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Information Systems and Technology Education: Perspectives from USA Community Colleges

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ABSTRACT

According to the Bureau of Labor Statistics, at least 57 percent of job openings in the United States (US) in 2006-2016 will require some post secondary education, jobs for community college graduates are expected to grow at twice the national average and the highest paying jobs will be in the Information Technology (IT) sector. Yet studies of preparation of IT professionals typically explore four-year institutions rather than community colleges. Given the percentage of the USA population that attends community college, exploring information systems and technology education in community colleges and students’ readiness for the IT workforce are important subjects to investigate. In this paper, community college students’ perceptions are examined to identify how students perceive the importance of specific IT skills, how confident students are about their ability to learn and engage with the specific IT skills, and how the gender of respondents affect gender stereotyping of these IT skills.

Keywords  
IS Education, Community Colleges, IT Skills, IT Profession, Individual Differences Theory of Gender and IT, Gender Stereotype, Female, Male, Feminine, Masculine.

INTRODUCTION

USA community colleges are the nation’s noble educational invention. Students attending community colleges are provided numerous opportunities to enhance their future careers. The possibility to transfer to a four-year college, take for-credit courses for an associate’s degree, take noncredit courses, and the ability to enhance and refresh one’s skills for the workforce are some of the benefits afforded by community colleges. Moreover, community colleges provide students with the ability to attend college at approximately half the cost of tuition at a four-year institution with typically a more flexible schedule. In Fall 2008, approximately 12.4 million people in the United States were enrolled in two-year colleges, making up 44 percent of all US undergraduates and 43 percent of first-time freshmen (2011 Community College Fast Facts). In addition, community colleges have a significant role in Science, Technology, Engineering, and Mathematics (STEM) education: 44 percent of recent STEM graduates, about half of all bachelors’ graduates, one third of masters’ graduates, and about one twelfth of all doctoral graduates began their education at a community college. Twenty-eight percent of all recent STEM graduates also received an associate’s degree from a community college before transferring to a four-year college (Tsapogas, 2004). These data show the significance of community colleges to society, four-year institutions and to the STEM profession by providing students with the skills they need to advance their education and become productive contributors to the economy. This is particularly salient as the labor market has become ever more demanding (Pathways to Prosperity, 2011).

A salient factor in examining the role of community colleges in the preparation of IT professionals is the diversity of demographics and perspectives represented in the student population. In this study, we analyze the diversity of vision and perspectives in IT related programs in community colleges. The organization of this paper is as follows. We begin with a review of the existing literature about community colleges and their roles in higher education and the economy. Then, our research design, data collection and analysis, and research findings follow. Finally, we conclude with some implications of our findings for the development of future IT professionals.
LITERATURE REVIEW

Community colleges focus on meeting the educational needs of local communities. Their mission is to provide regional educational opportunities for individuals, many of whom are nontraditional students (Marklein, 2008). As a community-based institution of higher education, a community college commits to serving all segments of society through an open-access admission policy that offers equal and fair treatment to all students, a comprehensive educational program, service to the local community and the provision of an opportunity for lifelong learning. Community colleges enroll over half of all beginning public postsecondary students, adult learners, students from low-income families, and ethnic and other underrepresented students. Community colleges welcome all who desire to learn, regardless of wealth, heritage, or previous academic experience (Johnson, 2011). Hence, many students arrive in community colleges with poor academic preparation, excessive work and family responsibilities or sometimes lack of focus on educational goals. Not surprisingly, all these factors are usually correlated with student underachievement (Barr and Schuetz, 2008; Boggs, 2011). Across the US, approximately 1,167 community colleges serve local cities, and of these, 993 are public, 143 are independent, and 21 are tribal with a total of 12.4 million students. Forty percent of the enrolled students are full-time and 60 percent are part-time. Of the 12.4 million students enrolled in community colleges, 7.4 million students enrolled in credit courses and 5 million attended for noncredit courses (2011 Community College Fast Facts). This means that community colleges provide not just credit courses for students, but many other options for anyone interested in refreshing their skills or learning new skills in response to changing workforce needs in economically unstable times such as these. Further enhancing accessibility, community college campuses are located within commuting distance of over 90 percent of the US population (Boggs, 2011).

As the US works to keep pace with other industrialized nations, more of its workforce will need to be educated, including those who have traditionally been left behind by higher education such as those with a low-income, working adults, underserved minorities, and those who need remedial help prior to transferring to a four-year institution (Dassance, 2011). Globalization is driving these changes in our economy, and the need for an educated workforce being able to work in geographically distributed teams has never been greater (Kulturel-Konak et al., 2010; Malkan and Pisani, 2011). The majority of new jobs will require some type of postsecondary education (Donokov, 2007, p.2). Therefore, without community colleges, millions of students and adult learners will have limited opportunities and access to continue their education. Community colleges often are an access point for education and a real facilitator for economic development, although some community colleges might not be equally capable of providing career oriented training (Donokov, 2007, p.3).

One of the challenges for community colleges is that many people assume that community college students are homogeneous with respect to age, ethnicity and educational background. The most common stereotype would be low-income students attend community college right after high school due to the inability to be accepted at a four-year institution. Although a significant number of community college students meet this profile, recent high school graduates are far from the only students who attend community college. In fact, in 2007-2008, the average age of students in community colleges is about 28 with 38 percent being 21 or younger, 45 percent ranging in 22-39 and 15 percent being 40 or older. In addition to age diversity, there is a great deal of diversity when it comes to gender, race, ethnicity and economic background. In 2007-2008, 58 percent of community college students were females, 42 percent males, and 45 percent minorities (2011 Community College Fast Facts). Barron et al. (2007) stated that everyone benefits from the opportunity to participate in educational settings including students, faculty, and staff from different backgrounds and this will contribute to the learning process a great deal. Leaders in community colleges often like to point out that two-year schools are perhaps our most democratic institutions when it comes to providing equal opportunity to all. Instead of choosing students from a large pool of applicants, community colleges admit virtually everyone who can benefit from postsecondary studies. Although some people might claim that this openness in acceptance diminishes the quality of the educational experience, others feel that this is, in fact, a great strength insofar as it allows students from all kinds of perspectives to share the college experience.

Community colleges are low cost, market-driven, easy-to-access and popular (Milano et al., 2009). Community colleges have a long history and tradition of addressing the academic needs of students identified as underprepared for four-year college-level work. The expectation is that the students will correct deficiencies and then enroll in college level courses appropriate for the two-year degree or transfer to four-year colleges. Another benefit is the ability of students to take
required prerequisite classes at a community college. Attending community college before completing a bachelor’s degree at a four-year institution can save a sizable amount of money. Tuitions and fees at community college average less than half those at four-year institutions. According to the American Association of Community College, community college average annual tuition and fees is approximately $2,713- public, in district versus a 4-year college at $7,605- public, in state (Community College Fast Facts, 2011).

In this research, the particular area of interest is community college students’ perspectives about IT skills in what has been historically known as an occupation for white, middle class males. IT programs bring information, people, and technology together. The IT field helps students prepare for careers related to the way people create, modify, and use information technology. To succeed in IT programs, students should not only be technology savvy and good with communication and information, but they also should be able to juggle multiple tasks with ease. Woszczynski et al. (2006) performed a study to uncover the differences in perspectives among students in 4-year colleges in a number of areas, such as gender ethnicity, major, age, work experience, and disability status. They found no significant difference in terms of age, gender, work experience and disability status; but differences in perceptions based on a college major and ethnicity were significant. Kulturel-Konak et al. (2011) presented gender differences in learning styles and commented on teaching methodologies that appeared to appeal to female learners in STEM courses. But despite the compelling evidence of the importance of community colleges to the USA economic and educational competitiveness, to the best of our knowledge, there has been only one article to date in the Proceedings of the American Conference on Information Systems (AMCIS) that was focused on the community college context. Green (2011) presented a case of a community college’s use of specific metrics, defined in the service level agreement, as a tool to manage the relationship with an outsourced IT help desk support service. In response to this gap, we engaged in a study which extended the scope addressed in Joshi et al. (2010) which examined four-year college students’ perceptions about IT skills and knowledge to the context of community college students. Hence, we asked the same questions in this study, namely: how important are specific skills for community college students in IT programs, how self-confident are these students about their knowledge and experience with IT skills, and how does the intersectionality of gender and ethnicity affect gender stereotypes about IT skills and knowledge for community college students?

MEHODOLOGY

In this research, we used the same theory used by Joshi et al. (2010) to examine variation in perceptions about the IT field based on the intersectionality of gender and ethnicity: the Individual Differences Theory of Gender and IT (Trauth, 2002, 2006; Trauth et al. 2009). This theory is comprised of three constructs. The individual identity construct includes personal demographics (e.g. ethnicity, socio-economic class) and career items (i.e., type of IT work). The individual influences construct includes personal characteristics (e.g., educational background, personality traits) and personal influences (e.g., mentors, role models, and significant life experiences). The environmental influences construct includes: cultural influences (e.g., attitudes about women); economic influences (e.g., cost of living); policy influences (e.g., gender discrimination laws); and infrastructure influences (e.g., childcare facilities). The theory posits that, taken together, these constructs can explain the gender imbalance in the IT field. The contribution of this theory to gender and IT research is that it offers a middle ground between the “nature” (i.e. essentialist) and “nurture” (i.e. constructivist) explanations. This theory has recently been used to investigate with-in gender variation in factors affecting the gender imbalance in IT based upon the intersectionality of gender with factors such as race, ethnicity and socio-economic status (Trauth et al. 2012a, 2012b). This theory is appropriate because it accommodates both exogenous (e.g. societal and institutional) and endogenous (e.g. individual) factors examined in this study: gender, ethnicity, type of education and self-efficacy.

Data collection for this study occurred by means of a survey, administered between 2009 and 2011, to students enrolled in IT programs of study at three community colleges in Pennsylvania, US. The survey instrument that was used in this study was adapted from the one used by Joshi et al. (2010) and Trauth et al. (2010) which was designed to examine the influence of IT skill importance, IT self-efficacy and gender stereotypes about IT skills on intention of university students to pursue a career in IT. In our study, the survey was used to explore community college students’ perceptions about these topics. That is, the
aim of this study was to examine the perspectives of community colleges students about the following research questions (RQs):

RQ1: How do students in community college IT programs perceive the importance specific IT skills to be successful? (importance of IT skills),

RQ2: How confident are students in community college IT programs about their ability to learn and engage with the specific IT skills? (level of self-confidence in IT skills) and

RQ3: How does respondent gender affect gender stereotypes about IT skills and knowledge that are held by community college students? (gender stereotyping of IT skills)

The survey sample was comprised of 126 students in IT courses at three community colleges. The gender distribution of those who identified themselves as females was 35.7% and as males was 64.3%. The other demographic characteristics of the sample can be seen in Table 1. The sample was comprised of 40.3% students from IT related majors, 24% non-IT, and the remaining 35.7% students have not yet chosen a major. Students participated in this study on a volunteer basis. To avoid any bias due to sequencing, the 39 skills that are included in this survey were presented to each individual in a randomized fashion. Using a five-point Likert scale, students were asked to rate a list of 39 skills that are found in the literature as being those required of IT professionals (Trauth et al., 1993; Huang et. al, 2009; Joshi et. al, 2010). Those 39 skills surveyed are as follows: networking, dependability, web development, leadership, critical thinking, ability to engage in independent learning, design, customer relationship, IT security, business analytics, analytical ability, workplace relationship, domain knowledge, initiative, project management, creativity, IT architecture/infrastructure, ability to handle ambiguity, integrating enterprise applications, openness to new experiences, ethics, communications adaptability, ability to learn new technologies, sensitivity to organizational culture and politics, process analysis, global awareness, ability to work under pressure, ability to train end-users and peers, professionalism, problem solving, database management, negotiation, business knowledge, system auditing and information assurance, system implementation, ability to work in teams, ability to understand technological trends, and programming skills. Data was analyzed using standard deviation from the median. The median in this survey was 3 and expressed as follows: somewhat important (for RQ1- importance of IT skills), moderately confident (for RQ2- level of self-confidence in IT skills), and gender neutral (for RQ3- gender stereotyping of IT skills). Then, the weighted averages were calculated across each trait for all three cases. If the weighted average deviates from the median and it was greater than +0.1, that trait was classified as very important (for i), totally confident (for ii), and masculine (for iii). On the other hand, if there was a deviation and it was less than -0.1, that trait was classified as not at all important (for i), not at all confident (for ii), and feminine (for iii). Finally, if the deviation was only between -0.09 and +0.09, that trait was classified as somewhat important (for i), somewhat confident (for ii), and gender neutral (for iii).

<table>
<thead>
<tr>
<th>Majors</th>
<th>Ethnicity</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science &amp; Engineering</td>
<td>Asian or Asian American</td>
<td>18-23</td>
</tr>
<tr>
<td>Information Sciences and Technology</td>
<td>Black or African American</td>
<td>24-34</td>
</tr>
<tr>
<td>Management Information Systems</td>
<td>Hispanic or Latino</td>
<td>35-44</td>
</tr>
<tr>
<td>IT/Computer Technology</td>
<td>White but not Hispanic</td>
<td>Over 45</td>
</tr>
<tr>
<td>Undecided</td>
<td>Native American/American Indian</td>
<td>1.5%</td>
</tr>
<tr>
<td>Non IT Major</td>
<td>Other</td>
<td>8.2%</td>
</tr>
</tbody>
</table>

Table 1. Demographic Characteristics of the Sample

FINDINGS

The first research question examined community college students’ perceptions about the importance specific IT skills for a successful IT professional. Our results show that these students perceive all of the IT skills to be very important to one’s success as an IT professional. The male and female students’ perceptions of the importance of IT skills for IT profession were also analyzed. All participants, both female and male, agreed that the need to know all 39 IT skills in this study was
very important to be successful within the IT profession. A two-sample t-test determined that the differences between male and female participants were not statistically significant ($p = 0.799$).

The second research question examined community college students’ level of self-confidence regarding these IT skills that are recognized as important to success. The level of self-confidence regarding the student’s ability to learn and engage with specific IT skills is shown in the Venn diagrams in Figure 1. It shows the confidence levels for all participants (2a) compared with those for female (2b) and for male (2c) participants in the study. As this Figure shows, the majority of the participants perceive themselves to have a high degree of self-confidence on their ability to learn and engage with 37 out of 39 IT skills. It is noteworthy, however, that the participants revealed moderate level of self-confidence for skills such as design and programming. When responses are analyzed by gender, we see differences appearing. Male respondents revealed complete self-confidence regarding all of the skills whereas female respondents revealed less self-confidence in the areas of programming and IT architecture/infrastructure. A two-sample t-test determined that the differences between male and female participants were statistically significant ($p = 0.001$).

The third question examined the degree to which these community college students applied gender stereotypes to the various IT skills. Clearly they do (Figure 2). When male and female responses were considered together, we note that 27 of the 39 skills are considered to be masculine. Only one skill is considered feminine: sensitivity to organizational culture. Eleven skills are considered gender neutral. What is noteworthy is that the results do not change that much when responses are broken out by gender. Female respondents added only one more skill to the feminine category: negotiation skills. What is also noteworthy about the females’ responses is that more of the skills are rated as gender neutral (21) than as masculine (17). The responses by male students are also noteworthy in two respects. First, no skills are considered by them to be feminine. Second, only nine skills are considered to be gender neutral. This leaves 30 out of 39 skills ranked as masculine. A two-sample t-test determined that the differences between male and female participants were statistically significant ($p = 0.001$).
Figure 1. Level of Self Confidence
DISCUSSION

The findings with respect to the first research question – students’ perceptions of the importance of specific IT skills - suggest that there is consistent understanding of the IT profession and the skills and knowledge that constitute it. It also validates the fact that students in community colleges understand what the IT profession actually is. It is good news to see that contemporary students’ perceptions match the IT research literature and the IT job ads.

The findings for the second research question – students’ self-confidence with respect to certain IT skills – raise two important issues. First, the results show a high level of overall self-confidence. This raises the issue of whether this strong personal self-efficacy is warranted. Do these students, in fact, have the skill to match their self-confidence? Hamlin et al. (2010) have found that four-year university students are entering technical academic programs with a high level of confidence about using computer and technology but that their actual skills are not indicative of this confidence. The second
issue is about the gender difference in self-reported technical confidence levels. These results are consistent with the research. A review of research on gender differences in self-efficacy – across decades and countries – consistently shows males over reporting their technical skills, even when the actual data shows otherwise (Hamlin et al., 2010; Henwood, 2000; Kwan et al., 1985). A dramatic expression of this phenomenon was found in Katz et al. (2006): “[m]ale students who earned less than a B in an introductory Computer Science course were more likely to take the next course in the curriculum than were women who earned less than a B” (p. 42)! The issue of self-efficacy is intimately bound up with stereotype threat. The research on gender and self-efficacy is consistent: when stereotype threat is introduced, both males’ and females’ performance reverts to type (Guimond and Roussel, 2001; Serva et al., 2009).

The findings regarding the third question – the amount of gender stereotyping by community college students about IT skills and knowledge – show considerable gender stereotyping. Classifying most of the skills as masculine provides some of the explanation for the under representation of women in the IT field. To the extent that community colleges represent an academic point of entry for many students, it is incumbent upon community college administrators and faculty to address these stereotypes. Finally, the appearance of a gender neutral category of skills, one that is quite large for the female respondents, suggests that things are changing. The classification of some skills as gender neutral and feminine gives one hope that females are beginning to see IT work as compatible with their perceptions of their own gender identity. On the other hand, the failure of male students to identify any IT skills as feminine and only a few as gender neutral suggests that much more work needs to be done.

CONCLUSIONS

This study makes a contribution to both research and practice. A contribution to research is the development of insights into the perceptions and stereotypes held by a student population that has been understudied in IT educational research. Given the percentage of students who start their careers in community colleges, this study is particularly important. When transitioning from school to the workforce students from community colleges, like their counterparts graduating from 4-year colleges, face daunting challenges. For community college students, the challenges will be particularly difficult when it comes to IT skills involving programming skills, design skills, and IT architecture/infrastructure. They will be confronted with overcoming stereotypes, self-confidence issues and perhaps the challenge of excelling in a post-secondary program without adequate academic background. Adult students will have to cope with working with younger employees who might have the same or a higher level of skills and having managers and leaders who will be younger than them. Hence, this study represents a contribution to a much needed area of educational research. This study also contributes to the growing body of gender and IT research by revealing the persistence of strong gender stereotypes about the IT field that are held by both males and females.

The contribution of this study to practice is the concrete findings that point to areas that can be addressed by community college administrators and faculty. The skills community college students perceive to be lacking can be more heavily integrated into their academic curriculum and mentoring programs. Developing programs that have all the useful and necessary skills students should learn prior to graduating, will allow students to have an easier transition from college to workplace minimizing the skill gap. Further, our results point out to the need for interventions to counteract gender stereotypes held by both males and females that could hold women back and contribute to males’ inadvertent gender bias in the workplace.

In this study due to space constraints only the influence of gender on attitudes about importance, self-efficacy and gender stereotypes was examined. In future work, the influence of the intersectionality of gender with race, ethnicity and socio-economic class on these perceptions will be examined. In addition, for future data analysis, an Exploratory Factor Analysis (EFA) will be utilized.

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REFERENCES


