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47. A SERVICES SCIENCE MAJOR IN A BACHELOR OF SCIENCE (IT) PROGRAM: THE CASE OF UAE UNIVERSITY

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Abstract

This paper presents a proposed design for a new undergraduate major in services science within a bachelor of science in information technology program. Potential students in the major will be Emirati nationals with strong verbal skills but sometimes weak writing, math and problem solving skills. Math and problem solving skill are essential in the new services dominated environment, so it is important that these skills be developed in students if the nation is to continue to lead the region in IT service provisioning. The curriculum proposes three new courses and inclusion of four existing course from related majors.

Keywords:

Services Science, SSME, IS Curriculum

1. Introduction

Commerce has become increasingly service-dominated over the past two decades necessitating increasing reliance on information sharing and use. „Services science’ or „Services Science, Management, and Engineering’ (SSME) is an interdisciplinary approach to the design and implementation of service systems. Pioneered by IBM, the new „discipline’ is based upon principles and processes grounded in established disciplines such as engineering, management, and science (including management science). Already a few universities, often supported by IBM, are offering graduate programs in services science. Such programs aim to develop in students the ability to employ a set of basic tools and skills, an understanding of best practices, and an ability to think innovatively that will equip them for future managerial positions in organizations.

Is there also a need for undergraduate training and education in Services Science? If so, what skills, knowledge, and abilities should we foster in students? These were the questions we faced at UAE University when debating the potential development of a new Services Science major. The answer for the authors and the faculty in the Information Systems group was an assured „yes’. Certainly services science is required by managerial-focused information technology (IT) specialists in post-graduate, post-experience courses, and these managers will need skilled employees to work with them; employees trained at the undergraduate level. The need is particularly strong in service-based economies such as the United Arab Emirates (UAE).

The UAE is a modern economy which has grown at a phenomenal rate, particularly the Emirate and city of Dubai which is „one of the most dynamic business environments in the world’ (Molavi, 2007, p.103). Fuelled by oil and natural gas revenues, modern cities have replaced the once small fishing towns on the edge of the Gulf waters at Dubai, Abu Dhabi, Sharjah, and further North. While oil and gas continue to provide the wealth necessary to fuel infrastructure development, services provide the foundation that will carry the nation into the future. Prominent among those services are those associated with information and communication technologies (ICT).

The nation has a strong ICT infrastructure and a high uptake of computing and internet use amongst its population, business and government (Cherrayi, 2008a, 2008b). Currently the ICT industry in the UAE includes some research and development of hardware, but the major component of the industry is provision of IT services. Most of the ICT development is located in the city of Dubai which acts as an ICT hub for the Middle East (Cherrayi, 2008b). Dubai’s Internet City contains a large cluster of ICT firms with a targeted customer base encompassing the Middle East, Asia, Africa, and the former CIS states (formerly part of the USSR) [Staff Report, 2008]. The UAE University and its College of IT (CIT) serve the educational needs of this vibrant community.

2. UAE University and the College of IT

UAE University was founded in 1977 and now comprises nine colleges, with 16,000 students and 1,000 staff. National (Emirati) students meeting entry requirements are provided free tuition, textbooks and accommodation. The nine colleges include a Faculty of Business and Economics, a College of Medicine and Health Services, and a College of IT. The colleges of Medicine and IT attract premier funding within the university; Medicine because it provides for the welfare of the people, IT because it is seen to be the future of the economy. Both have commitments to research and to education.

The College of IT (CIT) has 800-900 students, 90 staff and a spectacular new building with state-of-art teaching and lab facilities. Only Emirati nationals are admitted to the CIT, but courses are taught in English - their second language.

3. The College of IT program

The CIT offers one degree, a Bachelor of Science in Information Technology, with a strong core program and currently seven specializations (Intelligent Systemsⁱ, Computer Systems, Software Development, Networking, Security, Enterprise Systemsⁱⁱ, and E-Commerce). Following a year of training in basic educational skills for undergraduates (required of all university entrants), CIT students complete 128 credit hours over four years. Of these credit hours, 21 (7 courses) are allotted to the specializations. This does not include the mandatory final year project course (Senior Exhibition) which usually includes elements from the student’s specialization. The breakdown of courses is shown in Table 1.

Table 1: BSc(IT) Summarized Curriculum

	Courses*
Math + Science	4 + 2
English + Cultural Electives	3 + 3
Information Technology Core	13
<i>Development Project Exhibitions</i>	4
<i>Internship (one semester)</i>	4
IT Breadth Electives	3
Specialization	7
TOTAL	42

* 3 credit hour courses
Italicized items = course equivalents

The four math and 13 IT core courses provide the foundation skills for all specializations, and would be particularly important to the proposed specialization in Services Science. These include a mix of math, hardware, software, networking, security and information systems topics (Table 2)

Table 2: BSc(IT) Foundation Courses

Calculus (2)*	Computer Organization (1)
Discrete Math (1)	Comm & Networking (1)
Probability & Statistics (1)	Operating Systems (1)
Professional Ethics (1)	Security Principles (1)
Basic Principles of IT (1)	Programming (3)
Information Systems (1)	HCI (1)
Database Systems (1)	Project & Project Mgmt (1)

*(n) number of courses: Total 17 courses

Most classes include theory and lab sections incorporating active learning techniques. The inclusion of a project course and exhibitions introduces students to real-life practical training to enhance the theoretical underpinning. With this foundation, students proceed to the specializations.

4. A Services Science Specialization.

In designing a Services Science specialization, we needed to take into account the background provided in the core (Table 2), the abilities of our students, a general understanding of Services Science as it applies to IT, and the needs of potential future employers. In initial planning we assumed UAE employer needs with respect to services science would equate to the general understanding of Services Science in industry. This assumption has yet to be tested through a survey of our stakeholders.

CIT students have excellent verbal communication skills but are often limited in English writing skills. They are often challenged by tasks requiring math, logic, or problem solving skills. This may be partly cultural but it is also a result of the still developing primary and secondary school educational curricula. We needed to keep this in mind as we considered requirements of a Service Science discipline, but we could not compromise our responsibility to meet industry needs. If the

pre-requisite skills for a needed services science skill are lacking, then we must teach it within the program rather than overlook it.

Our first step was an examination of the practitioner-focused literature, our own collection of management science texts, and a selection of the growing number of ‚how to’ books on Services Science for IT (ITSMF, 2007; Steinberg, 2006; Lawrence & Pasternack 2000; Winston & Albright, 2006).

The second step was to review courses in the existing majors to determine what, if any, courses could be, or should be, co-listed with the proposed Services Science major. All curricula were examined with particular attention given to enterprise systemsⁱⁱ. Services Science can be viewed as the confluence of management, people, and technology (Spohrer, 2007); a definition which fits well with the discipline of information systems (in CIT “enterprise systems”). Cross listing of courses is common in the CIT because with seven existing majors, it is essential that we be parsimonious in our development of new programs and new courses.

5. Curriculum Requirements

In selecting courses, and later topics, we sought to envisage what a Bachelor of Science (Information Technology) with a major in Services Science would or should *look* like. What knowledge, skills, and abilities would they possess? What might be their future career paths? We expected that upon graduation, CIT bachelor degree students would take entry level positions in industry or government. Since our students are all Emirati nationals, it can also be expected that their rise to senior positions will be much more rapid than in Western nations. Based on this and on our study of the literature and available texts, we considered that the program needed to include material on:

- Nature of services
- Service quality
- Service in the IT department context
- Statistical process control
- TQM - total quality management
- Business process reengineering
- Change management
- Software release management
- IT-business alignment
- Value chain and value networks
- Data architecture requirements
- System architecture requirements
- Applied management science models
- ITIL, including ITIL metrics

6. Proposed Curriculum.

We needed to meet the proposed curriculum requirements at an appropriate undergraduate level in seven courses. We chose to introduce three new courses and co-list four existing courses.

6.1. New courses

The three new courses proposed were: Services Science; Measuring ITIL, and Services Modeling and problem solving. The brief course descriptions for these courses are given next, assuming a naming structure of SSME for courses in the new major.

SSME 301 Services and Services Science

This course introduces students to the basics of successful service delivery: it provides both a foundation and an overview. Topics may include: nature of services, service quality, statistical process control, TQM philosophy, root cause analysis, BPR, change management, release management, and introduction to ITIL.

SSME 401 Service Performance Evaluation

This course provides an overview of the ITIL structure and focuses on developing metrics for the measurement of information systems and technology (IST) service quality within the ITIL framework. Topics may include: KPIs, CSFs, Balanced Scorecard, and Dashboards. Metrics for management of incidents, problems, change, and outsourcing contracts. Measuring help desk performance, system availability, and service continuity in emergencies.

SSME 402 Applied Management Science

This course focuses on solving real world problems (cases) using standard management science tools. Methods studied and used may include: linear programming, network models, project scheduling (Pert; CPM, Gantt); decision trees, game theory, queuing theory and models, forecasting models, and simulation models.

6.2. Existing courses to be co-listed

Several courses from existing tracks were considered suitable for inclusion in the Services Science major, but only four could be included as requirements for the specialization. Other related courses could be chosen as one of the “breadth electives” required in the degree. The four required courses were: IS fundamentals; systems analysis and design; internet computing, and e-government.

The inclusion of e-government may be surprising to some. It is included because information technology and eCommerce initiatives in the UAE are being led by the governments of each emirate (or state) [Cherrayi, 2008b]. Furthermore, many graduates will find their first workplace in a government department or business. If they do not, they will certainly be interacting with government electronically. It is, therefore, important in the UAE environment that students have knowledge of eGovernment.

The course descriptions of the course selected from existing curricula are listed below.

ESBP 300: Information Systems Fundamentals

Information systems (IS) and their roles in today's business and organization; Distinction between IS and IT; Stakeholders and their roles in using IS for competitive advantage; Characteristics of various types of organizational systems; Roles of telecommunications and the Internet in business and organization; e-Commerce, Intranets, and Extranets as parts of IS in Organizations; Overview of IS Planning for IS strategic management and use of IS in organization.

ESBP 370 Systems Analysis and Design

Successful management of system development or enhancement projects for enterprise-level systems; Managing the system life cycle: requirements elicitation, logical design, physical design, testing, and implementation; System and database integration; Network and client-server management; Metrics for project management and system performance evaluation; Managing user expectations; Project staffing; Analysis of cost-effectiveness; Reporting and presentation; Managing both the behavioral and technical aspects of a project; Change management.

INSY 440: Internet Computing

Web Technologies (HTTP Protocol, Presentation abstractions, Web-markup and display languages, Client-side programming, Server-side programming), Web services and servers, Emerging technologies, Information Architecture. Hypertext/hypermedia, Web design, Digital Media. Web Development (interfaces, database access). Vulnerabilities (client and server). Social Software

ECBP 402 E-Government

Business, technical, and managerial concepts necessary to run an e-government project; Local, national, and regional topics may include: legal framework, security and trust; biometrics and ID systems; GIS in government; reengineering government through technology; web enabled services; digital equity.

6.2. Pedagogical Approach

Services Science education is not suited to a „lecture, listen, repeat back to me” approach to university education – indeed, it is difficult to identify subjects that are suited to this approach! Courses in the CIT, including the new Services Science major, must focus on active learning techniques. Such techniques place the responsibility for learning on the learner, and require him or her to be involved in the process. Active learning techniques include the fostering of class discussions, student and group tasks or projects requiring „report back’, and exercise which mimic real world situations requiring students to practice what is learnt rather than merely write about it. Inclusion of guest speakers from industry would also be used.

7. Summary

This paper presented an initial analysis of courses and topics for a proposed new undergraduate specialization in a Bachelor of Science (IT) program. The program was designed to meet the perceived needs of constituents in a rapidly developing Middle Eastern nation, the United Arab Emirates. Students entering this program have high verbal skills but are weak in mathematical and problem solving skills essential to services science. Consequently, these skills are emphasized in the major. The degree has a high core component and the specialization is restricted to seven courses. With seven existing majors and a limited number of students, it was necessary to co-list courses from other tracks to parsimoniously create the proposed major.

The authors feel that the curriculum provides a set of courses to meet industry and student needs, but it has yet to be finalized and tried in the classroom. Further preparation is required and it may be expected that other topics and perspectives will be required. The curriculum presented is

designed also to create questions in the reader's mind and will be open for discussion at the workshop.

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ⁱ Intelligent Systems; elsewhere Computer Science

ⁱⁱ Enterprise Systems; elsewhere Information Systems