AC 2010-613: PREPARING THE INFORMATION TECHNOLOGY PROFESSIONALS OF TOMORROW: WHAT INFORMATION TECHNOLOGY PROGRAMS CAN DO TO ENSURE THEIR GRADUATES ARE EMPLOYABLE

Kim Nankivell, Purdue University, Calumet

Joy Colwell, Purdue University, Calumet

Jana Whittington, Purdue University, Calumet

Preparing the Information Technology Professionals of Tomorrow: What Information Technology Programs Can Do to Ensure Their Graduates Are Employable

Abstract

It is well understood that technical graduates need more than technical skills to be professionally employed; they also need the so-called "soft skills" to be effective. Rapid change in Information Systems (IS) and Information Technologies (IT) has placed enormous demands on the IS/IT professional. These demands create skill gaps which must be addressed by working professionals and by new graduates entering the work world. This paper will examine the present understanding (based on a literature review) of the skills required for a successful IT/IS professional, including the various definitions of IS/IT skills, along with those soft skills required for the IS/IT professional to be effective. Finally, the authors will identify the various methods used by organizations and the IT professional to enhance these skills both formally and informally, and make some recommendations for how IS/IT programs can incorporate these training methods to help make their graduates more successful in the workplace.

Introduction

The understanding of the skill levels that are required to analyze and implement information systems/information technology (IS/IT) strategies are critical for an organization to be successful. These skill sets have evolved as the requirements and responsibilities of IS/IT professionals have expanded. "The profession of ISD is characterized by specialized technical training and circumstanced theorizing. … Unfortunately, a technologist's perspective does not encourage an accurate diagnosis of the role of computing in business strategy and operations".[1]These technical skills must be supplemented to better implement the new IS/IT strategies called for in the fast paced and competitive environment within which these organizations must operate. It has also been noted that "Experience, in addition to knowledge and skills of personnel, is a distinctive competence that helps companies obtain competitive advantage".[2]

The research also recognizes the need for the re-tooling of the IT professional. Barry Boehm observes "COTS [commercial-off-the-shelf] components are also requiring reprioritizing the skills needed by software engineers".[3] Along with the retooling of the IT professional in IT skills there is also a significant void in financial working knowledge that the IT staff is now being required to comprehend.[4] The need for these skills and competencies is recognized in such a manner that "If there are some competencies an organization needs but does not have, it must either develop a cost effective plan to obtain them".[5] This re-tooling is across the spectrum of skills which creates a challenge for the IT professional in what skills to focus in on and to what degree to enhance them.

The definitions of these new skills and knowledge are nebulous at best. These skills have been recognized as issues even in the board room "what's going wrong is that CIOs still lack business credibility and understanding".[6] The perceptions of these required skills vary from the user and

the IT professional. Gallivan, Truex, and Kvasny (2004) reported that in 1989 research revealed that "users tended to focus on the importance of systems analysts' technical skills and the technical roles they performed … whereas the analysts themselves focused much more on importance of interpersonal skills and their nontechnical roles".[7] These divergent views compound the problem of defining the skills required to be a successful IT professional.

A more current review of IT skills requirements found that "employers are asking for ever-increasing number and variety of skill sets for new hires".[8] Along with the increased number of skill sets, certain skills have become more in demand while other skills have declined in value. While software development and programming skills have maintained their stature, web development and network skills are the most rapidly growing sets of IT skills. Gallivan et al. (2004) also reported that soft skills were important factors with communication skills the most often reported, followed closely by leadership and interpersonal skills.

Similar information comes from a recent research report. In 2009 a research report on The ILL-Prepared U.S. Workforce (Exploring the Challenges of Employer-Provided Workplace Readiness Training) was released by a consortium of organizations, including SHRM (Society for Human Resource Management), ASTD (American Society for Training & Development), The Conference Board, and Corporate Voices for Working Families.[9] The report was directed at exploring the need for workforce readiness training in corporations that were hiring poorly prepared employees. The report raised the issue of whether employer-delivered workforce readiness training was the most effective way to address the gap in skills of poorly prepared entrants in the workforce. The survey results analyzed were directed at three levels, high school, two-year college, and four-year college. The survey results were obtained from 217 participants (employer respondents), who commented on three types of training: workforce readiness (remedial), job-specific, and career development training. The survey was intended to explore the need for workforce readiness training among the three groups, any gaps in training in responding employers, and whether such employer-delivered training was effective. Skills that needed additional training according to the employers included both applied skills and basic skills. Skills which were listed as high need included Creativity/Innovation, Ethics/Social Responsibility, Professionalism/Work Ethic, Lifelong Learning/Self Direction, and Critical Thinking/Problem Solving. Responding employers were grouped into four categories or industry clusters: manufacturing, financial services, non-financial services, and education/government/other non-profits.[10] See Table 1 below for applied skills listed by employers.[11]

Table 1. Applied Skills listed by Employers in 2009 Research Report

- Creativity/Innovation
- Ethics/Social Responsibility
- Professionalism/Work Ethic
- Lifelong Learning/Self Direction
- Critical Thinking/Problem Solving
- Written Communications
- Diversity
- Oral Communications
- Teamwork/Collaboration
- Information Technology application
- Leadership

The IT professional is becoming more integrated into the business strategies of many organizations. So what are these skills and how does the IT professional acquire them?

The remainder of the article is divided into the following sections. The second section will examine methodology of the literature review adhered to in this article. Section three provides a brief perspective of the IT skills and the fourth section reviews IT training methodologies. The fifth section offers results and discussion on the literature review and the sixth and final section is devoted to the conclusions drawn from this literature review.

IS/IT skills

The Information Technology (IT) skills requirements can best be exemplified by the statement "Competent IT skills are critical for the success of IS projects and operations".[12] These skills are often difficult to quantify which causes IT managers and IT professionals to struggle with articulating what they are. Nakayama and Sutcliffe, in the article "Perspective-driven IT talent acquisition" provide exploratory research on what are IT skills and how an organization can acquire them. There are three reasons[13] for the challenges in defining and planning to acquire IT skills. These reasons are (a) the growth of IT has created shortages in IT skills, (b) the advancement in IT technologies have created new skills while eliminating outdated ones, and (c) the realities of downsizing, outsourcing and cost reductions. Their research discovered that current classifications reveal that the number of skills required range from 43 in curriculum models and up to 97 that have been revealed from empirical studies. To understand these multitudes of skills, the skills were placed in two groups, the first as organizational level skills including "organizational knowledge, abilities and skills as well as general IS knowledge, IS product knowledge/skills, and technical skills".[14] And the second group focused on specific IT skills at the job level.

These groups were then analyzed based on the IT skills as perceived by managers. The three perceived IT skills are listed as (a) task to IT skills, (b) fundamental key skills as they drive other skills, and (c) the IT skills as they fit into the cultural framework of an organization. These perspectives were then explored as how they relate to the IT professionals perception of these skills.

The IT skills to task skills are most clearly identified by the content of ads for such positions and the planning of projects. Thus these skills are connected to the task at hand or the job requirements. This skill group includes "task skills, business task skills, systems development task skills, technology skills and people skills".[15] They have clear outcomes, measurable, goal or task driven, and attained through education or on the job training. This skill perspective is quite general and often dependent on the job at hand or the job position need.

The second perspective of IT skills could be considered more general skills required for the IT professional. The perspective is not task oriented but focuses on the range of job outcomes and is a function of how to integrate a number of technologies. These core skills are more about organizational skills such as communication and interpersonal than specific IT skills such as programming. IT leaders are more apt to require these skills and might vary from organization to organization and from project to project. This skill perspective can be characterized by complex

task, outcomes, deliverables not measurable, continuous education, and long term focus. The major concern with this perspective is the equilibrium between generalized skills as opposed to the detailed IT skills. If the skills are too detailed then the management functions become too cumbersome while too general of a skill set will make job requirements and task very challenging.

The final perception of IT skills deals with the cultural skills as it relates to the IT professional. The presumption here is that the individual does not work in a vacuum and that there are interactions within the various groups of an organization. These interactions are difficult to quantify and the measure is more of the match of the individual to the working environment. This skill set can be portrayed as largely dependent on group efforts, coordination of complex projects, mentoring, organizational knowledge, and cooperation among shareholders. This perspective is typified as the need for teams to work together such as in agile software development where teamwork is a necessity.

The rapidly changing field of Information Systems (IS) requires the continued re-evaluation of educational programs and their curriculum. The need for this re-evaluation requires an understanding of the IS/IT skills currently required of IT professionals. The article "Critical skills of IS professionals: A model for curriculum development establishes through research the anticipated skills and knowledge base for three groups of IT professionals: (a) programmers, (b) analysts, and (c) support.

The underlying need for identifying the actual IS/IT skills can best be summarized with the rapid growth of the field as indicated by the Bureau of Labor Statistics for the period of 2000-2010. The article reports that "the 10 fastest growing occupations, computer-related occupations occupy eight of the top ten positions: software applications engineers, support specialists, systems software engineers, network and systems administrators, network systems and data communications analysts, desktop publishers, database administrators, and systems analysts".[16] This forecasted growth in the IT field requires a clear definition of these skills to better prepare the IT professionals expected to fill these positions. Currently the demand for IT professionals outstrips the qualified applicants.

The research designed to develop a framework of IT skill sets involved a business survey which included the preparation and distribution of a questionnaire. The questionnaire instrument listed a number of skills associated with the IT profession. The instrument was then distributed to 380 companies and 100 of the Best 100 places to work in IT as developed by Computerworld in 1999. Though the response produced only 60 (13 %) useable questionnaires, the researchers justified this as those responding were from companies that regularly recruit IT students. The respondents were asked to rate each of the IT skills presented in the questionnaire.

The results of the survey provided insights into the degree of importance by group for each of the IT skills established in the survey. The IT skills were categorized into five distinct sets (a) Business knowledge, (b) Advanced IS applications, (c) User support, (d) Programming, and (e) IS planning. These five sets were then analyzed as they related to the three groups of IT professionals. The business knowledge category distribution results showed that it was most important as a perceived skill for the analyst group and was rated the highest skill among all

groups (mean of 4.08). The second highest rated skill category was the user support which was indicated by a overall mean of 3.82 with the user support group ranking significantly higher than the other two groups (M = 4.44).

The next three skills were ranked based on mean as follows (a) Programming (M = 3.50), (b) Systems planning (M = 3.29), and (c) Advanced IS applications (M = 3.11). Programming demonstrated the most variation in mean where the Programmer group (M = 4.09) had the highest significance followed by Analyst (M = 3.73) and finally User support (M = 2.73). In all cases other than User support category, the User support group demonstrated the lowest significance for the listed skills as indicated by the mean. The results also disclosed that the Analyst group demonstrated the highest overall mean for each skill factor other than Programming category. A final notation of the results was that the most important programming language for the Programming group was Web-related languages such as HTML, JavaScript, Perl, etc.

Table 2

Means of Critical Skills Factors Business Respondents				
	Means			
Factors	All	1	2	3
Business Knowledge (Factor 1)	4.08	3.95	4.5	3.82
Advanced IS Applications (Factor 2)	3.11	3.18	3.31	2.85
User Support (Factor 3)	3.82	3.35	3.64	4.44
Programming (Factor 4)	3.5	4.09	3.73	2.73
Systems Planning (Factor 5)	3.29	3.15	3.79	2.95
1= Programming, 2= Analysts, 3= User Support [16]				

Noll and Wilkins (2002) reported on their analysis of an online Alumni survey, polling graduates of an IT program encompassing a sample size of 337 graduates with a return rate of 16.6 % (56 responses). The survey was to ask the graduates to rank the importance of the same skills as listed in their original study reviewed earlier. The graduates were also asked to classify their particular job as it relates to one of the three IT skill groups identified earlier. The results of the graduate survey were quite similar to those of the business survey. The Business knowledge category was still ranked the highest (M = 4.17) while the other four categories had mean scores slightly higher than the business survey.[17]

This research validates the notion that IS/IT jobs are becoming more challenging with diverse job skills becoming more in demand. The programming skills are moving more to the new web based technologies as the more traditional languages are being less emphasized. The skills that have been traditionally considered soft skills are becoming increasingly important as the roles of the IS/IT professionals increase and diversify.

The theme that IT job skills are critical factors in the success of an organization is further developed in the article "The systems developer skill set: Exploring nature, gaps, and gender differences research in progress". Newton, LeRouge and Blanton (2003) set out to define and "explore the nature of actual and desired systems developer, job skills".[18] The researchers differentiate those skills considered specific such as job requirements, project orientation, and relevant technologies from those skills considered to be soft skills such as interpersonal, organizational knowledge, political, and business skills. These defined skill sets are similar in nature to those of other researchers and help validate these skill sets as meaningful.

The research conducted by Bassellier, Reich, and Benbasat (2001) explores the competency of business managers in their abilities in IT leadership roles. In their article "Information Technology competence of business managers: A definition and research model" they outline the importance of the need for IT competency by business managers and develops guidelines for skills required. This IT competency is eloquently stated as "Business managers are now expected to deploy IT effectively and strategically, to assume ownership of IT projects within their domain of business responsibility, to develop a partnership with IT professionals, and to take the leadership in IT implementation".[19] These new competencies are necessary for an organization to prepare for the future and cannot afford technology inept managers.

The authors' purpose is to design, propose, and refine an IT competence model for business managers through the exploration of literature and the interviewing of selected IT experts. The research entailed a two pronged approach for the literature review, initially focusing on the general literature on IT competency, how it is implemented and defined. The second phase of the literature review centered on the obvious and implied types of IT knowledge. They further developed these types of IT knowledge into subcomponents. The research then proceeded to receive feedback on the proposed model developed from the review at a workshop for the Society for Information Management. They ended the process by interviewing a number of IT consultants, three line managers, and 20 CIOs of leading organizations. To better facilitate the research, the authors defined competence "into three main ideas: competence as a skill, competence as a personality trait, and competence as knowledge".[20]

The definition of competence into three main ideas is important to understand the levels of competence of managers. Competence as a skill is defined as the fit of the job requirements and the employee's skill set. This definition is adequate when the organization is in the hiring process and/or creating a training program to improve these competencies. This competency alone is wholly inadequate to allow a business manager to take advantage of IT opportunities. Personality traits, as a competency is not considered in the research as it does not, in the authors view, fit into the functionality of an IT manager.

The inclusion of knowledge as a competency is extremely important in the views of the authors when they state "Bringing knowledge into the [IT] competence definition broadens the concept by making it dynamic and interactive".[21]This competency is the focal point of their model. Within this knowledge competency there are two components tacit and explicit knowledge. These two components are defined as "Explicit knowledge is the formal knowledge that can be clearly transmitted using systematic language … [while] The ability to perform well is tacit knowledge".[22] From these competency definitions, the authors provide their own definition of IT

competence as "The set of IT-related explicit and tacit knowledge that a business manager possesses that enables him or her to exhibit IT leadership in his or her area of business"[23]. This definition is well founded and can be applied in all areas including the IT profession.

The model developed from their research identifies the two IT competence skills. The model[24] proposes that the explicit IT knowledge component consists of (a) Technology, (b) Applications, (c) Systems development, (d) Management of IT, and (e) Access to IT knowledge. The other skill component, tacit IT knowledge is divided into Experience (personal use of IT, IT projects, and management of IT) and Cognition (process view and vision for the role of IT).

The researchers surmise that IT competence on its own does not guarantee success for managers, that other factors such as partnerships with IT and other business elements are essential. The conclusions drawn from the research and the proposed IT competence model is that IT personal and line managers need the underlying IT competence. In the case of the IT professional, this includes the tacit competencies characterized in the model.

The need for IT skills is further exemplified in the article that provides insight into why many IS projects fail. The article "Learning failure in information systems development" by Lyytinen and Robey (1999) describes a number of reasons that create failure in IS/IT systems development. Through the use of two case studies and a literature review the authors provide timely causes of these failures and prescribe methodologies to reduce these failures. The overall premise of the article is that "organizations fail to learn".[25] The reasons for these failures are that organizations are unable to learn how to deal with problems such as project scope and risk.

The failure to learn in an organization can be divided into four distinct obstacles. The first obstacle is limits to the organizational intelligence. Within this obstacle are four reasons for these limits. The first reason is described as information overload where organizations and personnel are so wrapped up in the now that they do not have the time to absorb what information is available. The second reason is attributed to the high turnover rates in many IT organizations. This turnover drains the organization of the key experience needed to move from one IT project to another. A third reason involves the pre-existing organizational perceptions thus blocking many new concepts and strategies. The final cause is the lack of perceived scientific validity and rigor where many decisions and conclusions are based on one or a very few samples. This reason is compounded as most organizations lack the properly trained personnel to establish scientific validities.

The second obstacle identified by the authors[26] is the disincentive to learn. There are many incentives for success but few incentives for failure. Organizations will typically reward individuals and teams when a project or systems succeeds, but will cover-up or hide the project that fails and possibly remove those individuals responsible for the failure. Thus providing the organization little opportunities to learn from the failure. When there is learning from failure, this learning is protective in nature and not changed behavior in a positive way.

A third obstacle, organizational design, can also inhibit the learning within an organization. Boundaries established between departments can restrict important information from flowing freely and limit the development of alternate ideas. This can be in the form of new technologies

deployed in one department and not shared with other departments. Organizational politics and competition for limited resources can also create obstacles.

The final obstacle described in this article involves the educational barriers established within an organization. The technical focus of IT establishing that "technically valid design that meets functional specifications must have its requirements stated in advance of system building".[27] This philosophy inhibits learning by blocking a more reflective and innovative approach.

The authors conclude that organizations commit substantial amounts of time and money to learn from external sources and willingly accept new technologies. This commitment however makes them less open to critical review. They neglect to learn from their own experiences and that these experiences are not valued. Learning from experience is an important avenue for knowledge that can be expensive but without this knowledge, organizations are doomed to continue to fail.

IS/IT training

The ever expanding skill set for the IT professional to master has created a new array of issues for the IT profession. The IT organization, to remain successful, must foster IT competence which requires not only attracting competent IT professionals but provide training for these professionals. This training comes in many forms including: academic IT programs, IT workshops, self motivated training, vendor training, and organizational instigated training. The research literature is mainly focused on the traditional academic classroom with few directed studies on other avenues for training. Rather than focusing on the traditional classroom approach to IT training the following will cover the other opportunities IT professionals have to upgrade or improve their skills.

The article "The professional development challenge for IT professionals" provides an intriguing perspective into the issues of IT professional competency with the observation that "Maintaining competence is a continuous challenge resulting from the continuous stream [of] technical innovation in applications … capability, diversity, and complexity of IT and the importance of IT innovation in the overall performance of organizations".[28] This need for continuous upgrading of skills creates many challenges to the IT professional in maintaining a perspective between life and work responsibilities while maintaining the competency required for employment. This research explores these dilemmas and what training opportunities are available. The research consisted of a survey in the form of a confidential questionnaire with 172 IT professionals responding.

The motivation for training is a key element in upgrading competency, these motivations vary among the various skill levels of IT professionals. The research indicated that the higher the perceived skill level the more motivation there is to improve competency. The participant's expectations were that the more effort placed in skills improvement the higher the level of competency and work rewards. The various learning activities both formal and informal were the main focus of this research which was quite informative.

Over 99 % of those surveyed participated in some form of formal or informal professional development activity. The most often reported formal activity was in the training provided by the

employer (66.5 %) on average 3.7 hours per month (HPM). The formal activity that consumed the most time was academic education. For those that participated in the activity on average spent 24.8 HPM, but were far fewer in number constituting only 14.7 % of the participants. The formal activity that the participants felt returned the most value was the vendor supplied training which on a scale of 1 to 6 (1 = inferior, 6 = excellent) was 4.1 with attending professional society meetings coming in second with a score of 3.9. Overall, 9.4 % reported no formal training activities per month, 20 % participated in these activities 1 to 2 hours a month, and 70.9 % reported over 2 hours of formal professional development activities per month. The average overall time spent in formal activities was reported to be 13.8 HPM.[29]

The informal activities are less structured and constitute discussions with colleagues, reading, structure self study activities, and experimentation. These activities consumed a disproportionate amount of time reporting 30.6 HPM as compared to formal activities of 13.8 HPM. The reading activity was the most widely reported activity where participants spent 9.2 HPM. The activities of discussing technologies with colleagues, researching vendor documentation, and experimentation fell into the HPM range of 4.5 to 4.7. The other informal development activities ranged from 0.4 HPM to 3.6 HPM.

The most widely reported reason that participants could not participate in more of these formal and informal activities was the lack of time. The largest hurdle for this lack of participation from an activity standpoint was project deadlines. Surprisingly, social factors presented only marginal hurdles. The actual work location had little significance in hindering their ability to develop professionally. Sustaining IT competence as characterized by Schambach and Blanton (2002) is

> Staying professionally competent requires substantial effort and participation in effective development activities, despite the demand for their current competencies. Over time, complacent IT professionals inevitably witness their competencies become obsolete and their contributions diminish due to the diffusion of IT innovation and its resulting contribution to overall organizational performance.[30]

The research established that the main mechanism for formal professional development was through employer provided training.

The organizationally provided training is one of the main avenues for the IT professional to enhance his/her competency. A prerequisite for reviewing these organizational training opportunities for IT professionals is to have an understanding of what training is and how its success can be evaluated. Gjestland, Blanton, Will, and Collins (2001) define training as “the systematic acquisition of skills, rules, concepts or attitudes that result in improved performance in the work situation".[31] This definition serves well in describing the process and results expected from training. This training is described as a five step process (a) a needs analysis, (b) a design phase, (c) a development phase, (d) deployment, and (e) evaluation. All of these steps must be thoroughly planned and managed to achieve the full benefits of the training.

The process of developing a training methodology begins with a needs analysis as suggested by Gjestland et al.[32] This analysis requires an examination of the needs for training at the organization level, task level, and personnel level. The organizational level analysis will assist in

determining whether the training will enhance the job performance of the individuals. The task analysis will determine the skills and knowledge required for a specific job function. And finally, the personnel analysis will help determine which individuals need the training and where that training should be focused.

Once the analysis phase is complete, the design phase is driven from the findings of the analysis phase. This will allow the designer to create the training objectives which are then transferred into content during the development stage. In the development phase along with the objectives, pedagogical principles are employed to create the framework for the training. The content created in the development phase is then employed during the implementation stage for the actual training. It is then important to evaluate the outcomes of the training process to appraise the overall effectiveness of the training and determine whether there are quantifiable improvements in the trainees' performance.

Organizations that provide training for the IT professionals have a number of obstacles to overcome and the goal is to assemble as highly skilled group of IT professionals as possible. These obstacles as described by LeRouge and Webb (2003) as (a) training is costly, (b) skills become outdated, (c) high quality technology trainers are difficult to find, and (d) there is a vast array of training methodology. With this understanding, the authors investigated four organizations that actively participate in training of their IT and other personnel. The researchers investigated the organizational context for the technology training, the staffing issues that training managers' encounter and the technology strategies use within this training framework.[33]

The training missions of the organizations studied provided in-depth knowledge into the underlying reasons for the training activities.[34] These missions and/or reasons for instituting training varied as follows (a) "*Training needs to have a direct link to the management team it services in order to be part of the corporate mission and strategy and have the most impact",* (b) *"Our training mission is really to spread the knowledge about **, to get ** in more hands, get people thinking about ** and how to use the technology"*. (c) *"Organized and structured applications training was a surprising afterthought. It was thought that implementation specialists could handle on-site on the fly, training as part of the implementation. Employees gathered around a desk with unstructured walk-throughs and interruptions was not working. Technical support was trying to handle far too many education issues and we were facing potential lawsuit situations",* and (d) did not have a training mission.[35] These statements demonstrate that organizations establish training for varied reasons but all are self motivated with an eye to financial gain or protection against loss.

The research established that these training units require support from their organizations. This is highlighted by the statement "Managers unanimously felt a commitment of corporate dollars and other resources was necessary to the effectiveness of their departments". [36] Outsourcing for this training is an option that these organizations use on occasion but look at this from a cost to benefit analysis. The use of outsourcing also limits the flexibility of the training and the control of the content. The most frequent use of outsourcing was in the area of IS/ IT as some of their specialized training requirements are beyond their scope. All four organizations commented on the collaboration and support required from the IS/IT departments. The major justifications of in-house training and the resultant additional cost incurred are reduced training time and just in time

training. The additional cost included possible travel and classroom overhead. In the view of these managers, the additional cost was outweighed by the benefits incurred. There was no indication of how these justifications were measured only that they were the impressions of the managers surveyed. It was pointed out "that the integration of training management and course content delivery systems provided a means for easier assessment of training effectiveness". [37] This evaluation process is an integral part of these training programs.

As suggested by Piccoli, Ahmad, and Ives (2001) virtual learning environments (VLE) can be used for IT technology skills training. This preliminary research suggests that these VLEs can provide organizations an "effective means to update the IT skills of their work force".[38] Virtual Labs (VL) have become more prevalent in current research. The Rochester Institute of Technology[39] and Drexel University[40] have created essentially Virtual IT labs for students to perform tasks online that in the past required a physical classroom environment. These two implementations have proven to be quite successful demonstrating that the flexibility of the architecture provides for a highly extensible approach to IT training.

Discussion

The role of the IT professional has expanded as new organizational and business strategies require new skills. These new skills are a result of the ongoing expansion of new IT technologies which place extreme burdens on the IT professional to stay competent. As suggested by Blanton, Schambach, & Trimmer (1998) "Although not extensively examined in IT research, professional obsolescence threats have been acknowledged and evaluated in referent research".[41] This obsolescence is due in part to the divergence of the IT professionals' skills and the evolution of the technologies he/she is expected to know. This obsolescence is not a new concept as it was discussed in research by Leitheiser (1992) when he predicted quite accurately "some development skills that are crucial now (e.g., COBOL …) will drop rapidly in importance over the next ten years. Other skills are expected to increase in importance dramatically (e.g., CASE, prototyping, electronic data interchange, LAN …)".[42]

The literature demonstrates that the skills required to be competent in IT are evolving not only in the explicit skills required but also in the soft (also called professional or applied) skills that are more ambiguous. These soft skill requirements are a function of the new roles that IT professional must portray. As stated by Schambach and Blanton (2002) "because of their boundary-spanning role in organizations, analysts need strong interpersonal skills, as well as technical and organizational knowledge, to be professionally competent".[43] The research has provided some guidance in what constitutes the soft skills as demonstrated by the knowledge skills as proposed by Bassellier et al. (2001).[44]

These soft skills can assist in the classifications of the IT skills that an organization is requiring and assist an IT professional in assessing his/her own worth to an organization. These skills enhancements take on many forms which involve either formal or informal development activities. This review centered on those skills development methodologies outside academia examining what forms they take. It has been discovered in the research of Schambach and Blanton (2002) that the most often pursued formal training was through employer provided sessions. These training programs come with a cost such as possible travel and overhead

expenses that an organization must incur. These formal activities on average require approximately 10 hours a month. Conversely, informal development activities are more often utilized by IT professionals to enhance their competencies requiring on average 30 hours per month. Combined, these activities create a daunting time requirement that many IT professionals do not have.[45]

These skills development approaches have garnered little research as indicate by Wingreen, Blanton, Newton, and Domino (2005) when they discovered "very little, if any research has addressed how to directly target and prioritize individual employees based on specific skill development and training needs, [and] allocate specific development and training resources".[46] The research that has been undertaken indicates that the most effective forms of formal skills development training are employer and vendor instituted training. Other forms of training that appear to be of great value are self motivated, where the expectations are that increased skill sets will create personal as well professional satisfaction and advancement.

It has been suggested that employer initiated training requires a substantial commitment in the form of cost and overhead. The training research that might reduce this overhead is the research being performed in Virtual classroom and Virtual Labs. The research demonstrates great promise in providing a cost effective means of creating learner environments that are not restricted by time, distance, or physical space. These environments are extremely versatile and can be adapted to various learning requirements.

In meeting their requirements for a well-prepared workforce, some employers are exploring formal training programs such as the ones mentioned above, as well as informal training and newer technology techniques such as wikis, blogs and podcasts. Some types of informal training opportunities for readiness include the company intranet, email, mentoring and coaching, self learning modules, and the newer technologies including wikis, podcasts and social networking.[47]

Conclusion

The research literature involving IT professional skills and training are less than substantial. The literature that is available suggests that the IT skill sets required by the IT professional are ambiguous and that there is a trend towards more soft skills to be included in the IT competency framework. Along with these developing definitions of IT competencies, there is a growing need for additional avenues for training of these competencies. The research suggests that competency development requires substantial commitments of time on the part of the IT professional. This time commitment is hampered mostly by the project deadline requirements that these same IT professionals face on a regular basis.

Continued and more clarifying research into the required IT stills is mandatory. As the IT competencies become more clearly defined, research can be more focused on the required training methodologies to enhance these competencies. The current research on virtual classrooms and virtual labs should also be explored to adopt these emerging methodologies for training of the IT professional. Ultimately, the research should converge how to combine these technologies and pedagogical methodologies to better assist the IT professional in the quest for competency.

The authors suggest that there are some techniques which can assist IS/IT programs in developing well-rounded graduates who have the skills employers desire. Some techniques to consider are incorporating well-designed team exercises in coursework. A course in professional skills may be very useful. Leadership, communication (both oral and written), professional behavior, problem solving and ethics can all be incorporated into existing courses or into an advanced professional practices course. Presentations can enhance communication skills. In some institutions, courses in leadership and communication are available and may be incorporated into existing plans of study as electives. Experiential education may also be useful, in which "real world" situations are incorporated in the classroom, possibly including working with real clients, up to and including internship opportunities where available. Student organizations can provide leadership opportunities. While these are suggestions, the area is ripe for further research to evaluate the effectiveness of these and other techniques.

Noll and Wilkins (2002) propose in their Information System curriculum 8 core skills required for all concentrations. These core skills are: a) Knowledge of business functional areas; b) Ability to interpret business problems and develop appropriate technical solution; c) Ability to understand the business environment; d) Knowledge of specific industry; e) Ability to work collaboratively in a team project environment; f) Ability to develop and deliver effective, informative and persuasive presentations, g) Ability to plan, organize, and lead projects; h) Ability to plan, organize, and write technical manuals, documentation, and reports. Are these core skills a comprehensive listing of all perceived core skills to be incorporated into an IT/IS curriculum or should modifications be made to this list?

Soft skills (also known as people skills or professional skills) are personal attributes that enhance job performance as well as interactions. Soft skills are sometimes broken down into personal attributes, such as: a) optimism, b) common sense, c) responsibility, d) a sense of humor, e) integrity, f) time-management, and g) motivation. Along with personal attributes interpersonal abilities are also considered a part of soft skills, such as: a) empathy, b) leadership, c) communication, d) good manners, e) sociability, and f) the ability to teach. Employers overall have included such soft or applied skills as Creativity/Innovation, Ethics/Social Responsibility, Professionalism/Work Ethic, Lifelong Learning/Self Direction, and Critical Thinking/Problem Solving as high need skills.[48]

With a general understanding of what soft skills are defined, how does an academic IT program integrate soft skills into the curriculum becomes the question for future research.

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