HEALTH INFORMATICS EDUCATION IN THE ICS CURRICULUM – THE NEED FOR BENCHMARKING

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ABSTRACT

Health Informatics lies at the intersection of informatics and the health care disciplines. It is a subject that has evolved to fulfil the need for healthcare professionals with better information handling and interpretation skills. As information systems supporting health and the mode in which care is delivered undergo significant change throughout the UK and Ireland, this paper addresses the need for accepted benchmarking of the discipline, from the perspective of Informatics/Computer Science. It reviews the plethora of stakeholders and collates views from a benchmarking exercise, which has contributed to the British Computer Society Education Steps initiative.

Keywords

Benchmarking, health, informatics, learning, curriculum

1. INTRODUCTION

There are many views of Health Informatics (HI). The UK Department of Health defines HI as: *The knowledge, skills, and tools which enable information to be collected, managed, used and shared to support the delivery of healthcare and to promote health.*

HI lies at the intersection of Informatics/Computer Science and Health Sciences and relies heavily Library studies for support. It is a heterogeneous area of learning and is taught to medical, computing, engineering and professions allied to medicine. It is often taken in a part-time or self-directed mode. It is a subject which has evolved relatively recently, and has been relatively poorly benchmarked with many courses providing varied syllabus material. Better medical informatics education is one of Altman's '*Ten notable challenges for medical informatics'* [1].

The International Medical Informatics Association provided recommendations on Education in Heath and Medical Informatics [2]. These recommendations acknowledge the different perspectives of potential practitioners: an 'informatics-based approach' and a 'health-care based approach'. IMIA recommend that the 'informatics based approach' should:

- Focus on data, information and knowledge, as appropriate to the skills of an informatician (or Computer Scientist);
- Treat health care problems cooperatively with physicians and other healthcare professionals.

This was a good starting point, but the document could only provide general guidance for the world-wide health and medical informatics (HMI)[1] community. These recommendations need to be localised appropriate to education in the UK and Ireland, and brought up to date for the advances in Information and Communication Technology (ICT). In particular the uptake of the e-Health paradigm [3], which puts patients at the centre of their healthcare, and the changes associated with the introduction of technology to support electronic records, appointment booking, electronic document transfer and prescribing, mainly post-date the publication of the IMIA recommendations.

In England, the National Health Service (NHS) 'Connecting for Health' [4] aims to bring modern computer systems into the NHS which will improve patient care and services. Over a ten years roll-out

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[1] Terminology in this area is not universally agreed. Health and Medical Informatics (HMI) is a wider term which embraces both Health Informatics (HI) and Medical Informatics (MI). MI has been widely used and normally refers to clinical data, used in hospitals. HI encompassed all healthcare disciplines and in this paper we use the term HI.

time frame from 2003, it proposes to connect over 30,000 GPs in England to almost 300 hospitals and give patients access to their personal health and care information, transforming the way the NHS works. Similar strategies are in place in the NHS in Wales [5] and Scotland [6]. In Northern Ireland, a consultation report was published in July 2002 [7]. It described an ICT Strategy for the Health and Personal Social Services (HPSS), based on analysis of the current use of ICT in the service and consultation with service users.

In Ireland, *'Embedding the e in Health'* sets out a strategic ICT framework for the Irish health system [8], which aims to be responsive to and facilitate specifically, the vision of a people-centred health service.

This environment clearly establishes a clear need for enhanced education and training to provide a better skilled workforce. However Murphy et al. [9] report a lack of progress in HI education in the UK. A questionnaire to elicit details of HI skills was derived from the NHS Information Authority's '*Learning to Manage Health Information*' document [10]. This research particularly addressed the clinical and managerial professions. It concluded that progress was slowed by: lack of understanding of HI, and an already crowded curriculum. HI appears to lack appropriate leadership and collaboration from the various stakeholders (administrators, academics, research groups, employers) and often 'IT skills' are taught as an 'easy win' in the resulting confused environment. In July 2005, the NHS launched the Institute for Innovation and Improvement [11], which aims to "*improve health outcomes and raise the quality of delivery in the NHS by accelerating the uptake of proven innovation and improvements in healthcare delivery models and processes, medical products and devices and healthcare leadership*". HI is a key component of this mission. However there is no widespread acceptance of the scope of HI beyond simple IT skills.

A British Computer Society Health Informatics Forum [12] meeting in Otley (March 2005), brought together stakeholders from the UK universities and health care professionals to explore theoretical constructs underpinning HI and to identify and explore the educational issues, using the 'cognitive domain' of Bloom's taxonomy [13, 14]. HI requires significant cognitive skills as often knowledge and ideas must be synthesised in order to explain findings, to hypothesise and arrive at some interpretation. As such HI incorporates all six levels of the revised taxonomy [15]. This is equally as relevant to the debugging of hardware, software or communication errors, as it is to the diagnosis of a patient's complaint. The discussion took account of the practical skills required with the sector, and the need for skills update, due to the rapid pace of change in both technology and organisation. The meeting also explored the evidence base of HI and examined the existence of, the need for and content of different levels of education in HI. A report [16] concluded that HI included 13 broad themes (using a 'pond' metaphor) comprising a total of 221 finer elements (using a 'duck' metaphor), see [17].

Subsequent to this meeting Pritchard-Copley et al. have provided a paper on benchmarking, which provides a first step towards defining the learning outcomes and competencies for a student of 'biomedical informatics'[2] [18].

The current study aims to build upon the recommendations of the Otley meeting by identifying the concepts of HI that relate specifically to Informatics/Computing Science. It is envisaged that this will provide a sub-set of the wider Otley objectives and published outcome. This work[3] is timely as there is a drive towards increased professionalism in HMI [19], and given the possibility of the need for more specialists in ICT, driven by Connecting for Health and other regional initiatives.

2. BENCHMARKING

A benchmark may be defined [18] as:

"*The conceptual framework that gives a discipline its coherence and identity; about the intellectual capability and understanding that should be developed, the techniques and skills which are associated with developing an understanding in that discipline; and the level of intellectual demand and challenge which is appropriate to that discipline*."

The area of Computing Science is relatively mature and has benchmark statements set by the Quality Assurance Agency for Higher Education in 2000 [20]. Computing is concerned with the understanding, design and exploitation of computation and computer technology. It is a discipline that blends theories (derived from disciplines such as mathematics, engineering, psychology, graphical design or well-founded experimental insight) with the solution of immediate practical problems. In addition, it combines the ethos of the scholar with that of the professional. Thus computing embodies both *theory* and practice.

If HI can be considered to be a discipline, then it will also combine both theory and practice, where the practice is applied to healthcare issues. The Computing discipline may be characterised as hardware, software (structuring of data, programming and tools), communication and interaction (networks, operating systems and

[2] Biomedical Informatics encompasses HI and the discipline of bioinformatics, which investigates genetic markers in the disease process

[3] The work was initiated by a meeting held in Belfast 30th-31st March 2006.

human-computer interaction). Appropriate theory aspects include algorithm design and analysis, use of formal methods, modelling and frameworks, analysis, prediction and generalisation, and human behaviour and performance. Computing practice includes problem identification and analysis, design, development, testing and evaluation, management and organisation, professionalism and ethics, commercial and industrial exploitation.

In HI, practice issues may be dictated by National Occupational Standards for Health Informatics [21]. The purpose of these standards is '*to enable, promote and support the effective use of data, information, knowledge and technology to support and improve health and health care delivery*'. The standards define four areas:

- lead, promote and manage the use of resources to improve health care delivery;
- identify, collect, analyse, disseminate and maintain data and information to improve healthcare delivery;
- enable, develop and manage knowledge to improve healthcare delivery
- plan, implement, sustain and review the provision of ICT to support and improve healthcare delivery.

3. HMI COURSES AND SOURCES

There are a number of existing courses in HI throughout the UK and Ireland[4]. A survey from BCS-HIC [22] revealed courses in: Aberystwyth University, Coventry University, Exeter University, University of Wales Swansea, St George's, University of London, University College London CHIME (includes Royal Free), University of Brighton, University of West of England, University College Winchester, University of Central Lancashire, Trinity College Dublin. The courses have a range of levels and delivery modes. These include: undergraduate diploma, postgraduate certificate, postgraduate diploma, Master of Science, Master of Arts. Delivery modes are full-time, part-time, distance learning and blended learning. In addition full-time undergraduate BSc and foundation degrees are in the planning stage.

The NHS also provides a Professional Certificate in HI [23] which involves work based learning. The syllabus comprises: The role of informatics in the provision of health and social care services; Information management in health and social care; Information and communication technology in health and social care; Analysing and presenting data and information; Using data to assist in clinical decision making and planning care; Introduction to electronic communications; How an organisation used IM&T to support the delivery of care; Implementing electronic care records; Clinical Coding: The collection, use and management of health data.

The Irish Computer Society has developed distance learning material in HI for healthcare professionals, to be delivered in e-learning mode [24]. This is called the Health Informatics Training System (HITS). It addresses IT Basics in Healthcare, Computer Hardware and Software in Healthcare, Networks and Health Informatics, Information Management in Healthcare, Understanding data, information and knowledge, Protecting Information – Security, privacy and confidentiality, Electronic record keeping in healthcare, IT Systems in Healthcare, Administrative Information Systems, Clinical Information Systems, Decision Support Systems

4. BELFAST WORKSHOP AND ONGOING WORK

The information in Section 3 reveals a lack of courses in dedicated computing departments. A workshop in Belfast (31-March-2006) collated this information and discussed relevant issues with stakeholders from NHS, UK and Irish universities. The profile of participants included HI course providers, Computing Science course providers, experts in library studies, NHS employers from UK and Northern Ireland, HI students and representations from professional bodies. The workshop was supported by a wiki (123.writeboard.com), a collaborative website that allows users to add, and edit content, very quickly and easily. In the context of benchmarking HI for Computing Science the following issues were discussed:

- *Is there is a need for a dedicated HI course in an engineering department/school?* Most courses are inter-disciplinary, combining students from engineering and medical courses. Factors which will determine whether a dedicated Computing Science based course is needed an viable include government and NHS policy, funding support for students and the employability and contribution of the graduate.
- *What level of course is appropriate*? Most courses are at postgraduate diploma or MSc level, which provides a one year equivalent. This suits the profession, many of whom will already be graduates. However St Georges (University College London) have recently introduced a full undergraduate programme (3 years), aimed at school leavers, which can lead to a Masters in 4 years. This course will produce graduates who are much more specialized in HI. Flexibility of delivery is a key issue, and it is attractive if an academic qualification can also incorporate National Occupational Standards, without further top-up.

[4] This information is not exhaustive and is currently undergoing updates

- *What would be the core curriculum?* This topic addresses whether the course provides further specialized computing or more breadth (i.e. wide ranging topics appropriate to understanding the current health care system). The choice depends on whether the scientific base is sufficiently different from existing Computing Science to warrant a new degree. If not, addition of relevant options in an existing course may be appropriate. The philosophy of the course will dictate the content and relevance to the industry. A pragmatic approach to the distinctiveness and scope is to base the course on core concepts and models which will not change significantly over time and to supplement this with case studies and laboratory sessions, which utilize the latest tools and packages. It is important that the course delivers education and knowledge, and can reflect the latest HI research.
- *What mode of delivery is appropriate?* The options include: continuing professional development using short courses or e-learning, delivery in block mode, during office hours or at night. Again flexibility is important but this can adversely affect progression rates and university funding, if the regulations are too lenient. Workplace support can also determine which mode of delivery is viable.
- *Is collaboration across institutions feasible?* This may depend on teaching expertise and staffing mix. Inter-disciplinarity may be a desirable way forward but requires good working relationships between colleagues. There are institutional barriers to co-operation related to ownership and financial pressures. There may also need to be consolidation between education providers. The Bologna agreement (harmonisation of course throughout Europe) is a driver for this.
- *What is the role of HI occupation?* There is much on-going work in this area with regard to professionalism [19], and many questions are not settled. Should HI professionals require a domain specific qualification? Will a qualification enhance career progression of a HI professional? Should occupational standards and contractual expectations reflect academic achievement?

5. DISCUSSION

As Section 4 illustrated, discussion at the Belfast workshop raised many questions. The Otley model characterised the HI discipline using 'ducks' and 'ponds' as metaphors, and this framework has received support across academic and professions within HI. However there is a need for benchmarking of HI from a Computing Science perspective. It is anticipated that the benchmark statements will map to a subset of the overarching HI disciple, but also that the Otley model may need further validation and possible refinement. This is a concept that Computing Scientists are comfortable with, i.e. inheritance and polymorphism. It is important that this mapping also takes into account the National Occupational Standards. The overlap with existing Computing Science discipline and feedback from the employers will dictate whether the delivery of an MSc in Health Informatics (Computing Science) requires a new course or whether flexibility in options will permit an existing MSc to include this as a strand. For example, traditional Computing Science courses will provide modules on Database Technology, but not tailored to medical records, and not with the same emphasis on confidentiality and ethics. Communication standards are emphasised, but again not specific to the health domain, e.g. HL-7. In terms of web communication, e-commerce, secrecy and authentication will have relevance to e-Health delivery. User interface design, usability and Human-Computer Interaction (HCI) are key components with correlates in health technology and software.

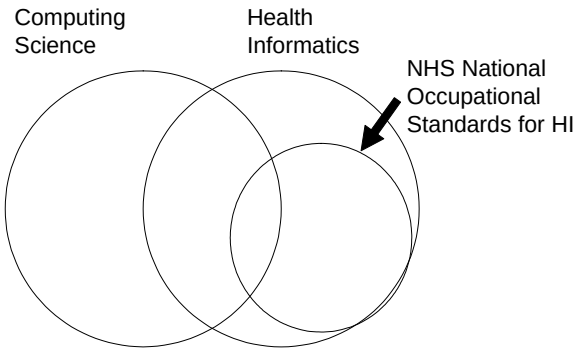

Figure 1: Relationship between Computing Science, HI and Occupational Standards.

Figure 1 illustrates the intersection of the disciplines and the Occupational Standards. Current HI courses tend to satisfy the requirements of the right HI area, and the Otley workshop addressed this area. We aim to specify benchmarks statements for the intersection between Computing Science and HI and satisfy the Occupational standards if possible.

6. CONCLUSION

This paper has raised the need for benchmarking of HI with a focus on a Computing Science, based on the accepted taxonomy of Bloom. This is timely due to the expansion of ICT in healthcare, and the additional expertise required. The benchmarking process, which is ongoing, is taking account of existing information sources: computing benchmarks, Otley 'ducks' and 'ponds' specification of HI, NHS National Occupational Standards, and benchmark statement for biomedical informatics. The benchmarking statements which form the

output of the project will be evaluated by the British Computer Society Health Informatics Forum and will contribute further to the Education Steps initiative.

The overall aim is to provide a better educated workforce in HI with advanced Computing skills. It is expected that this will benefit graduates, employers, patients and the community.

7. REFERENCES

[1] Altman R. B., Informatics in the care of patients: Ten Notable Challenges. *The Western Journal of Medicine* **166(2)**, 118-122 (1997).

[2] International Medical Informatics Association (IMIA) recommendations on Education in Health and Medical Informatics. *Methods Inf Med* **39**, 267-277 (2000) www.imia.org/wg1/rec.htm

[3] Wilson P., Leitner C. and Moussalli A., Mapping the Potential of eHealth: Empowering the citizen through eHealth tools and services. eHealth research report, European Institute of Public Administration.http://www.eu2004.ie

[4] Connecting for Health. http://www.connectingforhealth.org/

[5] Informing Healthcare: Transforming healthcare using information and IT. Crown copyright (2003).http://www.wales.nhs.uk/ihc/documents/ihc_a5-e.pdf,

[6] ICT Strategy making a difference with technology.http://www.show.scot.nhs.uk/gghb/Depts/Finance/ict_strategy_02-04.pdf

[7] HPSS ICT Strategy (2002). http://www.dhsspsni.gov.uk/report_for_consultation.pdf

[8] Health Boards Executive. Embedding the e in Health (2003). http://www.hebe.ie/Publications/SubjectArea/InformationCommunicationTechnology/ICTStrategy/

[9] Murphy, J., Stramer, K., Clamp, S., Grubb, P., Gosland, J.,Davis, S. Health informatics education for clinicians and managers: what's holding up progress? *International Journal of Medical Informatics* **73** (2) 205-213. (2004).

[10] NHS Information Authority. Learning to Manage Health Information: A Theme for Clinical Education. Moving Ahead. (2002) http://www.ic.nhs.uk/informatics/archive/arch/ltmma/file

[11] NHS Institute for Innovation and Improvement http://www.institute.nhs.uk/

[12] British Computer Society – Health Informatics Forum. http://www.bcs.org/

[13] Bloom B. S. *Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain*. New York: David McKay Co Inc. (1956)

[14] Clark D. *Bloom's Taxonomy*, http://www.nwlink.com/~donclark/hrd/bloom.html

[15] Anderson, L.W., & Krathwohl (Eds.). A Taxonomy for Learning, Teaching, and assessing: A Revision of Bloom's Taxonomy of Educational Objectives. New York: Longman (2001).

[16] Murray P.J., Betts H., Roberts J., Richardson G., Ward R. and Wright G. *Report on the Education Steps project – the Otley meeting (full report).* Swindon: The British Computer Society Health Informatics Forum (2005)

[17] Education Steps web site. http://www.differance-ngine.net/educationsteps/

[18] Pritchard-Copely A., de Lusignan S., Rapley A., Robinson J. Towards a benchmarking statement for biomedical informatics. *Healthcare Computing* 221- 229 (2006).

[19] UK Council for Health Informatics Professionals. http://www.ukchip.org.uk/

[20] Quality Assurance Agency for Higher Education, Computing Benchmark (2000). http://www.qaa.ac.uk/academicinfrastructure/benchmark/honours/computing.pdf

[21] National Occupational Standards for Health Informatics (2004). http://www.skillsforhealth.org.uk

[22] Internal communication from British Computer Society Health Informatics Forum.

[23] Professional Certificate in Health Informatics (2205). http://www.ic.nhs.uk

[24] Health Informatics Training System (HITS), www.ics-skills.ie

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