary functionality, and so should not be evaluated against one another, but rather in combination. This combined solution is compared collectively against comprehensive system alternatives in Sections 4 and 5.

Although the project team has evaluated specific systems to make up a sample modular solution for the purpose of this report, any of these systems could be replaced prior to implementation if a better system became available in the market. This ability to "swap" systems in and out of a modular solution relies on the ability to integrate the new system with the other systems which can be a time consuming and costly activity. Nevertheless, this ability is an attractive aspect of managing a modular solution rather than one comprehensive system, where all functional areas come as a package.

Introduction: One45

One45 provides curriculum management, program administration, and searching and reporting functionality. It is a commercial suite of tools designed specifically to meet the needs of healthcare education institutions. One45 is currently in use at the UBC FOM for curriculum management, as well as several separate functions that are out-of-scope for the current evaluation, such as course and session evaluation surveys, student assessment by instructors and preceptors, course selection, and logging for patient encounters and clinical procedures.

One45 is currently in use by approximately 44 clients across North America. While it is still a relatively small company, this broad customer base implies a reasonable measure of stability. UBC FOM was one of One45's first customers, providing a long history of collaboration and a strong working relationship. UBC FOM currently pays approximately $130k per year in licensing fees for the suite of One45 products (flat rate which includes moderate ongoing development, as well as support and hosting).

Functional: One45

One45 currently meets the FOM's core curriculum mapping requirements for curriculum administration. The curriculum management interface has recently been made available to faculty and students; however it is not well designed for casual access by learners and educators.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators	Usability
Curriculum Management	Fair	‣ Links exist between events and curriculum map ‣ Curriculum map supports a variety of taxonomies	‣ Linkages not as seamless as other systems (between the curriculum map and other elements)	Fair
Program Administration	Needs Improvement	‣ Scheduling of events is linked to the curriculum structure	‣ Limited user communication tools ‣ Limited schedule export	Good
Learning Management Tools	N/A	-	-	-
Searching and Reporting	Fair	‣ Strong curriculum map searching and filtering functionality ‣ Able to present summary reports of all courses, learning events, schedules, and faculty.	‣ Satisfactory ability to create user defined reports ‣ Dynamic links to related components could be improved	Fair
Learning Object Management	N/A	-	-	-
Portal	N/A	-	-	-

Technical: One45

A lack of adherence to interoperability and data exchange standards will make One45 a challenge to integrate into a wider modular solution. The technical architecture of One45 is assumed to be weak based on design history and known practices of the vendor.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Interoperability & Data Exchange	Poor	‣ Supports curriculum upload to CurrMIT	‣ Presents challenges for integration; does not adhere to integration and data exchange standards
Scalability & Maintainability	Needs Improvement	‣ Adequate maintenance and support from vendor	‣ Risks to scalability and maintainability from weak software design ‣ Does not meet industry standards for enterprise software design
Access & Security	Needs Improvement	‣ The application supports secure data transaction	‣ Limited ability for advanced user permissions management ‣ Access and security issues could emerge when integrating with other systems ‣ Minor potential security risks uncovered during testing

Adherence to User Interface Best Practices	Fair	‣ Relatively stable in current state	‣ User interface not designed according to best practices

Organizational: One45

One45's status as a well adopted and commercially supported product is a positive factor in assessing organizational risk.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Sustainability	Fair	‣ Stable business situation with 44 clients across North America	‣ Curriculum management is relatively new and not widely adopted with only 8 known clients using CurrMIT upload ‣ Vendor has loosely defined product roadmap
Support Availability	Fair	‣ Long relationship history; vendor is highly responsive to MedIT's needs	‣ Small development team lacks focused vision of product and has moderate best practice standards ‣ Requires close supervision for design and testing
Strategic Alignment	Good	‣ Aligns with MedIT organizational structure and focus ‣ Retaining current curriculum mapping system mitigates risk of changing systems in an immature market	‣ Investing in improvements to One45 escalates commitment to non-ideal vendor
Cost & Schedule Considerations	Not Rated	‣ Net zero licensing cost to MedIT with low-level development costs provided for free by vendor. ‣ Already in place and populated with curriculum map	‣ Integration will be difficult as the technical architecture is not designed for it ‣ Cost considerations are hard to estimate as the vendor's development pathway is currently unknown ‣ Difficult to estimate schedule associated with integration as system is not designed for integration ‣ A fair amount of customization needs to be considered

Introduction: Moodle

Moodle provides the learning management and educational delivery functionality of this example modular solution set. It is an open source, learning management system designed for education in general. It is widely adopted by educational institutions around the world, creating a highly-functioning development and support community. There is a significant amount of information

freely available online for support and training. Also, there are many experienced developers worldwide who are equipped to support and customize Moodle without the need to hire developers within MedIT.

Moodle is one of two learning management system finalists in UBC IT's search for a campus-wide solution. We have chosen to investigate it here as an example of a traditional learning management system that could be combined with other systems to produce a modular solution set. Based on the environmental scan, medical schools seem to be more satisfied with Moodle than other similar products available.

Functional: Moodle

Evaluation Area	Score	Positive Differentiators	Negative Differentiators	Usability
Curriculum Management	N/A	-	-	
Program Administration	N/A	-	-	
Learning Management Tools	Good	‣ Robust quizzing functionality	‣ Limited group collaboration functionality ‣ Limited ability to create customized surveys	Fair
Searching and Reporting	N/A	-	-	
Learning Object Management	N/A	-	-	
Portal	N/A	-	-	

Technical: Moodle

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Interoperability & Data Exchange	Excellent	‣ Supports industry standards for content interoperability and data exchange ‣ Demonstrated integration with various learning management systems, learning object repositories, and other systems	-
Scalability & Maintainability	Excellent	‣ Uses standardized software framework ‣ Paths exist to scale and add functional components ‣ Easily maintainable with much existing documentation	-
Access & Security	Excellent	‣ Supports secure data transaction (SSL) ‣ Supports CWL single sign-on ‣ Granular roles and permissions	-

Adherence to User Interface Best Practices	Good	‣ Interface follows best practices	‣ Custom themes may need to be applied to optimize the UI and navigation

Organizational: Moodle

Moodle outperforms most other systems on organizational criteria due to its status as one of the most widely adopted Learning Management Systems available.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Sustainability	Excellent	‣ Very stable product with large open source community	-
Support Availability	Good	‣ Free online support ‣ Specialist software developers are available for customization requirements	‣ Lacks a single point of accountability because it is not a commercial product
Strategic Alignment	Good	‣ Does not require MedIT to hire developers	‣ MedIT does not have a history of implementing open source software
Cost & Schedule Considerations	Not Rated	‣ Free to obtain ‣ Already integrated with Equella	‣ May need customization for FOM needs ‣ Requires integration

Introduction: Equella

Equella provides the learning object management functionality of this example solution set. It is a mature, traditional learning object repository. This market is relatively niche and consists of approximately three or four products that fit broadly within the UBC FOM's needs. Of these, Equella is likely the strongest functional match for classifying and accessing learning objects. Colleagues at BC Campus use Equella for various libraries across BC and have had a positive experience, both with the tool itself and with the vendor. The product was recently acquired by Pearson, a global education publishing company. Equella's development team is located in Australia and it is used by a growing customer base across North America, Europe, and Australia.

Functional: Equella

Evaluation Area	Score	Positive Differentiators	Negative Differentiators	Usability
Curriculum Management	N/A	-	-	
Program Administration	N/A	-	-	
Learning Management Tools	N/A	-	-	
Searching and Reporting	N/A	-	-	

Learning Object Management	N/A	-	-	
Portal	Excellent	‣ Robust learning object management functionality	-	Excellent

Technical: Equella

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Interoperability & Data Exchange	Excellent	‣ Supports industry standards for content interoperability and data exchange ‣ Integrates seamlessly with popular learning management systems	-
Scalability & Maintainability	Excellent	‣ Uses standardized software framework ‣ Highly maintainable and scalable	-
Access & Security	Excellent	‣ Supports secure data transaction (SSL) ‣ Supports CWL single sign-on ‣ Granular roles and permissions	-
Adherence to User Interface Best Practices	Excellent	‣ User interface follows industry best practices	-

Organizational: Equella

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Sustainability	Good	‣ Owned by a large, global educational publishing company ‣ Mature, stable product	‣ Unclear how many other medical education institutions are using it
Support Availability	Excellent	‣ Very good support available 24/7 (report from BC Campus)	-
Strategic Alignment	Excellent	‣ Aligns with MedIT organizational structure and focus	-
Cost & Schedule Considerations	Not Rated	‣ BC Campus pays approximately $40k/yr in license fees ‣ Already integrated with Moodle and Blackboard	-

Entrada Notable Findings

Introduction

Entrada is an open source, web-based platform designed to enable management of and access to curricular information. It was originally developed by Queen's University, starting in approximately 2005. Queen's subsequently offered the product as open source and the University of Calgary joined the community in 2009. Currently, the product is in use by the Faculties of Medicine, Nursing, and Rehabilitation at Queen's and the Faculties of Medicine and Veterinary Medicine at the University of Calgary.

Queen's started developing Entrada in response to the relative immaturity of the curriculum management system market and the belief that available commercial systems would not sufficiently meet their needs. Entrada is designed to be a comprehensive solution, meeting a broad range of functionality needs from curriculum and learning event management to quizzing, searching, and collaborative spaces.

The community is relatively small with two key contributing faculties. Understandably, each member organization is focused first on meeting the needs of its program, with the University of Calgary rewriting up to 40% of Entrada to meet its own requirements. However, members actively collaborate on common priorities. If the UBC FOM were to adopt Entrada, it would need to hire development staff to maintain, support, and contribute to development of the system.

As an open source product, it is free to download and install. There is a small fee of approximately $25,000 to join the development community.

Functional

Entrada received moderate and good scores on curriculum management, program administration, and learning management tools functional areas but showed significant weakness in searching and reporting, learning object management, and portal functionality.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators	Usability
Curriculum Management	Fair	‣ Tracks linkages between learning events and the curriculum map ‣ Options exist for displaying learning objective coverage	‣ Learning events are the hub of linkages; no direct link from the curriculum map to learning objects ‣ Cannot browse the curriculum map ‣ Limited workflow functionality	Good
Program Administration	Good	‣ Strong user management and communication functionality ‣ Efficient scheduling across curriculum map and learning platform	‣ Requires custom development to match UBC FOM's scheduling model	Good

Learning Management Tools	Good	‣ Robust collaborative group functionality ‣ Quiz delivery can be attached to learning events	‣ Limited quiz structure options	Good
Searching and Reporting	Needs Improvement	‣ Can view and report on learning objective coverage over time	‣ Search limited to event titles and free text objectives ‣ Limited ability to identify gaps and overlaps in curriculum ‣ Cannot export reports	Good
Learning Object Management	Needs Improvement	‣ Can selectively release learning content	‣ Limited ability to tag learning content ‣ Learning objects exist within learning events (not independently) ‣ Limited content management workflow	Good
Portal	Needs Improvement	‣ Personalized dashboard for displaying relevant information	‣ Dashboard is not customizable (beyond RSS feeds) ‣ Limited ability to navigate between courses and lectures	Good

Technical

Major concerns arose during the technical investigation due to Entrada's lack of adherence to standards for integration and data exchange.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Interoperability & Data Exchange	Poor	-	‣ Difficult to integrate (if required) because it does not adhere to standards for integration and data exchange ‣ Built to include many diverse functional areas with no apparent effort to enable integration with other systems
Scalability & Maintainability	Needs Improvement	‣ Developed using a standardized software framework ‣ Modular design enables scalability	‣ Maintainability compromised by lack of technical documentation and nature of custom developed systems
Access & Security	Fair	‣ Good security features upon preliminary investigation	‣ Requires custom development to enable single sign-on and more granular roles and permissions
Adherence to User Interface Best Practices	Good	‣ Stable and well-built ‣ Conforms to user interface best practices	‣ Limited data validation capabilities

Organizational

Entrada has similar risks as Homer in that it requires a change to MedIT's organizational focus. Further concerns exist regarding strategic alignment because Entrada community members appear to be attempting to build the product in too many disparate directions with no effort to integrate with existing functionality in other systems.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Sustainability	Fair	‣ Community members appear to be very committed to the product	‣ Few active contributing Faculties (2 active; 3 passive)
Support Availability	Needs Improvement	‣ Open source community exists with established procedures	‣ Difficult to obtain support as no technical documentation exists
Strategic Alignment	Poor	‣ Internalizes control over customization and roadmap	‣ Requires major change to MedIT staffing model and organizational focus ‣ Internalizes risk for product quality assurance and development outcomes ‣ Members appear to be attempting to build the product in too many disparate directions
Cost & Schedule Considerations	Not Rated	‣ Free to download; minimal fee to join community (~$25k) ‣ Core functionality already integrated	‣ Need to hire staff to support, maintain, and develop ‣ Significant functional and technical deficits to be overcome ‣ Would have to migrate curriculum and other content

OpalQM Notable Findings

Introduction

OpalQM is a commercial, comprehensive solution designed to meet curriculum management, program administration, learning management tool, search and report, learning object management, and portal functionality. The history of OpalQM involves some initial development at the University of Calgary, a transfer to the University of Manitoba, and an engagement of Online Business Systems (OBS) to rebuild the system for University of Manitoba's needs. OBS commercialized the product in 2009.

OBS is a business and IT consulting firm with a global staff of approximately 250 divided into regional consulting groups and product groups. Representatives have pitched a fixed, yearly fee partnership whereby OBS would work with the UBC FOM to install, customize, and support the solution for an initial 5 year term. They represented this partnership model as a "best of both worlds" solution in which MedIT would not have to become an IT development shop but would still have the freedom to guide development and product roadmap.

Other than the University of Manitoba, no other institutions are using OpalQM which is a significant source of risk. Nevertheless, OBS appears to have an interesting approach to curriculum management that they have pitched as quality management (the "QM" in OpalQM), with interesting existing and planned features such as business intelligence reporting which can be used to optimize curriculum design.

Functional: OpalQM

Evaluation Area	Score	Positive Characteristics	Negative Characteristics	Usability
Curriculum Management	Good	‣ Ability to identify gaps and overlaps in the curriculum. ‣ Easy navigation among curriculum map components	‣ Limited ability to browse the curriculum map ‣ Limited curriculum map workflow features	Good
Program Administration	Good	‣ Robust program scheduling and management functionality	‣	Good
Learning Management Tools	Good	‣ Integrated with third party quizzing, examination and collaboration tools.	‣ Limited ability to track learning and object analytics	Good
Searching and Reporting	Fair	‣ Ability to search for objectives, learning objects and events ‣ Ability to produce reports based on courses, schedules	‣ Reports need to be customized for UBC FoM	Good
Learning Object Management	Good	‣ Integrated with a third party Learning Object Repository which permits tagging and object management	‣ Learning object repository has limited selective release functionality ‣ No ability to search within documents	Good
Portal	Fair	‣ Ability to customize and integrate Portal with multiple plug-ins from third party vendors	‣ Unable to test calendar or external links to third-party sites ‣ No CWL integration	Good

Technical: OpalQM

The technical investigation for OpalQM was mainly reliant on documentation and anecdotal information. Further investigation would be necessary to confirm the preliminary findings below.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Interoperability & Data Exchange	Fair	‣ Components of the system meet industry standards ‣ Ability to interoperate demonstrated through existing integration with Question Mark Perception (for assessment) and Business Intelligence tools (for custom reporting)	‣ Custom developed curriculum management functional component does not meet industry standards for interoperability and data exchange ‣ Custom integration will be required for adding learning management functions
Scalability & Maintainability	Good	‣ Developed using a scalable standardized software framework (not directly tested).	‣ Custom developed curriculum management function lacks technical documentation
Access & Security	Fair	‣ Supports secure data transaction (SSL) ‣ Portal meets high security standards with sensitive data encrypted	‣ Custom development required for CWL integration ‣ Custom development required to enable more granular roles and permissions
Adherence to User Interface Best Practices	Good	‣ Stable and well built ‣ User interface is intuitive and adheres to data validation standards.	‣

Organizational: OpalQM

The vendor has received positive recommendation from partners at UofM; however the risk associated with a commercial product with only one customer is significant.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Sustainability	Needs Improvement	‣ Large company with a large customer base across North America for other services ‣ Contractual risk mitigation strategies were successful for UofM	‣ High level of uncertainty regarding future product offering (currently only one institution is using it)
Support Availability	Good	‣ 12 OBS staff members actively involved in the product ‣ Partnership would provide the ability to steer development ‣ Opportunity to define service level agreement ‣ Positive reports from UofM	‣ Accepts risk that vendor could discontinue supporting the product

Strategic Alignment	Good	‣ Aligns with MedIT organizational structure and focus ‣ OBS appears to understand the medical education context ‣ Development philosophy is to interoperate wherever possible	-
Cost & Schedule Considerations	Not Rated	‣ Fixed yearly fee for 5 year agreement	‣ Would have to migrate curriculum and other content

HOMER Notable Findings

Introduction

Homer is an online learning community developed by the University of Alberta (UofA) Faculty of Medicine and Dentistry beginning in 2005. It is designed to be a comprehensive solution that provides curriculum management, learning delivery, portal, and learning material management functionality. Homer was developed in response to needs that UofA felt could not be met with commercially available products.

Homer is currently only used by the UofA Faculty of Medicine and Dentistry. As such, there is no defined path for the UBC FOM to join the community. To define this path, the UBC FOM has been in discussions with the Assistant Dean, Clinical Informatics and the Director, Centre for Health Evidence, Dr. Robert Hayward. Dr. Hayward has indicated willingness to collaborate with UBC in this regard, and has stated that UofA would be willing to share Homer in a manner similar to open source software. If the UBC FOM were to adopt Homer, it would need to further define the partnership and the modes of collaboration.

There are no licensing fees associated with Homer. To adopt this system, the UBC FOM would be required to hire staff to maintain the system and contribute to product development. UofA has indicated that, should the UBC FOM select Homer, both parties would need to develop and sign a Memorandum of Understanding outlining the nature of the relationship and the expectations, such as relative levels of contribution.

Functional

Homer meets all functional requirements very well, obtaining the highest scores of any system.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators	Usability
Curriculum Management	Good	‣ Strong and flexible curriculum map with effective navigation ‣ Robust display of curriculum gaps/overlaps ‣ Robust linking between curriculum map and all other elements	-	Good

Program Administration	Excellent	‣ Strong tools for managing schedules, teaching hours, etc. ‣ Excellent event creation functionality with ability to draw on other information in system ‣ Robust user and permission management	-	Fair
Learning Management Tools	Excellent	‣ Excellent collaborative space functions ‣ Robust quiz functionality ‣ Ability to link directly to research databases	-	Good
Searching and Reporting	Excellent	‣ Advanced searching, browsing, and reporting throughout ‣ Can export schedules, reports, and search results in multiple formats	-	Good
Learning Object Management	Good	‣ Robust learning objects management and retrieval based on advanced tagging and metadata ‣ Automatically converts uploaded files to multiple formats ‣ Strong selective release functionality	-	Good
Portal	Excellent	‣ Content is highly tailored to user and customizable ‣ Can integrate with assessment, evaluations, and electronic medical records	‣ No CWL integration ‣ Would need to customize logging system	Good

Technical

Homer meets technical requirements to a moderate degree with strong stability and adherence to user experience best practices. Scalability and maintainability are potential areas of risk. The technical investigation for Homer was mainly reliant on documentation and anecdotal information. Further investigation would be necessary to confirm the preliminary findings below.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Interoperability & Data Exchange	Fair	‣ Demonstrated ability to develop custom integrations with other systems (One45 and IDEAL)	‣ Difficult to integrate further (if required) because it does not adhere to standards for integration and data exchange

Scalability & Maintainability	Fair	‣ Developed using a standardized software framework ‣ New version planned for release in spring 2011 to improve platform	‣ Platform technology is old and may be difficult to support in coming years and/or require redevelopment
Access & Security	Fair	‣ Good security features including SSL (secure data transaction)	‣ Requires custom development to enable single sign-on and more granular roles and permissions
Adherence to User Interface Best Practices	Good	‣ Stable and well-built ‣ Conforms to user interface best practices	‣ Limited data validation capabilities

Organizational

The organizational evaluation for Homer identified risks related to the small development community, internalizing responsibility for product development and quality, and the requirement to expand MedIT's organizational focus to include software development.

Evaluation Area	Score	Positive Differentiators	Negative Differentiators
Sustainability	Fair	‣ UofA appears to be highly committed to the product, reducing the risk of discontinuation	‣ Relies on only one other institution for partnership and co-development
Support Availability	Needs Improvement	‣ UofA appears to be eager to build relationship ‣ Have been highly responsive during high-level evaluation	‣ Self-support would be required as UofA is not structured to support external groups.
Strategic Alignment	Needs Improvement	‣ Internalizes control over customization and roadmap ‣ Development philosophy is to create custom functionality only where a need is not met by the market	‣ Requires change to MedIT staffing model and organizational focus ‣ Internalizes risk for product quality assurance and development outcomes
Cost & Schedule Considerations	Not Rated	‣ No acquisition or license fees (expected to collaborate) ‣ President set for quick response time from UofA ‣ Core functionality already integrated	‣ Need to hire staff to support, maintain, and develop ‣ Would have to migrate curriculum and other content

Appendix E: Eliminated Systems

The following systems were eliminated by project team consensus. The team discussed each of these potential systems in light of positive and negative characteristics discovered through high-level investigation including discussions with product representatives and demonstrations of product functionality. The specific reason(s) for eliminating each system is/are described in the Rational for Elimination column of the table below.

Systems	Rational for Elimination
Compass by University of Sydney (proprietary) *Source: discussions with Gareth Denyer*	• The programmers involved in creating the system have been diverted to other projects and are no longer dedicated to Compass. • The University now owns Compass instead of the Medical School and sees ownership of the program as a liability. • This appears to be a "worst of both worlds" situation: the system was locally developed and is for sale (semi-commercialized).
CURE by UCSD (proprietary) *Source: discussions with Helene Hoffman*	• The UCSD School of Medicine seems to take an undisciplined approach to adding functionality. They indicated that they spend a lot of time fixing bugs because they do not properly test before incorporating new code into production. • The UCSD SOM is not able to provide demo accounts for CURE. • It is unclear how we could proceed with developing the relationship necessary to proceed
Ilios 2 by UCSF (will be open source) *Source: discussions with Chandler Mayfield and system demonstration*	• Ilios 2 currently has no curriculum mapping functionality. It contains mostly LMS-type functionality. It would be ill-advised to select a locally developed LMS (without curriculum management functionality) because the LMS market is quite mature. • Currently no institutions are using Ilios 2; it is still undergoing testing.
Navigator + SharePoint by University of Pittsburgh (proprietary) *Source: discussions with JB McGee and system demonstration*	• The University of Pittsburgh has not yet decided whether they want to make the system commercial, share it, or make it open source. They are unable to make a decision until April at the earliest. • The technical architecture of the system is unsuitable for the UBC FOM, according to Ranvir. • The University of Pittsburgh is in the midst of redesigning the whole system.
TUSK by Tufts University (proprietary; will be open source) *Source: discussions with Susan Albright*	• Tufts started writing program in 1994/95, making the code very old. • The code is not clean. • Potential release as open source will not happen until April at the earliest and is not guaranteed.
WEAVEonline by Weave (commercial) *Source: discussions with Matthew Pfeiffer and system demonstration*	• Only meets a small portion of functional areas and limited possibility for integration due to the hosted nature of the system. • WEAVEonline does not have search functionality.