

Information systems program and business needs: Case study of a Midwestern University

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ABSTRACT

The course contents of the undergraduate Information Systems (IS) curriculums are vital to the IS field and to IS graduates. Technological advances and their associated impacts on businesses have necessitated changes in the contents of the undergraduate IS curriculums and the skills and knowledge required of IS graduates by the business communities. As a result of these changes various studies have been done by IS researchers and business practitioners, and various model curriculums have been published in efforts to align the undergraduate IS curriculums with the needs of the business communities. In this study a single case study methodology was used to address an identified research gap in IS related skills studies: Lack of study of skills and knowledge sets required of IS graduates by businesses in a region and the content of the undergraduate IS curriculum of a university in the same region. Some recommendations were therefore presented to both the IS educators and the business communities on how to address the identified gaps in this study as well as any perceived gaps. The study also showed that any gaps were not due to differences in perceived importance of skills and knowledge sets between IS instructors and the business communities, but due to a curricular implementation latency period which is the time between realization of the importance of skills and knowledge sets and the subsequent addition of the necessary building courses to the IS curriculum. Further studies were recommended to formulate best practices for effective curricular changes and implementations.

Keyword: IS Curriculum development, IS skills and knowledge sets, IS graduates skills, Business IS needs, Curriculum design, Information systems.

INTRODUCTION

Information Technology (IT) has come a long way since the 1960s. Over the decades, IT has transcended its infantile back office support role, and become the backbone and center piece of modern business operations and subsequently revolutionized the modus operandi of organizations and corporations (Davenport & Short, 1990; Henderson & Venkatraman, 1999; Porter & Millar, 2001; Santa, Ferrer, Bretherton, & Hyland, 2009). The following statement by Porter and Millar (2001) “Information Technology revolution is sweeping through our economy. No company can escape its effects. Dramatic reductions in cost of obtaining, processing, and transmitting information are changing the ways we do business” (p.149) adequately summarized the impacts of IT on business operations. With such impacts on business operations, IS graduates are now required to have in addition to the technical skills required of the discipline, non-technical skills and knowledge sets that include business fundamentals skills and business operating environment (Mata, Fuerst, & Barney, 1995; Kanwar, Singh, & Kodwani, 2009; Outlay & Krishnan, 2010).

These skills have been identified as essential skills and knowledge sets for IS graduates in order to identify business opportunities and leverage those opportunities using the appropriate information systems and business acumen (Kearns & Lederer, 2003; Y. Lee, Chu, & Tseng, 2009; Outlay & Krishnan, 2010). In order to provide IS graduates with the skills and knowledge sets required of them, the undergraduate IS degree program curriculums need to be reflective of the skills and knowledge sets required of IS graduates by the business communities. Doing so requires knowing what skills and knowledge sets are required of IS graduates by the business communities, what the undergraduate IS curriculums currently offer and then implementing the necessary curricular changes to bridge any identified gap in the curricular contents.

BACKGROUND

IT has became the center stage of business operations as well as an integral part of the business enterprise management systems and possession of non technical skills by IS graduates have become important for achieving strategic business purposes (Porter & Miller, 2001; Byrd, Lewis, & Turner, 2004) as IS graduates have become “of critical importance as the strategic value of Information Technology in modern organizations has become apparent” such that their skills and knowledge sets have become very important to organizations as organizations depend on IT and IT enabled processes (Byrd et al., 2004, p.38). Studies have found that organizations that have invested in the appropriate IT infrastructure outperformed those organizations that did not invest in IT infrastructure (Das, Zahra, & Warkentin, 1991; Newkirk, Lederer, & Johnson, 2008). A recent International Business Machine (IBM, 2011) study found that 53% of respondents expected their IT budget to increase over the next 12-18 months. The study also found that 75% of the respondent planned to upgrade their IT core systems, and IT security (63%), customer relationship management (62%), and analytics/information management (59%) and these were also cited as the most critical IT priorities. With such financial investments IS graduates need to have the necessary skills and knowledge sets.

Numerous studies have been undertaken by both IS researchers and business practitioners that involved the use of different variables such as expectations from end-user managers, IT practitioners, IT consultants, students, advisory board members, end users, IS faculties and educators, Specific skills sets of IS/IT graduates (Y. Kim, Hsu, & Stern, 2006; Bullen, Abraham, Gallagher, Kaiser, & Simon, 2007; Brookshire, Hunt, Yin, & Crews, 2007; Surendra & Denton, 2009; K. Lee & Mirchandani, 2010; Stevens, Totaro, & Zhu, 2011). Studies of the curriculum, model curriculum or frame work (Kung, Yang, & Zhang, 2006; D.C. Davis & Woodward, 2006; Bailey & Mitchell, 2007). No study has focused on the local skills and knowledge sets required of IS graduates by local IS managers and if an institution that offers an undergraduates IS degree program within that locality reflects those requirements in its undergraduate IS degree program curriculum.

This is an important research gap since local educational institutions are the primary sources of locally needed manpower and talents, and business needs tend to drive academic degree programs (Havelka & Mechout, 2009). This study addressed this important research gap by focusing on the skills and knowledge set required of IS graduates by IS managers in the Midwestern region of United States and the skills and knowledge sets impacted to its IS graduates by undergraduate IS degree program of a Midwestern university (TZ University- pseudonym) which has its IS degree program residing within the business school or a business division of the university and accredited by Association to Advance Collegiate Schools of Business (AACSB). Since universities accredited by the AACSB in the United States are expected to link their undergraduate IS curriculum to business domain fundamentals and fundamental knowledge and skills unlike the IS degrees offered at non-business institutions such as colleges and schools of computing or IT, where the IS degrees are just technical degrees focused on IS specific knowledge areas and skills with weak or no link to any specific business domain fundamentals (Hilsop, 2003; Topi et al., 2010).

LITERATURE REVIEW

Information Technology (IT) has transformed the modern world both socially and economically and organizations are increasingly investing in IT as an essential business strategic tool and in information systems (IS) graduates as the knowledge base for achieving organizational strategic business and information technology- alignments and objectives (Porter & Millar, 2001; Santa, Ferrer, Bretherton, & Hyland, 2009; Akhavan, Jafari, & Ali-Ahmadi, 2006; Newkirk, Lederer, & Johnson, 2008; P.D. Brewer & Brewer, 2010). Studies have been done to identify the skills and knowledge sets required of IS graduates by the business communities (Farwell, Kuramoto, Lee, Trauth & Winslow, 1992; Trauth, Farwell & Lee, 1993; Bryd, Lewis & Turner, 2004; Kanwar, Singh, & Kodwani, 2009). More than a decade ago, a landmark exploratory study by Trauth, et al., (1993) using comparative investigatory analysis found the existence of a curriculum gap in the undergraduate IS curriculums as a result of perceived differences in importance of the critical skills and knowledge sets required of IS graduates between the business communities and IS educators. Another exploratory study by Koh, Lee, Yen and Havelka (2001) found that the importance of technical or non-technical skills and knowledge sets depend on the career choice, career path, and career progress of IS graduates. A

qualitative case study of organizations by Surendra and Denton (2009) found that business fundamental skills and knowledge were considered as the most valuable skill for a successful IS career.

Educational institutions therefore have the “academic responsibility and a moral obligation to provide students with an inclusive education that will enable them to deal with the contingencies of living in a diverse world” (p.67). For educational institutions that offer undergraduate IS degree programs and IS educators to continue laying emphasis on only the technical competences of IS graduates despite the needs of the business communities for IS graduates to possess business skills and knowledge would be like in the words of Patricia Cross as cited by Abebe & Abebe (2004) “using old maps for new highways.”

METHODOLOGY

This study was qualitative in nature, and utilized a single case study research design. This study focused on the skills and knowledge sets required of IS graduates by IS managers in Midwestern region of United States with regards to the IS specific or core knowledge areas, proficiencies, and business expertise and the undergraduate IS degree program curriculum of TZ University located in same region, to ascertain how proactive and engaging the IS department of TZ university in producing IS graduates with the skills and knowledge sets expected of its IS graduates. The research question for the study was: RQ: How is the undergraduate information systems curriculum at TZ University aligned with the career needs of its IT graduates?

The study also investigated how TZ University’s undergraduate IS curricular changes were made and implemented. In order to provide answer to this research question, the following questions serviced as guidelines. (1) What are the skills and knowledge sets required of IS graduates by IS managers in the Midwestern region of the United State with respect to IS core knowledge areas, proficiencies, and business expertise? (2) What are the course topics, course work and course contents and the associated skills and knowledge the current undergraduate IS degree program curriculum of TZ University provides and equips its IS graduates with? (3) How are curricular changes identified and implemented by the IS department to reflect changes with respect to the skills and knowledge sets required by the business communities?

A total of 15 IS managers from various organizations within the Midwestern region of the United States using non probability sampling were interviewed. The IS manager were functional departmental heads of their respective IS departments with supervisory roles as well have hiring decision powers in their respective organizations. To better understand the undergraduate IS curriculum, and how curriculum changes are implemented, 2 academic members of TZ University involved in curricular design processes and implementations were interviewed.

DATA COLLECTION

The IS managers were asked to rank the component of each of the specific skills and knowledge sets categories based on the level of perceived importance from 1 through 10. 1 represented very important and 10 not important. The academic members were

asked to describe the processes involved in undergraduate IS curricular changes and implementation in the university. The content of the current undergraduate IS degree program curriculum of TZ University was tabulated to identify the course work, topics and associated skills and knowledge sets.

RESULTS

The descriptive statistics of the IS managers' demographics are presented below.

Table 1: Years in IT and as IS manager

Years in IT field	Years
Minimum years in IT field	8
Maximum years in IT the field	30
Minimum years as IS manager	1
Maximum years as IS manager	15

Table 2: Educational levels of IS managers

Educational levels of IS managers	Level
Minimum education level	AAS
Maximum education level	MS

Table 3 – Respondents' title

Title	Number of respondent
IS director	2
IS manager	13

Table 4: Respondents' industry

Industry type	Number of respondents
HealthCare	4
Manufacturing	3
Software and application development	5
IT Consulting	3

DATA ANALYSIS

Question Guideline 1 and Analysis

The first research guideline for the study was: What are the skills and knowledge sets required of IS graduates by IS managers in the Midwestern region of the United State? The following themes emerged from the IS managers' interviews (See tables 5)

Table 5: Themes from the analysis of Skills and Knowledge sets

Themes	No of References
Basic critical required skills	35
Job roles/Position/Responsibilities dependent	35
Better business relationship	31
Organizational factor	25
Become efficient	22
Understanding of the business environment	18
Higher job levels	16
Good project management	11

Analysis of IS Core or Specific Knowledge and Skills

Analysis of the IS Core or Specific knowledge set and skills showed varied rankings amongst the IS managers (see Table 6).

Table 6 Ranking of the IS Core or Specific knowledge and skills.

IS SPECIFIC KNOWLEDGE & SKILL	Ranking	%
Information Systems security	1	68%
Computer hardware and software skills	2	47%
Computer Operating systems	3	73%
Project management	4	40%
Computer Network management (hardware and topologies)	5	41%
Database design, query, maintenance and administration	6	47%
Systems design and analysis	7	53%
Systems development cycle	8	47%
Programming languages (JavaScript, Java, PHP, HTML etc)	9	33%
Enterprise Resource Planning Systems	9	33%
Web development	10	20%

Note: % of importance is the highest percentage of ranked perception of importance in the specific skills and knowledge. The ranking were based on the average ranking of each of the components.

All the IS managers agreed that acquisition of IS Core or Specific knowledge set and skills are “must haves” for IS graduates. The values of IS specific knowledge set and skills were summarized by the following statements:

While not all these skills are needed by all IS graduates and proficiency is not needed for all of these, one would expect IS graduates to have these skills or knowledge as they are critical basic skills and knowledge for most if not all IT positions. (Participant D)

Another manager provided the following explanation:

These are critical basic skills and knowledge sets needed in most IT positions for any to call him or herself an IT professional. If an IS graduate could not perform any task related to these skills, then there is a problem. These are important skill sets to have when working within an IT department. Without these skill sets maintaining system components and software would be difficult. (Participant A)

Information Systems security (IS security) was ranked as 1st skill and knowledge set for IS graduates to have by 68% of the IS managers, although each of the IS managers have different reasons for such ranking. For example while Participant G stated that: IS security as an important knowledge for ALL information systems jobs; Participant A stated the importance of IS security by this statement: knowledge and skills of IS security will protect all other areas of the system. Participant E viewed knowledge of IS security as complaint issue with regards to The Health Insurance Portability and Accountability Act of 1996 (HIPPA) with the following statement:

Working in a healthcare environment, IS security is must to maintain HIPPA standard.

Computer hardware and software skills and computer operating systems were ranked 2nd and 3rd skills and knowledge sets for IS graduates to have by 47% and 73% of the IS managers respectively. One of the IS managers had this to say:

These (Computer hardware and software skills and computer operating systems) are critical basic technical knowledge sets for IT professionals to have for basic logical troubleshooting. (Participant E)

This was echoed by another IS manager with the statement:

These are important skill sets to have when working within an IT department, without these skills and knowledge maintaining and troubleshooting any system components and software will be difficult. (Participant F)

Another IS managers had this to say:

While Computer hardware and software skills and computer operating systems are important to have, these are second level skills once a person gets to a management level. (Participant B)

Project management skill and knowledge set was ranked the 4th skill and knowledge set for IS graduates to have by 40% of the IS managers. While Participant D recognized the value of project management as “critical skills for an IS graduate needed in higher job levels to manage projects”, Participant F viewed project management skill as basic skill that comes with any job responsibilities. Participant F summarized his view on the importance of project management skill and knowledge set with the statement: My experience is that everyone follows some sort of project plan.

Participant A viewed project management skill as important skill to have and explained it this way:

This skill is needed when working in an IT department or any organization that has multiple projects with different goals and dates. Without this skill-set it would be difficult to complete projects in a timely fashion.

While Systems Design and Analysis and Systems Development Cycle were viewed as important, they were ranked 7th and 8th skills and knowledge respectively for IS graduates to have because these are seen as important in systems or applications development only.

One of the IS mangers (Participant G) summarized the values of Systems Development Cycle and Systems Design and Analysis skills as follows:

Having the capability and knowledge about systems design and being to analyze the system is critical in IT. This skill (Systems Design and Analysis) is essential in problem solving and enhancing the system. This skill set (Systems Development Cycle) is important in the software development processes. This skill set is essential in the process of creating/altering information systems and the models and methodologies that are used to develop these systems.

Enterprise Resource Planning Systems (ERPS) was ranked as the 9th skills and knowledge for IS graduates to have, although the IS managers appreciated the value of being skilled in ERPS.

According to Participant A:

Having this skill and knowledge will enable a person to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholder.

One of the reasons for such ranking was the individual IS manager's organizational usages or experiences. For example not all the IS managers have or make use of Enterprise Resource Planning System even though they all acknowledged its values. One of the IS managers (Participant F) said:

Our facility is fairly localized, this (Enterprise Resource Planning System) is not as much important to us as it would be for an organization such as Wal-Mart and Dell that has branches and offices all over the place.

Another IS manager (Participant I) had this to say:

Most facilities have an Enterprise Resource Planning System and that is the source of knowledge transfer between departments and source of historical data to make better business decisions down the road. For those organizations, it is an important skill and knowledge for an IS graduate to have.

Analysis of IS Proficiency

While the IS managers viewed IS proficiency as important, the level of importance varied and was dependent on the IS graduate's job task, and responsibilities as well as on organizational usage of the applicable software or applications (see Table 7).

Table 7 Ranking of IS Proficiency

IS PROFICIENCY	Ranking	%
Client-server database	1	40%
Spreadsheet (Excel, Lotus, etc.)	2	40%
Enterprise Resource Planning (use and understanding)	2	40%
Project management tools	3	60%
Personal database (MS Access, etc.)	4	33%

Note: % of importance is the highest percentage of ranked perception of importance in the specific skills and knowledge. The ranking were based on the average ranking of each of the components.

For example, while the importance of proficiency in client-server database was recognized by all IS managers, it was viewed by Participant M as role specific proficiency “needed in some positions” such as Network or database administrative role for “knowledge sharing and for security and greater control”.

Client-server database was ranked the 1st IS proficiency for IS graduates to have. The importance for the proficiency in client-server database was summarized by the following statement:

It gives far greater control and ease of management of PC and data. I know some organizations that do not have this in place and I cannot imagine the nightmare they have trying to manage data and users. (Participant H)

Participant G on the importance of client-server database proficiency had this to say:

Client-server database is an important proficiency needed for information and knowledge sharing. Without this proficiency, the resultant lack of information sharing will stagnate an organization’s operations and communications. Since information sharing is what IT is all about, this is skill that is vital to network and systems administrators.

Enterprise Resource planning proficiency was ranked 2nd by 40% of the IS managers. Similar to the Enterprise Resource Planning Systems, Enterprise Resource Planning proficiency was valued as a proficiency to have as expressed by all the IS managers, but not all the IS managers make use of Enterprise Resource planning System. In fact this reflects studies that have found that 95% of Fortune 500 use ERPS, but only 30-40% of the Fortune 500 companies that use it are successfully using it (O’Leary, 2004).

Participant F provided this explanation:

If our facility makes use of Enterprise Resource planning systems, then proficiency in it will be very important.

Analysis of Business Skills

Similar to other skills and knowledge sets categories in this study, the importance of each of these skills and knowledge sets varied (see Table 8).

Table 8: Ranking of the Business skills and knowledge

BUSINESS SKILLS & KNOWLEDGE	Ranking	%
Knowledge of business ethics and privacy issues	1	93%
Knowledge of general business environment (economic, legal, etc.)	2	52%
Knowledge of business models	2	40%
Knowledge of business foundation and functions	3	73%
Knowledge of a business function area (finance, marketing, production, etc.)	4	47%
Knowledge of globalization issues, trends, and requirements	6	34%
Globalization issues	7	33%

Note: % of importance is the highest percentage of ranked perception of importance in the specific skills and knowledge. The ranking were based on the average ranking of each of the components.

Knowledge of business ethics and privacy issues was ranked 1st business skills and knowledge for IS graduates to have by the 93% of the IS managers.

According to Participant A:

Knowledge of business ethics and privacy issues are essential in any organization.

This ensures that one does what is right and saves the organization from lawsuits.

Participant H added to the importance of business ethics and privacy issues with the following:

These skills (business ethics and privacy issues) are necessary no matter where a person works, since trust is the basis of any business relationship.

Knowledge of business of general business environment and knowledge of business foundation and function were ranked 2nd and 3rd skills and knowledge sets for IS graduates to have by 52% and 73% of the IS managers respectively. Participant G summarized the importance of such skills:

As an IT professional, it is helpful to understand how IT systems support or should support different functional areas in an organization.

Participated A added this statement to buttress the importance of having knowledge of business of general business environment and knowledge of business foundation and function:

It is imperative that an IT professional know the general business environment in order to be complaint with the regulations and laws and also know the importance of IT in business operations and where IT falls in the scheme of things in the organization.

Overall Analysis of the Skills and Knowledge set Study

The Analysis of all the skills and knowledge sets components showed that both technical and non technical skills and knowledge sets are required from IS graduates by the IS managers (see Table 9). Knowledge of business ethics and privacy issues and IS security were ranked as the foremost skills and knowledge sets for IS graduates to have. Proficiency in spreadsheet (Excel, Lotus etc) is in the same rank with client sever database, computer hardware and software skills, Enterprise Resources Planning, knowledge of business foundation and function and computer operating systems. One of the reasons for the Excel ranking was found in the statement by participant O:

After 14 years of project management experience, many customers I have come across have not invested in the high end project management systems, but every one of them has Excel!

Table 9: Summary of All the Skills and Knowledge Sets Rankings

Skills	Ranking of importance	% of importance
Knowledge of business ethics and privacy issues	1.1	89%
IS security	1.6	84%
Client-server database	2.1	79%
Spreadsheet (Excel, Lotus, etc.)	2.3	77%
Computer hardware and software skills	2.7	73%
Enterprise Resource Planning (use and understanding)	2.8	72%
Knowledge of business foundation and functions	2.9	68%
Computer Operating systems	2.9	71%
Knowledge of general business environment (economic, legal, etc.)	3.0	70%
Knowledge of a business function area (finance, marketing, production, etc.)	3.2	68%
Project management	3.3	68%
Computer Network management (hardware and topologies)	3.7	63%
Knowledge of globalization issues, trends, and requirements	3.9	61%
Database design, query, maintenance and administration	4.3	57%
Knowledge of business models	4.4	56%
Systems design and analysis	4.5	55%
Globalization issues	4.6	54%
Personal database (MS Access, etc.)	4.7	53%
Systems development cycle	5.1	49%
Programming languages (JavaScript, Java, PHP, HTML etc)	6.1	37%
Enterprise Resource Planning Systems	6.6	34%
Web development	9.0	10%

Note: % of importance is percentage of ranked perception of importance in all specific skills and knowledge. The ranking were based on the overall average ranking for each of the components.

Question Guideline 2 and Analysis

The second guiding research question of the study was: What are course topics, course work, contents and associated skills and knowledge areas the current undergraduate IS/IT degree program curriculum of the university provide and equip their graduates with?

The undergraduate IS degree courses are grouped in to three categories (See Table 10, Table 11, Table 12).

Table 10: Group 1 Courses - Required Undergraduate IS Courses

Course topics	Topics, Content and work	Associated Skills/Knowledge
Information Technology for Networked Organizations.	IT, Internet Technologies, E-Commerce and business models, organizing and modeling enterprise data, Network protocol and architecture, development of IT systems, and IT management and organization design.	Network design, implementation and management
Database Design and Management	Data concepts, techniques and management and use of data in organizations. Data modeling, database logical and physical designs, implementation, database administration and web-based database environment.	Database design, implementation and management
Information Systems Analysis and Design. (Prerequisite: Database Design and Management)	Developing large-scale information systems, including preliminary planning, feasibility analysis, design implementation, and post-implementation review of the system; a term-long project	Systems design, development, implementation and analysis, system development cycle

Table 11: Group 2 Courses - Intermediate Undergraduate Elective IS Courses

Course category	Topics, Content and work	Associated Skills/Knowledge
E-business Management	Enterprise IT-applications and management issues	Business management and environment.
Management of Data Communications	Business oriented approach to evaluating and selecting data communications technology. Knowledge of network telecommunications technology including hardware and software. Design systems and network components.	Network design management
Enterprise Software Management	Enterprise projects and IT projects, and management. Provides fundamental managerial skills for IT projects. Enterprise Resource Planning, Customer Relationship management and supply chain management IT systems. Use project and project-management software. Estimate and manage costs, schedules and resources.	Enterprise Resource planning system/Project management. Managerial and management skills
E-commerce Applications and Web-based Systems	Technical skills for building web-based e-commerce applications using the Microsoft .NET framework as well as knowledge of web services. Topics include: ActiveServerPages.NET (ASP.NET), VisualBasic.NET (VB.NET), XML, web services, the Microsoft .NET framework	Web development and programming languages
Decision Support Systems	Developments in information technology for managerial decision support with an emphasis on Internet-based and mobile information technologies. Application of these technologies to management information systems	Decision making skills
Enterprise Computing Management	Java, C and C++ languages. Programming skills for building and managing enterprise applications and general principles of computing.	Programming languages, computer hardware and software skills.
IT Governance	Development, research and business practice of IT governance. Managerial issues for the prevention of business frauds and threats; the key technology for IT governance for users and businesses; issues concerning integrity control, privacy, ethics, risk management, and reliability; best practices concerning regulatory compliance requirements; and enterprise information management issues, policies and practices.	Business ethics and privacy issues, IS security, Enterprise information management

Table 12: Group 3 Courses - Advanced Undergraduate Elective IS Courses

Course category	Topics, Content and work	Associated Skills/Knowledge
Individual Behavior in Organizations	Behavior of employees in work organizations; Employee motivation and employee satisfaction elements of the work environment; management strategies to modify employee motivation and satisfaction.	Knowledge of general business environment, and management
Organizational Design and Environment	Understanding of complex organizations and team work; organizational changes and adaptation.	General business environment and function
Marketing Research	Techniques and methods of marketing research; survey research and experimental design	Business fundamental and functions and business function area
Purchasing and Supply Management	Analysis, planning, and forms of organizations those are associated with the buying functions in business. Focus on the principal issues involved in the procurement of raw materials, components, equipment, operating supplies, and services. Also treats the unique aspects of institutional and government purchasing.	General business environment and function and business function area
Management Decision Models	Methods of operations research from an executive or managerial viewpoint, formulation of business problems in quantitative terms; industrial applications of linear programming, dynamic programming, game theory, probability theory, queuing theory, and inventory theory	General business environment and function and business function area
Business Process Management	Methods of design and management of manufacturing and service business processes; central concepts include managing process-speed, -capacity, -inventory, and -uncertainty; simultaneous product and process design, and quality management, process improvement and lean thinking	Knowledge of general business environment, business model, business fundamentals, functional areas and management
Project Management	Management concepts, tools, and techniques that apply to the organization, planning, and control of projects analyzing needs, defining work, scheduling tasks, allocating resources; assessing costs, managing risks; tracking and evaluating performance; and building and leading teams.	Project management skills and tools, general business environment, business model, business fundamentals, functional areas and management
Business Process Improvement	Philosophies and tools for enhancing customer-defined value created through processes. Statistical Quality Control, Value Stream Mapping, Total Quality Management, and Six Sigma. Prerequisite: Junior standing.	Knowledge of general business environment, business model, business fundamentals, functional areas and management
International Business	Field of international business and management. Examines the economic, political, and legal environments of international business. Analyzes differences in financial management, marketing, and management practices for firms doing business abroad.	Knowledge of global issues, tends, economic, political and legal issues, knowledge of business environment and functions
Small Business Consulting	Through guided experience, students identify and offer advice to local small business firms; exposes students, serving as consultants, to the wide variety of problems facing the smaller firm as well as enables them to apply current business methods to real problems. Students work in teams.	Knowledge of general business environment, business model, business fundamentals, functional areas and management
Entrepreneurship: Small Business Formation	Entrepreneurship, prepare a comprehensive business plan for starting or acquiring such a business; also the problems small business.	Knowledge and skills in general business model, foundation and functions

Table 10 comprises of three required. These courses are called “basic skill courses or IS core courses”. In the word of an academic member of TZ university, the skills and knowledge sets provided by these courses “are all essentially what every IS graduates is expected to know” (FM B). Table 11 comprises of 7 elective courses. These 7 courses are called intermediate courses and are described as “finer grained electives for the IS students” (FM A). The students are required to choose any two courses from this group of courses. A prerequisite for all the courses in this group is the “Information Technology for Network Organization” from table 10 courses.

Table 12 comprises of 11 elective courses and requires 5 prerequisite courses. These 11 courses are considered as “advance elective courses” and are described as “program electives”. The students are required to choice any 4 courses from this group of courses. The 11 program elective courses provide flexibility of career choices to IS graduates. As one of the faculty members (FM B) stated: One can combine Operations Support or Operations Management with IS or Decision Making, Operations process Management with IS to round off their skills.

The 5 prerequisites courses for Table 12 courses are to be taken in the freshman and sophomore years (see Table 13).

Table 13: Group 3 Prerequisite courses

Courses	Prerequisite courses	Topics, Content and work of prerequisite	Associated Skills/Knowledge
Individual behavior in organizational	Management and Organizational behavior	Analysis of management and organizational behavior. Organizational theory and management Science, environmental forces, planning, organizing, motivation, control processes, incentive leadership, interpersonal relationship	Business fundamental skills, Communication, leadership, decision making process
Organizational Design and Environment			
Purchasing and Supply Management	Principles of Marketing	Emphasizes the concepts of planning, organization, control, and decision making as they are applied in the management of the marketing function. Provides an overview of aspects of the marketing discipline.	Business operating environment, business fundamental skills, business decision making
Marketing Research	Principles of Marketing		
	Economic Statistics I	Basic concepts in statistics, presentation of data, descriptive statistics, probability theory, discrete and continuous distributions, sampling distributions, estimation, and hypothesis testing. How to apply these concepts in "real-life" situations.	
	Economic Statistics II	Continuation of Economic Statistics I simple and multiple linear regression and time series techniques.	
Management Decision Models	Economic Statistics I Economic Statistics II	Same as above	

Examination of the prerequisites courses, the topics and courses work reveals that the prerequisites courses provide knowledge that cover various aspects of organization

environment, international businesses, the impact of political and legal issues on business operations, organizational changes, organizational management “to understand organizations and the functions within organizations” (Topi, et al, 2010, p.60). The case for the prerequisites and the associated skills and knowledge sets could be summarized by the statement by FM A:

We encourage the more the better because recruiters will like you to have much more skills than fewer skills. Our students are always encouraged to take courses across campus in sciences or in library as long as it does not interfere with the IS program.

Question Guideline 3 and Analysis

The third research guiding question for the study was: How are curricular changes identified and implemented by the IS department to reflect changes in skills demands. The following themes emerged from the interviews of the faculty members (See Table 14).

Table 14: Themes from interviews of TZ University faculty members

Themes	No of References
Continuous course assessment	8
Communications among faculty staff	6
Communications with recruiters and organizations	5
Collegiality among staff	4
Collaboration among staff	4
Staff responsibilities	4

According to the FM A, there is a continuous assessment and re-evaluation of the undergraduate IS program curriculum by the faculty member based on interactions with recruiters and businesses while been mindful of the AACSB accreditation criteria. On the question on how often the university’s undergraduate IS/IT curriculum is re-evaluated, FM A stated:

We are very dynamic with course contents and topics and undertake incremental intra-course adjustments every semester based on informal quality evaluation of skills and knowledge sets from two or more recruiters, or organization, as well as from social media and research.

FM A further elaborated:

If only one organization or recruiter mentions any skills and those skills are not part of an existing course structure, we are not bothered or concerned, but if two or more organizations mention any skills that are not part of the courses contents. We ask ourselves “are we missing something here?” Then we look at the possibility of adding those to exiting course contents to make sure we are not missing any key components in the market.

FM A then added:

But every two years cycle, we ask ourselves are there any new opportunities or any market skills that is required and we are seriously lacking? So there is a re-evaluation of the whole undergraduate IS degree curriculum based on student enrollments, required skills and knowledge based on the markets, external inputs from recruiters, businesses, social media and research findings.

While there is regular incremental intra-course adjustment, the decision for any incremental intra-course adjustments are always based on consensus of the department IS faculty members, such that:

If in the course of making any course adjustments, somebody says “Wait, I do not think this is true”. We will have another meeting. We want to make sure we are not been shorted sighted in decision making. We will ask “Do we really want to do this because it is a long term change and it might affect some other objectives that we are having. But this rarely happens because we really see the need before making the change. (FMB)

Faculty member (FMB) elaborated further:

The undergraduate IS Curricular re-evaluation is grounded on 99% research by the faculty members and interactions with recruiters and organization and as a result we are on top of new or emerging technology and the necessary skills and knowledge sets required.

The faculty member (FM B) elaborated further:

New course is not always required, we change course contents sort of intra refinement. The creation of new courses is based on if the skills required can not be fulfilled with any existing courses. If there is an exiting course with those components of skills and knowledge sets, then some course adaptations are carried out.

According to FM A while there are regular intra-course adjustments, any major curricular changes aimed at addressing any identified major technology, skills and knowledge sets gap in the long term involve the “whole structure or organization of the university and are stepwise in nature”. The stepwise implementation according to the FM A “involves all institutional resources, areas, departments, college and provost”.

Reason for such institution wide involvement according to FM A was to be able to:

Identify the degree name, course title and associated topics, associated credit hours, faculty resources needed, if there are any other courses within the institution that can fulfill the target skills, and if so what adjustments may be required. Once the decision is made the departmental head then communicates the decisions to the faculty members that then look at the specifics and the necessary changes.

According to FM A:

We are current with technology and skills and knowledge sets required because we are very dynamic with curricular changes and most of the changes or adjustments are grounded on 99% research findings by the faculty members who are all research orientated, and also from interactions both formally and informally with recruiters and organization. We often encourage open communication from all folks. While some course adaptations are made every semester based on inputs and suggestion from informal interactions between businesses and faculty members, we do re-evaluate the whole curriculum every

two years to make sure we are not missing something new, we are not missing any critical skills required out there.

DISCUSSION, RECOMMENDATIONS, AND CONCLUSION

The study revealed that IS managers in the Midwestern region of the United States valued the possession of both technical and business skills and knowledge sets by IS graduates. The study showed that the undergraduate IS degree program curriculum of TZ University offers three groups of courses to its IS students : Required IS core courses, Intermediate elective courses, and Program elective courses, and also the undergraduate IS department of TZ University has continuous and regular intra-course adjustments carried out every semester based on inputs from IS recruiters, business practitioners, research finding by the faculty members, but every 2 cycle years, have a re-evaluation of the whole undergraduate IS degree program and curriculum to make sure that there are no “new opportunities or any market skills that is required and we are seriously lacking”. (FM A)

The examinations and analysis of all the data pertinent to this study show that the undergraduate IS curriculum of TZ University is in alignment with the career needs of its IS graduates as its IT curriculum contents provide the skills and knowledge set required of IS graduates by its business communities. While studies have found the existence of a curriculum gap due to differences in perceived importance of the critical skills and knowledge sets required by IS graduates between the business communities and IS educators (Trauth et al., 1993; Tang, Lee, & Koh, 2001; Bryd et al., 2004), this study reveals that TZ University undergraduate IS educators and the business communities interact either formally or informally with one another in efforts to match skills needs and supply, any curriculum gap or expectancy gap is due to what this researcher calls *curricular implementation latency period*, which is the time difference between the realization and demand of new skill and the implementation of curricular changes to address the new skill. This study also proves that business skills and knowledge needs tend to drive academic degree programs.

RECOMMENDATION FOR FUTURE STUDY

This study focused on the Midwestern region of the United States and it utilized a single case study design, a comparative study of IS managers perceptions of the skills and knowledge sets expected of IS graduates from different regions of the United Stated and universities from those regions of the United States is recommended, so as to help to highlight the best practices for curricular change and implementation for undergraduate IS program.

IMPLICATIONS OF RESEARCH FINDINGS

While universities make efforts to provide IS graduates with the skills and knowledge sets to meet business communities, it is impossible or difficult to meet all the varying skills and knowledge sets required of IS graduates by the business communities. Therefore IS managers should institute some training and development programs in their

respective organizations to address any perceived lack of skills due to organizational factors. The IS managers could accomplish this through the use of project assignments to provide opportunities and challenges for skill development and enhancements, encourage enrollment in specific classes, provide on the job training seminars, make use of teams to encourage peer learning.

CONCLUSION

Every IS managers expect IS graduates to at least have the basic and core IS skills and knowledge sets. The IS managers also expect IS graduates to have some understanding of business fundamentals, although the expected depth or level of understanding varies with the IS graduates' job roles, responsibilities and positions. It is also reasonable to say while studies have identified curriculum gaps due to perceived difference of the importance of required IS skills between IS instructors and the business communities, that is no longer the case as IS educators listen to the business communities, and try to meet the skills and knowledge set expectations. While there may be expectancy or curriculum gap, it is no longer due to the differences in perceived importance of IS skills and non technical skills between IS educators and business practitioners as previous studies have indicated, but due to what this researcher calls curricular implementation latency period, which is the time difference between the realization and demand of new skill and the implementation of curricular changes to address the new skill demands. Further research is needed on best practices for curricula changes and implementations.

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