

The Development of Model Curricula for Health Informatics

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Abstract

We have developed model Health Informatics (HI) curricula for the education of three categories of professionals: Applied Health Informaticians, the professionals that deploy information technologies, Research and Development Health Informaticians those that develop new concepts, techniques, and solutions, and what we have called Clinician Health Informaticians, providers who use HI capabilities to support their professional work. The curricula specify the competencies that each type of professional must acquire.

Keywords:

Curriculum Development; Health Informatics Education; Competency

Introduction

In this paper we describe the work we have done related to the specification of required HI competencies, and of curriculum contents for educational programs that address the needs of three groups of professionals. These include Applied Health Informaticians (AHIs), Research and Development Health Informaticians (RDHIs), and clinicians who will be users of health informatics solutions in their professional work (CHIs). We then describe the application of the AHI curriculum to the design of an AHI diploma program.

Curriculum Development Framework

We call our framework for curriculum development a “roles based” approach:

- Each IT professional is conceived as fulfilling a role (for clarity we term these “macro-roles”. Examples include: CIO, IS Director, Manager, Consultant);
- An IT professional in a macro-role faces challenges (examples include: strategic planning, technology deployment);
- In order to address these challenges, the IT professional performs “micro-roles” or tasks (e.g., micro-roles related to the challenge “IT/IM technol-

ogy assessment” include: identification of desired outcomes, and assessment of vendor and product viability).

- Each of these micro-roles requires that the professional have specific competencies: skills, knowledge, and experience.

We define a curriculum to be the content and sequencing of educational modules imparting these skills, knowledge elements, and experiences.

Curriculum Development Process

Beginning in 1994 with a meeting among several interested parties (C. Boal, D. Covvey, B. Dixon, and J. MacNeill), a framework was conceived for specifying Health Informatics learning requirements. Over the intervening years we addressed several key steps related to this framework:

- In preparation for detailed work, we apprised ourselves of existing HI education programs in terms of their objectives, candidates, content, and products, we reviewed existing curricula¹, and we familiarized ourselves with other curriculum development efforts².
- We developed a set of templates containing straw versions of the challenges, macro-roles, micro-roles, and the skills, knowledge, and experience elements. We validated portions of this work at several focus-type sessions.
- Through the HEALNet Center of Excellence (Managing Director, D. Royce), we obtained funding for and initiated a series of national workshops in Canada that would use the templates as a starting point for developing model curricula.

Working Group Methodology

The model curriculum development process was carried out in the following way:

- Detailed work on curriculum development began in December 1999 with a kick-off videoconference at 11 sites (approximately 100 participants). This

session introduced all participants to the process, and prepared them for their roles. Three teams were established subsequent to this meeting, the AHI, RDHI, and CHI Working Groups.

- Workshop participants were selected based on a stakeholder analysis, and include HI curriculum developers, HI teachers and researchers, potential and current HI students, employers (health and health-related industries), representatives of professional organizations, and potential certifiers of HI professionals.
- Between March and September 2000, approximately ten on-line workshops were convened for each Working Group.
- Each workshop was facilitated by a member of the core team of curriculum developers (AHI: D. Covey; RDHI: D. Zitner, and CHI, R. Bernstein).
- Each workshop started with a template that contained straw versions of the macro-roles, challenges, micro-roles, and, in some cases, skill, knowledge and experience elements.
- Workshop sessions were of approximately 2-hour duration, during which time participants discussed the materials, proposed alterations to the templates and sought consensus on changes. Between meetings these templates were edited to reflect proposed changes.
- The on-line participants were supported by document (Sprint's SprintConf facility based on PlaceWare) and audio conferencing technologies.
- All material provided as input and all material produced are made available on the project website, and input was sought from remaining participants via off-line e-mail interaction.

The Working Group sessions ended on September 14, 2000, and the core group is now involved in the process of finalizing the materials.

The materials produced are too detailed and voluminous for inclusion in this article. However, examining examples of the products of the AHI Working Group will illustrate their nature and value.

AHI Professional Roles

In order for an Applied Health Informatics curriculum to be relevant, it must encompass both current and future potential roles of IT professionals in all types of health organizations. The following is a listing of roles we have addressed:

- IT Leader (CIO, VPIS,): A professional who provides strategic leadership regarding all aspects of IT/IM for an organization.
- Director of IS: Tactical-level leader of an IS. department. Manages day-to-day tactical/logistical aspects of the IS function.
- IT/IM Resources/Project Manager: A manager of an IS team. Manages personnel, facilities, informa-

tion resources, and projects related to a portion of the IS function.

- Internal Health IT Consultant: A Methodologist, advisor, and facilitator.
- System/Applications Expert: Expert in specific applications (e.g., the HIS, a departmental system), software tools, a specific area (e.g., database management, data warehousing), or related to a specific technology).
- Process Analyst: An analyst able to characterize, design, and re-engineer complex health system processes.
- Evaluator: An expert in the design, implementation, and interpretation of the results produced by objective techniques to determine the impacts of systems and processes.

AHIs in these macro-roles are confronted by a set of challenges within the scope of their jobs.

AHI Health IT Challenges

Although the number of task-level challenges that will be faced by an AHI over his/her career is large, there is a finite set (27) of challenge types or "IT proto-challenges" (basic, recurring, non-reducible problems that require effective responses from IT professionals). Table 1 shows the challenges identified for the AHI professional note that their characterization has been modified due to space constraints):

Table 1- AHI Challenges

AHI Challenges
Collaboration.
Understanding of the Nature of the Health System, Current Issues, and Desired Outputs.
Formulation of IT/IM Components of the Strat. Plan.
IT/IM Strat. Business Planning; Strat. Mkt. Planning.
IT/IM Needs Analysis.
Determination of the Organization's IT/IM Situation.
Definition and Implementation of Organizational Approach to IT/IM.
Determination of the State of the Industry, Competition, and Viable Vendors and Solutions.
IT/IM Technology Assessment.
Eval., Adoption, and Implementation of Standards
IT/IM-Related Policy Development.
Development of the Justification for/Value of Sys's.
Obtaining Consensus on Solutions, Budget, Plan.
Procurement of Solutions (Products and Services).
Re-engineering of Work and Info. Mgmt. Processes.
Implementation of Solutions.
Planning and Day-to-Day Mgmt. of IT/IM Resources.
Management of Others' Data.
Integration of Multiple Systems.
Maintenance and Support of Solutions.
Evaluation of Solution Outcomes.
Management of Change (Acting as Change Agent).
User, Customer, Inter-Departmental and Public Liaison, Relations, Communications, and Publication.
Continuing Education.
System and Methods Customization and Ad Hoc Development.
Utilization of Technology.
General Day-to-Day Issues.

Micro-Roles To Address Challenges

In order to address each of these challenges, the AHI must be capable of performing a set of what we have called micro-roles. Tables 2A and 2B below show the micro-roles for the two challenges selected from the table above. The complete list is too lengthy for this paper (there are 184), but is available on request:

Table 2A – Example Challenge 1

Micro-Roles for the Challenge: Formulation of IT/IM Components of the Strategic Plan
Comprehension of Organizational Strategy
Interpretation (e.g., Translating IT Concepts + Industry to Management; bridging)
Presentation of Potential Strategic Opportunities for IT/IM
Involvement of Senior Management in IT/IM Strategic Planning Process
Involvement of Other Stakeholders in the IT/IM SP Process
Development of IT/IM Responses (IT/IM Strategic Requirements)
Strategic Options Analysis
Development of Multi-Year Budget
Promoting the Plan and Budget Throughout the Organization and to the Board
Management of Expectations

Table 2B – Example Challenge 2

Micro-Roles (non-Vendor) for the Challenge: Procurement of Solutions
Mobilization and Mgmt of Stakeholder Participation in the Proc. Process
Development of Statement of Required Capabilities, Performance, Technologies, and System Architecture
RFP or Other Procedure for Obtaining Vendor Responses
Management and Documentation of Site Visits, Demos, and Other Assessments
Assessment or Definition of Business Ethics Environment and Applicable Laws
Evaluation of Compliance of Vendors' Offerings with Requirements and Architecture
Identification of Preferred Solutions
Preparation and Negotiation of Contracts
Contract Finalization and Ordering

Skills and Knowledge

If we examine the challenges AHIs face, and determine the micro-roles that the AHI must perform, we come to the conclusion that AHIs must have methodological and intellectual skills as well as domain knowledge, and a set of practical experiences (together called competencies). The full set of AHI skills and knowledge elements is too large to present here (203 skills and 167 knowledge elements were identified by the AHI Working Group), therefore we have shown only the skills and knowledge elements associated with the "Formulation of the IT/IM Components of the Strategic Plan" challenge in Table 3. The full list of skills is available on request.

Table 3 – Skills and Knowledge

Challenge: Formulation of IT/IM Components of the Strategic Plan
Micro-Role: Comprehension of Organizational Strategy
Skills: Listening Skills, Synthesizing Skills, Systems Thinking
Knowledge: The Nature and Operation of the Health System, Health System Management and Organization, Understanding Corporate Culture (regarding acceptable approaches, methods, values), Principles of Systems Thinking
Micro-Role: Interpretation (e.g., Translating IT Concepts + Industry to Management; bridging)
Skills: Forecasting Skills, Communication Skills, Failure Analysis
Knowledge: IT and IM Basic Concepts, The Nature and Operation of the Health System, The Nature and Capabilities of Health IT/IM Vendors and Products, Principles of Failure Analysis; Knowledge of How Non-Health Organizations Address IT/IM
Micro-Role: Presentation of Potential Strategic Opportunities for IT/IM
Skills: Presentation Skills, Data Analysis Skills, Leadership Skills, Communication Skills, Interpretation, Teaching Skills
Knowledge: The Nature and Capabilities of Health IT/IM Vendors and Products, Infrastructural Technologies, The Nature and Operation of the Health System
Micro-Role: Involvement of Senior Management in IT/IM Strategic Planning (SP) Process
Skills: Motivation Techniques, Leadership Skills, Facilitation Skills, Communication Skills
Knowledge: Health System Management and Organization, Understanding Business and Clinical Processes, The IT/IM Strategies of Other Orgs.

Adding the Experience Elements

Our current work involves adding the experience elements. The Working Groups have developed a first draft of these additions, which is now being refined by the core group. They will be available in the first quarter of 2001.

The Course-Like Aggregates

Once all of the skills, knowledge elements were determined, they were subsumed under "competency categories": collections of related skills and knowledge that would likely be taught together. Twenty-two competency categories were defined for the AHI model. These resemble courses, although some competency categories are large enough that the material might be split into 2 courses, while others might be combined in a single course. Once the experience elements are completely defined they will be added into the relevant competency categories.

All 3 Working Groups elected to not define a specific set of courses, but rather to leave this to the schools that will base their programs on the model curricula. In making this decision, we have deliberately limited ourselves to the definition of curriculum content, and recognized that the schools that field an HI educational program are best positioned to creatively incorporate the content into their own educational offerings.

Quality Review and Packaging

In order to assure the quality of the materials, we are subjecting subsets to quality reviews by volunteers. All of the products will have been reviewed by at least 2-3 participants who have selected items they feel competent to address.

We are also presently putting all of the products into a standard form that will be circulated to interested parties early in 2001.

Motivation for an AHI Curriculum

All three Working Groups were motivated by the premise that informatics-based solutions are essential to our health system if it is to survive and thrive.

The AHI working Group realized that AHIs are the dominant type of IT professionals needed by health organizations, as they are the finders, planners, deployers, and managers of informatics-based solutions.

Reviewing medical and health informatics programs reveals that most target the development of Theoretical Health Informaticians^{3,4,5,6}.

We believe that, given the needs of the health system, the emphasis of existing educational programs on producing Theoretical Health Informaticians misses the mark. At the very least, greater emphasis should be put on the preparation of Health Informaticians that are qualified to address the day-to-day challenges of the health IT environment, i.e., that are steeped in the requisite intellectual and procedural skills, the essential knowledge elements, and the hands-on experiences needed to ensure that the health systems investments in systems deliver valued effects.

Based on the critical roles of AHIs, we undertook the model curriculum for educational programs that will produce qualified AHIs.

Using the AHI Model Curriculum

The use of the model curricula can be illustrated by an example.

The University of Waterloo has recognized that there are thousands of IT staff in the health system and in health system-related businesses that require the competencies defined in the model AHI curriculum. At Waterloo, we have used the model curriculum as the basis for a diploma program (the Education Program for Health Informatics Professionals: EPHIP) designed to reach these individuals.

This program will have the following characteristics:

- Its courses will incorporate the content defined in the AHI model curriculum.
- Individual skill, knowledge, and experience elements will be embodied in short, intense, and structured vignettes or micro-courses (modules of 1-3 hours) that are introduced via cases and complemented by pro-

jects that address the experience elements of the model.

- The EPHIP is designed as a distance education program delivered via document and audio-conferencing to address the needs of those already in the field.

The model curriculum dramatically reduced the time and effort required to define the program.

Graduate Product: the HI Professional

The model AHI curriculum targets the development of qualified applied informaticians; the RDHI curriculum, the education of HI researchers and developers; and the CHI curriculum, the production of clinicians who are competent users of IT in their professional work. Having an adequate complement of HI-capable professionals is essential if we are to realize our vision of IT and IM as enablers of an efficient and effective health system. The development of these model curricula is our contribution to ensuring we have the HI professionals to achieve this vision.

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