

DEVELOPING NEW MODEL INFORMATION SYSTEMS CURRICULA: FROM CONSTRUCTIVIST TO ANALYTICAL.

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ABSTRACT

This paper develops an alternative information systems curriculum. It suggests that there has been a significant shift within information technology departments in industry away from a focus on the IT artefact and its construction towards a focus on delivering a service involving the provision of technology, applications and information to the organisation. This is characterised as a shift from a constructivist philosophy to an analytical philosophy. The paper discusses the changes in the structure and activities of IT departments. It then considers why those changes are occurring and highlights the ubiquitous, global, commoditised and collaborative nature of information technology. A new information systems skill-set is defined, and the gap between that industry based skill-set is explored. This leads to a proposal for a service-oriented information systems curricula.

Keywords: information systems curricula, service-oriented.

I. INTRODUCTION

The primary role of undergraduate education in information systems is to prepare students for roles in organisations which will draw on the foundational concepts and skills learnt at college or university. Unlike, say, history or philosophy, it is very likely that the information systems graduate's employment will directly involve using knowledge gained as an undergraduate. Information systems is an interdisciplinary, vocational subject which is focused on the effective use of people and technology to deliver the complex information infrastructure which organisations rely on.

It is therefore important that the knowledge, skills and values disseminated in academic studies aligns with those practiced and preached within industry, within IT departments and by professional associations. Maintaining this alignment is a critical part of the educational process and a driver for curriculum development.

This is not to say that academics should slavishly follow industry trends and fads. For, example, the rush by academics to endorse business process re-engineering which resulted in the uncritical adoption of industry rhetoric in academic literature benefited neither industry nor academia. The uncritical

adoption of industry fads by information systems academics does a disservice to both industry and undergraduate information systems students. Industry trends and concepts must be critically challenged by information systems researchers. More long-lasting theoretical frameworks must be developed against which industry wisdom can be evaluated. Alignment between universities and industry must involve a flow of ideas both ways. Undergraduate curricula should be reflecting the latest technical and managerial progress in industry. Case studies should reflect the best and the worst in industry; not providing a superficial analysis of success but dissolving away the rhetoric and hype to expose the underlying philosophies and social context behind the information system development, implementation and use. Equally industry should be willing to stop and reflect on practice in the light of critical analysis and the promulgation of theoretical concepts by academics.

The result of such alignment should be the nurturing of information systems graduates who are industry-ready and prepared to contribute to information systems in a way that is immediate and relevant but questioning and critical. This alignment is dynamic and requires vigilance by information systems teachers. New IT industry trends must be rapidly assimilated and curricula and theory developed to critically analyse the trends and suitably prepare the students.

In order to encourage alignment, this paper discusses the current trends in IT functions within organisations and contrasts those trends with current information systems curricula. I argue that information system curricula had drifted away from industry practice and significant realignment is needed. Crucially, I reflect on the shift in industry information systems departments away from a constructivist focus on the IT artefact towards an analytical focus on the provision of value-creating services to support the organisation's information needs.

Firstly, I discuss the change in IT organisations and characterise the typical IT department within an organisation. Next I develop the context for the changing characteristics of an IT organisation and explain the consequences for the discipline of information systems. Then I develop a picture of the information skills needed within organisations. This leads to a review of current undergraduate information systems curricula and represented within IS2002 and a sample of United Kingdom universities. Based on this discussion I develop an alternative information systems curriculum, using ideas and syllabus which has been developed and accredited for a new BSc in Information and Communications Technology (ICT) starting in De Montfort University's School of Computing in 2007. I conclude by considering the future direction of information system curricula.

As part of the process of developing new curricula at De Montfort University, industrial input was sought. Hence, in developing the BSc in ICT, discussions were held with senior IT managers in a range of organisations. Comments from these managers are used here to illustrate points concerning IT functions and the skills required in IT functions.

II. IT FUNCTIONS IN ORGANISATIONS

The prime focus of IT in a typical organisation is on delivering a service. Along with other support functions such as finance, marketing, human resources and procurement it is a business-oriented function, undertaking both strategic and operational activities. Strategically, it is concerned with using information and information technology to drive the company forward, exploiting new technologies and providing new approaches to using information for competitive and efficiency gains. Operationally, it is concerned with the efficient day-to-day delivery of services.

This focus is achieved by harnessing internal and external resources and effectively planning and controlling their use. This involves developing internal service skills and buying services and technology from the external market. Infrastructure is created and managed, and the information flows through that infrastructure are supported.

The structure of a typical IT department, a UK City Council, is described below:

- **Customer Services** operates a help desk for internal customers. It looks after the front office activities and directs requests to technical services.
- **Technical Services** maintains telephony and network systems. It also includes an end-user computing team which looks after PC problems and include network consultants. Within technical services, a separate systems support team looks after the AS/400 mainframes and Unix systems for Social Services and Education.
- **The Operations Team** supervises the production of reports and outputs from the mainframes and ensures 24 hours working of key production systems.
- **Development Services** maintains and enhances packages using MS-Access, Oracle, RPG and DB2-AS/400. Their main emphasis is on financial management, housing benefit and education systems.
- **Corporate Projects Team** includes two business analysts and IT trainers.
- **Strategic Support** manages the council's web sites as well as providing IT consultancy.
- **IT Contracts and Security** involves two people, one dealing with the data protection act and security, the other administering IT contracts.

A similar local county council providing a wide range of services to over a million people, has an IT service department of 180 staff. It supports both mainframe and distributed systems. Split into technical services, development services and strategy services, it has a buy-only policy, limiting development to the maintenance of essential legacy systems. It displays a number of

characteristics which are typical of current IT applications and reflect a number of changes that have occurred over recent years.

Customer service focus. IT departments are increasingly focusing on the internal customer. Customer needs are being explored. Marketing strategies are being adopted such that previously silent IT departments are now actively marketing their services. Customer feedback is being sought, service quality addressed and results reported back to senior management, possibly as part of a balanced scorecard.

Reliance on proprietary software. Many IT departments no longer develop their own software. In UK hospitals, for example, software is procured, not internally built as a matter of policy. In local government, the policy of buying is prevalent:

In-house development is diminishing and integration is becoming key. My observation on this though would be that purchased/integrated solutions rarely meet all user requirements so there is usually a need for prioritisation, persuasion and negotiation. ICT Manager, County Council

The maturity of industry-specific software markets is such that there is no justification for the self-build of software. Where development does take place within IT departments it is likely to be driven by the need to maintain and enhance existing legacy systems. This is the case at the City council in the example above where development activities centre round legacy RPG and Oracle systems previously written in-house. Such a movement away from internal development means that processes are no longer designed around the software development lifecycle and are less likely to be project-driven. Furthermore, the demands of competitive markets no longer allow the luxury of long development times:

Most companies have shifted from an internal development Dept. to a strategy of 'Buy not Build' talking to lots of people from different organisations, Our bank is certainly not alone. The market and the business environment changes much faster now than ever before. It is common place that when companies identify a business opportunity within the market place then within 3-4 months other players will have launched competitive products/services or replicated them and then compete on price. Consequently, organisations are finding a 'buy not build' strategy is cheaper and more responsive as the package systems generally are more functionally rich as a result of their history and/or more parameter driven which means more flexibility. IT Business Relationship Manager, UK Retail Bank.

Increased Outsourcing. Outsourcing aspects of IT becomes the norm in IT departments. Software support is provided by the software vendors. Network maintenance is often provided by specialist providers. Large applications requirements, for example, the provision of enterprise resource planning systems by application service providers, managed externally. In large organisations, service desk functions may be provided by outsourcers. This

trend shifts the skills requirements in the IT department away from the more technical needs to the needs of contract and relationship management.

Increased emphasis on business alignment. A focus on alignment has become a core theme of IT departments not only at the strategic level, but also at the operational level. The alignment of service operations with organisational needs is often addressed through the service level agreements (SLAs). The development and maintenance of SLAs is an increasingly important activity in IT departments. Similarly, the development of aligned strategy and the strengthening of connections between IT and an organisation's senior executive is taking more IT staff time. Business understanding is now seen as being as important as technical competence.

Operational Service Focus. Many IT departments have woken up to the fact that they provide a service and cannot afford to be solely focused on technical concerns. There has been an increasing emphasis on service standards. IT departments are concentrating on service discipline, increasing the quality of interactions with the service desk, developing strategies and procedures for incident management, problem management and availability management. In the UK, the learning of procedural skills described in the Information Technology Infrastructure (ITIL) library has become popular. British standards in IT service management, BS15000, have been developed. In 2005, these evolved into the international standards, ISO20000. In the US, Cobit IT management standards have spread amongst companies and the capability maturity model has developed a service focus.

All this points to an evolving IT market where the construction of new computer systems becomes a minority, specialist activity and the attention of IT professionals shifts from the contents of the technology to the context of the business. The focus of interest is then on the creative application of information technologies to support the business. This trend away from constructing information systems towards their application is not only apparent at the business level, but also reflected in the interests of college and schools students. Hence, trends point away from a constructivist focus to an applied, analytical and creative focus.

III. CONTEXTS FOR THE CHANGING IT PROFESSION

In considering why the nature of IT in organisations is changing, and indeed, why college students are turning away from computer science, we need to pan out and examine trends and influences in IT. A wide variety of factors may be influencing the changing IT professions, but some major themes can be identified. IT within organisations may be described as ubiquitous, commoditised, global and collaborative.

UBIQUITOUS

ICT has become part of everyday life. An increasing percentage of the UK population has access to broadband Internet. Internet shopping has become

the norm. Email is an established part of everyday life. Programming concepts are taught in schools. Primary school children learn to use ICT to achieve learning goals through using word processors, presentation packages, and teaching programs. The Internet becomes the preferred source of information. Furthermore computer applications cover most aspects of everyday life. Digital cameras and MP3 players dominate photography and music. Satellite navigation becomes common in cars. Hence in any organisation the presence of IT is considered the norm and not the domain of the specialist. IT is then embedded in the organisation and supported as part of the infrastructure. Indeed in some organisations such as the United Kingdom Hydrographic Office IT services are considered equal with human resources, training, and site services. Hence service requests to any of these support services are made through the same service desk and IT is seen as part of the general organisational infrastructure.

COMMODITISED

Since the '70s and '80s there has been an emphasis on the programming and construction of bespoke systems within organisations. This focus fed through to computer science education producing a focus on the construction of software. In the 21st century ICT is a mature industry in which both the artefacts and the services are commodities, bought and sold on a market. Organisations are less likely to develop software for even the most complex applications. ERPs enshrine the basic business processes and can be bought as packages. Specialist software houses produce niche applications for specific industries. The development of new business applications has become a minority industry. For a majority of organisations, the focus is on buying the appropriate packages and components to meet the organisations ICT needs.

Hence the IT departments focus is on procuring and employing components rather than in-house development. The important function within ICT is one of technically evaluating, mustering and deploying resources based on what is available in the market. Where new applications are required, even development is more likely to be centred on the assembly of components. For some IT departments a move to service-oriented architecture increases the focus on service provision. Even at the development level, software components are seen as the servants of business services delivered dynamically within the organisation. The software developer must think in service terms, defining service level agreements which can be fulfilled by an aggregation of software components.

GLOBAL

The rise of the Internet has changed the way companies communicate and extended global markets, global value chains and global technology. The use of the web creates a more outward looking organisation, focusing on links with customers and suppliers through web applications. The Internet begins to behave as a global supercomputer enabling ICT departments to draw on

resources, ideas and applications worldwide. Even more significant for ICT and ICT education is the rise of offshore outsourcing of software development and call centre activities. Software products may be built in Russia, India or China and transferred over the Internet. If software is developed overseas, the skills required even in a US software house shift towards specification, testing and contract management. Global issues will now affect where software is procured from and how it is supported.

The forward thinking 21st Century internal IT Department should no longer be focused the line management structures required to support internal IT development work. There has been a huge outflow of this type of work over recent years to specialised systems integration providers who can benefit from economies of scale and global sourcing to bring down the costs associated with bespoke application development. These organisations now use low cost, high quality application development resources located in India, South America, the Far East etc. Alongside this there has also been a dramatic shift in the use of package based systems as opposed to bespoke development even in some of the more traditional vertical markets such as Telecoms, Financial Services, Healthcare, Public Services etc where major bespoke development and armies of in-house development resources were the norm. IT Consultant

COLLABORATIVE

The development of ICT within an organisation is much more collaborative and involves the ICT department looking outwards to connections with suppliers and customers. Hence the requirements for the provision of ICT in an organisation cannot be parochial. Similarly, the development, deployment and support of ICT involve collaboration with a number of companies. Sometimes this will involve extensive outsourcing and hence a new focus on contract management. IT vendors now take a wider and more service oriented view of business and the support of customers. Collaboration is promoted by the connectivity of the Internet. Ideas, systems and software can easily be disseminated.

This collaborative focus requires a great attention to the connectivity of processes and platforms. Business processes must connect across departments and between organisations. Connectivity must work at the business, technical and cultural level. Collaboration will also increase the importance of standards. Standards become key for the effective flow of information. Standards for information exchange based on XML, standards for service based on ITIL, standards for auditing based on COSO all support connectivity and collaboration. Furthermore collaboration requires good relationship management between the business collaborators.

I believe that the changing nature of ICT in organisations, driven by a variety of dynamic contextual factors gives rise to a need for an information systems

curricula that is significantly different from that currently offered by most information systems department. An emphasis on the systems development life cycle, and the low-level programming and construction of systems in a Greenfield environment is inappropriate for a majority of information system practitioners. A major shift is needed in the focus of information systems away from building the artefact to deploying and integrating the artefact into a business context. The next section explores the requirements of a new information systems curricula.

IV. DEFINING THE NEW INFORMATION SYSTEMS SKILLSET

The evolving nature of ICT in organisations points to an evolving set of skills. These skills will be more towards analysing the role of IT in the organisation. There should be an increasing emphasis on social informatics, on business analysis and on analysing IT usage in the organisation. This will involve a shift from the IT artefact and its construction to a focus on the IT environment and its analysis. Table 1 contrasts the characteristics of a current constructivist curricula with an analytical curricula.

Constructivist	Analytical
Product focus	Service focus
Moves from artefact to organisation	Moves from organisation to artefact's roles
Stand-alone software	Integrated systems
Discrete projects preferred	Continuous review preferred
Build	Deploy
Restricted convergent focus on single application.	Holistic divergent view of whole organisation and systems
Technology focus	Customer focus

This section explores the evolving demand from the IT profession and IT departments for skills in graduates. Comment elicited from industry during the development of the BSc in Information and Communication Technology, together with developments within IT professional organisations and government-sponsored organisations point to a widening set of skills needed by the information systems graduate.

A move away from the artefact and its programming will result in a need for a wider curricula providing a greater range of skills and a more rounded information systems education. That wider curricula should include:

- Understanding services,
- Evaluation skills,
- Relationship building skills,
- IT market knowledge,
- Understanding marketing concepts,
- Understanding information flows,
- Studying alignment issues,

- Systems thinking and holistic thinking,
- Understanding and applying standards,
- Understanding IT technical platforms,
- Understanding global issues,
- Understanding IT governance and operations,'
- Understanding design and design science including requirements production and inquiry methods,
- Understanding professional and ethical issues,
- Understanding the software manufacturing process,
- Understanding service-oriented and component-based computing,'
- Implementation skills,
- Understanding information systems evolution,
- Social issues, social context and social informatics.

It is not enough for the information systems student to focus solely on building the information system, particularly since its construction is effectively the smallest part of its lifecycle in comparison with its implementation and evolution. A broader set of skills is required together with a wider understanding of context. This evolved skills set is reflected in the concerns of IT professionals as to what they expect of their recruits.

Programming and development is taking a back-seat role in comparison with the need to deliver a service:

This means that the demand for the traditional I.T. specialist programmer/developer has shifted to people that can understand the flexibility of the system, the process it supports and can communicate to the business users in a way that it can be exploited therefore, we now actively recruit people which can design and document business processes as well as those skills around service delivery, service management, business analysis, project management, planning etc. I would also add to your list Supplier Management, fault management, process design as well as specialist testers who are highly skilled in automated testing tools so that new versions of systems can be tested quickly and efficiently. We now actively develop our people to analyse release notes to understand changes to interfaces but also where we may have to changes to business processes. Which then require trainers to develop and deliver business process training as well as system knowledge.

Supplier Management is a key skill which we are now developing in order to leverage value from our suppliers, we treat and manage our suppliers differently depending on if they are a strategic partner or supplier.

The in house technical skills centred very much around infrastructure support and development, database administration, systems integration using middleware products which have been purchased or website design and development.

I would also give some thought the generic skills like team work, communication, continuous improvement, taking responsibility, judgement and decision making, customer focus, planning and organising, and understanding people. Like many other companies we now select people based on their values as we can train and give people the skills easily but it's harder to change people's attitudes. IT Business Relationship manager, Building society.

A result of the increasing outsourcing, both in user organisations and IT companies is a need for skills in supplier management, co-ordination and integration of systems and services. Information system professionals are, I would suggest, more likely to be involved in requirements specification, procuring and implementing in the context of a service environment, than as part of developing a new information system.

The in-house IT Department is now shrinking down to a core of highly skilled, IT savvy business managers and industry specific business analysts who are able to successfully bridge the gap between business issues & technology based solutions. At the heart of this is a need to focus on the following disciplines:

- *Service Management*
- *Supplier Management*
- *Project Management*
- *Business Analysis*
- *Management of Change*
- *IT Strategy*
- *Portfolio Management*
- *Business case development*
- *Benefits management*

The internal IT Department is now becoming the Service Integrator, bringing together an understanding of the technology needs of the business and providing for this through a range of commercial relationships with external service providers.

Increasingly however the in-house IT Department will start to seek out those individuals who can enter the organisation at a graduate entry level with a common understanding of the service & supplier management issues which need to be tackled on a day to day basis, a clear view on the importance of a solid approach to project management and the capacity to engage with business users to help solve real business issues. Those graduates filling these new roles will have opportunities to quickly accelerate up through the business as they rapidly gain experience which can be applied to the benefit of the organisation they have joined. Principal Consultant, IT consultancy.

As information systems become commoditised, there is less interest in how they are coded, in their internal workings and structure. For the user

organisation, how they behave and their adaptability to business processes is far more important.

I feel a reference to the moves in IT towards a service based architecture would be useful. The need for specific languages is reducing, and IT staff in particular need to be much more aware of data quality, business logics and integration issues, than of code. Perhaps you could consider including an ITIL foundation accreditation?

Graduands [awareness] of the full range of Information Systems, the compliance and governance context (perhaps a Sarbanes-Oxley overview, data protection, freedom of information), and the need for business process improvement is vital these days.

Also, does mention need to be made in the teaching courses of benefits management? Obviously, project management and development life cycles will be useful, if the focus is on defining and achieving business outcomes.

I would suggest that there is an increasing need for people who understand learning technologies and how content management, document management, metadata standards, and learning styles all work together to produce learning materials and environments. University IT Director

The view elicited from IT professionals during the development of De Montfort University's BSc ICT only serve to highlight the wider view of the shift in information systems skills requirements within the IT professional community. In the United Kingdom, the IT Service Management Forum (itSMF) has experienced rapid growth in recently years to a point where there are 2500 companies in memberships and country chapters forming across the world. The Information Technology Infrastructure Library (ITIL) best practice standards, under the stewardship of the itSMF, have become widely used in IT department across the world, and indicate a growing awareness of the importance of IT support and the service nature of the activities of any IT department.

At the government level in the UK, E-Skills UK was launched in April 2003, as a sector skills council which acts as the voice of IT employers. Its purpose is to ensure that employees can get staff with the IT skills they need. E-Skills UK looks at the way IT is changing and through a business council, identified the skill set it considers relevant to the needs of IT.

E-skills recognises the need for broader, changing IT skills within the IT profession and the general workforce. It recognises that the skill set is changing, and that there is a lack of good IT graduates. Their mandate includes increasing the general skill level as well as producing IT professionals. E-Skills consider that the IT workforce still needs significant numbers of graduates, although their skill set may be different.

Together with the British Computer Society, the Institute for the Management of Information Systems, itSMF and e-skills have developed the Skills Framework for the Information Age (SFIA) which covers the 'skills needed to

develop effective information systems'. Skills are classified in categories with associated levels of attainment. The categories of skills are Strategy and Planning, Management and Administration, Sales and Marketing, Development and Implementation and Service Delivery (SFIA, 2006). Of 54 practitioner skills, systems development (that is the construction side) involves six: business analysis, data analysis, technical authoring, systems design, database design and programming. Service delivery involves 14 skills covering education and training, infrastructure, operation, and user support. There are 12 skills categories in strategy and planning and 13 in management and administration. It is clear that the skill set defined by SFIA covers a much wider variety of skills than is seen in the traditional constructivist information systems syllabus, and that the emphasis has moved away from development.

Development is now a small part of a diverse skill set. The software engineers support a discipline driven by a service philosophy. Producing new systems is no longer the driver for IT activities.

The evidence from sources including the SFIA and the British Computer Society (IT Now September 2005) suggests that there has been a substantial shift in the skills requirements within the IT industry. A typical chief information officer or IT director was asked to delineate his or her expectations for an information systems graduate it might be as presented in figure 1.

I'm looking for a good all-rounders and team workers who are flexible to move between technologies and roles. I want them to have a strong foundational knowledge of how ICT works in an organisation. I expect them to understand the basic processes and technology involved in both the development of new systems and the support of systems and provision of services. They will need to know about procurement, evaluation and implementation.

"I expect them to be focussed on quality: both product quality associated with hardware and software and service quality associated with the delivery of IT services. Related to this I expect them to be aware of the basic standards involved in IT services including ISO9000, BS7799 and ISO 20000.

"I require a basic knowledge of the fundamental technology – networking, Internet technology, software, hardware such that they can evaluate systems. I expect that this basic understanding will enable them to rapidly pick up the specifics of the information technology we use and contribute to the service process. I expect an understanding of the concepts of IT service management and familiarity with the workings of a help desk / call centre.

"I require a good understanding of e-commerce platforms including the front end interfaces and the database engines. I expect candidates to be able to write and run SQL queries, and to develop XML.

I expect them to be able to meet with customers and express themselves well. I look for a professional attitude, some understanding

In summary, there has been a shift in the philosophy of IT departments and a change in the range of skill required. The IT artefact is no longer the pre-eminent driving force for the management of IT. Its commodisation and globalisation has given it a more contextual role. The information system is there to support a service. That service involves the delivery of value to the organisation through the provision of information services.

This repositioning of information systems in organisations promotes the value of continuous service, procurement and evaluation, and customer focus. Information systems development, where it does occur, involves the assembly of resources – whole applications, components, externally delivered application services – to deliver a whole information service to the organisation. Connection and the taking of a holistic view is important and systems development is often more a case of systems integration, of designing and implementing the connections between systems. A focus on the systems development lifecycle, on standalone development of databases and applications becomes in appropriate for the 21st Century Information Systems Professional.

V. IDENTIFYING THE GAP BETWEEN INFORMATION SYSTEMS CURRICULA AND INFORMATION SYSTEMS PRACTICE

Having discussed the extent of change within IT departments and how the activities of IT departments have evolved towards a service function, I now turn to an examination of current information systems syllabus in order to identify the gap between curricula and practice which needs addressing through a new model curricula.

Two sources are examined to determine the nature of current curricula and critically appraise its relationship to industrial requirements. Firstly, the information system curricula offered in United Kingdom (UK) universities is surveyed. This leads to some critical comments about the derivation of those curricula, and an identification of the gap. Secondly, the IS2002 model curricula, which will subsequently provide a template for a suggested new curriculum is reviewed and certain gaps highlighted.

The survey of UK information systems curricula involved examining the honours degree offering of 46 universities. These were accessed via the website of the Universities and Colleges Admissions Service (UCAS), a centralised organisation that administers all student applications to UK universities. Hence the UCAS website lists all courses available at UK higher education institutes.

In all, 87 institutes in the UK offer a total of 625 courses involving information systems content. Of these institutes, 18 were not universities and were not sampled. Some universities were offering traditional computer science courses which appear in the UCAS list because of the use of information

systems as a keyword. The 46 universities samples all had core information systems degrees, although the title varied between 'information systems', 'business information systems', 'computer information systems' and 'IT for business'. The course content of an example information systems degree from each university was examined, as was any introductory material accompanying the course content description.

The 46 courses reviewed showed a fair amount of consistency. Only four did not mention programming. A majority focussed around the software development process. Some shared a common first year with computer science. Programming content varied, but included Java, Visual Basic or more generic software engineering courses. Information systems courses which were associated with 'harder' computer science departments tended to emphasize software construction, program design and implementation and object-orientation. Their vocabulary was pitched in engineering terms. At one particularly engineering-oriented university, information systems involved engineering and project design work, computer system design and discrete mathematics and hence was difficult to differentiate from computer science. In other universities there was a greater emphasis on systems analysis and database design. Human computer interaction was often added. Management studies focused on the management of IS projects.

Thus the foundation of the majority of the information systems courses in the United Kingdom is on the software development life cycle and the technical development of artefacts in a project context. Such content is clearly constructivist, focusing in on the IT artefact considered as a separate entity disconnected from its context and based on a linear flow of activities from systems analysis, through design and programming to testing. Beyond the core systems development life cycle, little attention is paid to areas such as on-site implementation, integration, evaluation of off-the-shelf systems, connectivity and organisational issues.

Comparison of the content of UK information system degrees with the range of skills and activities occurring in IT departments in the 21st century, highlights a gap which can be characterised in constructivist versus analytical terms. It is clear that the focus on holistic systems, integration, service and customers is not present even peripherally in academic curricula. Consequently students are ill prepared in knowledge, and in technical and communication skills to operate effectively in IT departments.

Interestingly, two institutes suggested that they were aware of this gap. One declared its degree to be not development focuses and another declared itself to be people focussed and reflected their orientations significantly in the course content.

What was even more interesting was a number of institutes which, while offering a classic constructivist curricula, indicated some understanding of the current nature of IT departments in the accompanying introductions to the courses. University A, in its introduction that information systems is 'concerned with the use of computers and their interactions with humans to

provide coordinated access to large quantities of data' and refers to the 'management and deployment of computing'. Its curriculum, in contrast, offers a classic programming, computer architecture and systems development mix of courses. University B starts out by saying 'information systems is as much about understanding the needs of the organisation as it is about technology' and goes on to offer a 'classic' degree in information systems, including significant amounts of programming. University C comments that 'there is an emphasis on how organisations work and are affected by computers' and offers an information systems degree whose first year is common to artificial intelligence and software engineering, suggesting little differentiation from a traditional computing syllabus. A fourth university, while recognising that 'an increasing number of roles in the IT industry focus around business integration of information systems including the use of off-the-shelf systems or customise component-based systems shows few deviations from a 'classic' information systems syllabus in its outline of course structure.

Hence the gap between current industry practice and academic courses can be seen some course marketing literature which is internally contradictory, arguing for a service-oriented, analytically profession while offering a traditional constructivist curriculum. Such contradictions may arise from the need to satisfy the requirements of professional bodies. In the UK, many information systems courses offer exemption from all or part of professional qualifications such as Membership of the British Computer Society. Hence curricula may be driven from the top, despite disquiet amongst the rank and file.

In many ways the characteristics of UK Information systems are reflected in the IS2002 model curriculum. The focus is on the artefact, the networking, the computer architecture, the programming and the analysis and design. Organisational issues, ethic, professional practice, and the long-term support of the artefact play second fiddle to its construction. Implementation is defined as the physical building of the system: the implementation of code rather than the installation of the system in the organisation and most importantly the development of its usage. Management is restricted to the management of the construction project rather than the long-term continuous management of the service.

Additionally, the internal conflict between curriculum content and professional ambitions can be discerned. The characteristics of an IS professional, described early on in the model curriculum concern business and real world perspective, critical thinking, interpersonal communication and organisational performance. They are organisationally focussed and contrast with the technical focus of the detailed syllabus. Similarly the scope of information systems, described in terms of acquisition, deployment, management, and operation as well as development contrasts with a very development-oriented syllabus which addresses the development of new information systems in preference to examining the evolution and maintenance of existing systems, and the tailoring of bought packages which dominates practice in the real world.

While the gap between practice and teaching may be understood as a gap between a constructivist and analytical view, it can also be seen as a disorientation. While information systems professionals need to turn to face the user, their gaze is directed to the artefact. In such an orientation, insufficient attention is given to services, components, ethics, integration, relationships connections, and information systems usage. I would argue that, to cross this gap will require a shift in information systems mindset.

VI. SHIFTING THE INFORMATION SYSTEMS MINDSET

The creation of a new information systems syllabus which more closely meets to changing needs of industry will require a change in mindset away from the constructivist view to an analytical view. At a more detailed level, this shift in mindset will be characterised by a shift in the focus of subject areas and a significant redefining of the context within which information systems subjects are studied.

The following paragraphs identify some key mindset shifts which characterise the constructivist to analytical change in focus.

From Software Testing to System evaluation and procurement: Understanding software testing at a basic level is scant preparation for the practice of selection and implementing software resources for an organisation. Abilities to develop requirements specifications which can be converted into invitations to tender are required. This difficult skill involves sensitivity to the limits of what a supplier can do, understanding how to define and test criteria and significantly how to negotiate and manage contracts.

From IT artefact to IT Service: This mindset shift underpins several others, and involves an understanding of the nature of services and their management.

From Standard Applications to System Integration and Connection:. Skills in defining standalone databases, and modelling new systems on greenfield sites provide little preparation for the complexities of integrating new systems with existing systems, migrating data from old systems, creating feeders from existing systems to new systems. It has been said that IT departments are really systems integration departments. System integration skills should be a key element of information systems studies.

From bounded system to exploring system boundaries:. The key problems lie not in the internal scope of a system, but in the system boundaries and the interaction that occurs at those boundaries.

From parochial and local systems to holistic and global systems: The information system student's mindset must be context aware. Information systems are developed and used globally. Their effect is across the whole organisation. New systems tend to operate both inside and outside the organisation and their holistic and external effects should be considered.

From Systems Development to Contract Management: A focus on the system development lifecycle is less appropriate within organisational IT. Contracts may involve several systems, or several versions of a system; and may involve many activities beyond the delivery of software.

From utilitarian economics to ethical, moral and professional: Exploration of the justification of the information system and its feasibility have often been limited to cost benefit analysis. While financial considerations are still important, the justification of systems and their usage needs to be considered on a much broader canvas.

From first principle programming to component usage and system assembly: The componentisation of system development is gaining pace with the rise of service-oriented architecture. As such the assembly of components to meet a service need as defined within a service level agreement is becoming more important. Rather than programming from first principles, students need to define requirements in terms that can be satisfied by component-based solutions.

From technical to social: A focus on technical implementation leaves students lost in the real world where the key implementation problems are social, political and cultural. For many organisations the real problems are in obtaining the business value and getting customers to incorporate systems usage into their activities and tasks. Implementing an enterprise resource planning program can be technically straightforward. Getting it accepted in the organisation and used effectively is much more difficult. It requires social communication skills, marketing, persuasion, and the understanding and use of organisational politics. Students may quickly find themselves out of their depth in an organisation however technically competent they are.

From discrete projects to continuous service: Project management teaching must be expanded to understand the problems of continuous service management. This is basically a different paradigm, with different goals and outcome measures, and requiring greater understanding of the client.

VII DEVELOPING A SERVICE-ORIENTED MODEL INFORMATION SYSTEMS CURRICULA

Based on the discussion above, a service –oriented information systems was designed and accredited. This is currently being marketed in the UK as a BSc in Information and Communications Technology (ICT) from De Montfort University. The new information system curricula described below is present in a format to suit a US-based degree, with differentiation between majors and minors.

In the UK BSc ICT, an underlying three tier philosophy was applied. The courses are spread over three levels, each level taking a year to complete. Levels 2 and 3 are separated by a placement year (internship) which the student spends in an IT department gaining industrial experience and understanding. Each level has an over goal in terms of how the student is engaged with the material.

LEVEL 1 : BROADENING THE HORIZONS

Level 1 is about creating excitement and giving the student an understanding of the wide application, the complexity and the relevance of information systems. It is about the development of an understanding of the applications of information systems, the business and social impact and how such technology comes about. Technical details of, for example, hardware and software, are learnt within the context of their use.

Level 1 involves:

- Broadening horizons,
- Creating excitement,
- Creating social and global awareness,
- Watching future trends and following news,
- Promoting investigation and creativity,
- Connecting with real-world examples,
- Awakenning interests and enthusiasms,
- Recognising future trends and creating sensitivities,
- Asking questions about nuts and bolts.

LEVEL 2: PREPARING FOR BUSINESS

Having established an enthusiasm for information systems at level 1, Level 2 builds the technical and business skills and understanding needed to implement and manage information systems within their technical and business context. The focus of this year is on achieving goals in organisations through the evaluation, delivery and support of information systems which offer clear business value. Hence the student must have a grasp not only of the technical infrastructure and applications but also of the business value and how to draw the business value out of the raw technology, since the business value cannot be derived without attention to people and processes. The student on placement is likely to get involved in assisting on the help desk, organising support, learning to maintain networks, putting together servers or desktops for users, shops, server farms; evaluating and procuring software, liaising with suppliers and writing small database application to help with admin. Level 2 has to cover this. It does so by getting to grips with databases, providing an understanding of the basic technology and its implementation, for example how do you configure a server, learning how to be involved in the everyday operation of information systems, and providing an understanding of how to treat organisations and their information systems which includes how to understand the strategies and policies that drive the

organisation and its IT management. Hence data, technology, operations, systems gives coherence to the level 2.

Level 2 involves

- Understanding the organisations,
- Understanding the technical infrastructures,
- Understanding the role of information systems in organisations and businesses,
- Being able to evaluate information systems in the context of the goals of the organisation,
- Establishing appropriate technical skills;
- Creating excitement about what information systems can achieve in a particular situation,
- Assembling and tailoring information systems to meet business needs,
- Communicating with clients, contractors and suppliers.

LEVEL 3: DEVELOPING SPECIALISMS WITHIN A GENERIC FRAMEWORK.

By level 3, a strong skill-set and a good understanding of the scope and contexts of information systems have been established. Level 3 provides an opportunity to specialise in a cluster of courses, together with a focus on a tailored project which reflects that specialisation. The definition of the student's project will be key to establishing a specialism. The focus of all courses is on current practice and industry relevance.

Level 3 involves:

- Building areas of specialist expertise on the generic foundations of IS knowledge,
- Creating an awareness of current trends, and advances in both academic and commercial computing,
- Developing a sensitivity to the opportunities offered by to organisations by new IS developments,
- Connecting with research groups within the institute,
- Developing the ability to challenge procedures and practice in IT departments and develop new ideas.
- Gaining skills, attitudes and values in ethical and service-based IS professionalism

As suggested in IS2002, IS minors may take on liaison roles within organisations. For such students, it is critical that level one and most of the level two philosophy are applied. These student must have an enthusiasm for the application of information systems, as well as an understanding of how an IS department operates and what problems are associated with the implementation and support of IS within the business.

IS Majors will be expected to deliver IT and IS within the organisation. While fostering a sense of excitement is still important, IS major would focus on the level 3 philosophy connected to elements of the level 2 philosophy. Any specialist skills must be set within the context of evaluation, procurement, service and strategy. Often IS majors combine level 3 and level 1 philosophies without any committed subscription to level 2 philosophies.

VIII. ARCHITECTURE OF A NEW INFORMATION SYSTEMS CURRICULUM

In accordance with the structure of IS2002, this section overviews the curriculum presentation areas, discussed the course sequences and provides high-level descriptions of the courses. The purpose of this is to provide a concrete basis for debate and to highlight the evolution of an information systems syllabus to meet changing industrial and environmental conditions.

CURRICULUM PRESENTATION AREAS

The arrangement of presentation areas is given in Figure 2, and the content of the five areas provided in Table 3. Presented in this form, the centrality of view IT as a service is established. From the service point of view consideration of the political and cultural elements, the development elements and the technical elements follows. There is an attempt to resist the split between development and service, between building and maintaining and between business and IT. These elements emerge from the service management perspective as integrated elements of the curriculum.

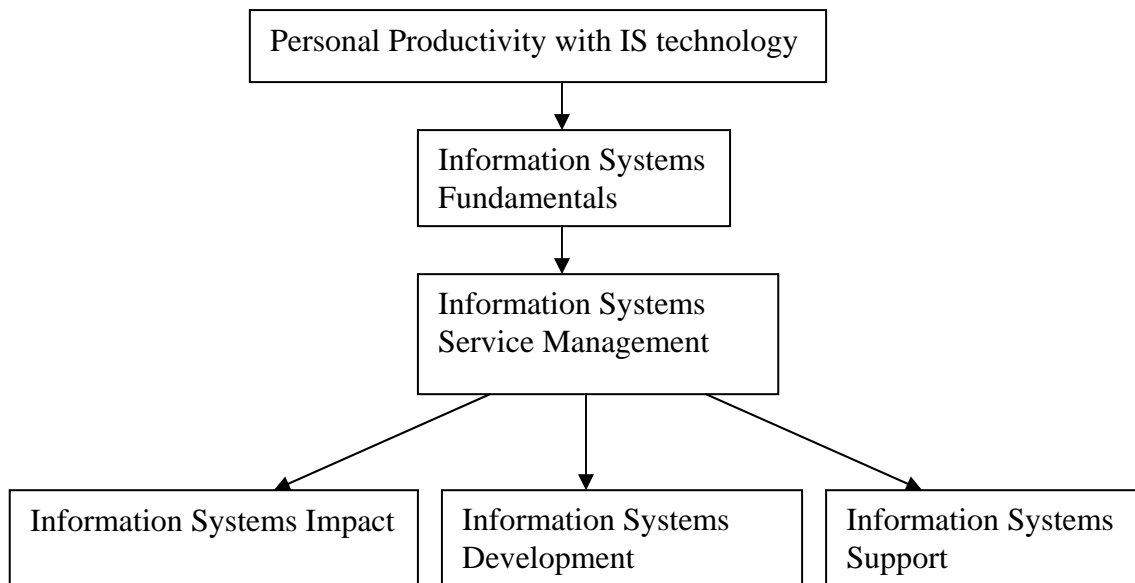


Figure 1. Curriculum Presentation Areas for IS Curriculum

Curriculum Presentation Area	Description
Information Systems Fundamentals	Broad introduction to fundamental structures of IS within businesses, particularly with reference to internal and external support of e-commerce. Fundamental grounding in systems, system thinking and systemic approaches to problem solving.
Information System Service Management	Concepts and theories around the management of IS as a service. Fundamental understanding will be provided of the strategy, management and operation of IS within an organisations, addressing both managerial and technical infrastructure.
Information Systems Impact	Social and organisational impact of information systems. Economic and moral roles within organisations. Wider social role of IS and consequences of globalisation. Ethics and professionalism. Development of moral frameworks and critical thinking

	skills.
Information Systems Development	Skill in the building of information systems against agreed requirements using components building methods within a service framework. Understanding of database development.
Information Systems Support	Technical support of hardware and systems, system integration, ability to deal with systems problems across the organisation. Technical issues with security and maintenance of systems.

Table 1. Content for Five IS curriculum presentation areas.

COURSES

The courses are indicative of what might be expected to run in a business school. The presentation of the courses in this paper follows the format used in the IS2000 document. A course in electronic production and publishing fulfils the goals of Personal Productivity with IS technology. Similarly to IS2002, a general awareness of desktop computing is assumed. Students may be expected to have a general knowledge of web-page creation using high-level tools. Figure 3 shows the course architecture and the suggested sequence of courses.

The course definitions widen the body of knowledge for information systems, expand the context and downsize the influence of programming as discussed in the section concerning the shifting of the information systems mindset.

Resources for this new information systems curricula should not differ significantly from existing resources. There may be a need for a wider software base, and when studying systems support access to servers, for example, which can be reconfigured by students needs to be considered.

Faculty would need to take up some new skills within to teach the more IT service-oriented courses.

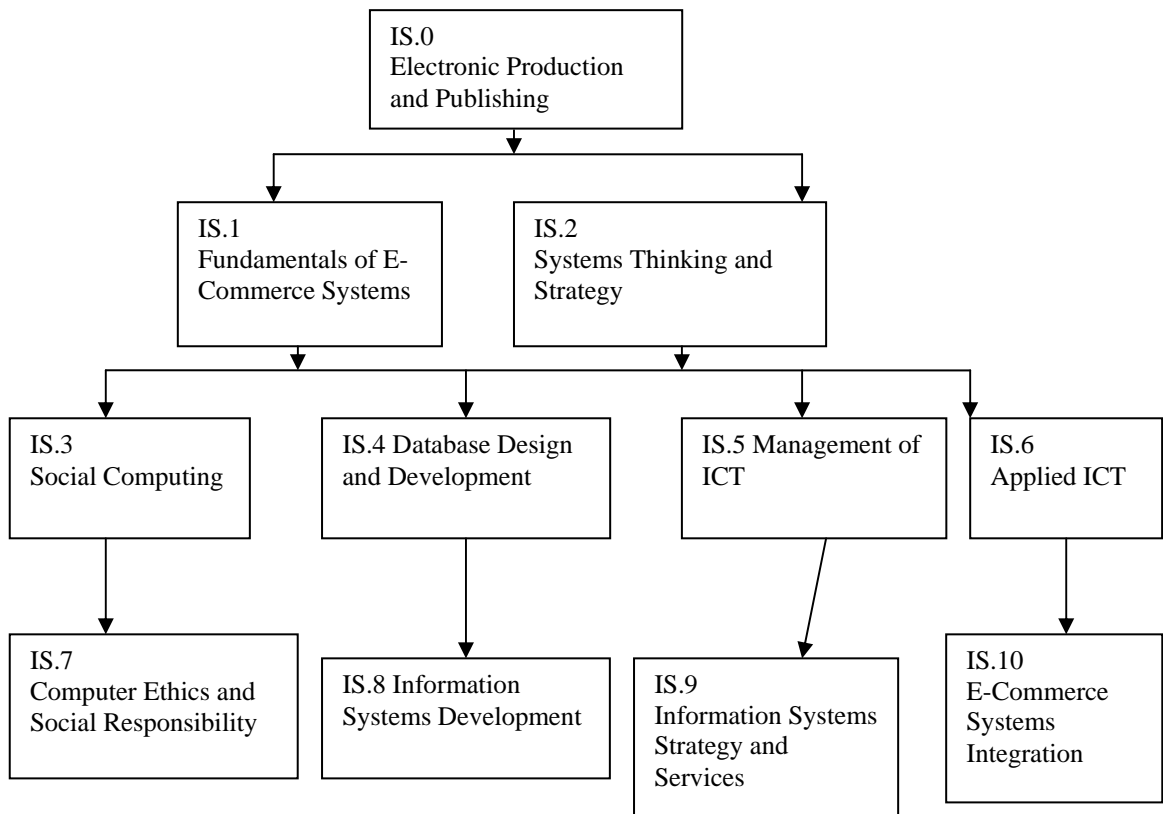


Figure 2 Representative Course Sequence

COURSE SPECIFICATIONS

In this section high-level course descriptions for the 10 courses are provided in the representative course sequence. These are based on course content in the De Montfort University BSc ICT. Each course is described with a catalog description, a scope statement and a topic list. The discussion raised specific issues associated with the course.

IS.0 Electronic Production and Publishing (Prerequisite: elementary knowledge of word processing, spreadsheets, e-mail and web-browsing)

CATALOG: Students with minimal skills in ICT learn to develop presentations and use graphical package to creative effect. Self teach packages are provided.

SCOPE: This course focuses on the treatment of the production of computer based media and systems as a film production task. Students may be examined at the end of the course on the basis of website and multimedia presentations. The course involves both the use of HTML and a multimedia authoring product such as Dreamweaver. Processual considerations are developed and techniques such as storyboarding are taught. It also considers the project management activities which support web and multimedia publishing. The course plays an important role in realising the creative potential of ICT, and exploiting that creative potential in products and services to meet needs and support activities in, for example, businesses, homes, schools and hospitals.

TOPICS: Web authoring / productivity tools, Simple prototyping tools Cascading Style Sheets, Media Editors -functions, usage, User needs and User Characteristics, Usability requirements / task analysis, characteristics of human- computer dialogues, Aesthetic considerations, Design process (scoping, content definition, scripting, media selection, etc), Storyboarding, Interaction techniques, Scripting techniques, Evaluation and testing, Introduction to project management.

DISCUSSION: This course is aimed at awakening students to the creative potential of ICT, and helping the student develop creative skills in using IS technology for self management and expression. This extends and replaces the personnel productivity with IS course. The metaphor of filmmaker or storyteller is used in place of the traditional architect. Improvisation is seen as important in developing artefacts using IT.

IS.1 Fundamentals of E-Commerce System. (Prerequisite: IS.0)

CATALOG: This course investigates the business and technology around e-commerce, which is the use of Internet technology by businesses. As such it increases the awareness of how businesses use the Internet. This course introduces the principle concepts in e-commerce, explaining the business processes, the technology and providing some vocabulary.

SCOPE: Starting from everyday practical experience of using an E-commerce site to purchase goods, an understanding of the business and technical processes involved is developed. The

course considers the business drivers behind e-commerce and a variety of possible models for e-commerce. It develops an understanding of how e-commerce is used by organisations in interactions with customers, with other businesses and with their employees. In addition the course explores the technology, including the software and standards that drives e-commerce implementations.

TOPICS: History and background to the Internet. How a business works: what happens when I buy groceries from Tesco or a DVD from HMV. Searching for a web page: How a web page is found and brought to your computer. E-commerce system tour: html, XML, TCP/IP, etc. How it fits together in the Internet jigsaw. Why should business use the Internet? What are the benefits? Strategy and content - what should a company put on a website and why? Ease of use - what makes a good web site? Security. The problems, Overview of answers. Viruses on the web. Types of e-commerce. Evaluation of business e-commerce sites. E-government, E-voting. HTML, XML and linking to a database. Introductory remarks. Introduction to moral and ethical issues surrounding e-commerce. Privacy and the web.

DISCUSSION: The course starts with the student's experience of e-commerce - e.g. visiting a web site, buying something from a web site and explores the technology and business processes behind the observed phenomenon. Working models will be used and role play will feature where helpful. The course intertwines a business strand - why is e-commerce important?, what to do with it?; and with a technical strand - what do I do to deliver a business need? How is it done technically? It intersperses business and technical fundamentals. It provides concepts and structure without going into the details. The course can be viewed as a tour of the concepts and issues. The business processes - buying, transporting, storing, selling, marketing, accounting are explored in information systems terms and related to students day-to-day experience. Technology is introduced through examples.

IS.2 Systems Thinking and Strategy (Prerequisite: IS.0)

CATALOG: This course examines the strategic and systems side of ICT in organisations. It encompasses the strategic issues around the decision to implement ICT within an organisation and the systems issues involved in procuring effective ICT. It develops system thinking through an understanding of soft systems methodology

SCOPE: It will cover a wide variety of techniques in order to gain a real understanding of system problems which are messy, non-simple and difficult to define. The course is about looking at systems, and particularly ICT as a whole and understanding the social and technical problems associated with them. An understanding of the general concepts of systems is established and the steps in classical soft systems method are followed through. This involves looking at over-viewing of the client and problems, defining the problem situation defined, developing a root definition, constructing conceptual models and deciding on what changes can be made to the organisation's systems which are both feasible and desirable. The course considers other approaches to systems thinking including critical systems thinking. The aim of the course is to develop your ability to think holistically and consider problems and their ICT solutions in the context of the entire organisation and its social and economic concerns.

TOPICS: Strategy. Introduction to concepts. Personal strategies. Business strategies. Deciding what to do. Strategies for e-commerce. Emergent strategies. How unexpected consequences follow some strategic decisions. Benefits management. Brief introduction to concepts and their relevance to the development and use of e-commerce systems. Telling a story. Through the examination of a series of interviews in an organisation, students will construct their own stories of what's going on in that organisation. Introduction to systems concepts. Closed and Open Systems. Negative and Positive feedback loops. Overview of approaches to systems thinking. What, in simple terms characterises these approaches. Philosophy and overall concepts of soft system modelling. Stages of Soft Systems Methodology. Comparison of SSM with other approaches:

DISCUSSION: It is important for all IS students to understand the concepts of systems, the nature of systems and to come to regard information systems as part of a whole system and not as isolated software and hardware. The system thinking is done in the context of e-commerce. Hence the course starts by establishing the strategic reasons for e-commerce systems before discussing the systems thinking which will enable a solution to be agreed by consensus. Systems thinking will be taught through examples and case studies. Mini-case studies or stories may be used to illustrate specific points. System ideas will be taught through a realistic e-commerce systems case study running through the course. It is important for the student to see organisations systems as a whole and to

understand the messy and uncertain nature of business systems.

IS.3 Social Computing (Prerequisite: IS.1,2)

CATALOG: This course explores the context of computing, starting with the student's own experience and exploring issues, conflicts and social changes brought about by ICT. It introduces the social, political, economic and legal context of ICT.

SCOPE: The purpose of the course is to create a foundational understanding of the relevance of ICT which will inspire the student to pursue more detailed studies. It sets both local and national context looking at globalisation as well as local issues of changing business practice. It explores the economic dependences brought about by ICT. How does logistics work? What are the dependencies between retail and logistics. Why does WalMart do so well? What are the education effects of computing? Does ICT help learning in schools? Does ICT influence crime? What are the moral issues behind ICT and policing? What are the issues around identity cards? What about the implementation? What are the flaws in chip and pin? How is ICT supporting bioinformatics? What are the ethical issues in medical computing?

TOPICS: Economic Aspects of ICT. Use of ICT in business: e.g. banking, health, new products. Positive aspects of ICT: e.g. productivity, new jobs, specialisation, efficiency, flexibility. Negative aspects of ICT: e.g. alienation, isolation, exploitation, unemployment, control. Globalisation. Social Aspects of ICT . Changing the nature of work and working. Changing the nature of the home and family. Digital divide.. Political Aspects of ICT E.government.. ICT in health. ID cards . Legal Aspects of ICT. ICT laws in relation to crime and terrorism. Health and Safety aspects of ICT. Privacy and Data protection.

DISCUSSION: The foundations for lectures and tutorials will be provided by worksheets. Worksheets define problem issues, outline concepts, ask questions, provide case studies and point to reading resources. Lectures pick up on worksheet content and tutorials are based on questions and research exercises set in the worksheets. The worksheets will pose problems and suggest mini projects.

IS.4 Database Design and Development (Prerequisite: IS.1,2)

CATALOG: This course provides a thorough grounding in the essentials of data modelling, developing the skills of producing a data model from a business perspective to meet stated requirements using commercially realistic scenarios. It develops the ability to map the data model to a relational database management system (such as Oracle) using the SQL Data Definition Language. It develops skills in database querying and data retrieval using the SQL Data Manipulation Language. In addition, the course considers key aspects of DBMSs such as transaction management, access control and security.

SCOPE: Covers both design and implementation of databases.

TOPICS: Basic concepts of databases. The relational model. Relational data modelling - first level data design: Second level data design. DBMS issues such as entity & referential integrity and transaction management including concurrency, recovery.

DISCUSSION: Both major and minor students need a grounding in producing database system whose design is rigorous and robust.

IS.5 Management of ICT (Prerequisite: IS.1,2)

CATALOG: This course explores the wide variety of issues and technologies encountered by ICT managers within user organisations. The course covers structural, processual and contextual areas concerning ICT within organisations.

SCOPE: An introduction to IT service activities in organisations, it covers aspects of both the procurement and implementation of applications and management information systems.

TOPICS: Roles of ICT in an organisation. Support and development roles. The role of the help desk and incident management. Overview of ITIL. Brief introduction to the disciplines. Introduction to IT asset management. IT security management and standards. Procurement of information systems and applications. Implementation of procured systems. Managing IT staff. Recruiting and appraisal. System integration. Problems and management issues. Integrating internal systems. Data management. Data warehousing. Management information systems. Outsourcing programming and support. Justification and management of outsourced functions. Education and customer training. Planning and controlling ICT in organisations.

DISCUSSION: The goal of ICT management is to deliver and sustain ICT service and products within an organisation to meet the

organisational needs for information processing. The recurring theme is one of the professional support of ICT functions.

IS.6 Applied ICT (Prerequisite: IS.1,2)

CATALOG: Practical ICT infrastructure in organisations is introduced. The fundamentals of networking and the implementation of networking are covered. Application implementation is considered in a technical context.

SCOPE: The practice of ICT in an organisation involves a wide range of technical understanding and implementation and diagnostic skills. This course provides a basic skill set, underpinned with the appropriate theoretical frameworks, to enable a student to undertake a useful role in an organisation's ICT department. The course overviews the typical IT infrastructure in an organisation, provides a grounding in networking concepts and studies the process of network implementation. It further studies the nature of client/server architecture and its implementation, addressing implementation issues with a range of servers including database and email servers. Problems with application implementation are considered, particularly integration and data migration. The course looks at IT security and introduces object-oriented concepts and component-based development. The course concludes with a brief introduction to open source.

TOPICS: Review of IT infrastructure in the organisation. Classifying IT hardware and application architectures. Evaluating ICT architecture and identifying technical alignment to the business. Network Concepts. LAN. WAN. Internet Protocols. Communication protocols. Implementing networks. Setting up a remote network. Implementation of links between businesses (B2B). Client / server architecture. Roles and type of servers. Server structure and implementation. Implementing operating systems such as Windows. Internet servers. Database servers. Email services. Structure of desktop clients. Setting up a desktop and connecting it to a network. Investigating and assessing technical standards for networking including EDI standards. Distributed networking systems. Architecture. Implementation Support. Steps in system rollout, for example rollout of new EPOS to stores. Implementation of applications. Structure of application. Application installation and testing. Exploring and evaluating technical documentation. Data maintenance. Data migration. Theory and practice of search engines. IT Security technology. Role and implementation of firewalls. Overview of object-oriented concepts. Concepts of component based development. Components and OO

technology. Recruiting and collating component resources to deliver systems. Overview of Open source. Differences between open source and e.g. Microsoft systems.

DISCUSSION: The teaching of this course will be very problem oriented, introducing students to the need to implement various information technologies and discussing the problems that occur. Lectures will explain the principle concepts and architecture. Laboratory sessions will offer the opportunity to try out some of the ICT procedures, including, for example, configuring a server and connecting the elements of a network.

IS.7 Computer Ethics and Social Responsibility (Prerequisite: IS.3)

CATALOG: The course addresses the ethical and social responsibility issues surrounding advances in ICT. It considers in detail how the development of system might encompass computer ethics. The value of professional codes of conduct is discussed. Ethical concepts and consideration of computer ethics as a discipline provide a necessary philosophical foundation for this course.

SCOPE: This course provides the professional and ethical foundations for IT professionals. In considers both global and local issues. It give students some foundations in critical and philosophical thinking.

TOPICS: Defining computer ethics Normative ethics: deontological theory, teleological theory. Issues of the information society. Health informatics, privacy, copyright, e.commerce, telecommuting, computer terrorism, e.democracy, gender, computer crime, trust. Surveillance. Service ethics. Ccodes of conduct and professionalism. Framework for ethical decision making.

DISCUSSION: It is important for students to have a strong understanding of the ethical contexts of their work.

IS.8 Information Systems Development (Prerequisite: IS.4)

CATALOG: Information systems project activities within the context of the systems development lifecycle are explored. Requirements analysis concepts are introduced. Design methods are explored and the system is realised using a simple relational database.

SCOPE: The intention of this course is to provide the student with a practical, integrated overview of the Information Systems (IS)

development process, from project selection and inception, through the capture and analysis of user requirements, to the design and production of a simple prototype system that satisfies those requirements. A constrained case study is used to take the student through a complete structured development cycle.

TOPICS: Information Systems: definition, types and components of. Systems Development Lifecycle: traditional (waterfall); alternatives to: iterative & incremental, spiral, prototyping. Project Selection and Feasibility Assessment Project Management: role and significance; use of simple techniques such as work breakdown structure and Gantt chart. Systems Analysis: function of, tasks undertaken. Abstraction: reasons for and forms of. Requirements analysis Design issues. Models for requirements analysis, e.g. Data Flow Diagrams, Entity-Relationship Models. Models for design, e.g. Entity-Relationship Models, Activity Diagrams. Documentation such as Requirements Specification, Design Specification: function of and typical format. Realisation of design using, e.g., MS Access. Creation of tables from design model; designing suitable input forms; writing and executing queries using SQL..

DISCUSSION: Although the focus of the IS syllabus is more analytical, a course is included to give students the basic constructivist skills. Note that project management is featured as the management context, so students experience project style management without needing an additional course.

IS.9 Information Systems Strategy and Services (Prerequisite: IS.5)

CATALOG: IS strategy, service strategy, service concepts. In depth analysis of ITIL disciplines. Contextual issues.

SCOPE: The information systems strategy and services course prepares students to work effectively in a service-oriented environment, instilling a service view of IT and setting the foundations of expertise in IT service management. It takes a service view of information systems in which the IS departments role concerns the provision of services and support for the information technology (IT) function. The course explores the application of service management concepts to the delivery and quality management. It examines operational issues surrounding the management of resources and computer capacity, the provision of help desk services and the management of IT assets. It considers the development of new services, the management of end-user computing and the development of IT service culture. An introduction to the

disciplines required for BS15000 / ISO20000 IT service standards is provided. The subject area is considered in the context of a business environment where many IT services are provided by third parties and managed through contracts. The strategic role of systems and service in the organisation is developed by exploring the alignment of information systems and the organisational strategy. An understanding of the strategy of an organisation leads to the development of a portfolio of systems and services which matches the objectives of the organisation and delivers competitive advantage. Frameworks and approaches to developing such an understanding of the strategic role of information systems are considered.

TOPICS: IT Service Fundamentals. What is a service? Nature of services. Moments of Truth. Front Office and Back Office. Service components. IT service quality. IT service marketing. IT service innovation. IT Service Strategy. IT/IS core competences and the Resource-based view of the firm. Developing a service-oriented IT strategy. IT strategy process. Understanding business strategy. Tools for relating business strategy to IT strategy. Managing the application portfolio. Auditing, Classifying, Identifying new systems, Role of IT in competitive strategy. Finding strategic information systems. IT procurement strategy. Globalisation issue in strategy and outsourcing. IT Service Relationships Business/ IT Alignment. Strategic use of Critical Success Factors. Maturity model of IT alignment. IT outsourcing - theory and practice. Strategic approach to IT outsourcing. Application Service Providers. Managing IT supplier relationships. IT system procurement. Managing internal and external customer relationships. Service support of E-commerce. Managing and motivating IT service employees. IT Service Governance. Organisational role of IT services. Structuring the IT organisation. Centralised, Decentralised, Federal. Reporting structures and the Balanced Score Card. Justifying IT services in the organisation. CoBIT and IT governance. IT Service Context. Managing End-User Computing. IT strategy and services in SMEs. Organisational and service culture. Effect of organisational power on strategy and services. Globalisation. Enterprise Resource Planning systems. Future trends. Autonomic Computing. IT Service Operations. Managing the IT helpdesk. Rationing IT services. Incident Management, Problem Management, Release Management. Information requirements for IT service management. Capacity Management. Managing and controlling IT assets. Availability management. Service level agreements - their creation and management. The IT service catalogue. IT service security issues. Configuration management service

issues.Global IT service operations.IT Service Process. IT service frameworks: ITIL and BS15000.The BS15000 certification process.Implementing IS.IT strategy and the role of IT strategy documents.

DISCUSSION: This is a key course in providing student with foundations for involvement in the IT profession.

IS.10 E-Commerce Systems Integration (Prerequisite: IS.6)

CATALOG: Provides grounding in the theory, practice and management of systems integration, addressing both internal integration and business to business integration.

SCOPE: This course tackles integration issues looking at e-commerce based systems, both internal and external. It examines the theoretical and practical aspects of integration. In particular, it will follow through health service case studies and will involve talks by practitioners actively involved in integration within the health service and other e-commerce dependent industries. The problems of system interaction will be discussed and classified. Both the business and technical issues involved in systems integration will be considered. Strategies for exploring the inter and intra organisational causes of lack of systems integration will be developed and methods for inculcating the necessary change examined. Technically, the course considers a range of integration solutions. Enterprise application integration is explored as one approach to integration. Object-oriented approaches are also considered. The role of XML is examined and skills in developing XML standards are built within the context of e-commerce case studies. The business and technical requirements for business to business e-commerce are studied. Both EDI technology and techniques and Internet EDI technology and techniques are discussed. While the focus of the course is on the integration of systems and data inside and outside organisations, actual technology and example will change to reflect current technology trends. The course will also consider the security and ethical issues associated with e-commerce system integration.

TOPICS: Introduction to System Integration Problems of diverse information systems within organisations Problems of linking between organisations Legacy systems. Intra-organisational Systems Integration. Setting standards for integration of disparate systems. Inter-organisational Integration. E-commerce integration. Integrating business courses and functions between organisations. Integrating partners and outsourcers. E.g. security outsourcers and payment outsourcers. Data integration between organisation. E-

commerce issues in integrating the supply chain. Supply Chain Integration – Vendor-based, Supplier-based. Systems Integration Problem Dimensions. Distribution - geographical problems. Heterogeneity. Autonomy. Systems Integration Levels. Business Models for Systems Integration Strategies for IT integration within organisations. Systems Integration frameworks. Modelling systems integration in the organisation. Business Process and technical interfaces between organisation. EDI – definitions. History of EDI and approaches to EDI. Internet –based EDI. Integration Technology. ERPs and Enterprise Application Integration. Overview of ERPs. Study of specific examples e.g. SAP, Peoplesoft. Technical and Managerial concepts. Does EAI provide a suitable SI solution? Problems with EAI : Loss of autonomy, Organisational fit, Moving the boundary of the integration problem rather than solving it! CORBA Integration Object Request Brokers Interface Definition Language XML. Writing XML language for specific industries. The XML standards definition process.

DISCUSSION: This course uses a variety of contexts to develop integration skills. It looks at the interface issues experienced in systems development and support

IX. CONCLUSIONS

The purpose of this paper is to identify the challenges that face information systems curricula and to highlight the necessary change by offering a new model curriculum, modelled on the IS 2002 curriculum. It is clear from examining the IT industry that a large shift in the type of activities that take place in IT departments is occurring. This shift in interests and activities is characterised as a move from a constructivist approach to an analytical approach. Development is giving way to procurement as the applications mature.

Such changes demand a rethink of IS curriculum as the body of knowledge expands and evolved. The challenge is one of expanding the interdisciplinary nature of IS. The applied nature of IS should be used to strengthen interdisciplinary links and evolve connections with disciplines such as management, biology and astronomy.

The information system curriculum should be outward looking, and through a service-focus looking at the individuals, organisations and societies it serves. It should be concerned with the global, industrial, social and technical context of the subject. The focus on the artefact may be dated and too narrow even just from an industrial point of view.

The challenge is to align with industry and even move ahead, providing technical and social awareness that can inform industry. It is my view that IS curricula tend to lag behind. Service orientation as seen through the spread of

ITIL, CoBIT and ISO20000; alternative systems development approaches as expressed in the rise of agile methods; different approaches to system construction as represented by componentisation, service-oriented architecture, enterprise resource management systems and systems integration: these are all missing from IS curricula or given a cursory treatment. Skills in the development of standalone systems in classical greenfield situations do not prepare students for the diverse and complex business world of IS. Small adjustments in IS curricula must be replaced by a radical shift if we are to realign with industry need and world issues.

Finally, I think the value of the development of a model curriculum should be critically reviewed. It may be part of the problem. Model curricula may represent not a consensus, but an agreement among the academically powerful as to what the syllabus should be. Social forces in academia, the tacit power structures of senior academics, conference leaders and the leaders of professional associations may influence the wider academic community.

Once a model curricula is created, it itself becomes an actor within an actor network whose function is to translate the interests of the curriculum into those of academics in IS departments. It is in IS academic interests to make sure their syllabus aligns with the model curricula. The social consensus becomes the social dictator and a kind of 'lock-in' occurs in which the curriculum represents a black box that may not be questioned.

The end result is a freezing of curriculum and an inhibiting of its evolution. Perhaps some deconstructing of model curriculum and critical analysis of the underlying purpose of model curricula is required. Perhaps emergent curricula cut free from the constraints of approved curricula should be encouraged. Information systems curricula would benefit from the development of a 'folksonomy' of the subject, perhaps through using social informatics approaches such as social book marking. Nevertheless, it is my hope that this paper will help open up the debate and speed the evolution of information systems curricula to meet changing industry needs in a rapidly changing world.

REFERENCES

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ACKNOWLEDGEMENT

I would like to thank the BSc ICT development team of John Bennett, Brian Kiely, Ivor Perry, Peter Messer, Tim Watson, Richard Howley, Ian Smith and Hussein Zedan who were instrumental in the successful accreditation of the BSc (Hons) ICT degree at De Montfort University, Leicester, United Kingdom, which provided the basis for this paper.