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THE IT WORKFORCE CHALLENGE: ADOPTION OF IT CAREERS BY MINORITY GROUPS – ISSUES AND RECOMMENDATIONS

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ABSTRACT

America faces an internal challenge to its position as a global leader in information technology. This challenge is real, and it impacts the core of this country's historical greatness – the preparedness of the national workforce. Simultaneously, the 21st century worker is facing a dynamic environment where technology and workforce diversity are key drivers for organizational change. The skilled workforce of the future must identify and evaluate opportunities and risks, leverage knowledge competencies, and effectively integrate information in a manner that creates value for their organizations. This study examined whether re-designing business curricula to incorporate culturally relevant business cases would be effective in increasing the number of underrepresented groups in the IT workforce. We used five undergraduate courses at a Historically Black University to examine students' technology awareness, technology integration capabilities, and attitudes towards IT career opportunities. Overall, the findings indicate positive changes in students' technology integration skills. Additionally, students' technology awareness increased, but changes in their attitudes towards IT careers were not significant.

KEYWORDS: IT Workforce, TAM, Minorities, Curricula

I. INTRODUCTION

America faces an internal challenge to its position as a global leader in information technology. This challenge is real, and it impacts the core of this country's historical greatness – the preparedness of the national workforce. The 21st century worker is facing a dynamic environment, where knowledge, speed, and performance will determine positioning as a “have” or a “have not.”

The workforce issue is crystallized by the projected demands for highly skilled information technology (IT) workers. Analyses of Bureau of Labor Statistics suggest that the United States will require 1.3 million new IT workers in the core technology disciplines by the year 2006 [Meares and Sargent, 1999; U.S. Department of Commerce, 1999]. These projections are important not only in terms of employment opportunities, but these high demand fields also offer high wage opportunities. By 2006, the statistics also indicate that 520,000 new systems analysts will be added to the workforce. In terms of occupational demand, the need for systems analysts is exceeded only by the need for *cashiers* [Meares and Sargent, 1999]. The wage differential in these two high-demand occupations is indicative of the importance of preparing workers to meet the demands of the market. Notwithstanding current economic declines, the worldwide demand for IT-skilled workers remains high [CompTIA, 2002; CompTIA, 2001]. Failure to address this issue will result in profound economic and social costs, including a widening of the income gap, curtailment of growth in essential industries, increased competition for low-skilled jobs, and even greater demands by U.S. companies for offshore hiring and increases in the H-1B visa cap [Meares and Sargent, 1999].

Meeting the IT skill challenge is critical and will require a multifaceted approach. The study set forth in this document broadens the definition of IT workers and examines how changes in the belief structure of university faculty influence IT acceptance within an underrepresented student population. Specifically, the study, which focuses on the underrepresentation of African Americans, posits that significant increases will be achieved only when individuals experience a fundamental change in their *awareness and attitudes* with regard to IT-focused career options. An opportune environment to impact such a shift in “mindset” is present in the higher education environment, but this systemic change must emanate from the introduction of innovative and simultaneous changes in curriculum, teacher and student roles, assessment, and professional development.

This study uses an extended definition of IT workers that includes, but is not limited to individuals with core technology degrees. While an informed IT workforce is essential, it is imperative that programs of study in business emphasize the increasing technological implications associated with managerial decision-making.

BACKGROUND

This study integrated critical IT knowledge and resources into the pedagogy of selected business courses. These courses crossed several business functions and student classifications, and applied different intervention experiences. The reconfiguration of the development, delivery, and evaluation of foundational courses can be disruptive to the traditional expectations of students, faculty, and administrators. Alavi, Yoo, and Vogel [1997] have been assertive in their explanations of the difficulties associated with integrating information technology into management education, and they stress that simply “providing computer access and training faculty and students” [p. 1312] is not of itself superior to alternative forms of learning and instruction. Rather, they support a more integrative technology-mediated learning environment that uses technology to leverage knowledge opportunities in and outside the classroom [Alavi, et al., 1997]. Such an environment facilitates information exchanges among course participants, and extends campus-based resources through the inclusion of external sources of business expertise.

Similarly, Agarwal’s [2000] research posits that the antecedents to individual acceptance of IT are direct interpersonal interventions (e.g., faculty interventions), social influences, and situational influences. With the existing shortage of technology workers, and the under-representation of minorities in the IT workforce, the goal of this research was to investigate whether changes in the instructional delivery of traditional courses would lead to a greater student willingness to embrace technology and seek employment opportunities in IT-related business environments. Further, the longer-term objective is to instruct a body of students in a manner that fosters continuous study and life-long learning. This study describes a process for engaging students in alternative learning experiences to enhance student motivation and performance and teaching effectiveness.

II. LITERATURE REVIEW

Information systems research investigates individual responses to computer technology from a variety of theoretical perspectives. Specifically, researchers examined the relationship using Diffusion of Innovations [Rogers, 1995; Compeau and Meister, 1997; Moore and Benbasat, 1991], the Technology Acceptance Model [Agarwal and Prasad, 1999; Davis, Bagozzi, and Warshaw, 1989; Venkatesh and Davis, 1996], the Theory of Planned Behavior [Mathieson, 1991; Taylor and Todd, 1995] and Social Cognitive Theory [Compeau and Higgins, 1995a, 1995b]. Each of the theories suggests that the responses of individuals to the use of technology are the result of a set of beliefs about the technology. While each theory reflects a cognitive basis for behavior, the Technology Acceptance Model (TAM) and the Social Cognitive Theory (SCT) are salient to this study. TAM is particularly important to this research because of the impact that social influences and belief structures have on acceptance and diffusion of innovations in communities [Rogers, 1995]. SCT is useful because of its role in explaining cognitive factors associated with individual behavior, and the prominence the theory gives to the concept of self-efficacy [Bandura, 1986].

TECHNOLOGY ACCEPTANCE MODEL

As researchers examine practical approaches for developing a more diverse IT workforce, one challenge that is recurrent in the literature involves the role of individual differences in the acceptance of new technologies. Kwon and Zmud [1987] reviewed varying research models pertaining to the implementation of information systems, and concluded that user motivation and capabilities are important determinants of success. Agarwal and Prasad [1999] observe, however, that while many studies find that specific individual difference variables are “germane influences on the implementation of a new IT” [p. 364], few studies examine the processes by which individual differences influence IT success.

Agarwal and Prasad [1999] describe the technology acceptance model as a parsimonious and theoretically grounded conceptualization that is useful in explaining and predicting individual behaviors toward information systems. According to this model, beliefs or perceptions act as mediating variables in the relationship between individual differences and IT acceptance. These researchers state that one implication that can be inferred from the model is that rather than focusing on individual differences, managers can “proactively [act to] influence beliefs directly through...broad-based information dissemination” [p. 363]. It is this last idea that is the essence of this study.

Agarwal and Prasad's [1999] empirical study of 230 information technology users from a Midwestern *Fortune* 100 corporation confirms the mediating role of beliefs (i.e., perceptions regarding technology usefulness and ease of use) as a predictor of technology usage. Further, a broader implication that emerges from the study relates to the tangential finding as to the importance of an environment that supports organizational learning. The authors note that “learning is critical to technology acceptance” [p. 385] and suggest the need for a work climate that encourages and rewards self-learning. While other authors discussed the relationship between technology acceptance and learning theoretically [Zmud, 1982; Rogers, 1995], Agarwal and Prasad's [1999] empirical findings advance our awareness of the issue and support the need for extended study of this relationship.

SOCIAL COGNITIVE THEORY

Social Cognitive Theory (SCT) is a widely accepted and empirically validated model of individual behavior [Bandura 1977, 1986]. The theory's premise is that environmental influences (e.g., social pressures), cognitive and personal factors (e.g., personality and demographic characteristics), and behavior are determined reciprocally [Compeau and Higgins, 1995]. The reciprocal relationship suggests that individuals make choices (e.g., about their environment), and they are also influenced by these choices. In describing SCT, Bandura [1986] advances two notions as the major cognitive forces guiding individual behavior. These notions are

- outcome expectations and
- self-efficacy.

The concept of outcome expectations posits that individuals will be more likely to engage in behaviors if they believe the outcome will be valued. What the individual is seeking through valued outcomes is some level of personal control regarding the benefits associated with changing a behavior (e.g., Will the action favorably affect my career or academic progress?).

Self-efficacy, or the personal judgments one makes about their ability to perform a specific task [Bandura 1986], influences an individual's choice about which behaviors they will undertake.

The linkage between outcomes and self-efficacy recognizes that if one doubts their own ability to accomplish an action, even positive expectations as to the value of the outcome will not motivate active participation in the endeavor.

Applying SCT to technology usage, Compeau, Higgins, and Huff [1999] state that an individual's self-efficacy and personal perceptions about the value of the outcome are critical to their decisions about whether, and to what extent, to use technology. Noting the tight linkage between outcomes and self-efficacy, the researchers comment that even when one believes the outcome is worthy, they still will not undertake the necessary learning required to change a behavior if they perceive that they lack the ability to perform the task. Compeau, et al. [1999] asserts that it is insufficient to anticipate a changed behavior in the adoption and use of technologies by simply offering individuals a well-reasoned argument regarding its merits. They suggest that changed behaviors must also be motivated through "coaching, teaching, and encouraging individuals to ensure that they have the requisite skills and confidence in their skills to be successful in their use" [p. 146].

Compeau, et al. [1999] tested the influence of computer self-efficacy, outcome expectations, affect, and anxiety on computer usage. The study used longitudinal data gathered from 394 end-users over a one-year interval. Findings from the study indicate a significant and predictive relationship between self-efficacy and computer usage, and the relationship was supported over a two-year period. With respect to outcome expectations predicting computer usage, the authors found a high correlation between expectations and usage. However, over the two-year period, the direct relationship between these two variables was slightly negative. Consistent with other expectation research [Ginzberg, 1981; Marcolin, 1994], Compeau, et al. [1999] found that when the expectations of participants about the benefits of technology were unrealistic (i.e., expected promotion, salary increase) users tended to be less satisfied and used the technology less than individuals with more realistic expectations. Using the longitudinal data, the authors found that persons who had expectations regarding financial rewards and increases in status in year one, had by year two, become disillusioned with those expectations, and that added information led to negative opinions about the use of technology. Otherwise, the model was supported, and persons with high beliefs about the personal benefit of technology indeed were more likely to use the technology.

SCT transfers readily to the goals for this study and for the challenge of increasing minority participation in the IT workforce. We believe that the process will encourage greater student use of technology, and further, give these students the confidence to seek employment opportunities in IT-related business environments.

THEORETICAL MODEL

The theoretical model (Figure 1), as adapted from Agarwal [2000], guides our research. We examined whether changes in pedagogical approach influenced students to improve use and familiarity with information technology, and whether this effort influences a subsequent likelihood of choosing an IT-related career. Incorporating variables associated with social cognitive theory, the model indicates that social influences, situational influences, and beliefs and attitudes directly motivate student acceptance of IT. Further, beliefs and attitudes are shown to be a function of faculty interventions within the target (i.e., student) population. Although TAM postulates that individual differences have an indirect effect on the acceptance of IT, a significant body of

literature in diffusion of innovations [Rogers, 1995] supports a simultaneous direct effect. The model used in this study includes indirect and direct effects of individual differences on IT acceptance. The diversity of the population with respect to gender, socio-economic status, and to a lesser extent age and ethnicity, should extend our knowledge of individual differences and the direct and indirect effects of such differences on IT acceptance.

Figure 1. Theoretical Model (adapted from Agarwal, 2000)

III. METHODOLOGY

Classic organizational change theory indicates that successful change is achieved through a three-step process of *unfreezing*, *moving*, and *refreezing* [Lewin, 1951]. Non-emphasis of technological knowledge and resources in traditional business functional courses represents the status quo, or equilibrium state. Unfreezing this state of equilibrium requires that faculty and students embrace a different model of instruction and learning - one in which IT resources and knowledge is integral in course information delivery. The unfreezing stage of Lewin's [1951] model corresponds to the *technology awareness* variable. The moving stage, in which we introduce a culturally relevant project, corresponds to the *technology integration* variable. Finally, the refreezing stage corresponds to the students' *attitude change* regarding IT opportunities. As the research model proposes, technology awareness impacts technology integration when moderated by the intervention of a culturally relevant medium. Continued use of a relevant medium impacts IT career opportunities, as measured by changes in attitude. The research model is presented in Figure 2.

Figure 2. Research Model

When examining a similar model, Hammond [1995] discussed several programs that are designed to increase the number of African-American professors, including the Florida Education Fund (formerly the McKnight Foundation), the PhD Project, and other programs under the auspices of the Ford Foundation and the American Institute of Certified Public Accountants (AICPA). These programs are effective in increasing the numbers of underrepresented minorities in graduate programs. Specifically, they:

- increased awareness of the need for individuals of color in higher education;
- used the medium of direct mentoring interventions to facilitate the integration of minority and traditional Ph.D. students;
- facilitated an attitude change among minorities with respect to Ph.D. degree programs and career opportunities in higher education.

As a result of these programs, the number of underrepresented minorities earning doctoral degrees in the business, sciences, and computer technology fields increased notably. The work presented here extends the concept to suggest that curriculum interventions could also be effective at the undergraduate level, as these students will make up a significant portion of the IT workforce.

RESEARCH DESIGN

Using selected undergraduate courses, we designed our study to enhance student awareness with respect to the needs and opportunities in IT related fields, with the expectation that this would change their propensity to pursue IT careers. The courses used for the study involved sophomore- to senior-level students and MIS and non-MIS majors. We examined the following research questions to determine if the introduction of projects that were relevant to business students would change their attitudes and enhance their knowledge of the career options in the IT arena:

1. What did the students perceive as their level of IT awareness and IT career opportunities?
2. What did the students perceive as their ability to integrate IT and business concepts?

3. Were the students willing to consider a career in IT?

For this study, IT awareness is defined as a basic knowledge and use of the Internet and IT tools (e.g., word processing, spreadsheets) for education, investigation, and communication. The IT integration construct refers to the student's ability to recognize how IT facilitates a competitive advantage for an organization's business functions.

Questionnaires were distributed to students during the first week of each class to assess the students' IT awareness and their career aspirations. The questionnaire was administered at the semester mid-term and again during the final week of classes. We measured the overall class response to the intervention as low, moderate, or high based on the individual responses to the topical areas on the three questionnaires. These measurements were as follows:

Low	fewer than 25% of the students responded positively to the related questions
Moderate	25% - 75% of the students responded positively to the related questions
High	more than 75% of the students responded positively to the related questions

We also conducted focus groups at the end of the semester to gain further in-sights about students' perceptions of IT use and their attitude towards IT career options.

Following is a brief description of the selected courses for this study. Additional details of the courses and projects are provided in Table 1.

Table 1. Description of Courses

Course(s)	Class And Major	Required or Elective	Total Students And Group Size	Project Descriptions ¹
<i>Introductory</i> • Introduction to MIS	<i>Sophomores</i> MIS majors and Non-majors	Required for all business majors	250 4-5	<i>Current Technology Trends²</i> Brick/Mortar vs. Dot.coms; CRM, data mining, out-sourcing, etc.
<i>General Business</i> • Organizational Theory • Business Information Systems	Juniors/Seniors Non-MIS majors	Business Elective	30 5	<i>Cross-functional Project</i> P2P technology (Napster) - examined business concepts/ strategies; related legal and ethical issues
<i>Software Development/ Programming</i> • Advanced Programming for Business Systems • Database Applications Development	Seniors MIS majors	Required for all MIS majors	10 ³ 2	<i>Enterprise Systems Simulation</i> Enterprise System - payroll system using Visual Basic and Oracle

¹ Refers to the "culturally relevant medium"

² Trends were examined over multiple semesters

³ Small class size - initial graduating MIS majors

1. *Introduction to MIS* – This course is an introduction to Management Information Systems and its uses and impact on organizations. The course involves the instruction of general MIS concepts using problem sets and case analyses.
2. *Organizational Theory* – This course examines the underlying managerial concepts of systems, organizational contingencies, conflict, and technology. Emphasis is placed on design, authority, structure and effectiveness.
3. *Business Information Systems* - This course is case-based and involves the discussion and evaluation of challenges of managing in an information age, information technology and strategy, and managing information assets.
4. *Advanced Programming for Business Systems* – This course presents object oriented and procedural software engineering methodologies for data definition and measurement, data construction, and data use in developing screen editors, reports and other information systems applications. The language used was Visual Basic.
5. *Database Applications Development* – This course covers information system design and implementation with a database management systems environment. Students designed business applications using Oracle.

IV. FINDINGS

This study used selected business courses to examine questions pertaining to students' IT awareness and their ability to integrate technology and business concepts. In addition, we sought to determine whether there was any change in students' attitudes towards IT career opportunities. Based on the introduction of culturally relevant business projects and the results of questionnaires and focus groups, we observed a mixed response to the interventions. The differences appear to be associated with the composition of the class, student classification, and student motivation.

INTRODUCTORY COURSE

The Introductory course was composed of sophomore business majors, including some MIS majors. The intervention mechanism was a project related to current technology trends such as the dot.com industry, Internet and data mining, outsourcing, Enterprise Systems (ES), and Customer Relationship Management (CRM). The initial questionnaires indicated that a low percentage of the students were familiar with IT trends and the integration of IT and business concepts. The results also showed that, with the exception of the MIS majors, most students did not intend to pursue IT careers. As the semester progressed, students gained a greater understanding of the critical role of IT in organizations. The end-of-semester questionnaires were closely aligned to those obtained at the mid-term. All students continued to exhibit increasing levels of awareness and the ability to integrate business and technology concepts, but long-term career plans remained unchanged. These results are summarized in Table 2.

Table 2. Findings for Introductory Course

Time	Awareness of IT Trends	Aware of Integration of IT and business	Pursue IS career? (non-majors)
Start of semester	Low	Low	Almost none
Mid- Semester	Moderate	Moderate	Almost none
End of Semester	High	Moderate	Almost none

The results found in the introductory course suggests that behaviors relating to the first two stages of the research model (awareness and integration) were as expected – technology awareness increased and students gained a greater understanding of how technology is integrated into business decision-making. The third stage – attitude change towards IT career opportunities – did not exhibit any observable change. In the focus groups, we found that students gained valuable insights regarding the business issues and the integral role of IT but, as sophomores, they had a strong desire to continue with their original major. They cited the influence of their parents, high school counselors, and peers as reference points for their decisions.

GENERAL BUSINESS COURSES

The Organizational Theory and Business Information Systems courses are usually taken as business electives in the junior or senior year by non-MIS majors. As instructors for these courses, the authors recognized the overlapping business concepts within both courses and saw an opportunity to introduce a relevant medium/project to increase the understanding of business theories and the integral role of IT in creating sustainable competitive advantages within organizations. At mid-term students in both classes were introduced to a research project involving Napster as a means to examine key business issues, peer-to-peer computing as a critical technology concept, organizational strategy, and legal/ethical issues. The project created a unique opportunity for students to (1) develop an understanding of the cross-functionality of business organizations and (2) explore IT careers.

As in the Introductory Course, we administered the questionnaire during the first week of class, at midterm, and again during the final week of class. The results indicated that a moderate percentage of students perceived that they had a basic knowledge and use of the Internet and IT tools. This percentage of students did not change throughout the semester. Regarding IT integration, we observed a positive change in students' ability to integrate business and technology concepts. By the end of the semester, the percentage of students who gained an understanding of the integral role of IT in organizations changed from low to moderate. For the third construct, attitudes and beliefs about the pursuit of IT careers, results indicated that a low percentage of students responded positively to a change in their career options; this response was consistent throughout the semester. The results for the Business courses are summarized in Table 3.

Table 3. Findings for General Business Courses

Time	Knowledge of Internet and IT Tools	Aware of Integration of IT and business	Pursue IS career? (non-majors)
Start of Semester	Moderate	Low	Low
Mid-Semester	Moderate	Low	Low
End of Semester	Moderate	Moderate	Low

Student responses to the questionnaires in the Organizational Theory and Business Information Systems courses were counter to our expectations. While we saw a moderate increase in the students' ability to integrate technology and business concepts, their level of IT awareness and their propensity to pursue IT careers did not change. Focus group discussions indicated two major factors as contributors to the outcomes observed.

1. The Napster project provided a relevant medium since students were very familiar with music sharing platforms. However, we found that because students tended to equate their familiarity and use of music sharing with IT awareness they were consequently reluctant to expend additional efforts towards expanding their overall understanding of

peer-to-peer technology. The lack of extended effort undermined the students' ability to integrate business and technology concepts appropriately.

2. The second factor was overall student motivation. As elective courses for juniors and seniors, students enrolled in the course with very strong preconceived beliefs about the process of course delivery. Their perception of the intervention was that it involved "more work" instead of more learning. Also, at this point in their course of study, they were highly committed to specific career paths and had no motivation to consider alternative models seriously.

SOFTWARE DEVELOPMENT/PROGRAMMING COURSES

Two software development courses, which are required courses for MIS majors, were team-taught by an academic and a seasoned practitioner. The courses, Advanced Programming for Business Systems and Database Applications Development, were composed of a total of 10 senior-level MIS students, seven of whom were enrolled in both classes. The project between the two courses represented one segment of an enterprise system. Students gained exposure to some of the inner workings of a Human Resource module of an Enterprise System (ES), and were able to simulate a payroll system. Students in the Advanced Programming course designed the front-end, Graphical User Interface (GUI), using Visual Basic. The datamart or back-end was developed in the Database course using Oracle.

Constraints often restrict the implementation of Enterprise Systems at colleges and universities with minimal financial and staffing resources. However, such constraints also occur in business sectors. Therefore, the project exposed students to a likely occurrence in a business organization, where modular ES implementation takes place.

The findings were as expected throughout the semester. Senior MIS majors were keenly aware of IT benefits and how IT undergirds every business function. They readily understood the connectivity between business concepts and technology solutions. In addition these students intend to pursue IT careers, and some already entered the workforce in the IT arena.

The basic results of the ES intervention in the senior-level MIS courses were also as expected, with students showing high awareness, integration, and attitudes and beliefs towards IT careers. However, what was surprising was the students' level of enthusiasm and their motivation to explore the project's nuances. Focus group discussions suggest that the following three factors played a significant role in the success of the project in these courses:

1. Students viewed this project as a direct enhancement to their IS skill portfolio, in that they were developing knowledge about high-demand business software. The use of the payroll system as part of the human resource function enhanced the relevancy of the project, since this type of software application is frequently used in organizations.
2. The energy generated by the academic/practitioner teaching approach was useful in terms of evaluating career objectives and instructive with respect to the types of projects commonly encountered in IS organizations. The opportunity for consistent interaction with a practitioner heightened overall student interest in the IT field.
3. The substantive content of the courses enabled the students to implement theoretical concepts into common business applications. In addition the overlapping participation of students in both courses created a synergistic effect that enhanced the value of direct contact hours and facilitated the project team approach that is often used in IT project development.

As these three factors indicate, students strengthened both their knowledge of IT in business and their resolve to work in IT.

V. DISCUSSION

As indicated in Table 4, the most significant changes in student perceptions occurred in their ability to integrate technology and business concepts. With respect to technology awareness, the only significant change noted occurred in the Introductory Course, with students moving from a moderate level of awareness to a high level by the end of the semester. There was no observable change across the three course types with respect to propensity to pursue IT careers. The career paths of MIS majors, who initially intended to pursue IT careers were reinforced by the project intervention, and non-MIS majors showed no intent to alter their career plans.

Although the students' perceptions of overall change were limited, several positive outcomes of the project interventions were identified in focus group discussions. First, students appreciated the introduction of relevant course projects. They generally found the projects interesting and gained valuable knowledge from the project intensity. Second, in each of the course types, the students observed a positive change in their ability to integrate technology and business concepts. In the focus groups, many students spoke enthusiastically about how this learning may assist them in future courses and in the workplace. The third positive outcome identified in the focus groups was that students now realized the myriad of possibilities for business careers that involve direct IT applications. Although most students were not prepared to change their career objectives, they viewed the knowledge of these career options as new longer-term opportunities.

Table 4. Summary of Findings

Course Type	Course(s)	Technology Awareness			Technology Integration			Attitude/Beliefs About IT Careers		
		Q1 ¹	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3
Introductory	Intro to MIS	Low ²	Mod	High	Low	Mod	Mod	Low	Low	Low
General Business	Organizational Theory	Mod	Mod	Mod	Low	Low	Mod	Low	Low	Low
	Business Information Systems									
Software Development/ Programming	Advanced Programming for Business Systems	High	High	High	Mod	Mod	High	High	High	High
	Database Applications Development									

¹ One assessment questionnaire was administered at three different intervals during the semester. Q1 (questionnaire 1) was administered at the beginning of the semester. Q2 and Q3 were administered at the mid-term and during the last week of the semester, respectively.

² The measurements refer to the percentage of students that responded positively to questions addressing the designated construct. The measurements were:

Low <25% of the students responded positively,
 Moderate (Mod) ≥ 25% and ≤ 75% of the students responded positively,
 High >75% of the students responded positively.

LIMITATIONS

Two major limitations should be noted from the research reported here. First, the observations are primarily based on self-reported student perceptions. It would be useful to evaluate actual

versus perceived change in IT awareness and IT integration using intellectual tasks – tasks for which there is a demonstrable right answer, and the group or individual must select/compute the correct answer (McGrath, 1984, p. 63).

Second, the research performed is similar to case study analysis in that we are reporting the results of specific projects in specific courses, and in some cases, with a low number of students. Therefore, significant statistical analyses cannot be made, and the generalizability of the results may be limited.

VI. CONCLUSIONS AND FUTURE RESEARCH

The present study addressed the issue of integrating IT into the core courses within the curriculum as a means of reducing the under-representation of minorities in the IT workforce. We proposed the development of an instructional delivery process that examines how teachers, through the beliefs and attitudes they impart in the classroom, can influence underrepresented groups to pursue IT related careers. Following the findings of other studies [Stanford University, 1998; Lester and White, 2000; Schiefele, 1991], we expected that as instructors express their enthusiasm for the subject matter and engage the students in the long-term relevance of course content, students will strive for high levels of performance and exhibit an intrinsic motivation for the subject. However, we found that changes in students' overall ability to integrate technology and business concepts, as well as their willingness to explore new career options, was significantly mitigated by the extent to which they could perceive direct value from the intervening mechanism and their personal motivation and capabilities. We believe these findings magnify the need for a greater integration of "real-world" IT experiences across the business curriculum, and more extensive involvement of business practitioners in the classroom.

A shortcoming of the study is the snapshot view of the outcomes. We designed the study to examine the changes in students' capabilities, attitudes, and beliefs over a period of one semester. It is likely, however, that such changes can only be observed over a longer period of time. Future studies of these behavioral changes should be examined longitudinally. For example, it would be interesting to learn if those students who, as sophomores, who were reluctant to consider IT career opportunities, changed their opinions as they continued their undergraduate program. Similarly, what careers are those students who were seniors in the general business courses pursuing three to five years after graduation? Another question that merits further study is the differences that employers observe among students who were involved in courses with an intense IT focus. Is there an observable difference in the readiness and proficiency of students exposed to IT intensive courses in comparison to students who have not had such experiences?

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REFERENCES

EDITOR'S NOTE: The following reference list contains hyperlinks to world wide web pages. Readers who have the ability to access the web directly from their word processor or are reading the paper on the web, can gain direct access to these linked references. Readers are warned, however, that

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Agarwal, R. 2000. Individual Acceptance of Information Technology. In R. W. Zmud (Ed.), *Framing the Domains of IT Management: Projecting the Future Through the Past*. Cincinnati, OH: Pinnaflex Educational Resources, Inc.

Agarwal, R. and Prasad, J. 1999. Are Individual Differences Germane to the Acceptance of New Information Technologies? *Decision Sciences*, 30(2), 361-391.

Alavi, M., Yoo, Y., and Vogel, D. 1997. Using Information Technology to Add Value to Management Education. *Academy of Management Journal*, 40(6), 1310-1333.

Bandura, A. 1977. Self Efficacy: Towards a Unifying Theory of Behavioral Change. *Psychological Review*, 84(2), 191-215.

Bandura, A. 1986. *Social Foundations of Thought and Action*. Englewood Cliffs, NJ: Prentice Hall.

Benbasat, I. and Taylor, R. N. 1978. The Impact of Cognitive Styles on Information Systems Design. *MIS Quarterly*, 2(2), 43-54.

Boyer Commission Report. 1998. *Reinventing Undergraduate Education: A Blueprint for America's Research Universities*. State University of New York at Stony Brook.

Compeau, D. R. and Higgins, C. A. 1995. Application of Social Cognitive Theory to Training for Computer Skills. *Information Systems Research*, 6(2), 118-143.

Compeau, D. R. and Higgins, C. A. 1995. Computer Self-Efficacy: Development of a Measure and Initial Test. *MIS Quarterly*, 19(2), 189-211.

Compeau, D. R., Higgins, C. A. and Huff, S. 1999. Social Cognitive Theory and Individual Reactions to Computing Technology: A Longitudinal Study. *MIS Quarterly*, 23(2), 145-158.

Compeau, D. R. and Meister, D. B. 1997. Measurement of Perceived Characteristics of Innovating: A Reconsideration Based on Three Empirical Studies, Workshop Presentation at the *Diffusion Interest Group on Information Technology*, Atlanta, GA, 12/13/97.

CompTIA. 2002. European ICT Skills Shortage Still Significant, Despite Economic Woes. 10/31/02, http://www.comptia.org/pressroom/get_news_item.asp?id=145.

CompTIA. 2001. The Ongoing Crisis in IT Management. 10/31/02, html version of the file <http://www.comptia.org/marketresearch/workforcestudy.pdf>.

Cook, T.D. and Campbell, D. T. 1979. *Quasi-Experimentation: Design and Analysis Issues for Field Settings*. Chicago: Rand McNally.

Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. 1989. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, 35(8), 982-1003.

Garcia, O. N. and Giles, R. 2000. *Research Foundations on Successful Participation of Underrepresented Minorities in Information Technology: Final Report from a Cyberconference*. <http://www.interact.nsf.gov/cise/html.nsf/html/itminorities/>

Hammond, T. D. 1995. Some Considerations in Attracting and Retaining African-American Doctoral Candidates in Accounting. *Issues in Accounting Education*, 10(1), 143-158.

KPMG Peat Marwick, LLP (Public Services). 1997. *Organizations Serving the Public: Transformation to the 21st Century*, New York, NY: KPMG

- Kwon, T. H. and Zmud, R. W. 1987. Unifying the Fragmented Models of Information Systems Implementation. In R. Boland and R. Hirscheim (Eds.), *Critical Issues in Information Systems Research*. Chichester: Wiley, 88-97.
- Lester, W. F. and White, S. D. 2000. Using the Music of the Inner City to Bridge the Digital Divide. *Proceedings of the Initiative for a Competitive Inner City, Business School Inner City Leadership Millennium Conference*, Kansas City, MO.
- Lewin, K. 1951. *Field Theory in Social Science*. New York, NY: Harper & Row,
- Marcolin, B. 1994. *The Impact of Users' Expectations on the Success of Information Technology and Implementation*, Unpublished Doctoral Dissertation. The University of Western Ontario, London, Ontario.
- Mathieson, K. 1991. Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior. *Information Systems Research*, 2(3), 192-222.
- McGrath, J.E. 1984. *Groups: Interaction and Performance*. Englewood Cliffs, NJ: Prentice Hall,.
- Meares, C. A. and Sargent, J. F. 1999. *The Digital Work Force: Building Infotech Skills at the Speed of Innovation*. Washington, DC: U. S. Department of Commerce, Technology Administration, Office of Technology Policy.
- Moore, G. C. and Benbasat, I. 1991. Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, 2(3), 192-222.
- Porter, L.W. and McKibbin, L. E. 1988. *Management Education and Development: Drift or Thrust into the 21st Century*. New York: McGraw-Hill.
- Rogers, E. M. 1995. *Diffusion of Innovations* (4th Ed). New York: The Free Press.
- Schiefele, U. 1991. Interest, Learning, and Motivation. *Educational Psychologist*, 26(3), 299-323.
- Stanford University. 1998. Capturing and Directing the Motivation to Learn. *Speaking of Teaching*, 10(7), Center for Teaching and Learning, Stanford, CA.
- Taylor, S. and Todd, P. A. 1995. Understanding Information Technology Usage: A Test of Competing Models. *Information Systems Research*, 6(2), 144-176.
- Venkatesh, V. and Davis, F. D. 1996. A Model of the Antecedents of Perceived Ease of Use: Development and Test. *Decision Sciences*, 27(3), 451-482.
- U. S. Department of Commerce. 1999. *The Emerging Digital Economy II*, Washington, DC: U.S. Department of Commerce. <http://www.ecommerce.gov>.
- Wheeler, B. C. 1998. The State of Business Education: Preparation for the Past? *Selections*, 14(2), 19-21.
- Yin, R. K. 1988. *Case Study Research: Design and Methods*. Newbury Park, CA: Sage Publications, Inc.
- Zmud, R. W. 1979. Individual Differences and MIS success: A Review of the Empirical Literature. *Management Science*, 25(10), 966-979.
- Zmud, R. W. 1982. Diffusion of Modern Software Practices: Influence of Centralization and Formalization. *Management Science*, 28(12), 1421-1431.

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