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Developing the Knowledge Base for Health Informatics: from the Otley Think-tank to the IMIA Strategic Plan

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Abstract

The original aims of the Otley (UK) 'Education Steps' think-tank meeting were to explore the evidence base for and theoretical constructs underpinning health informatics. From these, the aim was to identify and explore the educational issues and implications, including the need for, and so content of, different levels of education in health informatics. This work has become part of a larger research project that is being jointly funded by the International Medical Informatics Association (IMIA) and the British Computer Society Health Informatics Forum (BCSHIF). This paper explores the methods used, and the initial results, from the first two phases of the project. The research process used in the 2005 Otley think tank workshop (Phase 1) are explored in detail, and illustrative examples of the outcomes are provided. The methods being used in Phase 2 are discussed, together with plans for validation of the outputs by the wider international community. The outputs of the project will now help to define the knowledge core at the centre of IMIA's Strategic Plan.

Keywords:

medical informatics, information science, knowledge, review literature

Introduction

Researchers based in CHIRAD, the Centre for Health Informatics Research and Development (an Academic Institutional Member of IMIA, the International Medical Informatics Association, and the first Institutional Member of the European Federation for Medical Informatics, EFMI), have been attempting to build a mapping of the discipline of health informatics. The *Education Steps* think-tank meeting (March 2005 in Otley, UK) was the first stage of this project, which was initiated and originally funded by the Health Informatics Forum of the British Computer Society (BCSHIF) and conducted by CHIRAD. The original primary aim was to explore the theoretical constructs underpinning health informatics, and from this, identify and investigate the educational issues. The further aims were to consider the evidence base of health informatics, and examine the existence of, or need for, and so content of, different levels of education in health informatics. Following considerable reflection by the CHIRAD research term and BCSHIF on the initial outputs of the Otley meeting, [1,2] and taking into account the development of the IMIA Strategic Plan, [3] it became apparent that this work could form part of a larger project that could benefit many sectors of the international health informatics community.

A second phase of research, now jointly funded by BCSHIF and IMIA, is contributing to the development of an international mapping of the discipline of health informatics, using a triangulation of expert opinion, document analysis and literature review. It is intended that this will contribute to the development of the knowledge core of IMIA's Strategic Plan.

This paper addresses the context of the phases of the project; the educational framework selected for the first phase; the approaches used for conducting the Otley workshop; and a summary of the discussions and opinions of the participants. Finally, it presents the approaches being used in the current work (phase 2) that builds on the outputs of the Otley meeting, together with some initial results and emerging issues for the future development of the project.

Background to and context of the Otley meeting

In the UK health informatics community there has been a growing concern about the pre-dominant modules/competencies approach, with work-based, skills-oriented delivery of health informatics education. While it was recognised that this work had a valuable role to play, it seemed, to some people, to be resulting in a 'lowest common denominator' approach that did not provide an atmosphere for the higher level scientific and theoretical development of the discipline of health informatics. Indeed, it could be argued that the approach potentially threatened an atmosphere in which one could nurture the exploration of the higher level scientific discussions.

The CHIRAD research team and BCS HIF recognised that there existed, from developments over the previous 5-10 years, and primarily funded through the former NHS Information Authority (NHSIA), much good work relating to skills and competency frameworks for health informatics. As this area had been well rehearsed, it was not the inten-

tion of the project to revisit this work (but to take cognisance of it) . It was also not the aim of the project to seek to define health informatics or explore the most appropriate name for the field (i.e., health, medical or biomedical informatics). Rather, the intention was, through essentially a mapping exercise that drew on the experience and views of health informatics experts, to examine the core components of the discipline by collating the scientific elements of the subjects and thematic areas within the domain.

It could be argued that much of the work envisaged within the project had already been undertaken, within the UK and internationally. In the UK, the NHS Information Authority had developed check lists of competencies for a wide range of staff, focused largely on IT skills but including issues such as security, confidentiality, data quality etc. which were considered vital or useful for different staff groups. These approaches formed a large part of the UK Department of Health's human resource strategy, and provided the basis for Professional Qualifications in IM&T. The adoption of the European Computer Driving Licence as the minimum standard in IT skills for NHS staff has perpetuated the competency driven approach.

The participants in the Otley workshop saw several important possible uses of the outcomes of the think-tank, including:

1. trying to answer the question of whether health informatics exists as an identifiable academic subject domain;
2. assisting in the maturing of the identity of the health informatics profession;
3. bringing together education and training elements of health informatics; and
4. contributing to the academic rigour of the United Kingdom Council for Health Informatics Professions (UKCHIP - www.ukchip.org) framework.

Why use Bloom's taxonomy?

The cognitive domain of Bloom's taxonomy [5] was used as a theoretical framework within which to situate discussions. As CHIRAD's research team has a strong academic background, and many years' experience in delivering education, designing curricula, and research and publication, they felt that the project needed an appropriate academic context. Bloom's taxonomy is well known from health, medical and nursing curricula, and provides a hierarchical framework for categorising levels of abstraction for objectives within educational settings, and maps well against other academic levels, e.g. progression from undergraduate to postgraduate levels.

Bloom identified three domains of educational activity: the cognitive, relating to knowledge and mental skills, the affective, relating to attitude, feelings and emotions, and the psychomotor, relating to manual or physical skills. Bloom's cognitive domain recognises six levels of educational objectives, from the lowest, knowledge, through comprehension, application, analysis, synthesis, to evaluation, the highest level. The intention was that participants in the workshop would collate the conceptual basis of health informatics to elucidate the elements that could be categorised as knowledge, comprehension, application, analysis, synthesis and evaluation.

In preparation for the workshop, we asked participants to familiarise themselves with documents such as the IMIA Scientific Content Map [4] and any other similar documents to which they had access. We asked, in particular, that participants should bring with them either the module descriptions from any health informatics programme that they were involved with, which should include the aims and objectives or learning outcomes, and indicative content; or a list of the models, theories and laws, constructs and concepts that framed their understanding of the discipline of health informatics.

The Otley workshop: the ducks and ponds metaphor

The Otley meeting was an intensive 24-hour residential think-tank, with workshop format and comprising small group and plenary discussions. It brought together 25 international health informatics experts, from variousheath informatics groups, including BCS Health Informatics Forum, BCS Health Informatics Specialist Groups, ASSIST (The Association of ICT Professionals in Health and Social Care) and IMIA. Most of the participants were from the UK, whilst others came from other European countries, Australia, South Africa and the USA.

The workshop aimed to capture all the elements of the discipline of health informatics, and also the broad themes or subject areas into which these elements might be grouped. The metaphor of 'ducks' (for the individual elements) and 'ponds' (for the broad themes of the framework) was felt to be an appropriate way of helping participants to visualise the tasks they would be undertaking. The six levels of the cognitive domain of Bloom's taxonomy were used to form the basis of the grouping of the 'ducks' within the 'ponds', and it was felt that they might contribute to understanding the development of the curriculum at different academic levels.

Participants in the Otley meeting were asked to identify 'ducks' (health informatics elements), but at the same time, to think 'what does a duck look like?' This meant that in describing them, there was a need to include an active verb from one of Bloom's cognitive levels, plus a generic principle. It was also felt that we would need to identify as many 'ducks' as possible, that is, capture the fullest size of

the 'flock of ducks' (total numbers). The CHIRAD team acted as facilitators in encouraging the discussion groups to pursue this challenging exercise, as there existed the risk of discussion focusing on a few examples if different participants had differing views on the nature or importance of particular 'ducks'; however, we also felt that the breadth of experience of participants would help in capturing a large number of different 'ducks'. The broad themes (ponds) were also identified. Within small groups, participants identified the main subject areas (ponds) from their own lists, curricula or knowledge and experience. Participants identified elements (ducks) of subject areas within small groups. Participants finally assigned each duck to a subject area and, if possible, to a level from Bloom's cognitive domain.

The first set of 'ducks' and 'ponds'

With 'ducks' and 'ponds' representing respectively the finer elements of the discipline and the broad themes within which those elements could be clustered, a first set of outputs comprise 221 'ducks' in total, grouped into 13 'ponds'.

Table 1 – Sample from Otley workshop

Theme ('pond')	Element ('duck')
Health Informatics standards	Assess quality of draft message design process standard
	Assess utility of a clinical interface
	Clinical coding systems
	Describes Technical Infrastructures
	Design of specific clinical message
	Explains the needs for technical standards
Health and social care – care processes	Apply telehealth solutions to the elderly population
	Describe systems currently used by clinicians to gather clinical information
	Evaluates how Health Informatics affects outcomes
	Knows the method of primary to secondary to tertiary care referral and the flows of information

An example of the current level of detail of one 'pond' and set of 'ducks' is given in Table 1. The ponds varied in size, with the smallest containing 6 ducks and the largest 37, although it was already recognised by participants that the largest pond would likely be divided following further discussions.

The 13 ponds are currently named as follows (although the names may change as a result of ongoing discussions):

- Health and social care - care processes;
- Health (care) records;
- Health informatics standards;
- Computer Science for Health Informatics (ICT for Health);
- Health and Social care Industry;
- Knowledge Domains & Knowledge Discovery;
- Legal & Ethical;
- People in organisations;
- Politics and policy;
- Terminology, classification and grouping;
- Toolkit (systems);
- Uses of clinical information; and
- Uses of informatics to support clinical healthcare governance.

The full set of outcomes can be found through the CHIRAD website on the Education Steps project website at:

http://www.differance-engine.net/educationsteps/documents/otley2005outputs.htm

Validating and disseminating the Otley outputs

The first lists resulted from a time-limited discussion among a relatively small group, albeit of nationally and internationally recognised experts. All participants recognised the provisional nature of the lists and the need for further reflection and refinement, which was envisaged as being conducted through international discussions in the later phases of the project, to generate a widely accepted list of ducks and ponds. The Otley participants were invited to comment on the list, and to propose amendments, through a mixture of individual commentary and online group discussions. There was a general feeling that the set of 'ducks' and 'ponds' that had been developed and agreed was not complete, and that others would emerge. There was a general consensus on the first listing, but it had been evident in the discussions that some people felt that what had been identified as 'ponds' might, as a result of further discussion and reflection, be seen to be simply 'ducks'.

In attempts to validate the outputs of the Otley workshop, in March 2006, a further 24 hour workshop was held in Belfast, which focused specifically on refining the technical and computing themes developed at Otley. This resulted in some success, as it included several of the Otley participants, and provided the time for immersion in the discussions. The outputs from Otley have been used to help formulate an undergraduate biomedical informatics degree programme. [6]

Reflections on the process and outputs

The question naturally arising from any project with seemingly limited outputs is 'would we do the same again, and in the same way?' Bringing together a group of 25 health informatics experts, from a range of practical and theoretical backgrounds, with a wide range of special interests, and collectively with in excess of 500 years experience in health informatics, and asking them to explore, and possibly challenge, the fundamental basis of their discipline, was always going to be a potentially risky undertaking. It is a tribute to the professionalism and enthusiasm for their areas of expertise that the participants at the Otley meeting engaged in the process so enthusiastically and that they felt that the beginnings of something useful resulted from the time and effort. The overall structure of the workshop was felt to work well,with the greatest complaint being the lack of time devoted to each stage of the process, and in particular to some of the discussions and sessions when there was an attempt to reach consensus where several disparate views clearly existed. The level of knowledge displayed by participants, the passionate defences of their views, and the enthusiasm displayed at all stages of the workshop clearly showed that we had the right types and mix of people involved. That we have had no-one significantly disclaiming the outputs indicates that some form of valuable output has been achieved.

Participants in the Otley meeting found that, although the metaphor had limits and could be stretched in many ways, it was a useful way of starting to think about what are the essential broad themes ('ponds') within health informatics as a discipline, and what are the essential finer-grained components ('ducks'). As the project evolves, the metaphor may become less useful. As might be expected from experts with strongly-held views and coming from a wide range of practical and theoretical backgrounds and interests, the discussions were wide-ranging. It was quickly acknowledged that the scope of the task was huge and that we could only make a small start. The attempt to focus on the cognitive domain of the discipline, and to break free of the constraints of thinking only about psychomotor skills and competencies, caused problems for some participants. Yet it is remarkable that, even within a short period of intense discussion, we managed to make some progress towards agreement on some of the broad themes.

Contributing to IMIA's Strategic Plan

Work on the development of IMIA's Strategic Plan, 'Towards IMIA2015' [3] was formally launched by incoming President Nancy Lorenzi at Medinfo2004, with the aim of having a final version ready for IMIA's endorsement at Medinfo2007. The core vision and conceptual framework for the IMIA Strategic Plan place knowledge at the core of IMIA's activities, and has lead to a realisation of the need to update the 2001 IMIA Scientific Content Map. Building on, in part, the Otley outputs, a second phase of work is being jointly funded by IMIA and BCSHIF to develop the knowledge core for IMIA, and the wider international health informatics community.

Phase 2 methods and pilot results

In Phase 1, the Otley workshop, a group of health informatics experts was asked to identify the elements of the discipline of health informatics. For Phase 2, the published and peer-reviewed literature is taken to be a valid proxy for such expertise. A literature analysis examining the emerging themes and high level descriptors is being undertaken, using document and discourse analysis software and methods. This is based in an analysis of available electronic literature, and will additionally use established and novel indexing and analysis techniques. The method is acknowledged to be similar to that used by Lorenzi to develop the original IMIA Scientific Map, but makes use of materials and methods not available at that time.

The research team is seeking to collect all the electronically available health informatics literature, i.e. in CD-ROM format and available via the Internet. This includes conference proceedings (e.g. Medinfo, AMIA, MIE), as well as journal articles and textbooks. To date, we have a corpus approaching 7,000 articles, items and chapters, most of which are in PDF format and comprise a total of 2GB of files. We are still seeking additional material, although expect that a saturation point will be reached in respect of identifying themes from only a small portion of this corpus.

Several searching and indexing methods have been used to determine the size of the available corpus of literature, and as a pilot test for the analysis methods being employed. An online search in August 2006 using Google Scholar, for example, returned 92,800 citations using the term 'medical informatics', 80,600 using 'health informatics' and 42,500 using 'clinical informatics. Using the Reference Manager 11 software to undertake online searches of PubMed returned 6,249 papers when using the term 'medical informatics', 3,611 using 'health informatics and 1,785 using 'clinical informatics'.

The corpus of articles collected so far is stored on a network hard drive and we have used several indexing tools to index the articles and then search them using a subset of the Otley outputs as a pilot analysis. Google Desktop, Copernic and ASK, as commonly available tools have been used. Table 2 illustrates some of the similarities and differences encountered in using the same search terms in different engines and algorithms. This work is ongoing, and is expected to be completed in early 2007, although several issues are already emerging. There will be a need for the research team to replicate and validate some of the indexing and searching, as different search algorithms are yielding differing results. The contextual nature (i.e., using

Bloom's taxonomy) of the Otley outputs may not match well to the more restricted searching allowed by some of the algorithms. Use of keywords in many publications depends on author selection as opposed to a consistent approach, and is causing some issues in indexing, and different 'in vogue' terms in different places and times seem to be skewing some of the results of the literature searches. All of these issues are important factors that we will be a an analysing as the current research phase unfolds.

The whole project seeks to use a triangulation of research methods (literature review, document analysis, and expert opinion) to obtain different perspectives on the issue of mapping the discipline if health informatics, and with the expectation that the different views will provide some congruence. Once the literature analysis has been completed, the results will be made available for discussion and refinement to the international health informatics community. A consensus conference will be held, to explore the commonalities and differences between the Otley outputs with the document analysis. An international advisory board of health informatics experts, especially including those who have undertaken work in health informatics education and aspects of defining the discipline, is advising on the methods being used and facilitating access to the source materials.

Conclusions

From an initially small scale project, a first set of elements was developed to contribute to a mapping of the cognitive elements of the discipline of health informatics. This work is now contributing to a larger international project, jointly funded and co-ordinated by IMIA and BCSHIF, that will contribute to the knowledge core of IMIA's Strategic Plan. As the results of the current phase of the research emerge, the CHIRAD, BCSHIF and IMIA research team will be inviting members of the international health informatics community to contribute to their refinement and validation, and so be involved in developing a commonly shared – but dynamically evolving – map of the discipline of health informatics.

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Table 2 – Examples from phase 2 indexing

Average	ASK	Copernic	Google Desktop	Element
814.67	735	1003	706	Health informatics standards
1306.67	1225	1486	1209	Standards
42.00	29	67	30	Terminology, classification and grouping
941.67	928	1031	866	Terminology
1140.67	1119	1334	969	Classification
188.33	140	258	167	Grouping
805.00	787	921	707	Healthcare records
1388.33	1327	1631	1207	Health care records