Project Management Characteristics and Education for eHealth Students

Norm Archer

McMaster eBusiness Research Centre, DeGroote School of Business, McMaster University, Hamilton, Canada

Abstract

Project management is a critical skill that is needed and used frequently by eHealth professionals. But eHealth projects often exhibit certain characteristics that require special background and knowledge to address. Specific characteristics that are of importance to eHealth projects and certain methodologies that can be of value in managing such projects are presented. The focus in this paper is how to impart relevant project management and eHealth content skills to students. An approach is described where a major eHealth project case is proposed to a class of eHealth students, and used to demonstrate the application of eHealth background and project management skills to implement such a project. For this purpose the class is organized into a number of teams, each responsible for a specific project characteristic (e.g. planning, workflow, development, eHealth standards, procurement, privacy and security, and organizational change management). This supports learning in project management while at the same time students learn about relevant eHealth issues. This approach has been used successfully in a required introductory eHealth course at the Masters level.

Keywords: eHealth; Project Management; Education; Group Project; Case

1 Introduction

"eHealth" is an overarching term used to describe the application of information and communications technologies in the health sector. It encompasses a range of purposes from purely administrative through to health care delivery. eHealth is a relatively recent term, although it has not replaced other similar terms such as Health Information Technology (HIT), or Health Informatics. According to Bernstein et al [1] there are five factors that influence the successful integration of eHealth into healthcare systems, including: the proper use and maintenance of the IT budget, the role of supportive leadership, the use of project management, the process of implementation, and significant end user involvement. eHealth project managers who direct or assist in managing IT-related must have the understanding of these factors in addition to having general project management training and background skills, and the ability to use these skills. Literature on the shortcomings of healthcare system implementation lays much of the blame on poor project management [2, 3]. A detailed analysis of the causes has identified communication deficiencies, cultural clashes, underestimation of project complexity, scope creep, organizational issues, technology problems, training issues, poor leadership, and failure to develop user ownership [2].

Because the preponderance of work that eHealth professionals do is related in some way to projects, project management is a skill that is particularly important to them. Unfortunately, project management skills are often in short supply among such professionals. One result is that IT projects continue to fail at an alarming rate. In 2009 a survey by the Standish Group [4] found that just 32% of projects succeeded, 44% were challenged (late, over budget, or with less than required features and functions) and 24% actually failed (cancelled prior to completion, or delivered and never used). Moreover, these rates are almost as poor as they were 10 years ago. The primary causes for the failure of com-

plex IT projects include: poor planning; unclear goals and objectives; objectives changing during the project; unrealistic time or resource estimates; lack of executive support and user involvement; failure to communicate and act as a team; and inappropriate skills [5]. High quality project management seems to be an important route to improved rates of successful project completion. The payoff can be significant. For example, University Hospitals, a multi-hospital system with headquarters in Cleveland, Ohio instituted changes in IT governance and project management that resulted in a an increase in the percentage of IT projects that were on-time and on-budget from 50 percent to 90 percent in the space of three years [6].

The objective of this paper is to discuss the role of project management in healthcare projects, and how project management can be integrated into the educational curriculum of programs in eHealth/health informatics. The next section deals with major issues faced by eHealth project managers and some methodologies that can help address these issues. This is followed by a discussion of the integration of project management into a course that also introduces students to relevant and focused concepts of eHealth in real environments. A case study is introduced that brings a real project into the course, with student teams assigned to various aspects of the project. The paper concludes with a brief discussion of the merits of such an integrative approach.

2   Characteristics of eHealth Project Management

A project manager is responsible for meeting project objectives, for schedules, budgets, and assessing alternatives, for assessing risks and deciding how to avoid, remove, or mitigate them, and for leading the project to successful completion [7]. A project manager works in a multi-dimensional environment, must negotiate with functional managers for technical workers, and must also relate to the parent organization, the user community, and contractors associated with the project. This is a complex environment that requires excellent leadership, communications, and negotiation skills. Normally, managers of the functional, technical, and support departments provide technical personnel and other support to the project manager on a temporary basis, so the project manager works in a matrix management environment. Here, although the technical staff work on the project temporarily, their direct report is to the functional managers with whom the project manager must negotiate for access to their technical skills [8]. That is, the project manager may not have direct influence over

the technical workers, and must rely on persuasion and negotiation to keep the project on schedule.

In a large project, the project manager oversees and manages project team members permanently assigned to a Project Office and subject matter experts temporarily assigned to the project from functional departments. For small to medium-sized projects being undertaken by an organization that does not maintain a permanent project management staff the project manager, aside from office assistants, may be the lone member of the project team. For relatively small projects, the project manager may, in addition to planning and managing the project, need to become involved directly in some of the technical work. This is probably the most significant difference between the necessary skill sets for managing large versus small projects. In recent years, there has been a declining influence of technical skills when choosing managers of large projects [9]. On the other hand, the manager of a small project who is deficient in technical expertise might have great difficulty in getting the project completed as planned without personally undertaking some of the technical work, since technical staff availability for small projects is often hard to find and even harder to schedule appropriately.

There are certain characteristics of eHealth projects that add complexity and require the specific attention of project managers to manage related risks. In addition, there are methodologies that can play a significant role in addressing these characteristics. Some of the most important characteristics and methodologies are discussed in the two sub-sections below, respectively.

2.1   Some eHealth Project Characteristics

a) Patient Safety. eHealth projects often involve the management of clinical data or real time collection of data from patients for the use of healthcare providers, so patient safety practices must be attended to first and foremost. Patient safety practices help to reduce the risk of adverse events related to exposure to medical care across a range of diagnoses or conditions [10]. An example is reducing or eliminating errors in patient health records [11], an aspect that must be addressed in implementing or updating any clinical record management process.

b) Privacy. Privacy is a major social issue that has arisen particularly in healthcare, due to increased online information dependence driven by advances in information technology. Patient privacy and security issues that arise from IT projects can be addressed by independent reviews of each system installed to handle patient data before pilot studies or full-scale production, to ensure that privacy and confidentiality is maintained at the ap-

propriate level. Reviews are often undertaken through Privacy Impact Assessments (PIAs), for systems implementations or upgrades of systems that handle health information. A PIA is a systematic process for evaluating the potential effects on privacy of a project, initiative or proposed system or scheme [12]. Privacy oversight agencies regard PIAs as a measure to counter the serious privacy-intrusiveness of business processes in the public and private sectors that have tended to be the result of rapidly developing information technologies. At the same time, governments and business enterprises alike have struggled to encourage public acceptance and adoption of technologies that appear to be privacy-invasive, and PIAs are a means of understanding personal concerns and mitigating business risks. PIAs are most commonly undertaken in Canada, New Zealand, Australia, Hong Kong and the US, particularly in the public sector. PIAs are helpful in identifying the potential privacy risks of new or redesigned government service systems, and provide guidance to developers in eliminating or reducing these risks.

c) Technical Standards Issues. A ranking of technical issues faced in eHealth system implementations would probably place system interoperability and its related topic of standards near the top. During the history of healthcare information technology, many independent and proprietary computer-based "silos" of medical information have been spawned. Medical interventions are often delayed or erroneous when information needed for diagnosing or prescribing is missing or unavailable due to an inability to transfer digital information automatically over interconnecting communications links. In support of increased information flows, the healthcare industry has invested much in semantic standards intended to specify, routinize, and make uniform the type and format of medical information for clinical eHealth. Most eHealth projects have as part of their mandate an improved technological linkage among existing legacy systems to improve the ready availability of clinical data to healthcare practitioners and researchers. Although this can be assisted by the adoption of technical standards, these can present restrictive barriers when there are unforeseen contingencies, or information is exchanged among different environments. From the technical perspective, information flow increases when more healthcare practitioners are supported by integrated and interoperable information systems. Conversely, incompatibilities between systems can cause the fragmentation of information [13].

But even when systems are technically compatible, information flows among healthcare systems may fail if different healthcare practitioners use different definitions, terms, identifiers and rules to record data. The objective of semantic standards is to ensure that a medical observation, for example, can be recorded by one healthcare professional, forwarded to another healthcare system, and interpreted by another healthcare user in another facility at a different time, with consistency. The standards perspective, therefore, emphasizes that predefined standards should be implemented in healthcare information systems in a manner that supports consistent information flows among healthcare practitioners. However, under "non-standard" local circumstances, standards may be too restrictive and interfere with the provision of care. This may result in healthcare practitioners selectively appropriating standards they perceive to fit in certain circumstances, and adapting or working around standard protocols they perceive as too restrictive. With certain patients, for example, practitioners will deviate more from prescribed standards than others, or may combine the guidelines of several protocols (e.g., when patients suffer from multiple conditions simultaneously). Therefore, standards making has to become a process of attempting to simultaneously balance localized information needs and work practices with a universal conceptualization of terminology, data and protocols, embedded into explicit and recognized standards [14].

d) Service Quality. Service quality is context dependent and difficult to define. In hospitals, for example, service quality can include measures of clinical quality, patient safety, and patient satisfaction, and these can be related to outcome measures such as process of care and lower risk-adjusted mortality rates [15]. The well-known project management triangle [16] (also known as the project triple constraint) demonstrates the close relationships among cost, schedule, scope, and quality (Figure 1). Changes in any of scope, cost, or schedule will affect project quality. For example, scope might be expanded or the delivery schedule compressed, resulting in a reduction of the overall quality of the project. But when an eHealth project impacts directly on patient health, the one variable that must not be allowed to slip is service quality. That is, an increase in cost and/or a lengthened schedule or a reduction in scope may be required to maintain service quality, provided that the project meets the criteria needed to continue to the next phase.

2.2 Some Relevant Methodologies for eHealth Projects

a) Change Management. If one were to rank the importance of "soft" organizational issues related to implementing eHealth projects, change management would most likely be at the top of the list. Stakeholders in

Scope/Functionality

Quality

Time　　　　　　　　**Cost**

Figure 1: The Project Management Triangle

most healthcare projects represent a range of healthcare providers who are often accustomed to working together in a defined pattern, so an understanding of organizational change management is essential to improving successful outcomes to any project that requires changes in how the team manages workflows and responsibilities, and how they interact with patients. Information and communication technology is increasingly important for all types of healthcare organizations, with its adoption almost always expressed through a vision for positive change and specific outcomes, and presented as a means to address identified deficiencies or problems [17]. Change related to eHealth system innovations is usually complex and affects the organization and all the people that it touches. Although most decision makers and researchers claim that eHealth can lead to successfully reaching goals relating to efficiency, cost-effectiveness, better clinical decision making, improved data privacy, team work, speed of delivery or improved quality of healthcare, such ambitions are often not met, and may result in project failure [2]. This is often due to a lack of proper attention to change management.

In healthcare, IT application selection and implementation often encounters substantial user resistance, resulting in clinical IT projects either not begun or failing during or after implementation. A key issue is the degree to which healthcare practitioners are ready to make the transition to electronic health records and systems. In Canada and the U.S., adoption rates by general practitioners for such systems are much lower than in other Western nations. Surveys suggest that this resistance to change is not because physicians do not believe these systems would improve care. Furthermore they may believe that doctors should computerize writing prescriptions, recording patient summaries, and keeping treatment records. However, at the same time, many have no intention of doing so. Important adoption barriers that are often stated include high cost, lower productivity, and lack of interoperability with other systems

[18, 19]. But part of the resistance can also be attributed to perceptions of a continuing conflict between the professional medical practitioners who value their independence, and managers of healthcare institutions or government agencies who wish to impose more structure and standards to manage resources more efficiently and effectively [20]. These causes of clinical IT system failure or lack of adoption, require considerable attention to "soft" or organizational change management to improve the likelihood of success [21, 17].

eHealth implementations almost always result in changes in the context where they are deployed, such as changes in work practices, professional roles, knowledge and skills deployed, and modes of collaboration. These changes may be met with different responses by those affected, ranging from acceptance and support to outright resistance. Resistance is not necessarily bad for the project, because this can be used constructively to revise the design and implementation to more closely meet the needs of those affected by the project. User reactions to change depend on how the changes are introduced and managed, and this is a major responsibility of the project manager. To achieve successful outcomes, change management must be addressed carefully by a project manager well versed in soft skills of interpersonal relationships. For example, one approach that can result in a positive impact on project success is regular stakeholder consultation and involvement during every phase of the project.

b) Project Decision Points. Projects involving the design, development, and implementation of innovative or improved healthcare systems should incorporate key elements [22] from the three domains of: 1) new product development, through adaptations of the stage-gate process [23], 2) user centred design [24] and 3) creativity and innovation [25]. This structured, flexible approach, with its emphasis on working closely with users to develop an in-depth understanding of the issues and different relevant ideas, can provide a useful framework for innovations and improvements in the healthcare systems field. For example, gating methods (adapted from the new product development literature [23]) are very useful in evaluating project progress at the end of each project phase. In particular, they bring stakeholders together at crucial points in the project to consider detailed information on how well the project is proceeding, and whether minor or major course changes (including possibly terminating the project) are needed at that point.

A process that can guide a project for the system development and implementation of a new or revised system is depicted in Figure 2. Here, major decision points occur after each phase in the process: initial in-

vestigation, feasibility study, development, and pilot test. At the decision points sufficient information will have been accumulated during the preceding phase so the project team can meet with the stakeholders (those with financial responsibility, user representatives, developers, and the project champion) to undertake a realistic review of whether the project is still on track, whether it needs significant adjustments, and whether it has a reasonable chance of success. If the project is unlikely to succeed, the sooner this is known the better, so it can either be terminated or cut back in scope to meet less ambitious targets than those set initially.

c) Workflow and Process Redesign. A workflow or business process is a series of tasks undertaken to produce an outcome. Business process or workflow redesign refers to how an organization re-organizes its staff and resources to conduct defined tasks to produce required outcomes [26]. An important aspect of workflow is the interactions among staff as they carry out their tasks, and the information that may be exchanged among them. By automating office processes, IT may make complex tasks simpler, more efficient, and less costly. It is essential that process improvements accompany the implementation of technology, thus gaining the leverage that technology can offer. For example, a reduction in delays of receiving lab tests or the loss of these tests, by installing communication links from labs that eliminate cumbersome mail or fax delivery. This also eliminates the manual work required to receive and record the information. Other simpler examples include the reduction in time spent explaining illegible handwritten prescriptions when typed prescriptions are generated or transmitted automatically, and a reduction in dictation time when a physician enters information directly into a patient's electronic record while interviewing the patient [26]. On the other hand, learning to use computerized systems may take more time initially, or dealing with unnecessary pop-up screens or alerts that can be annoying unless the system is designed and deployed with careful attention to end-user requirements. Physicians may also fear that working with electronic medical records (EMRs) or computerized physician order entry (CPOE) systems may disrupt physician-patient relationships.

d) Risk Evaluation and Mitigation. A meta-analysis of the published literature indicates that project managers paying attention to project risks has a positive impact on project success [27]. A project faces risks during every part of its life cycle. The best way to manage and mitigate these risks is to address them and either eliminate or mitigate them during the planning phase, thus reducing the likelihood of risk events and their potential impact on the project. This needs to be combined with solid project management practices such as: having a well-defined scope, incorporating input from the appropriate stakeholders, following a good change management process, and keeping the lines of communication open. A well-defined risk management process can reduce surprises or unexpected project risks, and help with problem resolution when changes occur, because changes have been anticipated and actions have already been reviewed and approved. For example, using a limited pilot test to evaluate an eHealth project in advance of system rollout will help to contain the inevitable teething pains of a new system while they are addressed, thereby greatly reducing the overall risk of failure.

e) Ease of Adapting to Local Needs or Adding New Features. No newly installed eHealth system (especially clinical systems) will handle all the information needs of prospective users. Every user will think of more possibilities or better ways of using the system as more experience is gained with the new system. For this reason, flexibility and the ability to add new features is an important aspect of any clinical healthcare system. If changes cannot be made easily by the users, such as new or revised information input templates or displays, users will soon lose patience and stop using the system. If every minor change requires expensive vendor technical support, or users must wait until the next software version becomes available to see fixes of minor problems, this is a strong signal to prospective users that the system may not meet their needs.

3 eHealth Curriculum and Project Management

In 2007, COACH (Canada's Health Informatics Association) prepared a comprehensive guideline for the core competencies that health informatics/eHealth professionals should have [28]. This guideline includes specific references to project management, organizational and behavioural management, and analysis and evaluation under the "Management Sciences" component of the core competencies. The other two competency components of the guideline are "Health Sciences" (Canadian healthcare system and clinical and health services) and "Information Sciences" (information technology and information management).

The M.Sc. eHealth program at McMaster University is a balanced collaboration among three Faculties: Business, Health Sciences, and Engineering (Computer Science). The three required courses include one specially designed eHealth course in each of these Faculties. The program recognizes the importance of the COACH guideline and has attempted to follow it, although the

Figure 2: System Development and Implementation Decision Process

topic categories do not necessarily fit neatly into the disciplinary expertise available in the three Faculties. For many of our students, this is a terminal program and it is critical that they develop professional skills that are important, if not crucial, to their future careers in the eHealth industry. Each Faculty offers one of the three required courses in the program, covering topics from the COACH guideline. Because of its importance, project management should be a required part of any eHealth educational curriculum. Unfortunately, because eHealth covers a broad range of topics, it is difficult to find space in a graduate level eHealth curriculum for a required course devoted specifically to project management. To ensure that project management is given some prominence in the program, the one required course in Business includes a blend of eHealth and project management topics. The following describes the reasoning and background for the topics included in this course, and gives some details about how the course is presented in the form of a major case study.

The classical approach to project management is set out in the *Project Management Institute's Project Management Body of Knowledge (PMBOK)* [16]. This includes the nine standard *PMBOK* project management classifications – managing integration, scope, schedule, cost, quality, human resources, communication, risk, and procurement. In *PMBOK*, the management of change focuses on managing changes to project cost, schedule and scope (referred to as "hard" change management [21]), and nothing is said about the organizational change management issues that arise in virtually every eHealth project. This gap in knowledge is partially filled by *Prosci Research*, which releases its *Best Practices in Change Management Benchmarking Report* on a regular basis [29]. Therefore, in addition to the nine standard *PMBOK* classifications, project management issues addressed in this course also include: "soft" change management, ethical principles and privacy, process redesign, and IT standards and interoperability, to more accurately reflect the reality of healthcare IT projects. These topics are listed in Table 1. At the same time, the topics used for project management instruction in the course described here are not intended for and should not be regarded as a replacement for a full introductory course in project management.

3.1 Teaching Project Management & eHealth

As there is no room in this M.Sc. program for a required course in project management (an elective course in project management is available), it is taught as an integrated component of a required Business course "Management Issues in eHealth". Each offering of the course revolves around planning and developing material related to a specific current eHealth project, and organizing, developing, and documenting specifications for the project as far as possible without actually implementing it. During the term, the class is taught project management basics that relate to the project, thus covering most if not all of the nine *PMBOK* classifications. In addition the specific issues previously mentioned that relate to eHealth projects are also covered, using for the most part examples from the literature for demonstration purposes, augmented with invited lectures on specific topics. During this time, a significant body of relevant eHealth knowledge is delivered in the course, through lectures and student presentations. Some is based on the academic literature (e.g. critical success factors, risk management and mitigation, practitioner adoption, disease characteristics, quality improvement, change management best practices, security and privacy considerations, knowledge management, etc.) and other information from the trade literature (e.g. specific medical devices that could be used in the project, existing systems that could be adapted to support the project, system standards and interoperability, conversion issues, etc.).

The class of about 25 to 30 students is organized into teams, each of which is responsible for addressing a set of tasks related to particular aspects of the current project, as indicated in Table 1. Team membership is assigned as much as possible according to student interests in the classifications noted. Each team is also responsible for becoming sufficiently familiar with the use of Gantt charts for scheduling project activities. These may then be amalgamated into one large Gantt chart schedule for the entire project. The case study discussed in this paper involved the implementation of an EMR (Electronic Medical Record system) to manage patient records (previously almost entirely in paper form) by the Gastroenterology Division in the McMaster University Department of Medicine. Additional impetus for

Team	Tasks
Coordinator	Organizing and coordination; Meets with team leaders at least once each week
1. Project planning	Strategic project characteristics and analysis; Project planning process; Stakeholder consultation; Survey questionnaire development, data collection, analysis
2. Workflow analysis and redesign	Designing eHealth workflows; Data collection and analysis; Business process graphical analysis for optimal design; Stakeholder involvement in redesign
3. System design	Development life cycles; Development process; User consultation and involvement; Content standards; System functionality choices; Usability issues
4. Usability	Human computer interface design; Usability design and testing; User adoption and acceptance
5. Project resources and allocation	Team selection and management; Tracking project resources and progress; Financial support; Commercial partners; Advantages, disadvantages, costs, benefits of adopting the proposed system.
6. Project development and implementation	Vendor solutions; Linking with legacy systems; Implementation issues; System conversion; Ongoing maintenance issues
7. IT standards and interoperability	Data content standards; Interoperability solutions; IT and EHR standards - SnoMed; HL7 V2 & 3; IHE; DICOM
8. (Procurement) Vendor evaluation and selection	RFIs and RFPs; Vendor evaluation and selection; Contracts; Outsourcing vs insourcing; Service level agreements
9. Ethical principles, privacy, security, confidentiality	PIPEDA and OHIPA requirements; Security and privacy issues for patients and staff; Meeting required specifications; Practitioner and patient acceptance and agreement; Privacy impact assessments
10. Organizational change management	Management support; Champions; Managing change; Training, support, maintenance

Table 1: Project Teams and Assignments

the EMR project came from their potential use of its data for research purposes.

Figure 3 depicts the roles of the project champion and project manager as they relate to the management of the project and project teams, and the development of project plans and specifications. In the Figure, team assignments and the normal time dependent flow of work through the project's phases are shown. One team is responsible for overall project planning, as shown just above the tabular component of the Figure. In the second column of the table, other team assignments involving the review of major activities in the project life cycle are listed. These include requirements and workflow analysis, system design, procurement, development, implementation, testing, and rollout. Note that all the project teams are encouraged to evaluate and mitigate risks associated with their assigned tasks. While project development is underway, teams that provide support on such issues as usability, standards and interoperability, organizational change management, and security and privacy should be involved in virtually every phase, as shown in the diagram. However, since the teams must complete their work before the actual project phases are completed (the term is 13 weeks long), the teams must do their work in parallel with each other rather than sequentially, with some resulting overlap and duplication. For the particular EMR project case undertaken by this class, one team was assigned the responsibility for developing a parallel plan to implement an associated ePHR (Electronic Personal Health Record) system that the clinic's patients could access for reviewing and entering their own information. This is a future addition to the system, providing the capability for patients to make much more frequent updates to clinical information than they normally provide on visits to the clinic at intervals of one to six months. Since there were not enough teams to handle all of the case assignments in Table 1, Project Resources and Allocation tasks were distributed to other project teams, particularly the Procurement team.

The class is led through a standard gating process at two points in the term, where major decisions are made concerning project direction (see Figure 2) [30]. In the case where the project of interest has not already been chosen by the client, the first gate follows an initial investigation by the teams (week 4) to choose a specific project alignment for further study. The second examines project feasibility in Week 6 (basically reviewing the business case for the project).
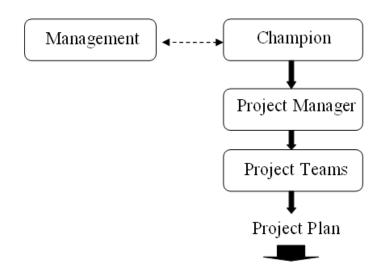
Each team is responsible for creating a class presentation and a written report on its tasks at the end of the term. It is impossible to eliminate overlap between work done by some of the project teams, which would, in the course of a normal project, be resolved on a continu-

ing basis. This is partly simulated by weekly general meetings at the beginning of each class where teams can communicate directly to all the other teams and work out responsibilities where there are conflicts.

In the past three years, the class has taken up the development of three quite different project proposals. Each was designed to reinforce the theory and practice taught from the extensive literature on both eHealth systems and project management. The first proposal involved the development of a personal health record network, and the second was the development of a system for mobile self management of diabetes. Neither of these projects involved a real client. However, the third was the exercise described above with a real client, including a significant degree of interaction between team members and the project champion, potential users including administrative staff, physicians, and researchers, and the EMR developer. In this case, the EMR was an open source system developed for commercial use by the McMaster University Department of Family Medicine, and used extensively throughout Canada and abroad by physicians in general practice. The case involved the adaptation of an EMR to the gastroenterology specialization, a new venture for such a system in Canada. Having a real client provided student experience with institutional eHealth problems, including working within the constraints of adapting to or linking to legacy systems in an existing institution. It also developed an understanding of the concerns of multiple stakeholders, including managers, IT support professionals, and end-users such as nurses and physicians.

4   Conclusions

It is very clear that project management plays an important role in the work of almost all eHealth professionals, since they are often called upon to lead projects that modernize clinical support or administrative systems through computer-based technology. Not only must professionals be familiar with the standard approaches reflected in, for example, the Project Management Institute guidelines [16], but their knowledge must extend well beyond to those organizational and technical issues that arise so frequently in eHealth projects. Imparting the importance of project management in an environment of a real eHealth case provides an integrative environment that encourages experiential learning. This gives students an opportunity to build a background in the characteristics of eHealth systems while at the same time learning some of the fundamentals of project management for implementing such systems. The ap-

Time	TEAMS	Future ePHR	Usability	IT Standards; Interoperability	Organ'l Change Man'gt	Ethics; Security; Privacy
	Requirements	X	X	X	X	X
	Analysis; Workflow Redesign	X	X	X	X	X
	System Design	X	X	X	X	X
	Procurement	X	X	X	X	
	Development	X	X	X		
	Implementation (Testing);		X	X	X	X
	(Integration);	X	X	X	X	X
	(Conversion)		X		X	X
	Pilot Test		X	X	X	X
	Rollout		X	X	X	X

Figure 3: EMR Project Management Case

proach described for this course provides a foundation for learning that students can build on in their choice of further electives that expand their knowledge in the more specialized areas of eHealth.

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Correspondence

Dr. Norm Archer
McMaster eBusiness Research Centre
DeGroote School of Business
McMaster University
1280 Main St. West
Hamilton, Ontario L8S 4M4
Canada

Phone +01 905-525-9140 Ext. 23944
Fax +01 905-528-0556
e-mail archer@mcmaster.ca