Experiences of Revalidating the Undergraduate and Postgraduate Courses Within the Information Systems Curricula at University of Westminster, UK

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Information Systems (IS) is probably the most frequently used name for a variety of academic programs focusing on applied information technology, whose curricula is available from a range of schools and university departments. For more than a decade we have successfully run at the University of Westminster, UK, BSc and MSc courses in IS, within our IS department of the Cavendish School of Computer Science. The major developments of curriculum design related to subject content, construction of courses and teaching/learning strategies, has triggered changes in our IS programs which were implemented through the IS course reviews in 2002. This paper addresses the purpose of course reviews within the UK Higher Education (HE) environment, gives a rationale for our curriculum changes, describes the revalidated IS courses at both BSc and MSc levels including our teaching and assessment strategies, and comments on our progress to date.

Keywords: information systems curricula, IS course review, curriculum change.

1. Introduction

The purpose of this paper is twofold:

(a) to document our IS course reviewing practices and to analyse issues arising from the implementation of reviewed programs;

(b) to illustrate our quality processes for introduction, maintenance and renewal of IS courses and to reflect on our experiences of IS curricula changes that might interest academic environments outside the UK HE.

Section 2 gives the context, purpose and process of the course review, section 3 analyses the rationale of our curriculum changes, sections 4 and 5 cover our reviewed BSc and MSc courses respectively, section 6 addresses our new teaching and assessment strategies and section 7 concludes with our progress to date.

2. The Context, Purpose and Process of the Course Review

The University of Westminster, in common with other UK Universities, operates quality processes for the introduction, maintenance and renewal of its courses [1]. The national context in which these processes are required is the audited adherence to best practice, as defined by the UK Quality Assurance Agency [2] in their Code of Practice for the Assurance of Academic Quality and Standards in Higher Education [3], on behalf of the Higher Education Funding Council of England [4], whose statutory duty is the allocation of public funding for the English Universities. Scottish/Irish/Welsh Universities operate in a similar, but not identical context.

The IS courses considered here have evolved over many years. As successful and mature programmes they have achieved "validation without time limit" which entails, under the University's regulations, a periodic review which

must occur at least every six years. A review offers the opportunity to critically evaluate the course's performance and to make significant changes leading to its license to continue. The independent Review Panel comprises senior university academics, experienced in quality assurance, and subject specialists from other UK universities. The long-standing BSc (Hons) Information Systems Engineering and MSc Information Systems Design were reviewed in 2002 and significantly updated as the now running BSc Information Systems and MSc Information Systems.

In the five years since their last review there have been major developments in all aspects of curriculum design: (i) in the subject content, (ii) in how we construct a course, (iii) in how and what we expect students to learn, and (iv) in how we communicate what distinguishes any particular course.

In terms of the subject content the nature of software systems development has been transformed through the sheer weight of most organisations now having some sort of electronic information system, the movement to higher level development tools, the broadening of the range of electronic media and the integration of processing with communication that has made possible distributed, virtual, or remote IS with all the new business possibilities that these create.

The National Committee of Inquiry into Higher Education [5] chaired by Sir Ron Dearing (reported in July 1997), has had a profound effect on all aspects of current UK Universities' practice. The recommendations which continue to be implemented include, most notably:

- a greater emphasis on teaching quality,
- an explicit rationale for a student's skills development,
- more effective partnership with Industry,
- a clear statement of a course's intended learning outcomes with a shift from what topics are taught to what students can do practically and intellectually,
- a standard framework for all University qualifications and a progressive development of standard discipline benchmarks with which to reference any particular course's content and expected outcomes.

Successive UK governments continue to set targets of widening participation, crudely: 50population having had a significant higher education experience by 2010 at least [6]. Hence the importance of students' employability skills development and the requirement for UK HE to actively engage with this.

3. The Rationale for Curriculum Change

The purpose of an IS, as defined by the British Computer Society [7] , is to collect, process and store data, and distribute information for a defined purpose or application using computing technology. Over a period of forty years, IS has been a continuously changing field that has moved ***from*** the mainframes maintained by large centrally organized data processing departments systematizing the routine manipulation of simple data records with the weekly turnaround of basic reporting, ***to*** globally distributed systems that generate multimedia information, integrated with key business functions for the purpose of enhancing competitive advantage, instantaneously.

It is no longer sufficient to think of how engineering principles of analysis, design, construction and management can be brought to bear to develop IS from scratch. When the precursor courses, BSc(Hons) Information Systems Engineering and MSc in Information Systems Design were validated in 1992, it was still considered desirable to train practitioners in a structured systems methodology, SSADM [8] , in particular. The thrust of the new courses is to give students a clearer perspective of the current nature and practice of IS and to prepare them for work in a messier, more complicated and altogether more challenging field. Whilst the teaching of classic systems analysis technique [9] has its place in honing students modelling skills and whilst structured methods [8,9,10] can provide a useful framework with which to compare and contrast other approaches, these must be embedded in a broader conceptualistion of how IS activities are actually currently undertaken. Students will need to be more knowledgeable

about, and critically reflective of, current practices.

Changes have also occurred in students' preparedness to undertake such conceptualizing of a complex world. There is evidence that without the background in symbolic manipulation and geometric representation that characterized a so-called "classical education" students find the various types of information modelling taxing and sometimes over- demanding. This course intends to attack this issue by making the acquisition of reliable modelling skills [11] a priority. To aid this, explicit use of a modelling language has been made. Although Unified Modelling Language (UML) [12] has to be used, in the first instance, the courses do not seek to train students as UML experts but through this will attempt to secure their modelling competence, whilst giving them a medium through which concepts of "object-oriented", "relational", "process" etc. can be more readily assimilated and communicated. An intention is to build on students' increased willingness to express ideas and opinions about the world and enhance the rigour and precision of their expression. Undoubtedly students are being attracted to work in Information Technology because of their many years of experience of using a PC and their observation of the dominating influence of the computer on society without wanting to engage exclusively in the activity of computer programming. Nevertheless, sufficient background in this, at level 1 within the undergraduate course will still be required, but unless students want to develop their programming skills further by choosing those options, the emphasis will be on developing students as secure users of higher level software: case tools, development environments and components libraries.

The undergraduate course name of BSc (Hons) Information Systems Engineering was changed to BSc (Hons) Information Systems for several reasons. "Information Systems" is now established as a discipline in its own right, as evidenced by its growing range of academic journals. Although engineering practice is a central activity, the field also embraces other practice which can form a highly appropriate vehicle for HE. Our aim is that all our students should have a solid foundation in the relevant technologies but will then build on this in different ways, some, properly engineering, others, more discursive. For example, our expectation is that some students will focus on constructing sound, literate, and scholarly argument as to the technological solution of a particular information problem rather than generating the technology. This will prepare our students for a wider range of employment that exists in *information systems*.

4. The BSc (Hons) Information Systems

(a) Aims and Objectives

The principal ***aims*** are to develop students' competences so that they can either work effectively as IS professionals or pursue further more specialized academic study. The detailed ***objectives*** of the course are that students completing the courses will be able to:

- describe accurately current trends in IS development;
- comprehend and illustrate key IS concepts;
- analyse the environmental issues that influence IS development;
- evaluate critically contending IS development strategies and practices;
- select and apply appropriate technology to deliver components of IS.

To achieve these objectives students will have established competences in:

- information modelling
- logical and quantitative analysis
- appropriate information technology: tools, environments and techniques
- literature search and report writing
- presentation

In placing the BSc(Hons) IS in Computing curricula the following key words from the *QAA Subject Benchmark in Computing Body of Knowledge* [13] apply: architecture; computer-based systems; computer networks; databases; data structures and algorithms; e-commerce;

HCI; information retrieval; information systems; interoperability; multimedia; operating systems; professionalism; programming; systems analysis and design; web-based computing.

(b) The Content

The BSc Information Systems is a fully modular programme; all modules are worth 15 credits and project is worth 30 credits. This indicates an expected total work load for the student of 150 hours per module. Students can actually take up to five years to complete their programme but the normal expectation is a full-time student attempting 120 credits each year for three years. The modules have progressively challenging learning outcomes set at three levels through the 3 year programme. These levels are labelled 4,5,6, which fits into the UK National Qualifications Framework [14] for post-16 education. The learning outcomes for the modules are expressed appropriate to the level according a nomenclature system of "level descriptors" widely adhered to in the UK , known as SEEC (South East England Consortium) [15].

The typical pattern of study for full-time students, showing in which semesters modules appear, over the three years is shown in Table 1. All students wishing to pass with Honours must undertake a level 6 project, which is equivalent to two level 6 modules. The project introduces the student to detailed in depth study of an application area and to the writing of a critical report on the work carried out. It is monitored by (i) an initial statement of the project objectives, (ii) a mid-year summary of the work in progress, (iii) submission of the final report and (iv) a viva session required only if the staff supervisor/moderator feel it is necessary.

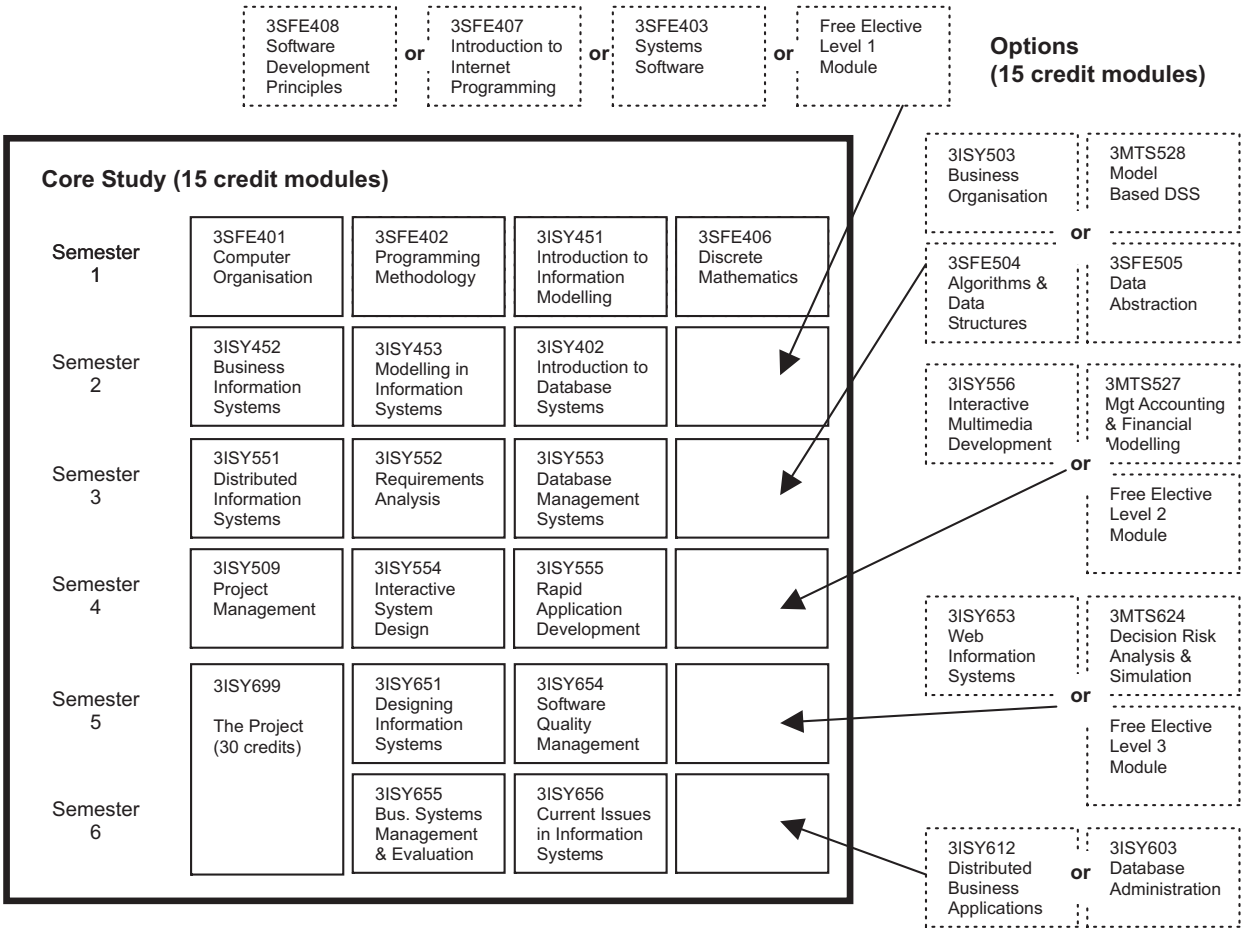

Table 1. The typical pattern of study for full-time students, showing in which semesters BSc modules appear, over the three years.

5. MSc Information Systems

(a) Aims and Objectives

The course was designed with a high degree of relevance to industry's needs and as such (i) it is a practitioner-oriented, (ii) provides highly marketable skills relevant to the functioning of corporate IS divisions and information centres. Its main ***objective*** is to develop students' competences so that they can either work effectively as IS professionals that have a strong awareness of the environment in which they operate and/or be able to pursue research oriented academic study. The course is ***aimed*** at graduates and/or to practitioners who want to enhance their professional abilities & career development and/or deepen their understanding of state of the art and emerging technologies in IS. The graduates should be capable of:

- thinking in a systematic and methodological way about IS issues;
- utilising their problem solving skills and their knowledge of various techniques / tools / methods, to deliver solutions to problems associated with IS practices;
- creating models and deploying appropriate tools to implement software artefacts that satisfy specified requirements and test their use in a target domain;
- studying the context within which the design of IS takes place, i.e. as part of the range of strategic/managerial/operational activities involved in the gathering, processing, storage and distribution of information;
- critically evaluating alternative design and implementation strategies and the impact of the emerging technologies advances on delivering solution within IS practices;
- independent in-depth analysis of a chosen topic making use of information resources outside a teaching environment. In placing the MSc in IS in Computing curricula the same keywords from the *QAA Subject Benchmark in Computing Body of Knowledge* [13] apply as for the BSC IS course.

(b) The Content

The MSc course is offered in three modes: part time day, part time evening and full time. Its modular nature allows students to adopt a flexible mode of attendance to cater for family, work and financial circumstances. Students have the option to switch between part-time and full-time modes to suit varying circumstances, up to a maximum period of registration specified by University regulations. The structure of the course is shown in Table 2 (the credit value for each module is given in brackets) To complete the programme students must take 6 taught modules and the project module:

- *Information Systems Practices (ISP)* introduces IS in business environments and in society, introduces the object-oriented paradigm and evaluates its effect on current and future IS development practices.
- *Requirements Analysis (RA)* covers modelling practices for capturing, validating, specifying and managing the requirements and focuses on successes/failures in IS projects with emphasis on the role of requirement analysis in reducing risks.
- *System Design (SD)* explores the role and applicability of component-based modelling and the relevant industry-standard platforms available for the development process. Legacy systems, their interoperability and connectivity with new and emerging applications in IS are also addressed.

	Semester 1	Semester 2
Year 1	Information Systems Practices (15) Requirements Analysis (15)	System Design (15) Information Systems Development Methodologies (15) (or Free Elective Module)
Year 2	Corporate Systems and Data Management (15)	Emerging Technologies & Systems (15)
		Project Module (30)

Table 2. The structure and content of the MSc course.

- *Corporate Systems and Data Management (CSDM)* evaluates technologies for capturing Corporate Data, their components and functionality. The evolution of Database Management Systems is presented and discussed, along with database languages, the functionality of these languages and current technological trends.
- *Emerging Technologies & Systems (ETS)* deals with understanding of client/server IS, the implementation of interfaces, and the impact of web-based systems on the way data is manipulated/ managed
- *Information Systems Development Methodologies (ISDM)* gives a historical review of methodologies for IS development and explores comparison frameworks for choosing a suitable development process across various problem/business domains.
- The *Project Module* emphasises the experience of planning and bringing to fruition a major piece of individual work, the scope of which is not only to complete it in a professional manner, but also to place the work into both its academic and current industrial practice contexts.

ISDM is the only elective module (replaceable with any other postgraduate elective module, which might better suit their individual needs and expectations).

The project module plays a unifying role within the course and rewards individual inventiveness and application of effort. It is the equivalent of three months full-time work: the planning and initial analysis phases of the project, which are carried out during semester-time, are underpinned by a series of seminars / workshops in order to clarify and discuss the various project deliverables and to teach students research methods and project management skills that will enable them to engage in a research activity. The main body of the work is undertaken over the summer vacation period.

6. Teaching and Assessment Strategy for the BSC and MSc Level

Our teaching and learning strategy is underpinned by the principle that (i) students are more likely to come to an understanding of a subject if they are immersed in it, i.e. if they practise it rather than being told about it and that (ii) students should be able to take a truly critical approach to the IS field in order to tackle unfamiliar problems as they arise. To achieve these we use:

- case studies to improve students' analytical and problem solving skills (undertaken either individually or in groups thereby encouraging teamwork);
- tools such as CASE and application development environments;
- presentations from speakers with industrial experience so that students can see how the taught material is applied in industry;
- presentation and academic writing as part of their assessment, through which transferable skills are developed;
- group work to develop skills which will enable students to work effectively in a professional environment;
- research methods involving the use of library and internet sources to develop students research and analysis skills.

The general principles governing assessment of both courses are that (i)variety of assessment methods should be used to supplement formal examinations, (ii) an appropriate assessment method should be selected for the particular learning outcome being assessed, and (iii) coursework assessments should be considered as part of the learning process, with appropriate and timely feedback being given.

All modules require the students to carry out some form of practical work to exercise and develop the skills taught in the module. The total weighting allocated to coursework assessment will depending on the nature of the particular module and the learning outcomes. Although the product of a piece of coursework is used for assessment purposes (summative) to determine the extent to which a student has achieved a learning outcome, the process of undertaking ***the coursework is viewed as an important contribution to the learning process*** (formative) as is the feedback given on the quality of the product. Coursework assessments therefore form an essential part of the total assessment for each module. Consequently, the assessment of

taught modules in the programmes may be entirely through coursework. The relative weightings of the examination and coursework components depend on the nature of the subject, the characteristics of the learning outcomes being assessed, and the extent to which they correspond to assessable practical skills.

7. Progress to Date

It is too early to produce a coherent evaluation of changes implemented during the review of both courses. Consequently, we are not able to write any comprehensive conclusions. We should be able to conduct an adequate assessment of our revalidation efforts after at least two consecutive years of running both courses. Hence, it remains to be seen if we can repeat the huge success that our courses enjoyed steadily throughout the 90s.

In our final section we choose to address a few issues from both levels in order to illustrate our current concerns and progress to date.

(a) BSc (Hons) IS

The BSc (Hons) Information Systems admitted 39 students into its first year in October 2002 with a further 80 students on the substantially overlapping programme BSc (Hons) Information Systems with Business Management. Students on related programmes in Software Engineering, Computing and Internet Computing can transfer into IS at various stages depending on whether they have opted for the Modelling in IS (MinIS) module which is key to the course's rationale. In this module students are provided with a framework for developing the intellectual skills required for effective modelling and the language for communicating this activity to other practitioners. The vehicle for this is a modelling language, through which IS development practice across various problem domains is demonstrated. On completion of this module students will be able to:

- Describe coherently the nature and purpose of modelling in IS
- Explain the Object Oriented paradigm
- Use reliably the basic structural and modelling elements of UML
- Construct a useful information model from a problem domain

Students have already been introduced to the role of modelling within IS activity in Introduction to Information Modelling and will go on to learn the use of a CASE tool like Select Enterprise or Rational Rose in Requirements Analysis.

The 120 students currently studying the MinIS module present a fairly indicative sample of students who will pursue an IT related career. Even excluding those (perhaps as many as 30%) who are not sufficiently motivated to complete their degree programme the range of ability exhibited by the group presents a demanding pedagogical challenge. With the UK's widening participation agenda this challenge will become more demanding.

Tutorial work has addressed basic limitations in students' grammatical knowledge:

Q. In UML, *use case* names are normally of the form:

a <active verb> <noun or noun phrase>

b <active verb>

c <noun>

d <adjective> <noun>

e <verb> <adverb>

and forced them to read critically and paraphrase challenging text:

Q. The pioneer psychologist, William James, in his "World of Sculpture" did not say:

a "The mind, in short, works on the data it receives very much as a sculptor works on his block of stone."

b ". . . the world of each of us, howsoever different our several views of it maybe, all lay embedded in the primordial chaos of sensations. . ."

c ". . . the world we feel and live in will be that which . . . we . . . have extricated. . ."

d ". . . the extracted ideas are like chippings, to be discarded. . ."

e "How different must be the worlds in the consciousness of ant, cuttle-fish or crab!"

Students are required to analyse interview transcripts in order to elicit characteristics of a system which they model using *use case* and *class*

diagrams. Working in groups of 5 they have to produce a portfolio of models for a given idealised case study; they reflect on the real world use of their modelling. What is evident from this approach is the core role of students' skills in and awareness of language. After initial surprise (and in some cases upset) it seems, so far, that such explicit addressing of these skills in such a new and socially interesting context is welcomed. In fact, the visual modelling language UML becomes a structured pedagogical tool for challenging students' accuracy and precision in formulating and communicating representations in general. It is too early to say how successful this is for the group as a whole but, certainly, there are about 20 students who now locate their interest and talents within *information systems* as opposed to *software engineering* or *business management*. This process of recognition of the level at which the student wants to work between computer and user and the way they want to work between technical programming and discursive description becomes central in students' identifying their career aspirations and employment prospects.

(b) MSc IS

The MSc course had its first intake in October 2002 and currently all the newly introduced modules are running for the first time. Although it is difficult to measure the success or failure of the new course so early, the course team has:

1. identified a number of issues that need further discussion and possible corrective action (e.g. changes in program planning),
2. analysed students feedback in order to address problems (e.g. overloaded assessment/course material and lack of some modules) and possible solutions.

We briefly overview the following three issues:

The Course Program Planning, i.e. the way the modules are offered for part time students, which was based on the following:

I. The database core modules (CSDM & ETS) might have a too demanding technical content for the expected cohort of our postgraduate part time students and might be more appropriately delivered in the 2nd year;

II. The ETS module should run after the CSDM module.

III. The ISP module has an introductory nature and consequently must be taken as early as possible;

IV. The SD module must follow the RA module.

This has resulted in elective module(s) being offered in first year, semester 2. There have been two immediate implications:

1. Part time students have had to chose an elective subject too early, i.e. before they have a more comprehensive understanding of the IS field (from the students' feedback)
2. Part time students were restricted from switching between part and full time modes in the 2nd semester of their studies (see II).

One obvious solution of either of the above problems would be to offer the CDSM database module to year 1 part time students. However, this will render the ISP module redundant, because its introductory content will become immaterial to part time students. This problem has to be resolved by the course team as soon as possible.

Overload of coursework and material covered has been identified through students' feedback and teaching team observations. We feel that our modules are overstretched with the intended teaching topics, which has resulted in more demanding assessment. A particular problem has been identified in the first semester, when the RA core module requires

- delivery in a very short period of time of two pieces of time consuming coursework of completely different natures ("individual research from industry and academia, finalised in the form of academic writing" vs. "modelling in IS and using the UML"), and working in different modes (individual vs. group work) and
- summarising all lectures and individually researched topics in a comprehensive exam.

We believe that some of these problems (i) might be related to this year's cohort and (ii) may have been caused by our overzealousness to introduce practical coursework when modules were designed. We will discuss both problems within the course team in September 2003.

The choice of modules studied was addressed in the students' feedback. They pointed out the

lack of HCI, multimedia modules, and wider coverage of project management modules in the syllabus. However, offering a wider variety of modules imposes two linked problems:

I. the overarching postgraduate framework imposes practical restriction to the modules student can take if all 'wanted' modules are offered only as electives

II. finding sufficient resources to run elective modules especially when they are to be taken by a smaller number of students.

The solution may lie in the development of a ***collection of modules*** that can be grouped into a number of different MSc courses. This will result in a wider variety of modules, and at the same time keep the overheads minimal. We are actively working on the generation of such modules hoping that they can be offered in 2004.

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