Towards the Design of an Interdisciplinary Bridge Curriculum in Health Information Systems: A Pilot Study

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Abstract - This research responds to the critical need to develop educational opportunities to facilitate interdisciplinary communication and field literacy to better prepare students in the health sciences and technology fields for more effective inter-professional collaboration as well as next generation workforce development. The product of this research has been evaluated by an external focus group and can be used by educators in developing a framework for curriculum development, implementation, and evaluation of an interdisciplinary "bridge" course, and avoid some of the pitfalls of interdisciplinary course development.

Categories and Subject Descriptors

K.3.2 [Computers and Education]: *Governmental Issues – Regulation*

General Terms

Legal Aspect, Security, Privacy, Health Informatics

Keywords

Education, Health, Informatics, Security, University, Literacy

1 INTRODUCTION AND BACKGROUND

There are several documented barriers to successful adoption, implementation, and integration of value-adding information technology solutions in public health and health care settings [1][2]. The American Medical Informatics Association noted some of the primary barriers to successful implementation of health information systems were inter-professional communication and failure for stakeholders to understand the unique workflows of clinical environments [3]. Having translational knowledge across disciplines is an important part of professional success for health professionals working in technology intensive environments and/or informatics professionals specializing in health care systems. The literature supports the crucial role that "boundary spanning," [4] leaders and champions have in creating critical success factors for health information system integration [4][5]. Silos in curriculum development at the higher education level can reinforce the inability of future professionals to translate key concepts and knowledge to diverse stakeholders and hinder the ability to work effectively in interdisciplinary teams.

Interdisciplinary or Inter-professional education (IPE) education has been proposed as an important component in reducing medical errors in health care environments [6]. Likewise, inter-professional education, knowledge transfer and sharing in course curriculums could assist in meeting several key goals identified by the American Medical Informatics Association including building capacity in public health informatics, creating opportunities for informatics to develop broader perspectives on what public health is, and strengthening disease prevention efforts in the public health and clinical domains [7]. The goal of the pilot study course was to increase basic-intermediate level field content literacy across disciplines (health professions and technology) as a step towards better preparing budding health and

informatics professionals for collaboration in health care and public health environments.

2 INTERDISCIPLINARY COUSE DESIGN FRAMEWORK

The course development and implementation process followed a logical progression based on the following steps: 1) Resource Allocation; 2) Identification of Core Curriculum Themes; 3) Course Implementation; 4) Course Evaluation.

2.1 Resource Allocation

This is a critical step in development of a new course, particularly one where faculty across different disciplines are required to collaborate. One must bear in mind that faculty members are resources to their respective departments, and each department and college within a university structure may differ in their priorities and procedures to utilize faculty resources.

There are several administrative issues to account for in the development and teaching of interdisciplinary courses, including departmental buy- in, determining faculty workloads, faculty salary, course titles, and course approvals. In order to come to an agreement on faculty workload, team teaching, and faculty salary to pilot the course, the authors met monthly for 3 months with relevant stakeholders in each Department to develop a formal proposal for the interdisciplinary course. The proposal included a literature based rationale for why exposing undergraduates to inter professional concepts in health and technology was a vital educational needs area, a regional market based overview of the employment prospects for those trained in health and informatics, and a sample syllabus. Both authors' departments were supportive of the course in theory, but could offer no additional financial support for faculty salaries to develop and teach the course. Authors were encouraged to apply for faculty funding from another school within the university that provides support for innovative course curricula and development. A proposal for the bridge course was finalized, submitted for review, and won a financial award

for development and teaching. In total, the resource allocation for the bridge course took well over nine months.

2.1.1 Identification of Core Curricular Themes

Perhaps one of the biggest challenges in developing an interdisciplinary curriculum is determining what content best serves the needs of students with diverse academic, professional, and pre-professional backgrounds. After surveying the literature, the authors determined three core curricular thematic sequences: a) Human Factors in Health Care and Public Health Environments; b) Health Data Structures and Security; c) Health Care Technology Policies and Regulatory Issues.

a. Resistance to technology adoption in health environments is complex [2] and personal characteristics of the adopter and the adopter's environment are integral to understand if persons are to become effective champions for the role that technology can play in improving health outcomes at the clinical and public health levels. Knowledge of how health environments drive tasks, how people process and conduct those tasks, and how those tasks fit with technology is important for health it implementation [2].

b. Health data types, and security are foundation technology themes that create an accessible entry point into technology topics in the era of data driven and evidence based medicine and public health. Health data security was identified as an especially important topic that all students would need to be versed in. The goal of these lessons and lab assignments were to provide students the opportunity to analyze the present and emerging security technologies in health care and public environments. Students would be given demo sessions on the System Development Lifecycle and its relevance to the design of the domain systems. Some of the topics for the case assignments included, but were not limited to: Breach Analysis, Risk Assessment, Data De-Identification, Organizational Policy Analysis and Application and Operation Analysis.

c. Finally, tech policies and regulatory issues as it related to the Affordable Care Act's Meaningful use regulations, HITECH, HIPAA and the HITRUST and NIST framework and policies were the key content areas. The Affordable Care Act created industry wide incentives and a sense of urgency to implement health information technology across a variety of health settings. While public health data falls out of the specific purvey of the Affordable Care Act, public health is a rich source of data for medicine and public policy, thereby encouraging even integration of technology into public health databases even in the absence of current regulatory mandates.

After coming to agreement on the thematic sequences that needed to be explored in the content, the instructors created a final syllabus. Below is a sample of the weekly laboratory & course content including topics relevant to the interdisciplinary pilot course study:

- Public Health/Health Care Systems (Affordable Care, Meaningful Use, Regulations) Systems Development Lifecycle Overview and applications to public health and health care environments
- Data Driven Disease Tracking & Trends in Public Health Informatics
- Health Information Exchanges (Design and Implementation)
- Algorithms, Data Capture, Retrieval and Data Visualization
- Clinical Informatics (clinical decision support systems, nursing informatics)
- Basics Database Design (SQL and non-SQL database systems, queries)
- Medical Databases and Standards
- Personal Health Information Management (personal health apps)
- Tools and Technologies for Health Information Management
- Hybrid Medical Systems (Architectures and Frameworks)

- Quality, Usability and Standards
- International Healthcare Informatics

There is a gradual movement into the more complex data driven and data security topics with hands on labs to expose those students who have minimal exposure to these concepts and ensure students with technology backgrounds understood the specificity of health care hardware and software requirements.

2.1.2 Course Implementation

The course was piloted as a combined undergraduate and graduate course over a 10-week summer session. The maximum enrollment cap was set at 20 with 12 students enrolling. The course was team taught with two primary instructors from the respective departments (a health science department and a computer science department) with the instructors assigned to different weeks consistent with their field expertise. Additionally, guest speakers from the fields of epidemiology, nursing informatics, and personal health informatics presented during the course. A primary text authored by nurse informatics was identified and utilized. To assess student learning goal achievement, instructors implemented a variety of subjective and objective measures including objective exams, student presentations, and a group project designed to address a real-world IT in health care problem.

2.1.3 Course Evaluation

For the pilot, the standard university course evaluation was used to gather student quantitative and qualitative feedback. Additionally, instructors implemented a variety of subjective and objective measures including objective exams, student presentations, and a group project designed to assess student learning. To review process, the instructors met post course to review student evaluations, student feedback on the team teaching structure, and met with other instructors in both of their respective departments and stakeholders to discuss the outcomes of the pilot course and gather feedback for improvement. As part of the funding agreement,

instructors also had to submit a comprehensive report to the internal funding school detailing the course implementation and student outcomes.

3 INTERDISCIPLINARY PILOT COURSE DEVELOPMENT: LESSONS LEARNED

3.1 Interdisciplinary courses require careful and target marketing

An interdisciplinary course will (in theory) work best when there is a diverse pool of students from different disciplines and backgrounds to both stimulate and simulate inter-professional dialogue and skill sharing. If a proposed course is not advertised well interdepartmentally, a skewness in student enrollment will alter the demographics of the class. In the pilot course, 10 of the 12 students were applied information technology students will little to no background in health concepts. Therefore, the ability to create balanced groups for in class discussion and the group project was not feasible. This skew in demographics also created challenges for the instructors who had to differentially scale the course content to support the lack of knowledge, and in some cases interest, in health concepts and the students' deficiencies in technology concepts relevant to health care, though they may have had strong academic knowledge in other aspects of technology. The lack of students from a health background was in part due to student fears that the technology topics would be beyond their scope of practice and abilities. The authors did not anticipate the importance of creating marketing materials that while conveying the clear intent of the class, were also crafted to allay technology fears for health professionals/ pre-professionals and emphasized the timely relevance of the health care topics to be discussed for technology professionals and pre-professionals. To address this issue, the authors strongly recommend that instructors prepare marketing materials specifically for their respective departments and disciplines rather than a one size fits all approach. Additionally, instructors will need to be very deliberate in the formation of in class student groups to avoid the "huddling effect" whereby students will naturally gravitate towards those in their respective disciplines.

3.1.1 Students career goals play a large role in student engagement

The pilot course revealed that undergraduate students with both low interest in healthcare as a career field and marginal technical skills performed below expectations on exam and project based assignments. However, at the graduate level students with either a previous health background and low technical skill, or an IT background with low previous healthcare knowledge performed above expectations in the course. These experiences emphasize the importance of student career goals (the healthcare field as primary or secondary career path) in course engagement and success. While the instructors decided to open the course for undergraduates and graduate to boost enrollment, it may have been more prudent to focus on early career graduate students rather than undergraduates. Persons pursuing post-baccalaureate, graduate, and professional education often have either a clear career advancement goal in mind and/or greater professional work experience that is advantageous in a course where communication across disciplines is a critical skill. Favorable qualitative feedback from graduate students (n=2) noted their levels of health, information technology, and the intersections therein expanded over the course of the semester.

3.1.2 Team Teaching and class structure should be modeled around inter-professional dialogue

Negative quantitative and qualitative feedback from some of the technology students that the course was too health-centric may reflect a missed opportunity and error on the part of the instructors. While the intent of the course was to mitigate silos, the course structure of alternating weeks to each instructor rather than collaborative teaching within the same session or week of the class seemed to both hurt student-teacher rapport, and the ability of the instructors to model the inter-professional dialogue so critical to the goals of the course. There are other alternative methods for co-teaching that could have effectively addressed student perception [8] including having both instructors present during some weeks to foster dialogue and highlight shared and divergent perspectives from both disciplines. Likewise, separating the academic topics rather than taking an integrated case- based approach

to the course from the beginning, may not have served all students well. Students seemed to excel on innovative group project proposals including patient portals, proactive healthcare applications, emergency care service efficiency, and secure healthcare services. This implies that late in the course group collaboration was still successful despite the obstacles, and opens the door to consider alternative forms of case based learning, co-mentored by both faculty throughout course delivery. Team-based learning systems have already been well established in the health field, particularly nursing education [9], and may lend much needed structure to interdisciplinary education since the goals (heterogeneous team formation, student accountability, real world problem solving, and continuous feedback) [9] are the same.

3.1.3 Multiple types of student assessment should be conducted pre, midterm, and post

Interdisciplinary courses, like other courses, benefit from multiple levels of evaluation. Student evaluations provide some student feedback, but response rates for the pilot course were very low. Additionally, standard student evaluations only gave a dim snap shot of student course perceptions, and those perceptions ranged widely depending on student background. Beyond student perceptions, instructors need to further evaluate curriculum and process for interdisciplinary courses. Field literacy assessments, team teaching and group evaluation process assessments, and future and/or present employment job roles and responsibilities assessments be integrated into the evaluation milieu for interdisciplinary courses. Preliminary field literacy assessments are critical to better understand student knowledge levels in order for instructors to be able to scale the level of the subsequent course content weeks appropriately. Post-course field literacy assessments showing marked improvement across both disciplines help to support the contention that interdisciplinary courses can contribute to the creation of boundary spanning professionals. Team teaching and group evaluations should be administered mid-term and not only at the end. This will allow instructors to make any necessary course corrections early in the semester to better ensure the goals of the course are

met. Assessing future and present desired employment job roles will allow instructors and relevant stakeholders to better match industry needs to the curriculum.

4 OUTCOMES OF THE PILOT STUDY

We conducted both formative and summative evaluation for the above pilot study. The students, faculty, curriculum design and external industry experts were active participants of the study. Because part of the impetus for the course was to be responsive to industry needs, three external industry experts from clinical fields (hospital and health care organizations) and one from the public health field (state government) participated in a focus group session to provide feedback on the bridge course syllabus, discuss the lessons learned from the pilot study, address industry relevance of several other interdisciplinary course initiatives, and determine next steps. Feedback from the industry evaluators was in general positive including indicating the employment categories most likely to benefit from these kind of courses (practicing health clinicians, data analysts, and federal employees). Industry evaluators also recommended strengthening the security and privacy curricular pieces within the bridge course and with other dedicated courses. Ultimately, industry evaluators and the internal funding school decided that a fully revised interdisciplinary course could serve as the first course within a 6-course sequence for a proposed post-baccalaureate certificate (PBC) program in Health Information Management. While the thematic sequences for the bridge course remain the same, revisions have been made in to address concerns about the target student market and curriculum alignment with regional health industry needs. Additionally, instructors will explore implementing an enhanced co-teaching structure and team based learning approaches. The revised course will also institute the formalized pre- and post-assessments identified to determine the efficacy of the course.

5 CONCLUSION

Interdisciplinary coursework in the field of health informatics presents challenges and opportunities to address the critical communication gaps that inhibit effective

technology adoption in health care and public health settings. With the emerging need and intersection of technology in the improvement of cost and quality of healthcare systems, we believe the design and implementation of the proposed course will lead to the development of a well-prepared and able workforce to address the growing challenges for the 21st century. The PBC is planned to be disseminated at the graduate level through a cross-departmental program starting from Fall 2017. We plan to conduct rigorous periodic assessment of the progress of the program via employers' and external expert evaluator feedback, as well as student recruitment, retention and post study success to further enhance and expand the proposed program.

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