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Student Perceptions of Diversity Issues in IT

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ABSTRACT

This study examines student perceptions regarding the desirability of diversity in the IT workplace. Several diversity variables were included: age, disability status, ethnicity, and gender. Participants included upper division students with declared majors in IT fields, as well as upper division students enrolled in an Accounting Information Systems course. We analyzed their perceptions in relation to diversity, along with distinguishing factors influencing the choice of IT as a career. We administered the Diversity Perceptions Inventory (DPI) to 162 undergraduate students from three institutions. Using multivariate analysis of variance, we found no significant differences in a number of areas: gender, age, work experience, disability status. We did find significant differences in perceptions based on ethnicity ($p<0.05$), as well as differences based on college major ($p<0.05$). The paper concludes with recommendations and implications.

Keywords: Diversity, Ethnicity, Gender, Age, Disability Status, IT Careers

1. INTRODUCTION

Information technology (IT) practitioners estimate that 85% of high value IT work is performed by teams and contend that a diverse team is needed for optimum performance (May, 2004). Diversity in the information technology workforce has multiple dimensions, from differences in perspectives to diversity in ethnicity, age, gender, and disabilities. Ethnicity is defined as "Of or pertaining to a religious, racial, national, or cultural group" (American Heritage Dictionary, 1985, p. 467.) The terms "gender" and "sex" are used interchangeably and inconsistently in current literature. For purposes of this paper, the authors have chosen to use the term "gender" in order to connote both the biological and sociological aspects of diversity, as identified by Frank and Treichler (1989). The effect of diversity on IT team processes and performance can and will have an impact on organizational outcomes (Ancona and Caldwell, 1992).

While practitioners have to grapple with and balance the full spectrum of these issues on a daily basis, the academic community has focused on only some of the subsets of the IT diversity landscape, predominantly gender (Moody et al., 2003).

Recently we have seen a drop in IT student enrollment (Khanna, 2005). The need to value and increase diversity is no less important in light of these new economics. We argue that preparing students for diversity in the IT workforce is important for a number of reasons. Without women on IT development teams, technology pursuits may focus more on doing things faster, and less on doing new things that reflect alternative perspectives (Woodfield, 2002). Without disabled persons on IT teams, technology advances may evolve further away from accessibility, as with graphical user interfaces. Without age diversity, rich knowledge may be lost. Teams may find themselves re-inventing or even missing successful development methodologies without the inclusion of experienced IT workers. Finally, ethnically diverse IT work teams are increasingly needed to provide cross-cultural perspectives necessary for supporting the growing number of global organizations and their customers.

The Diversity Perceptions Inventory (DPI) is an instrument used to identify diversity perceptions and career choice. The instrument provided us with a mechanism to examine the following main research question: Are there diversity-related differences in perceptions among university students choosing an IT career?

This paper is organized as follows: In the motivation and hypotheses section, we provide a legislative perspective on the need for diversity, as well as a review of the related IT literature. This leads to our hypotheses. In the methodology section, we describe the survey instrument and the demographics of the students. In the results section, we

report the findings of an orthogonal exploratory factor analysis followed by multivariate analysis of variance (MANOVA). In the conclusions section, we present an interpretation of our results, including implications for practitioners and educators, as well as limitations of the current work.

2. MOTIVATION AND HYPOTHESES

The concept of a diverse workforce has been part of organizational employment practices since 1965 when Lyndon Johnson signed into law Executive Order 11246 (Crosby and Konrad, 2002). This law required that employers over a minimum size have an affirmative action plan that: 1) monitors the number of its employees in protected classes; and 2) takes action regarding hiring and promoting those in the protected classes, should it find that the numbers do not match "the numbers of qualified people in the protected classes who are employable in those jobs" (Crosby and Konrad, 2002). Crosby and Konrad defined protected classes as women, African Americans, Hispanic Americans, Asian Americans, and Native Americans.

In addition, the Age Discrimination in Employment Act (ADEA) of 1967 prohibits discrimination in hiring and managing employees based on age. Areas covered include hiring, workforce reductions, promotions, firings, compensation, benefits, and job assignments, as well as education or training (EEOC, 2004). More recent legislation includes the Adults with Disabilities Act (ADA) of 1990 that prohibits workplace discrimination against disabled persons who are otherwise qualified. Giving equal access to persons with disabilities applies to the full career life cycle including formal education, as well as hiring, workforce reductions, promotions, compensation, job assignments and training, similar to the protections against age discrimination.

2.1 Gender Diversity in IT

The dearth of women in IT has been the subject of a large number of studies with emphasis on pipeline issues, particularly in undergraduate education. Because women choose and complete IT majors less frequently than their male counterparts (Camp, 1997), many studies have examined how to improve the recruitment and retention of women in IT majors. Others have examined women in technology from the standpoint of the glass ceiling and the work environment (Trauth, Quesenberry and Yeo, 2005; Trauth, Quesenberry and Morgan, 2004; vonHellens, Neilsen and Trauth, 2001). For example, Smits and colleagues (Smits, McLean and Tanner, 1993) found gender and age differences in self-perceptions and in the importance of various job characteristics in entry-level IT professionals. Women perceive problems based on their gender, as well as gender-related age discrimination against younger workers (Riemenschneider et al., 2004). Women often struggle with balancing work and private lives (Nielsen, vonHellens and Beekhuyzen, 2004). Lastly, women are assigned less technical, lower status jobs (Fang et al., 2004). Therefore, we propose:

Hypothesis 1: Women students and men students will have different perceptions of IT work.

2.2 Ethnic Diversity in IT

Ethnic minorities will grow much faster than the population as a whole in the United States in the next decade (Anonymous, 2003-4) and their numbers will be reflected in the workplace, as well as on college campuses. Research into ethnic differences and business career choices has been considerable (Delvecchio, McEwen and McEwen, 2001; Whiston and Brecheisen, 2002). For example, Hispanic and Black community college students rated job security and autonomy to make their own decisions as more important than did White students, while older Black students rated having a job that was important and interesting higher than did older White students (Teng, Morgan and Anderson, 2001). Another study found that Black college students rated starting salary levels and educational requirements higher than did their White counterparts (Delvecchio, McEwen and McEwen., 2001). However, empirical research on ethnicity and IT career paths is limited. Wallace and Clariana (2005) did include gender and race effects in their examination of test mode familiarity and performance. They reported no gender effects, but some interactions between gender and race.

Studies of minorities and IT are more likely to focus on early access (or lack thereof) to computers at school and/or at home, on science and engineering rather than IT, and on prescriptions rather than empirical results. As with women, early in the educational pipeline many events influence minorities' interest and abilities in pursuing IT careers. The oft-cited "Digital Divide" refers to an apparently growing gap between those who have access to computers and the Internet, and those who, due to socioeconomic circumstances, do not. Unfortunately, lower socioeconomic status and limited access to computers often correlate with racial background (Attewell and Battle, 1999). Therefore, we propose:

Hypothesis 2: Students of different ethnicities will have different perceptions of IT work.

2.3 Age Diversity in IT

As with ethnicity, little research has considered age in relation to IT as a career. In one survey, 50% of employers perceived that older workers cannot perform as well as younger workers, and 30% of management trainers perceived older workers less trainable (Reio, Sanders-Rejo, and Reio, 1999). However, this study referred to workers in general, not specifically IT workers.

Occupations paying high wages, requiring numerical aptitude, and using computers extensively, such as IT, include few older employees and few older new hires (Hirsch, Macpherson, and Hardy, 2000). Age discrimination in IT apparently exists but may be based more on perception than reality. For example, a study of computer engineers found no difference in job performance as they aged (Underwood, 1986). A survey of *Network World* readers, however, indicated that the younger the age of the hiring manager, the less likely he or she would be to hire someone over 40 (Weinberg, 1998). Reducing possible discrimination against older IT workers could result in the ability of the IT

industry to leverage a significant group of valuable IT human resources. Based on the literature suggesting the underrepresentation of older workers in IT, we propose:

Hypothesis 3a: Older IT students and younger IT students will have different perceptions of IT work.

Further, it follows that older workers are likely to have more work experience than younger workers. With increased experience and exposure to the workplace, the attitudes of IT students may change. Therefore, we propose:

Hypothesis 3b: IT students with different levels of experience will have different perceptions of IT work.

Moreover, student class standing implies a level of experience. That is, seniors are more experienced than juniors; juniors are more experienced than sophomores, and so on. Further, we also suggest that non-IT majors taking IT classes (such as Math or Accounting students) will have different views of diversity than IT majors. Therefore, we propose:

Hypothesis 3c: Students with different class standings will have different perceptions of IT work.

Hypothesis 3d: Students with different majors will have different perceptions of IT work.

2.4 Diversity In Disability Status

A diverse IT workforce should also include those with various disabilities, yet people with disabilities are less likely to work in IT than those without disabilities. Despite the fact that undergraduates with disabilities select majors in computer or information science in proportions similar to the population not having disabilities (Horn and Bobbitt, 1999), they do not have equal representation in the workforce. Approximately 35% of the employed work force is disabled (Braddock and Bachelder, 1994), but only 5.3% of Association of Computing Machinery (ACM) members identify themselves as disabled (Davies and Dipner, 1992). Therefore, we propose:

Hypothesis 4: Disabled students will have different perceptions of IT work than non-disabled students.

3. METHODOLOGY

3.1 Survey Administration

We administered the Diversity Perceptions Inventory (DPI) (Woszczynski, et al., 2004) to a group of students taking IT-related courses (see Appendix). The DPI captures self-reported demographic data, as well as perceptions of factors related to preferences for IT work. We used the DPI to measure participant perceptions and diversity dimensions including gender, age, disability status (as registered with the universities), and ethnicity, in order to answer the following questions:

- What motivates someone to choose a career in IT?
- Do IT students see diversity as a useful dimension of the workplace?
- Is teamwork viewed as useful and enjoyable?
- What is the relationship, if any, between prior experiences and these perceptions?

The original DPI included 30 statements to which participants responded using a Likert scale from 1 = "strongly disagree" to 5 = "strongly agree." Demographic data and two open-ended questions were also included in the survey instrument.

3.2 Participants

The survey was administered to students from three universities in majors including computer science, information systems, accounting, and other non-IT majors. Of these, about 100 were enrolled in a core IT subject, database systems. These participants included undergraduate students who had chosen IT majors, specifically majors in computer science (CS) or information systems (IS). To provide maximum coverage of the field, we include CS and IS students under the single umbrella term, IT (Randall, Price, and Reichgelt, 2003). About sixty accounting majors, enrolled in an accounting information systems course, also participated. We grouped the accounting majors with all other business-related majors at the participating schools. We included non-IT majors as a basis for comparison to CS and IS majors, which we labeled more generally as IT students. Additional majors included math and other sciences.

About two-thirds of IT participants were male. All accounting majors were male, due to the demographics of one of the participating institutions. Ethnic groups included White (65%), Black (14%), Asian (8%), Hispanic (5%) and Multi-cultural or other (8%). The majority (78%) was between the ages of 18 and 24, with about 15% in the age bracket of 25-34. Approximately 11% of participants reported having registered a disability status at their university.

All three universities are comprehensive public institutions with numerous undergraduate and master's level programs. One is a suburban university with approximately 16,000 students. Another is located in a small college town with about 7,000 students. The third is a state-supported military college with about 4,000 students.

4. RESULTS AND DISCUSSION

4.1 Exploratory Factor Analysis

A final usable sample of 162 undergraduate students in database or accounting information systems courses at three universities completed the DPI. Responses to the 30-item survey were subjected to an orthogonal exploratory factor analysis (EFA) using squared multiple correlations as prior communality estimates. Twelve responses were missing one data point, and individual average responses were used to replace the missing data. Three responses were discarded due to multiple items with missing data. After four rounds of rotations, the DPI was modified to 17 items, representing four factors, as shown in Table 1. Internal consistency reliability (ICR) (Cronbach, 1951) for the 17-item scale was 0.72, above the generally accepted guideline of 0.70 (Nunnally, 1970). Other research (Carmines and Zeller, 1979; Hair, et.al, 1998; Nunnally, 1978) suggests a minimum

reliability of 0.50 to 0.60 for exploratory research, which is the type of research we completed in this study.

In interpreting the rotated factor pattern, an item loaded on a given factor if the factor loading was 0.30 or greater for that factor. Loadings of 0.30 have been used extensively in the past, since they indicate that a factor explains approximately 10% of the variance for a particular variable (Blau, 1985; Nunnally, 1978; Segars, 1997; Tinsley and Tinsley, 1987). Further, we only included an item if it exhibited simple structure – that is, it loaded above 0.30 on one factor, and did not load above 0.30 on any other factor. Using these criteria, five items loaded on the first factor, which we labeled Work-Life Balance. Work-Life Balance captures the essence of how family fits into an IT career decision, the importance of money in selecting a career, and the importance placed on work that is deemed useful to society.

Four items loaded on the second factor, which we labeled Teamwork Preferences. These items capture the individual's team preferences.

IT History, the third of the four factors, focuses on the student's prior experiences with computing, whether at home, work, or school. Six statements comprise IT History. We have tentatively interpreted the third statement ("I prefer to let other students ask questions during class") to indicate a degree of experience. That is, a student with more perceived experience is more likely to volunteer in class.

Importance of Diversity is the fourth factor. Here the statements focus on the student's perception on the value of diversity and their preferences for working in diverse groups. These items capture the individual's beliefs about the importance of diversity.

Scale reliability was assessed by calculating coefficient alpha (Cronbach, 1951). Reliability estimates were 0.81, 0.82, 0.63, and 0.68, for the Work-Life Balance, Teamwork Preferences, IT History, and Importance of Diversity factors, respectively. Reliabilities for the Work-Life Balance and Teamwork Preferences factors were above the 0.70 threshold, while the reliabilities for the IT History and Importance of Diversity factors were above the minimum 0.50 to 0.60 recommended for exploratory research. Individually, the factors each accounted for a proportion of the common variance, with Work-Life Balance accounting for 30.7%, Teamwork Preferences 20.2%, IT History 16.2%, and Importance of Diversity 18.5%.

4.2 Multivariate Analysis of Variance (MANOVA)

After completing an EFA, we then used multivariate analysis of variance (MANOVA) to test the hypotheses. We developed factor scores to use as dependent variables in our MANOVA model. The dependent variables included Work-Life Balance, Teamwork Preference, IT History, and Importance of Diversity, with gender, ethnicity, age, work experience, class, major, and disability status as the independent variables. Since we are completing exploratory research, we defined an alpha level of 0.10 as marginally significant, with alpha levels of 0.05 or less as significant. Univariate F-tests were used to assess the significance of each of the factors, as shown in Table 2. IT History was significant (F= 2.66, p=0.0002), and Teamwork Preferences was marginally significant (F=1.52, p=0.0736). The other two factors were not significant and were thus dropped from the model.

Factor	F-value	p-value
Work-Life Balance	2.66	*0.0002*
Teamwork Preference	1.52	*0.0735*
IT History	1.16	*0.2891*
Importance of Diversity	*1.36*	*0.1394*

Table 2: Univariate F-Tests by Factor

We then tested the significance of each variable on the significant factors, as shown in Table 3.

Hypothesis	Overall MANOVA F-value	Factor	
		Work Life Balance	Teamwork Preference
1 (Gender)	1.29	0.80	*0.42*
2 (Ethnicity)	2.09***	2.31*	*1.07*
3a (Age)	0.99	0.31	*0.65*
3b (Work experience)	0.28	1.24	*0.32*
3c (Class)	1.60*	1.72	*1.40*
3d (Major)	2.53***	9.37***	*3.23***
4 (Disability Status)	1.03	1.15	*0.54*
*** $p<0.01$ ** $p<0.05$ * $p<0.10$			

Table 3: Multivariate Analysis of Variance (MANOVA) Results

As shown in Table 3, Hypothesis 1 was not supported (F=1.29, p=0.2789). MANOVA revealed that there were no significant differences in perceptions between men and women on any of the two retained factors. That is, men and women students held similar beliefs about Work-Life Balance and Teamwork Preferences.

Hypothesis 2 was partially supported. Based on t-tests, different ethnic groups provided marginally different responses to statements regarding Work-Life Balance (F=2.31, p=0.0611).

Since we found marginally significant differences between ethnic groups on Work-Life Balance, we completed pairwise comparisons to further interpret the results. Mean scores and number of respondents for ethnicity are shown in Table 4. Students with multi-cultural or other ethnicities differed from their Black and White peers ($p<0.05$). Multi-cultural students were more likely to choose IT as a career because of family or money considerations or because they felt the work would be useful to society. Results suggest that Blacks and

Variable	Factor 1	Factor 2	Factor 3	Factor 4
It is important to me that work in the IT field is useful to society.	0.77			
It is important to me that work in the IT field allows me time for family.	0.72			
Family obligations sometimes interfere with my schoolwork. *	0.61			
It is important to me that work in the IT field is well paid.	0.59			
It is important to me that work in the IT field is interesting.	0.57			
I prefer to work in a group on school-related projects.		0.75		
I prefer to work alone on school projects. *		0.74		
I prefer to work alone on work-related projects. *		0.74		
I prefer to work in a group on work-related projects.		0.73		
I have experience using tools such as the Microsoft Office.			0.50	
I know a number of people working in the IT field.			0.49	
I prefer to let other students ask questions during class. *			0.49	
I have a mentor (faculty, professional, or peer) in the IT field.			0.48	
I have work experience in the IT field.			0.46	
I have experience with computer games.			0.34	
I prefer to work with people of different backgrounds.				0.68
Teams that have more diversity are more creative.				0.62

* Indicates items that are negatively worded
Internal consistency reliability (ICR) (overall) = 0.72
Factor 1 = Work-Life Balance; ICR = 0.81
Factor 2 = Teamwork Preferences; ICR = 0.82
Factor 3 = IT History; ICR = 0.63
Factor 4 = Importance of Diversity; ICR = 0.68

Table 1: Variable and factor loadings for the revised 17-item DPI

Ethnicity	N	*Mean Scores*
Asian	13	*0.1715*
Black	21	*-0.2889*
Hispanic	9	*0.2058*
White	107	*-0.0409*
Multi-cultural or Other	12	*0.5301*
TOTAL	*162*	

Table 4: Mean Scores by Ethnicity for Work-Life Balance

Whites were not as strongly influenced by these factors. Although our sample consisted of a small percentage of multi-cultural (about 7%) and Black students (about 13%), compared to White students (about 66%), these percentages are consistent with the current IT work force (May, 2004). We found no other significant ethnicity differences.

As shown in Table 3, Hypotheses 3a (F=0.99, p=0.4427) and 3b (F=0.28, p=0.9713) were not supported. There were no differences in perceptions of IT work by age, work experience or student classification.

Hypothesis 3c (F= 1.60, p=0.0887) revealed marginally significant differences between students with different classifications. Mean scores and number of respondents by classification are shown in Tables 5 and 6.

Since there were only two freshmen respondents and one other respondent, we excluded those classifications from the analysis. Once those classifications were excluded, there were no other significant pairwise differences.

Classification	N	*Mean Scores*
Freshman	2	*-0.3042*
Sophomore	29	*0.0902*
Junior	75	*0.0174*
Senior	55	*-0.0619*
Other	1	*0.0933*
TOTAL	*162*	

Table 5: Mean Scores by Student Classification for Work-Life Balance

Classification	N	*Mean Scores*
Freshman	2	*1.2190*
Sophomore	29	*0.2238*
Junior	75	*-0.0666*
Senior	55	*-0.0933*
Other	1	*1.1974*
TOTAL	*162*	

Table 6: Mean Scores by Student Classification for Teamwork Preference

Hypothesis 3d was partially supported. That is, students with different majors had differing perspectives on Work-Life Balance (F=2.53, p=0.0010). Mean scores and number of respondents by major are shown in Table 7.

Major	N	*Mean Scores*
Computer Science	41	*-0.2442*
Information Systems	63	*-0.2029*
Business	53	*0.3795*
Science or Math	1	*2.9857*
Other	4	*-0.0756*
TOTAL	*162*	

Table 7: Mean Scores by Major for Work-Life Balance

Preliminary analysis of the data indicates that only one respondent was a Science/Math major. Therefore, we did not make any conclusions regarding Science/Math majors. Pairwise comparisons did, however, suggest that Business students differ from their CS and IS peers on Work-Life Balance ($p<0.05$). Business students had much more favorable views of the amount of family time available in an IT career, along with better perceptions of the amount of money the IT professional make. It appears that CS and IS students have less favorable views of the amount of family time that they will have and the amount of money they will make. Perhaps CS and IS majors have been reading about the recent negative publicity that IT professionals have received, including the difficulty in getting a job after graduation, increased use of outsourcing, and the stereotypical perception of IT loners performing programming skills in a vacuum, with little input from peers. This may partially explain the drop in enrollment in many IT departments across the country. Business students, on the other hand, may have a more practical viewpoint. They may have a better view of the entire organizational landscape, understanding that employees in each functional area of business will face advantages and disadvantages.

Hypothesis 4 was not supported, as shown in Table 2. There were no significant differences in perceptions of IT work between disabled and non-disabled students. However, the study had a small number of students who classified themselves as disabled. Perhaps we would find differences if we had a larger representation of disabled students. It is worth noting that the percentage of disabled students in this sample was actually higher than the 5.3% of Association of Computing Machinery (ACM) members who identify themselves as disabled (Davies et al., 1992), so we may have difficulty finding significantly larger groups.

4.3 Power and Effect Sizes

In addition to significance tests, effect sizes assist the reader in interpreting the meaningfulness of the results while allowing researchers to compare effect sizes between studies (Kotrlik & Williams, 2003). The effect sizes for this initial, exploratory study should be interpreted with caution until other researchers test the model with additional data. For our research, we used statistical power of 0.90 or higher to indicate that we would find an effect, if in fact it exists. Power results for the significant univariate factors (Work-Life Balance and Teamwork Preferences) and each variable are shown in Table 8.

As Table 8 shows, all power levels were 0.90 or higher, with the exception of Work-Life Balance/Gender, Work-Life Balance/Age, and Teamwork Preferences/Work Experience. Therefore, our non-significant MANOVA results for these hypotheses should be interpreted with caution.

Factor	Variable	df	Power
Work-Life Balance	Gender	1	0.374
Work-Life Balance	Ethnicity	4	>.999
Work-Life Balance	Age	2	0.599
Work-Life Balance	Work Experience	2	0.973
Work-Life Balance	Class	3	>.999
Work-Life Balance	Major	4	>.999
Work-Life Balance	Disability Status	2	0.991
Teamwork Preferences	Gender	1	>.999
Teamwork Preferences	Ethnicity	4	>.999
Teamwork Preferences	Age	2	0.957
Teamwork Preferences	Work Experience	2	0.321
Teamwork Preferences	Class	3	>.999
Teamwork Preferences	Major	4	>.999
Teamwork Preferences	Disability Status	2	0.918

Table 8: Statistical Power by Factor and Variable

5. CONCLUSIONS

One of the contributions of this study is that it extends previous research by considering diversity factors beyond gender. In addition, the analysis of the data has enriched our understanding of the complex factors that interact to produce varying perceptions of IT careers, as well as the desirability of diversity.

Using a sample of 162 students from three universities, we completed an exploratory factor analysis (EFA), followed by multivariate analysis of variance (MANOVA) on responses to the Diversity Perceptions Inventory (DPI), in order to identify differences based on gender, ethnicity, age, disability status, university major, and academic classification. Our results indicate differences between ethnic groups and among students with different majors, but we found no differences based on gender, disability status, age, or work experience. For university classification, we found no significant differences after excluding the two freshmen and one other respondent in our study. Based on our results, ethnicity or major may be better predictors than gender. Perhaps other variables, such as cultural background, may provide even better predictive capability.

While this initial analysis supports the usefulness of the DPI, further research is clearly warranted. Expanding the sample to include a more diverse age range, a greater number of disabled students, and a more diverse group based on gender

may lead to more compelling differences between groups. By further testing the DPI, researchers may be able to provide insights into how to reach underrepresented groups and encourage them to enter and succeed in the IT workforce, or indeed, if there are differences in perceptions between groups.

5.1 Implications

The dearth of diversity in the IT workforce is of concern to many people. Lack of diversity of vision and perspective may limit future innovations in technology and technology outcomes. Lack of diversity of vision and perspective may limit the success of our IT students once they enter the workforce. Furthermore, growing and important groups within society do not have full access to the intrinsic and extrinsic rewards of exciting careers in IT today.

Given the expected population growth rate of ethnic minorities coupled with our results, it would seem prudent to develop recruiting and educational programs that address areas of concern to ethnic minorities. For example, research has shown that while there appear to be no gender differences in the use of career counseling services, Hispanic students are less likely to utilize such services (Whiston and Brecheisen, 2002). As noted by Teng, Morgan, and Anderson, (2001), career counselors and educators should be sensitive to the different values that Black, Asian, Hispanic, and White students bring to career choices and assist them accordingly.

The results from this study should prove useful to IT researchers and educators. It extends prior work with important considerations of ethnicity, as well as gender. Participants included students from many groups differing with respect to gender, major, ethnicity, age, and disability status. Although similar in many ways, we found interesting differences. CS and IS educators must be sensitive to ethnic as well as gender issues when organizing teams and facilitating discussions in class. Awareness of ethnic differences could also affect an educator's ability to effectively advise and mentor IT students.

5.2 Limitations and Future Research

This study takes a positivistic approach. The growing body of literature related to IT diversity could benefit from future work examining the issues through an interpretive study. This may be especially important along the dimension of disability status, where the sample size is small. The positivist approach tends to suggest that there is an objective reality beyond human perception (Weber, 2004). The lens of an interpretive study may enrich our understanding of the results from this study and related ones. For example, this study considered ethnicity but not culture. However, social scientists are beginning to recognize the importance of distinguishing between the concepts of ethnicity (a self-reported variable related to nationality and ancestry) and culture (reflecting values, beliefs, and ways of processing one's experiences). Meaningful future research will require more refined operationalization of these constructs (Murray, Smith, and Hill, 2001). It may also be helpful to consider contextual attributes that contribute to a more complex view of culture (Straub et al., 2002).

Further, any study that uses self-reports to gather data runs the risk of common method variance (Woszczynski and Whitman, 2003). We did attempt to minimize some of the inherent problems with self-reports by allowing anonymous responses to reduce the impact of social desirability effects. Additionally, since we had a multi-factor solution, it did not appear that a common method was the predominant reason for the results obtained. Future studies could use confirmatory factor analysis to further reduce potential unintended effects of common method variance.

Because we made use of convenience sampling, it may be difficult to generalize with respect to non-IT students. The majority of our non-IT students were male and from a single university. This limits our ability to draw conclusions about gender and major. Future studies would benefit from an expanded sample of students from diverse universities. Moreover, some studies have suggested important interaction effects between gender and ethnicity (Llewellyn and Usselman, 2001; Wallace and Clariana, 2005). In this study, we were unable to examine interaction effects due to our limited sample size. However, future studies would clearly benefit by using a large sample and testing for interactions between gender and ethnicity, gender and major, and other effects.

A larger sample size would also maximize the chances of our finding an effect if in fact one exists. Particularly for the Work-Life Balance/Gender effect, we would recommend that future research more closely examine the relationship to determine if there is a gender effect.

This study is limited by examination of students rather than IT professionals. Additional studies of working people are needed. Our results do have implications for educators though, and to some extent on our understanding of related pipeline issues. Although there is still much to learn, a reasonable body of work focusing on women and IT has emerged. Are there other aspects of the lack of diversity in the IT career pipeline that must be considered? Are ethnic, or even cultural differences more important than gender differences? For example, is the shortage of women in IT primarily a crisis for Western women? Will current off-shoring and out-sourcing of formerly U.S. IT jobs change the questions, as well as the answers? Future research must seek to address these important aspects of diversity in the IT profession.

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APPENDIX

Diversity Perceptions Inventory

1. What is your major
   a. Computer Science
   b. Information Systems
   c. Business
   d. Science or Math
   e. Other
2. What is your student classification
   a. Freshman (less than 30 semester hours)
   b. Sophomore (30-59 semester hours)
   c. Junior (60-89 semester hours)
   d. Senior (90 hours or more)
   e. Other (such as graduate student)
3. Approximately what is your GPA ?
   a. 4.0
   b. 3.0-3.99
   c. 2.0-2.99
   d. 1.0-1.99
   e. less than 1.0
4. What is your disability status (registered with your school)?
   a. Vision
   b. Mobility
   c. Hearing
   d. Other disability
   e. None
5. What is your gender?
   a. Female
   b. Male
6. What is your age
   a. Under 18
   b. 18-24
   c. 25-34
   d. 35-44
   e. 45 or older
7. What is your ethnicity?
   a. Asian
   b. Black
   c. Hispanic
   d. White
   e. Multi-cultural or Other
8. Do you currently work?
   a. Yes, full time
   b. Yes, part time
   c. No

For the following questions, please select A for Strongly agree, B for agree, C for neutral or unsure, D for disagree, or E for Strongly disagree. Note that IT is defined to include computer science, information systems and related.

9. I have work experience in the IT field.
10. I have work experience, but outside IT.
11. I have experience using tools such as the Microsoft Office.
12. I have experience with computer games.
13. I prefer to work alone on school projects.
14. I prefer to work in a group on school-related projects.
15. I prefer to work alone on work-related projects.
16. I prefer to work in a group on work-related projects.
17. I prefer to work with people of different backgrounds.
18. I know a number of people working in the IT field.
19. Teams that have more diversity have more conflict.
20. Teams that have more diversity are more creative.
21. Teams that have more conflict are less effective.
22. Teams that have more diversity are less effective.
23. I am smart enough to be successful in IT.
24. It is important to me that work in the IT field is interesting.
25. It is important to me that work in the IT field is useful to society.
26. It is important to me that work in the IT field is well-paid.
27. It is important to me that work in the IT field allows me time for family.
28. Family obligations sometimes interfere with my school work.
29. I am comfortable asking questions in class.
30. I prefer to let other students ask questions during class.
31. In the classroom, teachers often call on me to answer questions.
32. I have a mentor (faculty, professional, or peer) in the IT field.
33. Before I began college, I was encouraged to enter a computer-related field.
34. An advisor or career counselor has encouraged me to pursue an IT career.
35. Most IT students have a very high IQ.
36. I sometimes feel isolated in my career pursuits.
37. Most IT students are male.
38. Most IT students are white.

For the following questions, provide answers in the space provided:

39. Please list any prior majors you have declared:

40. Please describe why you are or are not pursuing a degree in IT.