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Project-based Teaching in Health Informatics: A Course on Health Care Quality Improvement

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Abstract

Teaching the skills and knowledge required in health informatics [1] is a challenge because the skill of applying knowledge in real life requires practice. We relate the experience with introducing a practice component to a course in "Health Care Quality Improvement". Working health care professionals were invited to bring an actual quality problem from their place of work and to work alongside students in running the problem through a quality improvement project lifecycle. Multiple technological and process oriented teaching innovations were employed including project sessions in observation rooms, video recording of these sessions, generation of demonstration examples and distance education components. Both students and their collaborators from the work place developed proficiency in applying quality improvement methods as well as in experiencing the realities of group processes, information gaps and organizational constraints. The principles used to achieve high involvement of the whole class, the employed resources and technical support are described. The resulting academic and practical achievements are discussed in relation to the alternative instructional modalities, and with respect to didactic implications for similar endeavors and beyond to other fields such as systems engineering.

Keywords:

Problem-Based Learning, Medical Informatics, Education, Management Quality Circles, Educational Technology

Introduction

Health Informatics can be perceived as an applied science [2]. This has implications for the goals of education and for the means used in its instruction. The challenge is to not only convey knowledge of the pertinent basic sciences, but beyond that skills in the application of this knowledge to solving real life problems. Achieving this in a teaching environment is difficult since it requires a realistic interfacing with the professional world. A variety of approaches have been taken to assist students. For instance, our program contains a mandatory co-op component: students are employed four times during the five year study program [3]. Another approach explored by us is the close collaboration of professionals with students in projects as part of course work [4, 5]. We are relating here the experience with incorporating a professional project into an undergraduate course on health care quality improvement (QI). This paper presents the methods used, their results and the lessons learned

Background: Evolving with Quality Management Approaches

The pervasive concern with improving the quality of care in various components of the health care system has led to the adoption of quality improvement approaches originally developed for industry. These include 'Total Quality Management' (TQM) [6], an approach, which employs process control measures to ensure attainment of defined quality standards, and 'Continuous Quality Improvement' (CQI) [7], a strategy to engage all personnel in an enterprise in continuously improving quality of products and services. For two reasons the health informatician is frequently called upon in this context: 1) the scientific statistical approach is one of the foundations of TQM/CQI; and 2) information systems are usually motivated by the intention to improve existing processes. Their development and deployment relies on a similar set of principles and methods as TQM/CQI. A course in QI in health care seems, therefore, a logical component of a curriculum in health informatics.

Our QI course has been offered since the early eighties. It was originally based on the Quality Assurance (QA) paradigm, which emphasizes monitoring of incidents, and attempts to achieve their elimination or conformance to acceptable levels. At the beginning of the nineties, the emphasis was shifted from the QA paradigm to that of TQM/CQI, concurrently with the realization of the advantages of the latter throughout the industry. In addition, a project was incorporated in order to provide an adequate representation of professional reality.

Didactic Methods of The New Approach:

The innovative features of the course are its goals, the course components, supporting materials and technical aids, and their use in course delivery.

Fundamental Goals: It is easy to describe methods such as creative techniques, Pareto-analysis, control charts, etc., in a course. A much greater challenge is, to adequately assess a problem situation, select pertinent methods from among the alternatives, to apply them correctly in team collaboration, and to achieve quality improvement, in a real world problem context. *This should be the core goal of the course.* Its pursuit led us to introduce a project component.

The Course Components: The resulting course approach relies on three interrelated components: project component, didactic lectures, and guest lectures.

The Project: The project component is the core of the new course. It involves the entire class in one quality improvement project rather than having different groups pursue different projects in parallel. This increases control over the quality of the work, provides a more homogeneous learning experience, and enables the tackling of more demanding projects.

Didactic and practical considerations required an adaptation of the standard quality improvement approach. In order to achieve group sizes that approach the recommended size for quality improvement circles (around 9 members), groups are formed within the class of around 30 students. The assignment of individuals to the group is done randomly in order to avoid gross differences in the competency of the group, which tend to result from free association of students. Representatives from the work place that provides the problem to be tackled complement these "CQI groups". Different CQI groups are assigned to different phases of the project, such as problem definition, diagnostics, remedial intervention. Both, random group composition and assignment to successive project phases are concessions to the didactic context, which contravene principles of CQI.

We currently use 4 groups for 5 phases (see Figure1). The emphasis on diagnostics is based on the assessment that this is the most critical phase. Note that there is no 'implementation' phase. This was deemed to fall outside the available time frame and competency and is therefore exempt from the responsibility of the students and left to the work place.

An important part of the work is done in one "Quality Circle" session during scheduled class time, i.e., within a 90-minute time frame. All classmates observe the work of the "quality circle". For less obtrusive observation, work is done in an observation room. The rest of the class observes from an adjacent room through a one-way mirror and with the aid of two remotely controlled video cameras and two video monitors.

One of the other groups is charged with critiquing the CQI group's team work and their selection and correct application of methods. The resulting team and methods critiques are presented with the report of the results of the corresponding CQI group.

All work is presented subsequently in class and documented in written reports. Three reports result for each project session: CQI project report, team critique and methods critique. The project work, presentations in class, and written reports are critiqued in writing and graded by the instructor independently of the students' assessments. All written output is made available to the whole class on a LAN server. The output of previous years is made available as well.

The work of the CQI group during the quality circle session, and the presentations in class are video recorded. The video records are available to the class for review and analysis, e.g., for analysis of team characteristics. They are also used for the production of edited material to be used in class and for distance delivery of the course (see below). Examples on video proved particularly desirable in support of the work of the first group in each cohort.

The selection of projects is primarily opportunistic. Since the University of Victoria has no Faculty of Medicine, it proved initially difficult to find collaboration from health care institutions. So, after initially addressing problems within the School, we were only during the last two iterations able to address problems in health care institutions, such as the high incidence of musculo-sceletal injuries in nurses aides, and the documentation of services for billing purposes in long-term care.

Date 2000	Subject	Part			CQI	Meth	Team
II-Sep-7	Introduction, Organization, Quality, Personal Experience in QA	A	B	C			
II-Sep-7	Definitions, History, [illegible] Approach	■					
II-Sep-14	Problem Def., Information [illegible], Creative Techniques	■					
II-Sep-14	Project 0 (P0): Defining Project Scope (All groups)		■				
II-Sep-21	Overview of Group work, reporting and presentations	■					
R-Sep-21	Teamwork	■					
R-Sep-28	Diagnostics, Analytic Techniques	■					
R-Sep-28	P1: Problem Definition and Team Building		■		1	4a	4b
R-Oct-05	[illegible] diagnosis	■					
R-Oct-05	C1: Reports & Critiques of P1		■		1	1a	4b
II-Oct-12	Diagnostic Techniques & Validation	■					
R-Oct-12	P2: Diagnostics 1		■		2	3a	3b
R-Oct-19	Remedial interventions	■					
R-Oct-19	C2: Reports & Critiques of P2		■		2	3a	3b
R-Oct-26	Management of Change, [illegible]	■					
R-Oct-26	P3: Diagnostics 2		■		3	1a	1b
R-Nov-02	Guest lecture Linda [illegible]: QI Tools & Technology Assessment			■			
R-Nov-02	C3: Reports & Critiques of P3		■		3	1a	1b
R-Nov-09	Guest lecture Christina [illegible]: Quality Improvement, the CCHSA and Accreditation in Canada			■			
R-Nov-09	P4: Remedial Action		■		4	2a	2b
R-Nov-16	Guest lecture [illegible]: Quality Improvement Approaches in the CHR			■			
R-Nov-16	C4: Reports & Critiques of P4		■		4	2a	2b
R-Nov-23	Guest lecture M. Campbell: A Case Study of TQI/CQM in Health			■			
R-Nov-23	Final Summary Presentation		■				
R-Nov-30	Questions for Exam, Course Evaluation	■					
R-Nov-30	Open for Discussion		■				

Figure 1.: Course Schedule. The dates are listed in the first column, the subjects of each date in the second. The column A indicates lectures, Column B refers to project components, and column C to guest lectures. 'CQI' refers to activities of the 'CQI-teams', 'Meth' indicates methods critique, and 'Team' indicates team critique. The numbers in the cells to the right refer to groups 1 to 4, and their sub-groups 1a to 4b, charged with critiquing.

The standard, fairly detailed course description, provided by the instructors of all courses in the School, is augmented by a detailed schedule for this course. This fixes the dates for lectures and their content, and those of project sessions, reporting sessions and guest lectures. Care is taken that the methodology required for different phases of the project can be covered prior to the project "quality circle" session, which might make use of it.

The work is scheduled in such a way that groups are not critiquing a group by which they were previously critiqued. Also, each group is usually given a week between a quality circle session and the previous as well as the subsequent reporting session for preparation of their session, and of their report.

Since the beginning of the nineties, the core text for the course has been "Curing Health Care" by Berwick et al [8]. This choice was considered many times and retained because of the engaging style of this book. An increasing number of references regarding Methodology [9-11] and group work [12, 13] is kept on reserve for the class in the library. Additional references are provided in a literature list including many classics of the TQM/CQI literature [6, 7].

Didactic Lectures and Guest lectures: Prior to the start of the project, didactic lectures cover the fundamentals of TQM/CQI and related methodology. Principles, such as reliance on a scientific approach, customer orientation, and comprehensive involvement of all stakeholders, are explained and exemplified with material from TQM/CQI in healthcare. A lecture on the history of quality movement in health care – with particular emphasis on the Canadian approach to health services accreditation – is included in this part. The students are required to read the core course text concurrently [8]. Subsequently, the phases of a quality improvement project – problem definition, diagnostic phase, remedial phase, and holding the gains – are treated in more detail, with coverage of associated pertinent methods. In this preparatory phase for the project, edited video clips from the work of previous years are as illustrations for the students.

Guest lectures are typically placed in the third month of the 12-week course, so that students are likely to have acquired enough experience to take maximum advantage of them. The guest lectures involve TQM/CQI practitioners and members of the Canadian Council for Health Services Accreditation (CCHSA), as well as a health sociologist [14].

Results

All projects resulted in tangible practical suggestions for improvement of the investigated processes. Lately, the success goes beyond mere appreciation of the work of the students. In the most recent round, six to eight representatives of the collaborating work place were not only available at mutually agreed times for project sessions

in the work place, but also attended all sessions at the university and participated very actively in the project as equal partners. At present there are signs that we may not have to worry about lacking a project. This indicates practical success, an important didactic goal.

Likewise, students are highly motivated, some even passionately engaged in their part of the project. This is a very pronounced change from the bored atmosphere, before introduction of the project component.

The use of the project approach, the extensive feedback provided by the critiquing teams and the instructor, the ability to work in observation rooms and to have video records available for subsequent scrutiny, all received very strong endorsement from the students. The peer evaluation appears to provide an engaging active learning incentive, particularly for the critiquing students, to a lesser extent to those critiqued.

The grades achieved for the team assessment are significantly higher than for the methods assessments (mean of 95 and 87%, respectively, in the last course). This is consistent with the performance during group work, in which the team runs rarely into problems of group dynamics, but where flaws in the selection and errors in the application of selected methods are common. Improvement of the students' performance in methodology is therefore an ongoing challenge for the course.

The video-recorded edited material from previous projects has beneficial as well as potentially negative impact: It served superbly as illustration of what was expected of students. As a consequence, incidents of inadequate preparedness ceased after introduction of the video examples. An unexpected beneficial effect was the enthusiasm, which the videos generated with potential project partners. The videos give an engaging picture of the project work; they illustrate the potential benefit of the collaboration, and facilitate buy-in for collaboration.

Unexpected, unintended, and potentially counterproductive is that the video examples are so strong that they tend to be imitated by some students, even if they had had been selected as examples of how NOT to approach a certain task. Also, the examples seemed in some instances to limit the choice to less than the full range of method alternatives. This drawback has to be overcome by increasing the collection of materials, providing appropriate guidance and emphasizing the methodological instruction.

Discussion

An important issue is, whether it is possible to conduct such a course regularly where needed. The course hinges on the ability to conduct a project. In order for this to be realistic, some real world entity is needed that consents to a quality improvement project conducted by students. We may conceivably some time end up without a project. We are therefore experimenting with approaches to using substitutes for a collaborative project. We did conduct the course in correspondence mode with a limited number of students. Initially, we used 'projects' and problems based on printed output from previous classes. The average grade (79%), the quality of insights reflected in the papers, and the results of the final exams suggest that a challenging stimulus is provided in this manner, one which can adequately substitute for a real project. Lately, we also used edited video recorded material for the same purpose and with similar results.

In addition to the availability of projects, their accommodation within the course is a key challenge. On the surface, an ideal approach might consist of one course devoted to imparting the theoretical knowledge, followed by another course devoted to practice. Having used this approach extensively in the past [5], this was the initial paradigm. Out of consideration for the resources required, our School did not adopt this approach. The alternative arising directly from this scheme is a three-phase course, in which a first phase is devoted to covering the methodology in lectures, a second to the project, and a third to guest lectures and concluding discussions. In this way one can expect to be able to "finish" a methodology overview before its application, and to gain practical experience as a basis for appreciation of the guest lectures. However, this version entailed a very condensed, compact and therefore confusing rather than enlightening methodology overview, and also a very hectic project schedule. Neither provided sufficient time or mental space to cogitate and develop ideas. Therefore, the more demanding interleaving of didactic lectures and project components was chosen.

Is this approach a suitable model for other areas, which struggle with the incorporation of professional practice to studies? The representation of professional reality haunts the didactics of systems engineering in general. It is easier to teach how to build systems right, than to teach how to build the right systems. It is much easier to develop a data model and associated data structures for a case that is presented on paper, than to develop the appropriate model for an aspect of reality, e.g., processes observed and needs expressed by stakeholders in the work place. We have no proof yet that our approach will work in all these contexts, but our experience suggests that it may be worthwhile to try using the principles of this course in those contexts as well: *interleaving* of didactic lectures with *one project* which engages the whole class over a reasonable period of time, and with *intense scrutiny of the ongoing work* through members of the class in addition to the instructor.

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