3-1-2007

Information Technology Literacy in the Workplace: A Preliminary Investigation

Meg Murray
mcmurray@kennesaw.edu

Robert Sherburn

Jorge Pérez

Follow this and additional works at: http://aisel.aisnet.org/sais2007

INFORMATION TECHNOLOGY LITERACY IN THE WORKPLACE: A PRELIMINARY INVESTIGATION

Meg Murray
Kennesaw State University
mcmurray@kennesaw.edu

Robert Sherburn
Kennesaw State University
robertsherburn@yahoo.com

Jorge Pérez
Kennesaw State University
jperez@kennesaw.edu

Abstract

Today's college graduates in all fields of study are expected to be proficient users of computer technologies and applications. However, a generally accepted definition of computer literacy has been elusive in part because of the dynamic and complex nature of information technologies. Moreover, the business community has been slow to articulate what technology competencies are required of new entrants into the workplace. This study identifies computer and information technology proficiencies that are perceived to be critical among employees in ten corporations in the discrete manufacturing industry. The findings of this study indicate that information technology literacy is a moving target that warrants further consideration by educators and practitioners alike. Agreement exists among study participants that IT literacy of all employees is increasingly relevant to organizational vitality. All respondents also noted that workers must be proficient in standard office suite applications. Further exploration of corporate expectations of an IT literate workforce will enable educators to not only design assessments that effectively gauge IT proficiency but also develop curricula that amplify critical IT competencies.

Keywords: Information technology literacy, workplace skills

Introduction

Computing and information technologies have fundamentally changed the business environment. Once seen as a specialized area supported by workers with dedicated skill sets, information technology (IT) has become pervasive within the organization. IT now impacts all disciplines, industries and career fields, and is the driving force behind the 'New Economy' (The 21st Century Workforce Commission). Consequently, there is an expectation that today's college graduate be proficient in using computing technologies and applications, regardless of the graduate's field of study. However, a standard definition of "computer literate" does not exist, and the business community has been slow to articulate technology competency expectations required by new entrants into the workplace.

Computer literacy has traditionally been defined as the ability to use computers to perform a variety of tasks, but that definition is no longer adequate. Computer literacy no longer simply means viewing a computer as a collection of applications; it also means using the computer as a means of communication and a source of information (Hoffman, Blake, McKeon, Leone, & Schorr, 2005). These same authors provide an expanded definition of computer literacy stating that computer literacy includes both "information literacy, the ability to evaluate information found online, and critical computer literacy, the ability to incorporate computing technology in support of critical thinking" (p. 164). Haag et al (2007) distinguish between computer literate and information literate knowledge workers and define information literate knowledge workers as those who "can define what information

they need, know how and were to obtain that information, understand the information once they receive it, and act appropriately based on the information to help the organization achieve the greatest advantage." Further, the concept of Fluency with IT (FITness) has been around for a while. The National Research Council (1999) highlights three main areas including skills, concepts and capabilities which reinforce one another and when achieved demonstrate technology fluency.

Several studies have identified skills and competencies required of IS/IT professionals. Some of these programs are ongoing initiatives that provide guidance for curriculum development to insure IS/IT programs are in sync with industry needs. For instance, the National Science Foundation sponsors regional Centers of Excellence for Advanced Technological Education (ATE) whose goals are to advance IT education through collaboration of all levels (K-12, community college and university) with industry (Saad and Boisvert, 2005). Further, professional associations such as the Association for Computing Machinery (ACM) have developed curriculum guidelines to help colleges and universities design programs that provide relevant coursework for IS/IT and CS graduates (see http://www.acm.org/education/curricula.html). While these initiatives will help to meet the need for well-educated and quality IS/IT professionals, very little research has been undertaken to identify what basic IS/IT literacy is needed by the rest of the workforce.

The issue of workforce readiness by college graduates in the United States has become a topic of major concern. A report entitled "A Nation of Opportunity: Building America's 21st Century Workforce," identified literacy as the key to success. The report specifically defined 21st century literacy as "strong academic, thinking, reasoning, and teamwork skills, and proficiency in using technology" (p.8). The skills were further delineated as worker ability to "read, write, and compute with competence, think analytically, adapt to change, work in teams and use technology" (p. 25). The report addressed a need to bridge the gap between the lack of IT skills and the demand for a strong IT workforce and stressed that "all workers must be educated, trained, and empowered to be IT workers" (p.27).

"The Workforce Readiness Report Card" (Conference Board, 2006), however, paints a fairly negative picture indicating that new workforce entrants were "woefully ill-prepared for the demands of today's – and tomorrow's – workplace" (p. 9). Basic readiness is defined as a combination of fundamental knowledge and applied skills, the latter being more important. Among the applied skills is the area of information technology application or the ability to "[s]elect and use appropriate technology to accomplish a given task, applying computing skills to problem-solving" (p. 16). College graduates were rated as most prepared on the dimension of information technology application use. Graduates were most deficient in written communications and writing in English, which was interestingly partly attributed to the use of computing technologies such as email and instant messaging. The report conveys a need to redefine the knowledge, skills and competencies promoted in institutions of higher learning.

According to McLester and McIntire (2006), we are facing a "perfect storm of challenges arising from the disconnect between education and workforce values" (p. 29). The key to addressing these challenges begins with defining exactly what those workforce values are. This purpose of this study is to address these challenges by identifying what corporations perceive to be the "workforce values" for information and computing technology. The study does not attempt to address unique IT skills needed by different industries or individual organizations. Instead, it establishes a dialogue on fundamental computing and information technology literacy for today's workplace.

Methodology

This research explores how businesses perceive and define computer literacy. Moreover, it examines how firms translate those perceptions into expectations of what IT skills should be possessed by college graduates. Specifically the study addressed the following research questions:

1. What IT skills are employers looking for in college graduates?
2. Are there particular skills that should be taught in the undergraduate curriculum that prepare students to be successful in the workplace?

Data were collected using structured interviews. A questionnaire employing open-ended questions designed to solicit free-flowing responses was administered to all participants. Open-ended questions provide a means to identify specific patterns and trends when the boundary of possible answers is unknown or being developed. A pilot questionnaire was administered to two different groups of participants and refined. The final version contained the following five questions:

1. What IT skills do you look for in any potential employee, regardless of position?
   a. If the employee does not have the desired skills, is there a training program?
2. What IT skills do you look for in a college graduate?
   a. If the employee does not have the desired skills, is there a training program?
3. What do you think constitutes a computer-literate college graduate as it pertains to the success of your organization and the success of the college graduate in that environment?
4. Are there specific IT skills (e.g. Internet, software applications, troubleshooting) that you consider most important to an employee's success?
5. Please comment on this statement: 'IT is the fourth literacy, joining math, reading and writing as skills that should be assessed for all students in higher education.'

Participants

The participants were chosen from world class manufacturers that specialize in discrete manufacturing, defined here as the making of a complex assembly such as a radio, circuit board, radar system, missile, and so on. Ten of the fifteen companies that were selected for the study agreed to participate. The others declined, with the majority citing company policy that prohibited participation in external research. The ten that accepted represented the aerospace, defense, contract manufacturing, automotive electronics, gaming machines, consumer and commercial electronics industries.

A total of twenty-four individuals responded to the interview questions. Interviews were conducted in small group settings. Participants varied in job title but all were management level employees holding titles such as Manager, Director, Vice-President or Chief Information Officer. Specific titles and their industry affiliation are listed in Table 1.

Table 1. Participant Job Title and Industry Affiliation

Job Title	Industry Affiliation
Manager of Supply Chain	Electronics
Director of Computer Aided Process Planning	Aerospace
Director of Engineering	Aerospace, defense
Director of SAP Assets	Aerospace, automotive electronics
Product or Program Director	Automotive electronics, aerospace
Vice President or Director of Operations	Electronics, automotive electronics
Vice President of Finance	Defense, aerospace, electronics
Vice President of Enterprise Systems	Gaming
Vice President of Information Technology (IT)	Electronics
Vice President or Manager of Supply Chain and Procurement	Contract manufacturing, electronics
Vice President/Director/Manager of Manufacturing	Defense, aerospace, electronics, gaming
Senior Vice President Worldwide Manufacturing Systems	Contract manufacturing
Chief Information Officer (CIO)	Electronics

Results

Responses to Question 1 about IT skills needed by any employee regardless of position indicate that most companies expect all workers to have a basic level of knowledge about computing technologies. Of course, this expectation varied based on job function. For instance, one respondent indicated that computer knowledge was not necessary for 'simple jobs.' All companies in the sample offered training programs for their employees. The training programs were often extensive and were provided to employees on a regular basis. In one company, new employees were required to take an aptitude test and training was based on the outcomes of the test. Another company reported that specific skills and training are negotiated with trade unions where required.

Responses to Question 2 about IT skills expected of college graduates were fairly consistent. Nine of the ten companies cited an expectation of foundational knowledge of information technologies, using terms such as 'high understanding,' 'good foundation,' 'knowledge of the main computer skills' and 'general computer knowledge.' One respondent commented that skill sets such as Windows and office applications were no longer just desirable but needed by all employees. Further clarification of these generic responses was sought by asking the respondents to identify specific IT skills. The most cited skill was functional use of the basic office suite of applications (Microsoft

Office was specifically mentioned). For jobs encompassing engineering tasks, general knowledge of computer-aided design (CAD) applications was expected. One respondent put it succinctly by stating that a computer literate graduate has a "foundation in computer knowledge and a foundation in the concepts for the specific job area pursued" (i.e., CAD for engineering, graphic design software for graphic artists). Another respondent indicated that computer literacy included having a basic understanding of what enterprise systems do and how they work together. The respondent went on to say that knowing how to use an instant messaging client does not mean that one is computer literate. Finally, a respondent stated that a computer literate graduate is one who has a good base of knowledge and a high ability to quickly learn computing technologies. Table 2 provides a list of the most often cited IT skills considered to be important to an employee's success.

Table 2. IT Skills Considered Most Important

Skill Cited	Number Reporting
Office Suite of Applications (such as Microsoft Office)	10
Using a browser to search the Internet	8
Enterprise Systems (i.e., ERP, SCM)	8
Instant Messaging	5
Windows	2
Project Management Software (i.e., Microsoft Project)	1
Modeling Software (i.e., Microsoft Visio)	1
Specialized areas:	
Computer-Aided Design (CAD)	8
Statistical Process Control software	2

Participant responses to the statement citing IT literacy as the fourth literacy (Question 5) were varied and insightful. The most common response was that a particular company's success was directly attributable to IT systems that enable it to deliver high quality products in an efficient manner. One respondent noted that innovative use of IT made the firm a market leader, and that the firm's market leadership hinged on raising IT to the level of the other literacies. Respondents in two other companies reinforced this idea by mentioning that IT will become the most important literacy as their respective firms continue to rely more and more on technology. Interestingly, one respondent perceived IT literacy to be an aggregate of the other three literacies – reading, writing and math. On the other end of the spectrum, a respondent in one company disagreed with the statement, saying that "technology is just an enabler, without it we would still be able to do our jobs."

In reference to assessing IT literacy, the respondents were less definitive. Four respondents stated that assessment would be difficult because of the dynamic nature of computing and information technologies. Specific terms used included "unstable growth patterns," IT changing so frequently that it would be hard to generalize, and "so erratic that it would be difficult to build an adequate IT assessment test." One respondent commented that "IT is so general, I am not even sure where to start."

Conclusion

Information and computing technologies have transformed the workplace, and the need for an IT literate workforce has been clearly articulated. The challenge is defining and describing what is meant by IT literacy. While this research study was limited to ten manufacturing companies, it does provide preliminary findings and insights into what is expected of the college graduate seeking any entry level position. Generally, participants in this study see the uptrend in the use of computing technologies continuing, and recognize the need for employees who are "able to jump in and use the base applications" so that they can "immediately have an impact on the business right out of the gate." This translates into a college graduate who has a foundational knowledge of computer and information systems, and is also able to extend that knowledge quickly.

The competencies and skill set that comprise foundational knowledge have yet to be adequately defined. Part of the problem is that computing and information technologies change rapidly. Further, technology application is often distinct to specific industries, disciplines or areas of work. On the other hand, commonalities do exist. Respondents in all ten of the companies included in the study cited skills in using the office suite as an aspect of being computer literate. Respondents in eight of the ten firms referenced Internet skills and understanding of enterprise systems.

While enterprise systems might be considered specific rather than generic, the Internet era has made principles of computer system interoperability part of the foundational knowledge of IT.

At one time, colleges and universities focused on ensuring that the curriculum included coursework designed to develop a computer literate graduate. This emphasis waned as more students entering college had access to personal computers and the Internet. Interestingly, exposure became equated with literacy. However, simply having a suite installed on one's personal computer or being proficient at instant messaging in a social context does not mean that one is a competent or even functional computer user. Can students who are heavy users of social computing transfer those skills to appropriate use in a business setting? Do students need structured educational experiences in the use of office applications to achieve a level of competence that enables generalization of skills to various settings? Can we assume that students who spend hours using the Internet truly understand how this revolutionary technology facilitates the exchange of information and data?

The findings of this study indicate that information technology literacy is a moving target that warrants further consideration by educators and practitioners alike. Agreement exists among study participants that the IT literacy of all employees is increasingly relevant to organizational vitality. It is also clear that shared definitions of IT literacy are elusive, in part because of the dynamic and complex nature of information technologies. IT may have risen to the level of the *fourth literacy*, but educational institutions have long histories of evaluating only the *other three* literacies. Further exploration of corporate expectations of an IT literate workforce will enable educators to not only design assessments that effectively gauge IT proficiency but also develop curricula that amplify critical IT competencies.

References

Conference Board, Corporate Voices for Working Families, the Partnership for 21st Century Skills, and the Society for Human Resource Management. (2006, September). Are They Really Ready To Work? Employers' Perspectives on the Basic Knowledge and Applied Skills of New Entrants to the 21st Century U.S. Workforce. Retrieved January 1, 2007 from http://www.21stcenturyskills.org/documents/ReportCardFINAL_updated.pdf

The 21st Century Workforce Commission. A Nation of Opportunity: Building America's 21st Century Workforce. Washington, DC: The 21st Century Workforce Commission, 2000. Retrieved January 1, 2007 from http://digitalcommons.ilr.cornell.edu/key_workplace/21

Haag, S., Cummings, M. & Phillips, A. (2007). *Management Information Systems for the Information Age, 6th Edition*. McGraw Hill.

Hoffman, M. Blake, J., McKeon, J., Jill McKeon , Scott Leone, S. & Schorr,M. (2005 May). A critical computer literacy course. *Journal of Computing Sciences in Colleges*, 20(5), 163-175.

McLester, S. and McIntire. T. (2006, November). The Workforce Readiness Crisis. *Technology & Learning*, 27(4). p. 22-29.

National Research Council Committee on Information Technology Literacy. (1999). *Being fluent with information technology.* Washington, DC: National Academy Press.

Saad, A. and Boisvert, D. (2005, October). National science foundation advanced technological education projects and centers of excellence for information technology education: an overview. In *Proceedings of the 6th Conference on Information Technology Education* (Newark, NJ, USA, October 20 - 22, 2005). SIGITE '05. ACM Press, New York, NY, 233-238.