What Information Technology Asks Of Business Higher Education Institutions: The Case of Rhode Island

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ABSTRACT

Using data from Rhode Island, this research examines the relationships among certifications, skills, educational levels and the level of compensation across the IT field and attempts to discriminate between ten major job functions. It assesses the significance of skills and certifications to specific IT worker categories. The level of education was found to predict success. Certification and skills vary across job functions, and did not necessarily differentiate across IT job functions. Suggestions on the development of curricula are proposed.

Keywords: IT Professional, Curricula Development, Business Education

1. INTRODUCTION

College enrollment in the United States alone is projected to rise to 17.7 million by 2011, or increase by 20 percent from 1999 levels (Gerald & Hussar, 2001). Coupled with changes in the composition of the US economy, college and universities are attempting to meet the future needs of the digital sector, which in the years to come will demand an increasingly larger proportion of skilled information technology (IT) professionals (Buckley et al., 2000). IT professionals are projected to be in high demand until at least 2010, with over 1.8 million new jobs added in computer and data processing services (an 86 percent increase from 2000) (Berman, 2001). However, the existing supply of qualified professionals does not meet demand. Therefore, the focus of research should be on determining the appropriate educational level, skill sets, and certifications that professionals need for IT jobs.

IT professionals have diverse educational backgrounds, ranging from mechanical engineering (historically the original career route for IT professionals) to music degrees. Even though history tells us that different kinds of education are needed for different kinds of IT jobs, the general goals of higher education is in part to provide systems thinking, the ability to generalize, and abstract reasoning ("Understanding the IT workforce," 2001). On the other hand, technical work calls for some form of specialization. However, traditional IT educational purveyors' (i.e., mechanical engineering) inability to meet the demand for workers, coupled with the fast pace at which technology changes, has forced a hybrid career on IT professionals that includes a combination of managerial, technical, project and technology specific assignments (Bailyn, 1991; Burn & Ma, 1997).

In order to provide the skills needed for the profession, deans and educators at business schools across the country are taking a closer look at their curricula in an effort to capture a share of the competitive market of educating IT workers. Business schools are significant providers of both core business and management information system candidates, at both the undergraduate and master's level. Curriculum changes are being considered to address the changing needs of students attending higher educational institutions as a reflection of the market demand. Consequently, research has been conducted in the areas of core

information technology curricula (Burn & Ma, 1997; Gil & Hu, 1999; Stephens & O'Hara, 2001; Watson, Soousa, & Junglas, 2000), IT skills (Arnett & Litecky, 1994; Badawy, 1998; Lee, Koh, Yen, & Tang, 2001; Rada, 1999), and IT career paths (Arnett & Litecky, 1994; Bailyn, 1991; Igbaria, Greenhaus, & Parasuraman, 1991) in an effort to determine the critical educational success factors and required skills of IT professionals. Findings are mixed. Some research advocates the need for specialization and certification (Arnett & Litecky, 1994), while others put forth that "the standards for the skill or knowledge of an individual [should] be oriented to slower changing principles so that the standards retain value over time" (Rada, 1999, p. 25). Some suggest that work experience might have a greater impact on IT workers' long-term performance than formal education (Hilton, 2001). CEO's still find individuals ill prepared for technology jobs (Hahs, 1999), and call for curriculum reforms that meet their needs.

Unprepared workers could arise from inconsistency in the teaching of elements considered core to the industry. Current research has made few attempts to measure the significance of particular skills and certifications for the IT professional, and their relationships to educational principles. The present study intends to offer further direction to this developing line of inquiry and to identify curriculum areas that business schools could help shape in pursuit of training the next generation of IT professionals. The purpose of this paper is two fold. First, it attempts to measure the importance of the number and kinds of skills, certifications, education levels, and other demographic variables to individual career success using compensation level as one outcome measure. Second, it attempts to show if the presence of specific skills and certifications are predominant within and vary across job functions.

2. METHOD

Data collected via a web-based instrument by the Rhode Island Technology Council (RITEC) in the fall of 2001 were used for this research. This entire database included demographic variables, compensation, educational level, job title, place of residence and place of work, list of benefits provided by their employers, preferred methods of recruitment, acquired skills and certifications of IT professionals, and work related questions. For the purposes of the present study, this data set included demographic information, compensation levels, job descriptions [as defined by the Information Technology Association of America (ITAA)], as well as the levels of education that they had attained, the types and number of certifications, and the skills that they currently possess. The list of certification and skills was developed using various sources, including the ITAA industry standard and major software providers.

The resulting sample was not generated at random. Participation was solicited through public announcements on a local TV channel, local portal, direct e-mail to the RITEC membership, and using a company survey instrument that was mailed to over 3000 IT-focused companies in Rhode Island. A total of 208 individuals participated, with 192 respondents being retained for this research after discarding 16 unusable responses due to obvious inaccurate information or duplicate submission. The sample shared commonalities with US professionals in the field of IT, which allows us to generalize our findings to the IT professional population. That is, 60 percent of the sample had a four-year or post-graduate degree compared to an industry estimate of two thirds (Hilton, 2001). A large proportion of our sample and the national population of IT workers share a similar age range of 25 to 44 (71 percent in our sample compared to an estimated 67 percent for the industry) (*The 2002-03 career guide to industries*, 2001). Individual earnings from the sample are estimated at $62,866, which are well above the national average of $46,644; this difference could be explained by the high cost of living associated with the northeastern part of the United States (*The 2002-03 career guide to industries*, 2001).

3. RESULTS

The analysis, using SPSS 11.0.1 for Windows, was two fold. First, we analyzed the significance of the number of certifications and skills in determining the salary of our population using a multiple regression model. Second, through cross-tabulation and logistic regression analyses, we attempted to establish if different levels of education and numbers and types of self-reported skills and certifications were prominent across different job functions.

To address our first research question above, a regression analysis using 114 data points was run with salary range being the continuous dependent variable and 15 continuous independent variables indicative of level of education, number and type of certifications (in Internet/E-Commerce Development, Networking, Technical Support, Systems Analysis, Database Administration/Architecture, Software Development and Project Management), and number and type of skills reported by the respondents (similar to certifications). Seventy-eight respondents out of the original 192 did not have salary information and were blocked from the analysis. Results of the regression show that education level, certifications and skills significantly predicted salary range ($F = 4.083$, $df = 15$, $p<.001$). The model explained almost 39% of the variance in salary, but the coefficient analysis indicates that relatively few variables significantly predicted the salary of workers (See Table I). Specifically, only higher educational levels, higher number of database administration or architecture certifications, and higher number of project management skills were significantly

related to higher compensation levels.

To address our second question (i.e., are levels of education and the numbers and types of self-reported skills and certifications more prominent across different job functions?), a cross-tabulation analysis of each of the skills and certifications with each job category was conducted to measure the significance of the skills and certifications regardless of their reported frequencies. The significant results are summarized in Table II. Only results that showed significance ($p < .05$) were reported with descriptive statistics presented in the 3rd to 5th column. Again, no certifications and skills predicted Digital Media, Technical Writing and "Other" job categories, but all of the other job categories were significantly related to a variety of skills and certifications.

4. DISCUSSION

The research reported in this paper reinforces the importance of acquiring a degree [i.e., the level of education attained is significantly related to an individual's level of compensation ($p = .002$)]. This finding has been documented in the past literature. This research also indicates that the only certification to significantly influence pay across the IT field was Database Administration or Architecture Certifications ($p = .034$). This finding could signal both the current needs of the industry for genuine database-skilled professionals and organizations' day-to-day reliance on qualified database professionals compared to other major IT skills. These results also suggest that just having the database skills ($p = .257$), without certification, does not necessarily make one qualified. This is the reason that certified Database Administration or Architecture workers are paid more than non-certified ones. This finding could also signal that makeshift or improvised IT professionals could benefit from certified formal training in the area of database administration that is driven by industry standards.

An interesting finding points to executives or IT managers having acquired project management skills (with a frequency of 90.9 percent compared to the remaining population frequency of 32.6 percent), yet lack Internet or E-Commerce Development Skills (with a frequency of 9.1 percent compared to 49.7 percent in the overall IT professional population). This marks the need to expose executives to internet or e-commerce development concepts, since these concepts appear to be driving our digital economy (Barrenechea, 2001). This finding could signal a dangerous recipe for the organization, where by the blind is driving the herd. To where is the herd heading? We would argue that IT executives must at least have a strong knowledge (in the form of skills) of E-Commerce to be able to formulate a strategy in this area.

Further, the results seem to provide evidence that technical support professionals are not as skilled as other professionals in the field. Our analysis indicates that technical support job holders are unlikely to have Internet and E-Commerce Development skills (with an occurrence rate of 12.5% compared to 54.4% across all other IT professionals), and have a significantly lower proportion of Database Administration or Architecture (with an occurrence rate of 9.4%, compared to 43.8%), Software Application Development (with an occurrence rate of 6.3% compared to 26.8%), and Project Management skills (with an occurrence rate of 18.8% compared to 39.4%). These results might indicate that technical support workers have specialized functions that are not similar to other IT professionals and that were not measured in the present study.

Even though job-specific skills or certifications exist, they are not systematically and significantly related to specific job categories. That is, different certifications and skills appear scattered across different job functions, indicating that specific skills and certifications do not necessarily reflect the job function of an individual IT professional. Perhaps the development of the field is not mature enough to ascertain the specific types of skills and certifications necessary for particular IT jobs, or alternatively, perhaps different IT professionals can be successful with a diversity of educational and training experiences. However, these results underscore the importance of a good educational foundation for IT workers (shown to be significant in predicting salary with $p < .002$), where taught skills and knowledge principles might enhance the applicability and usefulness of a subsequently acquired certification. Since the level of compensation helps us assess an individual worker's contribution to the organization, it is safe to state that the IT industry values educational attainment. The lack of consistent significance of particular certifications or skills could also be indicative of the increased emphasis of the team aspect in the work environment, where a diverse group of individuals have complementary skills and certifications, and that no specific skills are more prominent than another.

On the other hand, project management skills might be a significant earning determinant across the IT sample population ($p < .002$), which echoes the increased importance of this skill in performing in the field. Even though an overwhelming majority of business schools provide projects as a medium for teaching (Stephens & O'Hara, 2001), it does not necessarily mean that the instructors know how to teach project management effectively. Project management is process-driven with a strong emphasis on teamwork and interpersonal communication. It is a function that requires a great deal of attention and effort, which could be demanding of individual instructors when properly implemented within the curriculum.

5. LIMITATIONS OF THIS RESEARCH

Further research might examine these questions with larger and more representative samples to verify the results found in the present study and to further explore the relationships between particular skills, certifications, level of education and job functions. Non-significant findings for Digital Media, Technical Writing or "Other" job categories reflect a limited sample size for each of the categories and should be further studied. Also, only Rhode Island professionals were studied which points to the possibility that findings could vary across regions of the country. In addition, career success variables other than salary, such as promotion rates, productivity, etc., might be examined in determining the training effectiveness of IT workers.

6. SUGGESTIONS FOR FURTHER RESEARCH

Since both academia and industry seek the similar goal of developing candidates that will be skilled in their respective fields, a greater emphasis should be put on creating partnerships among academic and industry leaders. Further research is needed to identify the skills that are considered "hot" by the industry, and to develop a tracking mechanism that will allow for timely responses by academe in adapting curricula to industry needs. Also, academic institutions must develop flexible curricula, such as offering the possibility of taking certification courses within a degree program. These reforms could help bridge the gap dividing academics and practitioners in making the higher education experience a reflection of the technological workplace that graduates are about to enter.

The present study also highlights the need to study the career paths of IT workers in an effort to define the skills that make them successful and allow them to meet the constantly changing needs of the industry in an evolving economy. The speed at which change is occurring in the IT field marks the need to develop a curriculum that focuses on developing the skills and the knowledge base which will allow re-training over time and that could be applied across functions and projects, such as project management. One could measure the emphasis of project management in the classroom and ask respondents to rate the process they have experienced (if one was used). A closer look at the relationship between the liberal arts curriculum and the business agenda could help define the future teaching at business schools in an effort to better prepare students for IT jobs.

Researching project management skills development across the curriculum could also indicate training needs for educators on the principles of project management, and on how to properly incorporate it into their courses. This could include measuring instructor knowledge of project management processes and pedagogical techniques, and could mark a step towards reducing the gap in actual and desired skills reported by executives in this area.

Last but not least, measuring the impact of September 11 events on the skills and knowledge base needs of organizations would help shape future learning to take place in high education institutions across the country as new sets of needs might emerge, such as technology security.

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TABLE I
Beta Coefficients and T-Statistics for Regression of Salary on Education, Skills, and Certifications

Variables	Std. Error	Beta	t	Sig.
(Constant)	.707		3.777	.000
Education Level	.144	.277	3.247	**.002**
Number of Internet or E-Commerce Development Certifications	.373	-.073	-.852	.396
Number of Networking Certifications	.275	-.137	-1.414	.161
Number of Technical Support Certifications	.344	-.079	-.859	.393
Number of System Analysis Certifications	.419	.009	.079	.938
Number of Database Administration or Architecture Certifications	.593	.190	2.147	**.034**
Number of Software Applications Development Certifications	.698	.098	1.024	.308
Number of Project Management Certifications	1.066	.170	1.571	.119
Number of Internet or E-Commerce Development Skills	.122	.061	.664	.508
Number of Networking Skills	.155	.093	.959	.340
Number of Technical Support Skills	.168	.003	.026	.979
Number of System Analysis Skills	.186	-.001	-.014	.989
Number of Database Administration or Architecture Skills	.278	.108	1.140	.257
Number of Software Applications Development Skills	.411	.056	.614	.541
Number of Project Management Skills	.384	.281	3.247	**.002**

TABLE II
Cross-tabulation of Job Category with Skills and Certifications

Job Category	Significant Skills and Certifications. (a)	Descriptives			Job Categories Case Proportion (b)		
		χ^2	*df*	*Sig.*	*Total*	*Group*	*Others*
Database Dev. & Adm.	6	40.207	1	<.001	7.8%	42.9%	3.5%
Digital Media	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Enterprise Sys. Ana. & Int.	8	14.985	1	<.001	5.2%	19.4%	2.5%
	9	4.246	1	.037	47.4%	64.5%	44.1%
	12	10.628	1	<.001	60.9%	87.1%	55.9%
	15	3.946	1	.047	35.9%	51.6%	32.9%
Network Design & Adm.	3	29.981	1	>.001	17.7%	63.2%	12.7%
	14	6.455	1	.011	23.4%	0%	26.0%
Programming & Soft. Engineering	6	3.987	1	.046	7.8%	1.8%	10.3%
	8	4.344	1	.037	5.2%	0%	7.4%
	9	9.046	1	.003	47.4%	64.3	40.4%
	13	4.814	1	.028	38.0%	50.0%	33.1%
	14	11.066	1	.001	23.4%	39.3%	16.9%
Technical Support	4	11.469	1	.001	21.4%	43.8%	16.9%
	9	18.755	1	<.001	47.4%	12.5%	54.4%
	13	13.372	1	<.001	38.0%	9.4%	43.8%
	14	6.322	1	.012	23.4%	6.3%	26.8%
	15	4.927	1	.026	35.9%	18.8%	39.4%
Technical Writing	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Web Dev. & Adm	9	5.188	1	.001	8.3%	42.9%	7.0%
	13	4.278	1	.039	47.4%	85.7%	45.9%
Executive/IT Management	9	6.867	1	.009	47.4%	9.1%	49.7%
	15	15.318	1	<.001	35.9%	90.9%	32.6%
Other	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(a) 1 = Education Level, 2 = number of Internet or E-Commerce Development Certifications, 3 = number of Networking Certifications, 4 = number of Technical Support Certifications, 5 = number of System Analysis Certifications, 6 = number of Database Administration or Architecture Certifications, 7 = Number of Software Applications Development Certifications, 8 = number of Project Management Certifications, 9 = number of Internet or E-Commerce Development Skills, 10 = number of Networking Skills, 11 = number of Technical Support Skills, 12 = number of System Analysis Skills, 13 = number of Database Administration or Architecture Skills, 14 = number of Software Applications Development Skills, and 15 = number of Project Management Skills.

(b) Total proportion refers to the proportion of the total population that has the skills or certifications. Group proportion refers to the proportion of the tested job category that has the skills or certifications. Other refers to the proportion of the remaining sample (job categories not included in the Group) that has the skills or certifications.

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