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More of the Same? Piled Higher and Deeper? Guidelines for Graduate Education in Health Informatics

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Introduction

Some professionals working in our health organizations have had the opportunity to take graduate courses or even to complete a graduate program at a college or university. Having spoken to many who have been there and done that, I know that the experience can be very variable. Some students just get subjected to a flurry of required courses, get little attention from the profs, and decide that they had enough of that in their undergraduate years. Others choose well or luck out, get a good supervisor and have the time of their lives doing research and taking courses that genuinely contribute to their knowledge base and stimulate their interest. Since I love graduate education, it disturbs me deeply that the experience is not a good one for all. But it isn't. In fact, one Ph.D. recipient years ago told me that when he first arrived in a graduate Health Informatics (HI) program he had been given a MUMPS manual and told to start coding. Wow, what a great introduction to graduate education!

In considering graduate education in Health Informatics, an area where few of us have had the opportunity to attend graduate school, we have to realize that we are dealing with something that is still educationally embryonic. Health Informatics is a relatively new area, there a relatively few long-standing programs, and there are many views of what Health Informatics is and what constitutes a curriculum. Recent work we did (1), for example, distinguishes between Applied Health Informatics, the discipline of the deployers of IT and IM systems and methods in health settings, and Research and Development Health Informatics, the discipline of teachers, researchers, and innovators.

Whatever the type of Health Informatics we consider, though, the developers of Health Informatics programs face the challenge of determining the distribution of program content between undergraduate and graduate levels. This article attempts stimulate discussion about this issue.

The Research and Development Health Informatics (RDHI) Curriculum Development Working Group (See Acknowledgements) of the HEALNet initiative to develop model Health Informatics curricula, took on this issue. Quickly, though, we recognized that different schools will design graduate programs that are influenced by the interests of their faculty, that are intended to address the needs of the health sector as the curriculum developers perceive them, and that embody specific principles that they value. However, we also concluded that all such programs should deliver the kind and level of educational experience that has come to be expected in graduate school. In consideration of these factors, rather than develop a specific graduate program model, we elected to develop a set of guidelines that could be applied in many settings. These guidelines are an expression of our view of what distinguishes graduate from pre-graduate education.

Some General Principles

The following are the principles that we believe should shape the thinking of the developers of guidelines for graduate program content, regardless of the discipline under consideration:

- An undergraduate program imparts those skills, knowledge elements, and experiences that are essential for basic competence in a field, and an undergraduate program emphasizes breadth. For example, the Applied Health Informatics (AHI) curriculum produced by the AHI Working Group (2) defines these basic competencies for Health Informatics professionals (e.g., analysts, project managers, technical experts, IS directors, CIOs, etc.) that are responsible for the deployment and management of systems.
- A graduate program supports the development of advanced competencies, such as acquiring a specialty, becoming a teacher, or engaging in research and development, and a graduate program emphasizes depth. Examples of specialties in HI include: Clinical Decision Support, Natural Language Understanding in Health, or Health Data Mining.
- A graduate program targets the integration of the knowledge learned in an undergraduate program, and often addresses the integration of this knowledge with knowledge from other disciplines.
- In an undergraduate program the student populates his/her "knowledge base"; in a graduate program the student exercises his/her knowledge base and inter-relates the knowledge elements, as well as deepening his/her understanding of the principles or theories that underpin the knowledge.
- The deepening of understanding is an essential characteristic of a graduate program. The deepening of understanding is accomplished by: the detailed defining and disambiguation of concepts, exploring the implications of concepts, discovering conflicts (e.g., logical) among concepts, uncovering inconsistencies among concepts, determining the limits of knowledge and/or its applicability, looking at facts and concepts in new ways, attempting to find new or alternate theories or explanations that account for facts and exploring their implications and failures, and recognizing redundancies. The acquisition of knowledge should go to the limits of the known, and attempt to characterize the possible nature of the incompletely known.
- Courses taught in a graduate program should directly motivate, catalyze, and support independent research, as independent thinking and investigation are essential components of graduate education.

- A limited amount of material that can be considered undergraduate level, but that is not taught or addressed adequately at an undergraduate level, can be included in a graduate program.
 - It is possible that some schools will elect to offer a “professional masters” (also called a “terminal masters”) program in addition to or instead of an “academic masters” program. Both types of programs should be geared to stimulating independent thinking, but the latter should stimulate independent research/development. A Professional Masters will typically: be more practically oriented, be based on a courses-only or courses-with-practical-project educational experience, not offer graduate mentorship (or only a limited amount of such), and be focused on the production of specialists. An Academic Masters will typically: be more theory oriented, require fewer courses, include a research thesis/project requirement, provide mentorship/ apprenticeship via a supervising professor, and focus on the production of researchers and teachers, especially those who will continue on to a Ph.D.
 - A graduate program should exercise students regarding and prepare students to be persuasive. It should motivate students to read critically, argue and discuss, interact intellectually, actively participate, be more critical of ideas, explanations, and their claimed effects/impacts, be more challenging (ask relevant, penetrating questions), be open to and unthreatened by being challenged, and to discover what is not fully known or explainable.
 - A significant component of a graduate program involves independent learning by the student, through reading, reviewing, critiquing, analyzing, participating in and leading discussions about, teaching about, and forming conclusions regarding the literature that reports others’ work.
 - A graduate program will, of necessity, be shaped by and imaged through the interests of its faculty.
 - A graduate program should produce graduates that are perceived as capable and valuable by key stakeholders, and that are enabled to pursue their own career goals.
3. Define the type and content of graduate courses based on the following rules:
 - 3.1. Focus on competencies not included in well-established undergraduate programs; require material that is found in such undergraduate programs as pre-requisites.
 - 3.2. Eliminate or assign to pre-requisites or self-study content that is of undergraduate level.
 - 3.3. For students judged capable, but who have not participated in an undergraduate program (as might be the case in some terminal masters programs for mature students), address their needs for background via pre-requisite survey courses, co-requisites, or self-study with examine-out options.
 - 3.4. Address all material in depth, defining and disambiguating concepts, exploring the implications of concepts, considering alternate explanations or theories, pointing out conflicts among concepts and theories, uncovering inconsistencies among concepts, recognizing redundancies, delineating the limits of knowledge and of its applicability, guiding students to look at concepts in new ways.
 - 3.5. Stimulate and emphasize the integration of knowledge that may have been learned as an undergraduate and/or that is taught in the graduate program.
 - 3.5.1. Provoke students and engage them in exercises that help them inter-relate the knowledge elements, as well as deepening their understanding.
 - 3.5.2. If appropriate, meld key knowledge from other disciplines into the program to stimulate inter-disciplinary thinking and to bring in different perspectives (e.g., social systems theory applied to the introduction of new technologies into health environments).
 - 3.6. Incorporate a variety of experience elements, including the above mentioned project/thesis, individual and group case studies, discussion groups, literature review groups, presentations, and focused student teaching assignments.
 4. While maintaining basic content excellence, shape the program based on the interests and capabilities of school’s own faculty.
 5. If essential faculty capabilities are lacking, import expertise via adjunct appointments, or recruit the faculty needed to underpin the desired program.
 6. Select faculty with an excellent graduate teaching and graduate student supervision track record.
 7. Require faculty to conform their teaching to the program syllabus.
 8. For an Academic Masters program, develop a faculty with HI-related research credibility, strong research interests, peer-reviewed publications, and a successful funding history.
 9. Require faculty to be engaged in HI research in which students can, from their perspective and for their benefit, productively participate. If expertise in specific research areas is less than adequate, then partner with and use co-supervisors at other organizations to address this deficiency.

Draft Guidelines

Based on these principles, we have proposed the following draft guidelines for the development of graduate programs in HI:

1. Determine the type of program desired, e.g., Professional Masters versus Academic Masters, and whether or not it will include a Ph.D. component. This will be determined by the needs of the market as perceived by the school, the educational philosophy/orientation of the school, and the interests and capabilities of potential faculty.
2. Design the program so as to encourage independent work and to develop independent thinking in its students. In particular, foster discussion and debate, intellectual interaction, leadership and participatory experiences, critical reading, thinking, and review, and opportunities that ensure students regularly challenge each other.
 - 2.1. In the case of an Academic Masters, require a research project/thesis carried out under the guidance and mentorship of a supervising professor. In the case of the Professional Masters, require a project that reviews some aspect of the field in depth and that takes the student to a point of deep expertise in his/her selected area.

10. Establish working relationships with health facilities that will provide the access to health environments, health data, providers, and potential collaborators needed for the furthering of learning and research. This would preferably include a variety of types of environments (e.g., acute care and public health settings), as well as a spectrum of different types of applications, (e.g., administrative as well as clinical).
11. Consider the creation of a Program Advisory Body that comprises key stakeholders and that provides continuing critical review, "sanity check", relevancy, peer-review, and other quality assurance functions to the program.

Conclusion

The decision regarding what should be addressed at the graduate level of Health Informatics education seems to us to be both an important and challenging one. If a significant amount of material that could be taught at the undergraduate level is included in a graduate program, there is the potential of devaluing the graduate experience and the resultant credential. On the other hand, schools must address the fact that students often enter HI graduate programs without having completed a formal undergraduate program in Health Informatics, but with credentials in other fields, such as Medicine, Nursing, Health Administration, or Computer Science.

We believe that graduate education should be a special kind of experience that should be shaped by principles along the lines we have articulated. The guidelines we have put forward here are intended to be a starting point. Specifying them is meant stimulate the definition of objective criteria for the selection of graduate program content. However, if our propositions are accepted as valid, then it would appear that some material currently taught at the graduate level in some programs, should rather be taught within pre-requisite courses or at an undergraduate level. If this is not done, then how can we consider graduate Health Informatics credentials to have the same meaning for Health Informaticians as do equivalent credentials in other disciplines? Health Informatics may finally have matured to the point where it is possible to characterize HI graduate education on a more formal basis. It may therefore be time for a similar maturation of our education programs.

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Other's Thoughts

Based on interviews with educators, we documented the following general heuristics for deciding graduate versus undergraduate content:

1. Graduate-level content is any material content not taught in a stable (say 25+ years) undergraduate program. Unfortunately, few, if any, HI programs are this long in the tooth.
2. Graduate-level content is content that is not essential for general competence in the field, but that is essential for undertaking graduate research thesis or research project.
3. Graduate-level content requires the full background and integration of the content of the undergraduate program for its comprehension and application.
4. Graduate-level content requires the integration of advanced knowledge from other disciplines with typical undergraduate material before it can be understood and applied.

The following were proposed by M. Yeates (3):

* Graduate work is generally focused, whereas undergraduate work is concerned with breadth.

* Graduate work is scholarly (that is, involved with the critical analysis of theories, policies, or practice in the area studied), whereas undergraduate work is involved with learning about the range of theories/ideas/practices and methods related to the broad area being studied.

* Graduate work is advanced, that is it builds on a known and defined body of existing knowledge which has been imparted and learned in some codified manner at the undergraduate level.

Thus, those graduate programs that are not focused frequently flounder through lack of depth and resources; if they are not scholarly they soon become hollow artefacts ignorant of recent knowledge and future trends; and if they are not advanced they invariably replicate work that is, or should be, provided at the undergraduate level.

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