

AN EMPIRICAL STUDY OF THE IMPORTANCE OF THE UNDERGRADUATE EXIT COMPETENCIES SPECIFIED IN THE IS 2002 MODEL CURRICULUM

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ABSTRACT

Fall 2002, the latest revision of the Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems was adopted. Included in the new curriculum model was an updated list of desired exit characteristics for information systems undergraduates. This study presents the results on an empirical investigation of the perceived importance of these exit competencies today and over the next three years. Implications for Information Systems curriculum development are presented.

Keywords: exit characteristics of IS graduates, IS 2002 undergraduate model curriculum

INTRODUCTION

Fall 2002, after a multi-year effort, the latest revision of the model curriculum for undergraduate programs in Information System was presented to and adopted by a consortium of professional and academic information technology societies (4). Key differences between IS '97 and IS 2002 include a new emphasis on e-business and emerging technologies, most notably web and enterprise software development (3). Additionally, the new model contains a revised set of key competencies for graduates. As academic Information Systems departments begin the process of incorporating the recommendations of IS 2002, it would be helpful to have a better understanding of the importance of the various key competencies.

The 2002 Model curriculum lists five major categories of general exit characteristics that an I.S. program graduate should have in order to function effectively in an entry-level position. Four of the high-level categories are (a) business fundamentals; (b) interpersonal, communication, and team skills; (c) technology; and, (d) analytical and critical thinking. The fifth category—information systems—is derived from the intersection of the other four (3). Each of the five major categories represents an aggregate of several middle-level subcategories. The subcategories, in turn, are a composite of several suggested examples of individual competencies. The purpose of this research project was to assess the importance of the various exit competencies, individually, and in the sub- and super-category aggregates. Specifically, the following research questions were addressed:

- According to information systems professionals, how important is exit characteristic in supporting today's organizational computing needs?
- Are some exit characteristics, subcategories, or major categories more important than others?
- Do information systems professionals anticipate a difference in the level of importance for the various exit characteristics three years from today?

PROCEDURES AND METHODS

Using IS '97 (2), IS 2002 (3), and relevant literature as a guide (5, 6, 7, 8), a survey instrument was developed to assess the perceived importance of key exit characteristics of Information Systems undergraduates. During December 2002, a survey of critical entry-level MIS skills was administered to I.S. alumni from an AACSB-accredited business school at a medium-to-large (18,500 students) state university, located in the U.S. intermountain west. The population frame of 128 alumni represented all four-year Information Systems program graduates for the last five years. Alumni received email inviting them to complete an easily accessible web-based questionnaire. As incentive to participate and as a way to keep the sample more random than voluntary, respondents were entered into a drawing for a new \$100 handheld computer. One hundred twenty-eight requests for participation were emailed. Of those email requests, 76 or 59.4% were returned as undeliverable due to outdated email addresses. An attempt to secure updated addresses resulted in successful dispatch of eight of the returned emails. In all, 60 email requests were successfully electronically delivered. Twelve responses were received yielding an effective response rate of 20.0%.

FINDINGS

As Table 1 indicates, even with a small sample ($N = 12$), the respondent profile was remarkably robust along the dimensions of professional experience, primary business activity, organizational size, staff size, and job title. On average, respondents reported 7.83 years of experience in information technology.

Table 1 Respondent Profile

Demographic Category					
	<i>f</i>	<i>%</i>		<i>f</i>	<i>%</i>
Primary business activity			Systems acquisition strategy		
Computer-related and communications	4	33.4	Purchase of packaged software	11	91.7
Education	3	25.0	In-house development	9	75.0
Manufacturing and process (other than computer)	2	16.7	Outsourcing	7	58.3
Agriculture/mining/oil/gas	1	8.3			
Healthcare/pharmaceuticals/biotech/biomedical	1	8.3			
Whole/trade/distribution/retail	1	8.3			
Company size			Organizational position		
Small (< \$250 million in annual sales)	3	25.0	Systems analyst	2	18.2
Medium (\$250 - \$1 billion in annual sales)	2	16.7	Website administrator	2	18.2
Large (> \$1 billion in annual sales)	3	25.0	Computer operator	1	9.1
Non-profit organization	4	33.3	Director of information systems	1	9.1
			End-user/technical support	1	9.1
Size of I.T. staff			Mid-level manager of I.S.	1	9.1
Small (< 50 people)	6	50.0	Programmer analyst	1	9.1
Medium (50 – 500 people)	3	25.0	Project manager	1	9.1
Large (>500 people)	3	25.0	Software engineer	1	9.1
	<i>M</i>	<i>SD</i>			
Average professional experience (in years)	7.83	4.61			

For each of the exit characteristics identified in the IS 2002 model curriculum, respondents

provided an importance rating for two time periods using a five-point scale (Not Important (1) to Extremely Important (5)). During the data reduction process, the 73 individual skill ratings were combined into subcategory and major category scales. Table 2 summarizes the ratings by major category, ordered from highest average importance to least average importance.

Table 2 Importance of IS Undergraduate Exit Characteristics by Major Category

Major Exit Characteristic Category	Now			3 yrs from Now			<i>t</i>	Incr/Decr
	Rank	<i>M</i>	<i>SD</i>	Rank	<i>M</i>	<i>SD</i>		
Interpersonal, communication, and team skills (I)	1	3.66	0.89	1	3.85	0.85	2.96*	↑
Analytical and critical thinking (II)	2	3.63	0.92	4	3.68	0.94	0.96	↑
Information systems: technology-enabled business development (intersection of 4 major categories) (III)	3	3.55	1.09	3	3.69	0.98	1.06	↑
Technology (IV)	4	3.45	0.94	2	3.71	0.81	1.48	↑
Business fundamentals (V)	5	3.06	1.04	5	3.24	1.01	0.18	↑

Note. Sample size (*n*) ranged from 8 to 12 because several respondents did not answer the questionnaire completely, leaving blank one or more importance rating questions. The roman numerals I through V represent major category labels to assist in categorical decomposition. See Table 3 for details.

* $p < .05$ based on pairwise *t*-tests

Based on the information technology needs of today's organizations, "Interpersonal, Communication, and Team Skills" received the highest importance rating ($M = 3.66$, $SD = 0.89$) of the five major knowledge categories, followed closely by "Analytical and Critical Thinking" ($M = 3.63$, $SD = 0.92$). "Information Systems" ($M = 3.55$, $SD = 1.09$) and "Technology" ($M = 3.45$, $SD = 0.94$) were rated slightly less important. "Business Fundamentals", on the other hand, at ($M = 3.06$, $SD = 1.04$) was rated significantly less important than the other four major categories (Interpersonal $t(7) = -3.47$, $p = 0.010$; Analytical $t(7) = -3.63$, $p = 0.008$; Information Systems $t(7) = -3.00$, $p = 0.020$; Technology $t(7) = -2.43$, $p = 0.046$).

Respondents rated the importance of all five major categories higher in the near future. Interpersonal skills ($M = 3.85$, $SD = 0.85$) continued to have the highest importance rating. The increase in mean importance for this major category was statistically significant ($t(7) = 2.96$, $p = 0.021$). Respondents rated technology ($M = 3.71$, $SD = 0.81$), information systems ($M = 3.69$, $SD = 0.98$), and thinking ($M = 3.68$, $SD = 0.94$) as more important in the future but somewhat less important than interpersonal skills. Business fundamentals ($M = 3.24$, $SD = 1.01$), again, was perceived as least important of the five major exit criteria categories.

Table 3 provides a ranking of each subcategory based on the mean importance rating. In terms of today's information technology needs "Organizational Problem Solving" ($M = 3.93$, $SD = 0.84$) was rated as having the highest importance, followed by "Communication" ($M = 3.88$, $SD = 0.89$) and "Systems Infrastructure and Integration" ($M = 3.83$, $SD = 0.67$). Respondents considered "Systems Analysis/Design/Implementation" ($M = 3.67$, $SD = 1.00$) and "Ethics and Professionalism" ($M = 3.67$, $SD = 1.04$) slightly less important. Of note was "Functional Business Areas" ($M = 2.80$, $SD = 1.22$) which received a rating below the mid-point on the importance Likert scale.

Respondents reported an increase in future importance for 13 of the 16 exit characteristic subcategories. "Communication" ($M = 4.02$, $SD = 1.16$) and "Organizational Problem Solving"

($M = 4.02$, $SD = 0.83$) retained their ranking in the top two. “Internet Systems Architecture and Development” ($M = 3.96$, $SD = 1.01$) moved up from eighth ranked today to third ranked three years from now. The increase in mean importance for this subcategory was statistically significant ($t(7) = 3.25$, $p = 0.012$). Only “Systems Infrastructure and Integration” and “Creativity” declined in mean importance. “Business Process Engineering (BPR)” importance remained unchanged. However, since the majority of the subcategories increased in importance, BPR dropped in importance ranking from seventh to twelfth.

Table 3 Importance of IS Undergraduate Exit Characteristics by Subcategory

Exit Characteristic	Now			3 yrs from Now			<i>t</i>	Incr/Decr
	Rank	<i>M</i>	<i>SD</i>	Rank	<i>M</i>	<i>SD</i>		
Organizational problem solving (II)	1	3.93	0.84	2	4.02	0.83	1.51	↑
Communication (I)	2	3.88	0.89	1	4.02	0.88	1.16	↑
Systems infrastructure and integration (IV)	3	3.83	0.67	8	3.70	0.71	-0.98	↓
Systems analysis/design/implementation (III)	4	3.67	1.00	4	3.92	0.76	1.60	↑
Ethics and professionalism (II)	5	3.67	1.04	6	3.84	1.02	1.95	↑
Interpersonal (I)	6	3.63	1.18	5	3.88	1.09	2.37*	↑
Business process reengineering (III)	7	3.56	1.51	12	3.56	1.42	0.00	-
Internet systems architecture and development (IV)	8	3.48	1.33	3	3.96	1.01	3.25*	↑
Team work and leadership (I)	9	3.47	1.17	9	3.64	1.15	1.16	↑
I.S. project management (III)	10	3.42	1.21	10	3.61	1.14	1.94	↑
Database design and administration (IV)	11	3.40	0.90	11	3.59	0.80	2.14	↑
Application development (IV)	12	3.40	0.96	7	3.71	0.89	1.12	↑
Creativity (II)	13	3.28	1.20	15	3.17	1.35	-1.51	↓
Evaluation of business performance (V)	14	3.25	1.27	13	3.48	1.20	1.26	↑
Business models (V)	15	3.13	0.83	14	3.38	0.92	1.53	↑
Functional business areas (V)	16	2.80	1.22	16	2.88	1.21	1.43	↑

Note. Sample size (n) ranged from 8 to 12 because several respondents did not answer the questionnaire completely, leaving blank one or more importance rating questions. Each exit characteristic subcategory is part of a larger major skill category. The following coding scheme was used to label major category components:

I Interpersonal - Interpersonal, Communication, and Team Skills II Thinking- Analytical and Critical Thinking
 III Information Systems IV Technology V Business - Business Fundamentals

* $p < .05$ based on pairwise t -tests

SUMMARY AND CONCLUSIONS

Discussion of Findings

The purpose of this study was to investigate information system professionals’ perceptions regarding the importance of the exit characteristics required of information systems undergraduates. Descriptive and inferential analysis of the alumni survey yields the following conclusions:

Exit characteristic importance by high-level and mid-level category. Using a mean importance rating above 3.0 on a 5.0 Likert scale as a cut-off point for importance, the four major high-level exit characteristic categories (Interpersonal, Thinking, Technology, and Business) and the intersection category (Information Systems) all rate as important. Fifteen of the 16 mid-level subcategories that comprise the high-level exit characteristics exceed the importance threshold. Only the “Functional Business Areas” subcategory fails. Further analysis

of the individual exit characteristics comprising the “Functional Business Areas” reveals that three topics—“Logistics and Manufacturing” ($M = 2.63$, $SD = 1.41$), “Marketing” ($M = 2.50$, $SD = 1.41$), “Human Resources” ($M = 2.50$, $SD = 1.31$)—account for the low mean importance of Functional Business Areas. For the most part, then, this study confirms the individual importance of high-level (major) and middle-level (subcategory) exit competencies as suggested by the IS 2002 model curriculum.

Relative importance of exit characteristics. At the major category level, Interpersonal skills is the most important exit characteristic. Thinking, Information Systems, and Technology are slightly less important. Business fundamentals, on the other hand, is significantly less important. It appears analytical, interpersonal, and technical skills are the core competencies required of information systems graduates. Business fundamentals provide important domain knowledge about the information systems host environment but are secondary in importance.

Examining the data in the middle-level subcategories, “organizational problem solving”, “communication”, and “systems infrastructure and integration” rank the highest in relative importance. “Systems analysis/design/implementation”, “ethics and professionalism”, and “interpersonal” skills are slightly less important. The next cluster of exit characteristics (“business process engineering”, “Internet systems architecture and development”, “team work and leadership”, “IS project management”, “database design and administration”, and “application development”) average 0.42 less important than the top three competencies. Finally, as expected, the least important group of exit characteristics are the three subcategories that comprise the Business Fundamentals major category (“evaluation of business performance”, “business models”, and “functional business areas”).

Anticipated future importance of key characteristics. Interestingly, survey results indicate that all major categories of key characteristics will increase in importance over the next three years. The anticipated increase in importance of interpersonal skills is statistically significant. “Interpersonal, communication, and team skills” will continue to be the most important skill set required of Information Systems undergraduates; business fundamentals will continue to be the least important major topic area. Technology skills will be more valued than they are today, as the rank importance increases from fourth to second place. Analytical and critical thinking skills will slip to fourth from second place. Information systems development remains in third place. The difference in means between second and fourth place is only 0.03 and is not statistically significant. For all practical purposes, the major categories of Technology, Information Systems, and Thinking are equally important three years from now.

At the subcategory level, relative rankings point to key shifts in exit characteristics importance. “Internet systems architecture and development” moves up from eighth to third place. The mean increase (0.48) is statistically significant ($t(8) = 3.25$, $p = 0.012$). As Internet development moves up in the rankings, it trades places with “Systems infrastructure and integration”. Systems infrastructure is one of two subcategories that decline in importance over the next three years, falling from a mean of 3.83 to 3.70. The other subcategory to see a decline was “Creativity” falling 0.11 on the importance scale. Other major shifts in relative importance involve (a) “Application Development” which moves from twelfth place to seventh place with an increase in importance of 0.31 and (b) “Business Process Reengineering” which drops from seventh to

twelfth place. All other shifts in relative importance are minor with exit characteristic clusters remaining remarkably stable over the next three years. The mean increase in importance was statistically significant for two subcategories—Internet Systems Architecture and Development, as mentioned earlier, and Interpersonal skills ($t(7) = 2.37, p = 0.050$).

Implications for Information Systems Curriculum

The IS 2002 Model Curriculum lists three factors that have been the impetus for the update to the IS '97 Model Curriculum. These are (a) the advent of the Internet, (b) changes in computing literacy preparation levels for entering freshmen, and (c) the specialized accreditation movement for Information Systems programs (4). As a result of these environmental factors, IS '97.2 "Personal Productivity with IS Technology" was reduced to prerequisite status and IS 20002.2 "Electronic Business Strategy, Architecture and Design" was added. The remaining core curriculum (IS.1, IS.3 – IS.10) was updated to reflect "more contemporary terminology and concepts" and the addition of "Internet centric-content" (4, p. 927). The nine major categories of exit characteristics listed in IS '97 (2) were recategorized into four major categories and one intersecting category. Each major category was further divided into 14 subcategories and the knowledge components rearticulated.

This study examined the perceived importance over the next three years of the exit characteristics specified by IS 2002. The results of the survey support the importance currently attached to the major high-level exit characteristics for Information Systems majors due to graduate soon and in the near future. However, categorical aggregation tends to hide individual differences at the subcategory level. "Functional Business Areas", for instance, fails to achieve a threshold rating on the importance scale. This would indicate that domain knowledge regarding the locus of the information system is not as important as foundational skills in systems development. Specifically, respondents questioned the importance placed currently on the topics of Logistics and Manufacturing, Marketing, and Human Resources. For this reason, it is recommended that the relative emphasis on these business functional areas be reduced. Instead of requiring undergraduates to complete separate courses in each of the core business functional areas, an appropriate domain knowledge component should be developed. This recommendation is in line with specialized accreditation guidelines for Information Systems that distinguish between domain knowledge, referred to as an "information systems environment", and systems theory, concepts, and applications (1).

One of the primary research questions addressed in this study involved perceived shifts in relative importance of exit characteristics. The data support the increased attention placed on Internet Systems Architecture and Development in the IS 2002 Model Curriculum. It is recommended that, at a minimum, the three individual competencies comprising the Internet Systems subcategory (Web Architecture Design and Development, Web Page Development, and Design and Development of Multi-tiered Architectures) be integrated into all undergraduate programs in information systems. One model would be to add a separate course patterned after IS2002.2 E-business Strategy, Architecture and Design and integrate a Web Development component into a later course such as IS 2002.9 – Physical Design and Implementation in Emerging Environments (3). Another model would be to develop a single E-business/Web development course and deliver it later in the curriculum sequence.

Limitations of the Study

Although the 20% response rate was satisfactory for an email survey, the sample ($N = 12$) was extremely small, calling into question any statistical analyses that were performed. Nevertheless, the sample was fairly representative of a cross-section of working professionals with an undergraduate degree in Information Systems and provided a form of confirmation of the importance of the exit characteristics proposed in the IS 2002 model. To address the low sample size, additional survey research is currently in progress. In May and June, non-respondents from the original survey were contacted via surface mail and invited to complete and return a paper instrument. Plans are to tabulate mail responses shortly after the survey cutoff date of July 31st and combine them with the online survey dataset. A revised analysis will then be conducted.

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