

AN END-USER INFORMATION SYSTEMS CURRICULUM FOR THE 21ST CENTURY

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ABSTRACT

This paper presents a model curriculum for students studying organizational and end-user information systems (OEIS). Developed by the Organizational Systems Research Association (OSRA), the curriculum contains seven required and six elective courses which are based on a foundation of general education and core business courses. Core courses include an introduction to OEIS; computer user support; planning, design, implementation, and evaluation; technical training and delivery methods; telecommunications and networking; cases in information technology; and an internship. The elective courses comprise eBusiness and web technologies, collaborative technologies and knowledge management, network administration, operating systems, information systems security, and special topics. College and university faculty members in a variety of disciplines are invited to consider this model when revising or expanding their information systems curricula.

Keywords: end-user information systems, end user computing, information technology, information systems education, organizational and end-user information systems (OEIS), IT curriculum development

INTRODUCTION

Due to recent breakthroughs in digital communication and information technologies, both academicians and business professionals are no longer limited by geographical distance or time zone differences when their virtual teams use computer-mediated communication. Such was the case recently, when the Organizational Systems Research Association national curriculum task force composed of over 20 information systems (IS) academicians and information technology (IT) practitioners met virtually for an academic reengineering process using web-based group decision support tools. These geographically dispersed content experts revised and updated an IT undergraduate curriculum model designed for preparing end-user support personnel for a digital, knowledge-based economy.

The need for IS workers is growing, but the identification of the specific skills required for the variety of IS positions is not as clear [49, 51, 52]. Information technology managers are challenged to find competent workers for positions open in the technology field. Computer security, data growth, data management, and the expansion of network technology also pose increasingly sophisticated challenges for managers of technology. These challenges are enhanced by the constant changes in information sys-

tems, end-user computing, and communication methods. Straub and Watson [58] note that "with the explosion of the Internet and other networks (e.g., cell phone, cable TV, satellite downlinks and uplinks), systems that have been the historical focus of IS research are being rapidly transmogrified" (p. 337).

Over a decade ago, Trauth and Farwell [62] identified a gap between IS/IT industry expectations and academic preparation. In order to narrow the expectation gap, continuous curriculum redesign and course updates have become a necessity to provide students with the essential skills needed upon graduation [61]. Educational institutions must be willing to review current curricula, and investigate how to update these curricula, to produce technically competent students with the skills necessary to succeed in the business world. Between 1991 and 2001, the number of professional IT-related jobs doubled, with an annual growth rate of 7.2% [16, 45]. Consequently, academics around the world face the difficult task of providing up-to-date curricula in an ever-changing environment.

Curriculum development is a method for educational institutions to help bridge the gap and produce qualified graduates who will become qualified applicants for the available positions in the IS/IT world. Those responsible for teaching key courses in the area of IT must ensure the curricula and courses result in the achievement of the critical skills required to advance in the job market or to continue in an advanced degree program. In a national survey of technology educators at the secondary and post-secondary levels, Wicklein [67] found that curriculum development was one of the top three critical issues identified by respondents. Rapid advances in e-commerce, wireless networking, and other technologies continue to increase the need for updated skills. While improving and adding courses and training modules remains necessary, it is imperative that each curriculum reengineering effort stay focused on the bigger picture of organizational and social needs [70].

The challenges of end-user support and information technology implementation go beyond solving technical problems in corporate settings [57]. An understanding of how businesses work in conjunction with interpersonal and management skills is also necessary. Hoplin [22] notes that "the rapid proliferation of emerging information technologies drives home the point that IS/IT cannot run in place without losing ground" (p.1).

Computer programmers have the slowest growth rate out of the four previously mentioned IT-related occupations. The Bureau of Labor Statistics, in its *Occupational Outlook Handbook*, says, "Employment of programmers is expected to grow more slowly than the average for all occupations through the year 2014" [xx,

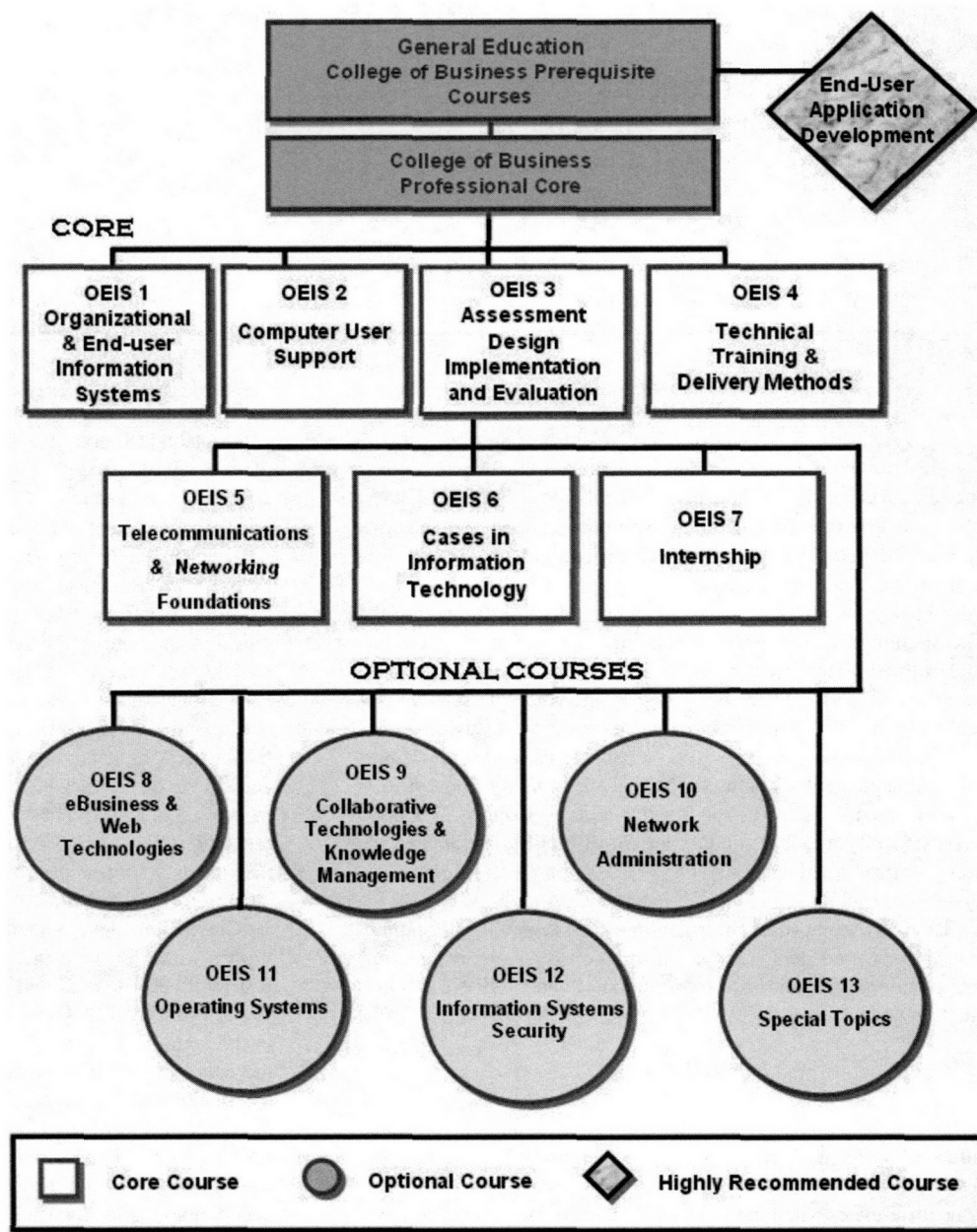
emphasis in the original]. Slow growth is due to outsourcing, automation in code writing, and advances in programming languages. At the same time, however, Meares and Sargent predict that the IS/IT area will add 2.5 million new jobs between 2000 and 2015, "resulting from growth in the occupations (2.2 million) and the need to replace those leaving the profession (331,000)." [45, p.16]. Gonzenbach [18] recommends that most emphasis should be placed on teaching telecommunications, operating systems, systems analysis and design, networking, and business communications.

IS/IT departments need employees with a variety of skills, and are particularly looking for IS/IT skills that will not only support but also enable business operations. As Meares and Sargent report, "IT is central to nearly all core business functions and to the overall operation of most companies, and IT professionals are integral to the core business team" [45, p. 4].

The Organizational Systems Research Association (OSRA), with a mission of advancing education in information technology, learning, and performance, recently selected a national curriculum task force of over 20 IS/IT academics and practitioners to redesign and update its 1996 end-user information systems curriculum model to meet the needs of technology-based businesses for the 21st century. The goal of the newest iteration is to provide a cornerstone on which graduates can build successful careers in end-user support as well as training and development. OSRA has developed a model intended to keep pace with current IS/IT requirements and to address the existing shortcomings of IS/IT education [26].

Task force members used group decision support software as the primary means of communication, interacting both synchronously and asynchronously. Discussion revolved around current essential competencies and the core knowledge IS/IT professionals need to enhance productivity and work performance at the desktop. The resulting curriculum model emphasizes organizational and technological knowledge and skill areas needed to support the use of emerging technologies in the 21st century. The OSRA model curriculum, shown in Figure 1, emphasizes that end-user computing is crucial to the well-being and success of any organizational enterprise.

Figure 1
2004 Organizational and End-User Information Systems Model Curriculum



MODEL CURRICULUM OVERVIEW

The philosophy underlying the Organizational End-User Information Systems (OEIS) model curriculum can be summed up as: Technology is just a tool. It is the knowledge behind it that matters. Similarly, Watts [66] who believes that technology is not simply a curriculum content area, but rather an approach to learning and the application of knowledge. This curricular philosophy includes creating products and processes via a purposeful application of knowledge, experience and resources to meet the needs of users. The OEIS curriculum incorporates technical knowledge in pursuit of meeting these human needs, using technology to teach technology.

The new iteration of the OEIS curriculum is designed primarily for a four-year bachelor's degree, and is best suited for a

school of business where students have a liberal arts foundation and study the core business curriculum. However, the curriculum also may be effectively implemented in other schools (e.g., education, computer science, technical studies) where the business common body of knowledge (accounting, economics, marketing, management, business law, business communications, and statistics) is included. Interpersonal skills, teamwork, communications skills, information security and assurance, and ethical considerations are developed and practiced throughout the curriculum. McCloskey [43], along with Smarkusky and Smith [56], note the importance of teamwork skills for information systems students. Other important skills necessary for IS/IT graduates include business knowledge, [2] considered a prerequisite in the model curriculum, communication skills, [42, 23], and information systems ethics [55, 39, 25].

The OEIS curriculum model illustrated in Figure 1 [26] assumes the general education requirements are fulfilled. It is highly recommended that an end-user application development course also be completed. For flexibility, the curriculum is divided into core courses and optional courses. The OEIS courses are briefly described below.

REQUIRED COURSES

OEIS 1 – Organizational and End-user Information Systems

An overview of organizational and end-user information systems (OEIS) technologies, business processes, and worker performance, this course emphasizes the methods used to plan for and implement information technologies in the workplace. It discusses advances in information systems hardware and software, emphasizing applications designed for technology end users. The course stresses understanding end-user needs and how to select or design systems to address those needs. Work flow and systems analysis methodology, work (re)design, organizational change, systems implementation, and management issues are covered. Basic computer literacy is assumed. As an introduction to the OEIS curriculum, this course provides an overview of course content covered in depth in future courses. Several of the topics contained in this course are identified as core subjects by the Joint Task Force on Computing Curricula [29].

OEIS 2 – Computer User Support

This course introduces the responsibilities of a computer user support specialist and develops skills for microcomputer troubleshooting. Students develop the expertise necessary to work with help desk and support center operations to fulfill end user support needs. Students examine how to support and communicate with non-computer professionals. They also use a variety of software, including remote management tools, call tracking software, and programs to support the statistical analysis of calls/issues. Students develop problem-solving skills and install, configure, and troubleshoot microcomputer hardware and software. The prerequisites are computer literacy and demonstrated skills in using hardware and application software. Success factors for end-user support that influence course content are described in Nilsen and Sein [48], Shaw, DeLone, and Niederman [54] and Rivard and Huff [53]. On computer literacy for information systems students, see McDonald [44].

OEIS 3 – Planning, Design, Implementation, & Evaluation

This course covers the four stages of OEIS development: assessment, design, implementation, and evaluation. Students learn methods and procedures that empower them to define and solve large-scale OEIS problems or address new opportunities. In studying the integration of hardware/software into jobs and the work environment, the course will give attention to various organizational development and management factors including strategic planning, techniques for developing return on investment, planned change strategies, human factors, and job redesign. Students will complete a systems analysis and design proposal with special attention given to inter-organizational goals. The prerequisite is OEIS 1. See Iivari, Hirschheim, and Klein [27] on the importance of information systems development process knowledge for information systems experts. Development methodologies, including implementation issues, were identified as increasingly important to employers by Galup, Dattero, and Quan [17] and Lee [34]. See Tastle and Russell [60] on the content of systems analysis and design courses.

OEIS 4 – Technical Training & Delivery Methods

This core course builds upon skills and knowledge acquired in OEIS 1, 2, and 3. Students briefly overview change management, learning, and training theory in conjunction with technical training practices. These training practices are supportive of and conducive to organizational and end-user information systems implementation where OEIS tools are to be integrated into the work environment. Students focus on the design, development, and delivery of technical training. Students investigate and apply delivery methods including both traditional and state-of-the-art techniques. Planned change strategies (including addressing resistance to change) for technology implementation are also addressed, along with the application of relevant theories and evaluation of technical training effectiveness. On instructional design methods, see Gustafson and Branch [20] and Visscher-Voerman and Gustafson [65] for a comprehensive review and paradigms, respectively. See Yellen [69] for the importance of end-user training to the organization.

OEIS 5 – Telecommunications & Networking Foundations

This course provides foundation information and skills relating to telecommunications and networking in the business environment, including conceptual information, telecommunication applications, networking fundamentals, and using of the Internet and intranets. Management issues and practical applications are an integral part of this course. See Crews [9, 10], Pandya [50], Johnson, Stallard and Tanner [28], and Crews and Ray [12] for research on the appropriate content for a telecommunications course.

OEIS 6 – Cases in IT

A capstone course, this class involves the analysis, synthesis, evaluation, and application of advanced concepts, theories, principles, and skills associated with information technologies through case studies of the development of solutions to business problems and the redesign of business processes. The course is ideally taken in the student's last term before graduation. The prerequisites are OEIS 1 through 5. On the usefulness of the case

method, see Kunselman and Johnson [32] and Hackney, McMaster, and Harris [21]. Barnes, Christensen, and Hansen [1], among others, is a standard reference.

OEIS 7 – Internship

This course is designed to provide the senior-level student experiential learning related to information technology in an approved on-campus or off-campus site. Students may perform information systems trainer/consultant and/or end-user support duties. Students will meet periodically with the instructor to discuss problems and issues relevant to the area of organizational and end-user information systems. Compensation may or may not be granted for the internship. See Carpenter [7] and Little, et al. [36] on the importance of internships and other workplace experiences to information technology education.

ELECTIVE COURSES

OEIS 8 – eBusiness & Web Technologies

This optional course or course stream is dedicated to investigating the implementation and administration of Web-based applications for non-profit and for-profit organizations in which e-business has become an integral part of the business model. It will provide the students with a foundation in the fundamentals of evolving Internet technologies and Web authoring using currently popular Web development software. Topics include e-business models and strategies, intermediate and advanced extensible hypertext markup language (XHTML), design principles of e-learning content, Website hosting and setup procedures, Web server administration, information security, Internet protocols, extensible markup language (XML), dynamic PHP/MySQL and ASP/JSP Web content driven by back-end databases, and streaming media. The students will apply the knowledge and skills learned to create or redesign actual e-business websites. The students are required to publish their projects on the Internet and ensure that all features and functions are properly working and the means of ongoing maintenance and updates are specified. See Lomerson, Jones, and Schwager [38], Brookshire, Williamson, and Wright [5], and Williamson, Brookshire, and Wright [68] for the importance of these skills and topics for IT professionals. See Mehta, Shah and Morgan [46] and Lim [35] for topics covered in a web development course.

OEIS 9 – Collaborative Technologies & Knowledge Management

This course is designed to provide the senior-level OEIS student with an introduction to group decision support systems, electronic meeting management, desktop video conferencing, and other groupware applications. Students will be introduced to concepts fundamental to an understanding of groupware tools and various collaborative technologies for enhancing group processes and computer-mediated communication in today's digital economy. The course addresses a wide range of topics including the implementation and design of group support systems (GSS), electronic facilitation, and GSS as an enabling technology for business process reengineering, knowledge management, and collaborative learning. Special emphasis will be placed on using groupware technologies and systems to create, store, and distribute explicit and tacit knowledge within contemporary organiza-

tions, and on incorporating these technologies in the curriculum. On these topics, see Martz, Shepherd, and Hickey [40].

OEIS 10 – Network Administration

This course is designed to develop senior-level OEIS students' advanced network administration skills. Both client and server applications will be dealt with, and a strong emphasis will be placed on network operating system software. Students will also be exposed to multi-vendor networking topics. Specific course topics will include setting up and configuring Web and e-mail servers, Web site security using secure sockets layer, the domain name system, the dynamic host configuration protocol, the Windows Internet naming service, remote access, Internet protocol (IP) routing, IP security, network address translators, and other core networking/internet applications. See Chenoweth, Pfeiffer, and Yuan [8] for recommendations on network administration course content. Galup, Dattero and Quan [17] and Caputo [6] found that network server knowledge and skills are increasing in demand among employers. Lee [34] found server and Internet skills the most highly sought network skills among Fortune 500 employers.

OEIS 11 – Operating Systems

This course will provide the theoretical foundation and practical skills required to install, troubleshoot, maintain, and support various operating systems. A thorough survey of personal computer and intermediate server operating systems available today will be provided, including Microsoft Windows, Linux/Unix, the Macintosh operating system, and the Microsoft Disk Operating System (DOS). Topics include their functional similarities and differences, file management distinctions, installation procedures, printer and other peripheral device management, interoperation with legacy systems, maintenance, backup operations, and troubleshooting methods. The Joint Task Force on Computing Curricula [29] identifies operating systems as a core competency. Galup, Dattero, and Quan [17] and Lee [34] found that firms seeking IS/IT employees identify operating systems as key skills.

OEIS 12 – Information Systems Security

This course is an introduction to end-user systems security from a management perspective. The course emphasizes the methods for the management of information security through the development of policies, procedures, audits, and logs. It also provides an understanding of the techniques used for identifying threats, vulnerabilities, and common human errors, as well as analyses of the legal, ethical, and privacy issues in information systems. It discusses emerging technologies related to systems security. See Bogolea and Wijekumar [3], Hsu and Backhouse [24], Kim and Surendran [30], Logan [37], and Surendran, Kim and Harris [59] on information security curricula.

OEIS 13 – Special Topics

This course is the study of advanced concepts and issues relevant to OEIS. Content will vary according to the needs and interests of the students and the interests and expertise of the faculty. Selected topics should emphasize current technological advances and OEIS management concerns.

SUGGESTIONS ON OEIS IMPLEMENTATION

A curriculum as a system means more than the sum of its parts, and is interdependent with the parent system, in this case a post-secondary education, that nurtures and supports it. Organizational and end-user information systems are, by nature, cross-disciplinary and experience-driven. No individual OEIS program could survive alone without help from relevant external parties, particularly sister programs that have endured their growing pains. Knowing that the OEIS Model Curriculum is only a point of reference and every OEIS program is operated under different budgetary and personnel constraints, the authors offer a number of suggestions to those who are or will be going through curricular reengineering. The suggestions include, but are not limited to:

1. Identify the strength of your program; keep it, build or reconstruct it.
2. Construct one or more service courses that support the entire college or school so that the need and importance of your program is sustained.
3. Compare your curriculum, course by course and as a whole, with competing and comparable programs in order to make necessary adjustments and alignment.
4. Emphasize the planning and management of IS/IT solutions across the curriculum. Expect students to become future leaders of business technologies instead of mere technicians.
5. Form an advisory board that consists of major regional employers and intern supervisors to inform you the business practitioners' perspective [34, 4].
6. Track the achievement of the graduates from the program and solicit input to improve the curriculum [61].

In addition, the technology business is people business. The final analysis of the success of a curriculum relies not only on those who have proceeded through it, but also the faculty who implement it. Only if educators continue to develop to the caliber of current IS/IT professionals and managers will there be an opportunity for our students and graduates to be properly prepared [70].

SUMMARY AND CONCLUDING REMARKS

Because a model curriculum must be flexible, courses and course titles are meant only to provide containers for competencies and instructional modules. The curriculum is presented in a framework of modules within semester courses. In actual implementation, it is expected that course content will be adapted to fit other time frames (e.g., quarters or 1 or 2 credit courses) and course goals. Such alterations are considered consistent with the intent of this model. The seven core courses (OEIS 1-7) contain the competencies that are considered vital. The optional courses (OEIS 8-12) are suggestions for more in-depth work in specialty areas and/or field experiences. Universities can customize courses to meet the needs of their students and the mission of their schools. Dwyer and Knapp [15] explain how departments use model IS/IT curricula.

The way technology is used today is changing the world at a rapid pace. Students who succeed in this ever-changing envi-

ronment will be ones who combine and effectively synthesize technology mastery with core knowledge of business skills and practices. Therefore, educational institutions must be willing to re-engineer curricula and investigate how to incorporate significant updates to produce the technically competent students who have the "soft" and "hard" skills necessary to succeed in the business world. New technologies, organization changes, and accreditation standards are forcing many educational systems to rethink curricula content at the graduate and undergraduate levels.

Davis, Feinstein, Gorgone, Longenecker, and Valacich [14] noted that developing curricula in the IS/IT areas has been an ongoing task since the early 1970s. One example of this is the IS 2002 curriculum which was developed through a group effort between the Association for Computing Machinery (ACM), the Association of Information Technology Professionals (AITP), and the Association for Information Systems (AIS). This collaborative effort emphasized the need for a useful model curriculum which can be adapted to a variety of IS/IT types of degree programs. The same is true for individual courses in model programs. It is necessary to develop frameworks for others to follow when creating or updating course content. In a study by Daigle, Longenecker, Landry, and Pardue [13], it was noted that 81% of the IS/IT faculty surveyed were aware of the IS/IT 2002 model curriculum but only 12% were committed users. Model curricula are presented as models, not as dictates on course structure or content. Van Veen, Mulder, and Lemmen [65] discuss different curriculum schemes, including model curricula, and the uses of such models.

Although there is some overlap between the OEIS Model Curriculum and the IS 2002 Model Curriculum [19], there are also considerable differences. Several topics that are included in the IS 2002 Model Curriculum are also included in the OEIS model. Some examples include computer systems hardware, networking, system administration, and security. The differences, however, insure that graduates from the two curricula will have distinct skills that will allow them to reinforce each other as technology team members in the workplace. See Landry, Pardue, Longenecker, and Feinstein [33] on the similarities and differences in curricular emphases of various information technology programs.

As technology evolves quickly to create an ever-changing, borderless business environment, the updating of technology courses is also on-going. In order for colleges and universities to keep their course content current and develop competent graduates, it is essential that to review curricula and make the necessary updates. Research and development in assessment and the assurance of learning will further help programs enhance their curricula and in turn help graduates succeed. It is the intent of OSRA to provide this curriculum model as a baseline to assist administrators and faculty in an effort to improve the quality of their curricula. This curriculum provides students with fundamental technological skills and core business knowledge to enter an ever-changing work environment.

Lastly, the fast pace of change in the global economy dictates that academics use various forms of web-based technologies and computer-mediated communication to increase input from key knowledge workers. The planning process itself can become a formidable and mammoth effort. As noted by McCall and Young [41], those leading the charge often get caught up in "processing the process," going through endless iterations in an effort to capture everyone's view and reach consensus, oftentimes ending in inefficient and exasperating exercise. With the use of WGDSS, however, meetings are more accessible, participants are able to

archive group events, and the collaborative technology makes it feasible and cost effective to include geographically dispersed experts. Moreover, the brainstorming, categorization, prioritization and voting features facilitate the dynamic, continuous and opportunistic nature of strategic planning and produce a dramatic impact on outcome-oriented group processes. Most significantly, it is an effective way to integrate the knowledge and creativity existing within virtual teams into the curriculum development process.

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