DIVISION OF COMPUTER SCIENCE

Teaching Information Systems at Undergraduate Level: a Viewpoint

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Abstract

This paper will consider the emerging importance of Information Systems as a subject area in its own right and will report on the University of Hertfordshire's proposed move from an Information System stream on a Computer Science degree to a specialist degree in Information Systems. It will present definitions of Information Systems which have been put forward but will propose that the rationale is as important as an agreed definition. It will suggest that the teaching should cover the integration of all relevant underlying social, technical and organisational principles and concepts, and include critical analysis of current thinking and developments.

Finally the paper presents the view that Information Systems must be positioned within the overall business framework and thus this context should underpin the teaching of the subject. This viewpoint is supported by our experiences of teaching IS/IT strategy within the Information Systems stream of the University of Hertfordshire's Computer Science Degree.

1 Background

It is generally accepted that the development of flexible organisations to meet the changing global environment can be facilitated by the right information systems and technical infrastructure, and furthermore, that there is a need for managers and professional staff with the skills and knowledge

to make this happen. The need for graduates who have the ability to support such developments has led to the growing importance of Information Systems as a subject area in its own right and students with an interest in computing, but in its application rather than its science have identified this as a challenging career path. It is most important in meeting these needs that any proposed programme in Information Systems should include a good theoretical underpinning enabling the subject area to stand in its own right and not be seen as a dilution of either Computer Science or Management Sciences (Earl in Palmer and Ottley, 1990).

In the early 1990's the solution to the failure of the investment in Information Technology in many organisations was seen to be the development of the hybrid manager (Palmer and Ottley, 1990). Simpson (1991) proposed that the challenge to the education system was to design courses for the so called 'hybrid' whilst avoiding the dilution of computer science and general management education. He continued that the hybrid should not be a generalist but a specialist in the interface between business and information systems and technology. A hybrid should have solid knowledge. Earl (1989) proposed that either a degree in computing followed by work experience and an MBA or a new specialist degree could provide the appropriate knowledge base.

Six years after the initial BCS report, the term 'hybrid' is little used, perhaps as suggested by Brackley (1996), 'it is no longer remarkable that people should combine familiarity with IT with other management and change agent skills'. She proposes the concept of a 'revised hybrid' where the knowledge of organisational and human factors are seen to be essential to the information systems practitioner.

The task of identifying the solid knowledge to form the foundations of a specialist degree has however continued. The University of Hertfordshire is at present developing a new Information Systems degree to commence in September 1997. This has evolved over the last three years from the BSc Computer Science via a stream in Information Systems. The skills and knowledge identified for the new Information Systems degree are based on the need for a graduate who will be able to:

- play a useful role in the development and maintenance of individual and distributed information systems
- understand the relationship between computer based information systems and their users

- appreciate the technical, ethical and organisational issues relating to information systems in society
- be aware of the importance of assuring and maintaining quality in information systems
- build on the experiences of problem solving, working in teams, researching, report writing and working in industry for their own personal development and education
- demonstrate well developed interpersonal and communication skills in a variety of contexts

This list may, superficially, have little in common with the preliminary work done by the UK Academy for Information Systems (UKAIS) set up in 1995 to further the debate in this area. The UKAIS work will be outlined later and compared with the University of Hertfordshire's approach.

2 Information Systems: Definitions and Perspectives

Many definitions of Information Systems have been proposed over the years and those with which we are most familiar are given below.

The Computer Science Department at the University of Hertfordshire first discussed the possibility of introducing a degree in Information Systems in 1992. Although at this time such a degree was not felt to be feasible, the working definition was as follows:

> 'Information Systems is the combination of two primary fields, computer science and management. Information Systems is concerned not only with the development of new information technologies but also with questions such as: how can they best be applied, how should they be managed and what are the wider implications'.

By July 1994 the University of Hertfordshire's Information Systems Strategy Group produced a more specific definition as a basis of its strategy document. This defined the University's Information System as

> 'the collection, storage, maintenance, retrieval, manipulation and dissemination of information in support of teaching, learning, research, consultancy, income generating and administrative functions'.

The definition is followed in the strategy report by the statement that the University recognises that Information Systems make heavy use of hardware, software and networking facilities and services, but is as much concerned

with the organisation and planning of the institution's use of information as with technology.

The move to a stream in Information Systems of the Computer Science degree in 1995 generated the following definition:

> 'The Information Systems stream is concerned with the relationship of the software system with its users and with its environment, including technical, managerial, organisational, human and social issues.'

Below is the definition, from Avison and Fitzgerald (1995), which we use at present with students on our course within the Information Systems stream. Interestingly, this definition was originally put forward in 1987.

> An Information System is 'a system which assembles, stores, processes and delivers information relevant to an organisation (or to society), in such a way that the information is accessible and useful to those who wish to use it, including managers, staff, clients and citizens. An information system is a human activity (social) system which may or may not involve the use of computer systems.' (Buckingham et al 1987b)

Finally, in September 1995 the UKAIS's Newsletter provided a draft definition of the domain of Information Systems (below) and supported this with a set of ten 'scope of domain/sub areas' of the subject.

> 'The study of information systems and their development is a multi-disciplinary subject and addresses the range of strategic, managerial and operational activities involved in the gathering, processing, storage, distributing and use of information, and its associated technologies in society and organisations.' (UKAIS, Sept 1995)

In spite of the work undertaken in an attempt to define Information Systems, Harry (1994) argues that definitions need to follow our understanding and experience not precede them. He further suggests that the chances of success for a very specific definition of the term 'system' are very limited and defining 'Information Systems' precisely, appears to present the same problem.

We believe this supports the concept of identifying an ethos, rationale or vision of the subject area within which further discussion and learning can take place. The ethos for the new degree at Hertfordshire was drafted in May 1996 as:

> 'The focus of this degree is on information as a resource: what information is needed, by whom, for what outcome, and the engineering of systems to provide it. The UH flavour of engineering should still

come through. Graduates should be able to go out into organisations, assess their information needs at a variety of levels, propose and design systems to meet these needs and be aware of the effects that such systems will have on the organisation as a whole and the individuals who are part of it.'

Specific requirements which differentiate this degree from the current BSc in Computer Science include:

- more focus on information its uses and provision
- more focus on information systems environments and contexts of use
- more focus on ethics of information systems (human, social and legal aspects)
- more focus on commercially oriented computing
- a different slant of systems development and implementation, including the use of higher-level languages and tools
- more focus on interpersonal and communication skills

The courses proposed for this degree are listed to help give a flavour of its content. All Honours students will study eight modules in each of the three taught years. In year 1, Information Systems students will study four courses of 2 modules in length defined as follows:

Information Science Techniques (i),
Systems and Networks 1 (ii),
Programming for Information Systems (iii),
System Requirements (iv).

In year 2, students will study a further four courses of 2 modules as follows:

Design Project for Information Systems (v),
Introduction to Databases (vi),
Business Issues (vii)
Software Quality and Management (viii).

After an industrial placement in year 3, final year courses totalling eight modules, will be chosen from a wide range of 1 or 2 module options but could include courses such as Developing Information Systems Strategies and Ethics of Information Systems.

This ethos or rationale together with the proposed courses come from a **computer science perspective**. The context is set by identifying a vision for the type of graduates we expect, a top down approach. This does not necessarily mean that the scheme will be purely vocational, but only defines the boundaries where the solid foundation of theoretical underpinnings will be required.

The definition and ten sub areas of Information Systems drafted in 1995 (UKAIS) are still being discussed and to date we have not been involved in these discussions. However without information to the contrary, the assumption taken is that each of the ten areas will have equal weighting, and thus provide, in our view, **a business perspective** of Information Systems. We feel this perspective will not produce graduates with a solid enough foundation of how to make things happen, but maybe this is not the rationale intended. The graduate may well still be an Information Systems graduate, but the boundaries of the 'solid foundation' seem to be very different from the University of Hertfordshire's Information Systems graduate (see diagram below).

In overview, we would not argue with any of the areas identified in the UKAIS draft or suggest that areas should not be covered, but there are some topics and areas which we feel could be positively stated in any syllabus for this area. These include:

- user interface and presentation (including the use of business statistics)
- quality, project management, management of change and implementation issues
- identification of organisational information requirements as distinct from system requirements
- backbone infrastructure, networking and security

General discussion of the underpinning areas, their relative weightings and priorities, to support the definition and scope or ethos proposed is ongoing. To further this discussion we outline in Figure 1, a number of general subject areas and core personal skills which we feel should be covered on an Information Systems degree. These are based on our teaching and practical experience, and deliberations over the past five years. These are related to the UKAIS 10 sub areas listed in the UKAIS newsletter of September 1995 (numbered 1 to 10), and against the proposed UH courses (Roman numerals i to viii). From our point of view we see the UKAIS areas grouping at the top towards the business domain generating a business perspective and the UH courses grouping in the lower middle towards a technology domain, arising from our computing perspective.

We pose the following questions. Can Information Systems be a subject area if it holds these two perspectives or does this just show the evolution of the subject area? And should we be

attempting to produce a single perspective covering all of these topics equally or will this just produce a diluted scheme which is too general to be of use?

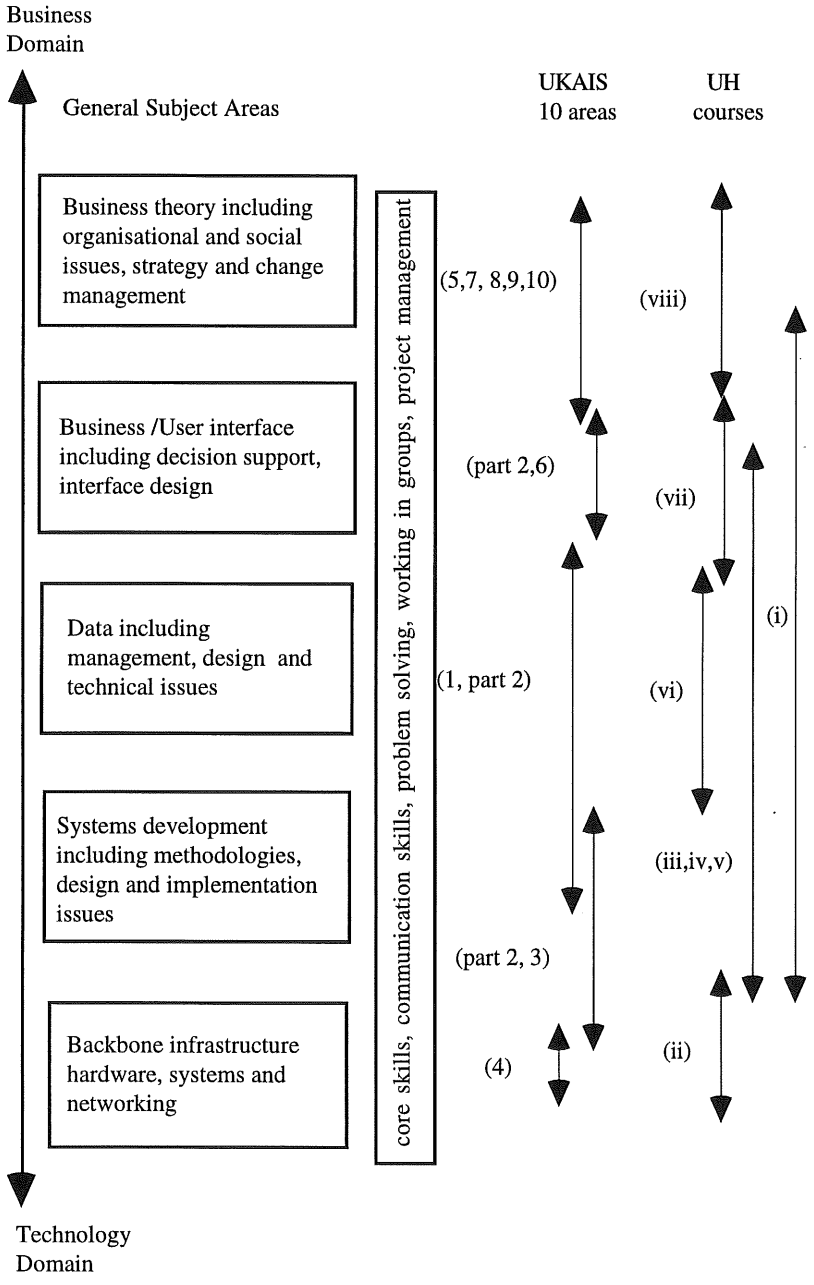

Figure 1

3 Viewpoint: Information Systems in Context

Having proposed possible general subject areas through a discussion of an ethos for the discipline of Information Systems, we believe that a discussion of the context for the teaching of Information Systems should form part of the deliberations.

For Information Systems to support the organisation, the alignment of information systems strategy with business strategy is now seen as essential by both practitioners and academics. Our view is that Information Systems must be positioned within the overall business framework and thus this context, that information systems should arise from a position of business strategy, should underpin the teaching of the subject. The focus of teaching the development and management of Information Systems should not be from an isolated systems position but from the position of the organisation's Information Systems and IT platform. We are not suggesting that this requires a specific course on developing Information Systems strategies for first year undergraduates, rather the key concept that Information Systems should be viewed from a strategic position and that this must be a central foundation for the scheme and should be introduced to undergraduates in the initial stages. Planning for Information Systems and the further issues involved can be introduced at a later stage.

Our view has arisen from our ongoing research and experience gained from teaching such courses as 'Strategic Management and Information Systems', and 'Information Systems Strategies' on the BSc Computer Science degree for the last three years. In outline, these courses have covered: the need for alignment between Information Systems Strategy and Business Strategy; developing an IS/IT Strategy; strategy implementation issues and managing the change process. This view has been supported by our consultancy work using the frameworks, UPQM (Hinton, Tagg and Bennett, 1995) and B•CCD (Bennett et al, 1996) for developing Information Systems Strategies for small and medium enterprises. The lessons learnt from this practical work have been fed back into our teaching by a programme of action research.

Without this foundation we believe that systems will be developed which may well be functionally correct against their specification, but do not meet or facilitate changes in business requirements. This view of the practice has been supported by the OASIG study in 1994 reported by Brackley (1996) which

found that successful projects were characterised by an integrated technology/organisational/human approach to change, with strategic objectives for change being set and reviewed, as well as by the work of Eardley et al (1995) who believe that developing systems without consideration of the future business direction will lead to more legacy systems. We believe that these considerations should also apply to the teaching of the subject area.

Recently interest has been shown by the Information Systems Examination Board (ISEB), an autonomous subsidiary of the BCS for identifying a common syllabus for a certificate in Business/IS/IT strategic planning for practitioners. A certificate would cover areas such as introduction to strategic planning, understanding business strategies, IS strategy principles, potential components of an IS strategy, getting the right IS strategy focus, IS strategy development, IS strategy implementation and review.

This strategic perspective is therefore also relevant to those working in today's organisations and its proposed content is in line with the strategy related courses we run at Hertfordshire.

4 Conclusion

The teaching of Information Systems and the discussion of the syllabus contents are coming under closer scrutiny as the area emerges as a distinct subject. We support the view that academic strengths in both business and computer science can be integrated to provide future Information Systems graduates with the necessary combination of skills. However, we are concerned that combining the business and computer science perspectives of Information Systems could lead to a single perspective which is too general and lacks focus. Representatives from both the perspectives are needed to inform the discussions.

In the light of the difficulties in achieving consensus, this paper concludes that a rationale is more useful than a formal definition of Information Systems. We believe that underlying the students' studies there should be a clear understanding of the need to develop information systems for the strategic benefit of the organisation together with a practical knowledge of how this might be carried out. It will also be necessary to identify professional development programmes to support existing Information Systems practitioners.

In an environment of continuing change and increasing complexity, one thing is certain, the discussion about what constitutes the ideal programme of study for Information Systems students and the nature of the academic support required for them will continue to be keenly debated by all concerned.

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