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Amy Woszczynski  
*Kennesaw State University*

Catherine Beise  
*Salisbury University*

Martha Myers  
*Kennesaw State University*

Janette Moody  
*The Citadel*

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# FACTORS THAT INFLUENCE PERCEPTIONS OF IT DIVERSITY

**Amy Woszczyński**  
Kennesaw State University  
[awoszczy@kennesaw.edu](mailto:awoszczy@kennesaw.edu)

**Catherine Beise**  
Salisbury University  
[cmbeise@salisbury.edu](mailto:cmbeise@salisbury.edu)

**Martha Myers**  
Kennesaw State University  
[mmyers@kennesaw.edu](mailto:mmyers@kennesaw.edu)

**Janette Moody**  
The Citadel  
[janette.moody@Citadel.edu](mailto:janette.moody@Citadel.edu)

## Abstract

*Although researchers have considered diversity in IT, few studies have specifically analyzed the underlying components of individual perceptions of diversity. This research-in-progress reports on an exploratory factor analysis as an initial step towards validating the Diversity Perceptions Inventory (DPI). The DPI was administered to a group of 165 students, and four factors emerged from the analysis: motivation to select an IT career, teamwork perceptions, prior experiences in IT, and perceptions of diversity use in IT. The DPI is expected to be useful to researchers who want to study diversity dimensions, including gender, age, ethnicity, and disability status.*

**Keywords:** Diversity, IT workforce, gender, sex, ethnicity, age, disability, survey design, DPI

## Introduction

Today's businesses often choose to locate near concentrated pools of talented workers (Bruno, 1997a), just as businesses of the past located their facilities near their main factors of production of natural resources. Studies show that a community that is socially, culturally and ethnically diverse positively correlates to the area's success in technology (Florida and Gates, 2001). In addition, governmental regulations have focused attention on the importance of a diverse workforce. Diversity in the information technology (IT) workforce has multiple dimensions, from diversity in perspectives to diversity in terms of ethnicity,<sup>1</sup> age, gender<sup>2</sup> and disabilities. The effect of diversity on IT team processes and performance can and will have an impact on organizational outcomes. 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 (Moody et al., 2003). This study seeks to expand the dimensions of diversity in the IT literature by considering perspectives of students who have chosen related majors.

It can be argued that 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. Without disabled persons on IT teams, technology advances may evolve further away from accessibility, as with graphical user interfaces. Without age diversity, rich knowledge is lost. Teams may find themselves re-inventing or even missing successful development methodologies without the inclusion of aging IT workers. Finally, diverse IT work teams provide cross-cultural perspectives necessary for supporting the growing number of global organizations.

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<sup>1</sup> Ethnicity is defined as "Of or pertaining to a religious, racial, national, or cultural group" (American Heritage Dictionary, 1985, p. 467.)

<sup>2</sup>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).

## Background

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 their numbers do not match “the numbers of qualified people in the protected classes who are employable in those jobs” (Crosby and Konrad, 2002). Here protected classes were defined 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 on the basis of age. Areas covered include hiring, workforce reductions, promotions, firings, compensation, benefits, job assignments, as well as education or training (U.S. EEOC, 1997). 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 hiring, workforce reductions, promotions, firings, compensation, benefits, job assignments, and training, similar to the protections against age discrimination.

### *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. Since 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. For example, Smits and his colleagues (Smits et al., 1993) found gender and age differences in self-perceptions and in the importance of various job characteristics in entry-level IS professionals. It is well documented that the proportion of women in this field is small and shrinking, in spite of the fact that women dominate information-related careers (libraries, communications, journalism), and that at least fifty percent of Internet users are female (Friedman, 2000).

### *Ethnic Diversity in IT*

Ethnic minorities will grow much faster than the population as a whole in the United States in the next 25 years (Bloom, 1994/95). Empirical research in ethnicity and IT is limited. 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 well-known “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, poorer socioeconomic status and limited access to computers often correlate with racial background (Attewell and Battle, 1999).

### *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 et al., 1999).<sup>3</sup> Occupations paying high wages, requiring numerical aptitude, and using computers extensively, such as IT, include few older employees, few older new hires, and limited openings (Hirsch et al., 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.

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<sup>3</sup>This study referred to workers in general, not specifically IT workers.

### ***Diversity in Disability Status***

A diverse IT workforce should also include those with various disabilities, yet people with disabilities are less likely to choose a career 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% of computer scientists in the workforce are disabled. A mere 5.3% of Association of Computing Machinery (ACM) members identify themselves as disabled (Davies, 1992).

### **Survey Design Process**

Because so little empirical research exists, we have developed and validated a survey instrument, the Diversity Perception Inventory (DPI), shown in Appendix A. The goal of this instrument is to measure perceptions related to choice of IT careers, teamwork preferences, prior experiences, and perceived usefulness of diversity in the work environment. The intended audience is both university students majoring in related fields and working professionals in the IT and related fields.

The instrument provides a mechanism for examining the following main research question: Are there diversity differences with respect to motivation for choosing an IT career? Diversity is measured along dimensions including gender, age, grade point average, disability status, and ethnicity. In addition the survey measures the following research questions:

- Is diversity perceived as a useful dimension of today's IT workforce?
- Is teamwork viewed as a useful and enjoyable component of today's workforce?
- What is the relationship, if any, between prior experiences and these perceptions?

The design of the instrument was based on several existing instruments and prior research in the area of diversity in the IT workforce, as well as standard demographic instruments such as census data. Initial tests of the instrument involved soliciting input from focus groups of students in one undergraduate class and one graduate class. Feedback from these groups led to re-phrasing of several questions.

The resulting survey includes 30 statements to which participants respond using a Likert scale of 5 choices from "strongly agree" to "strongly disagree." Demographic data and two open-ended questions are also included in this version of the survey instrument.

### ***Participants***

The current phase in survey development involved administration of the survey to students from three universities in majors including computer science, information systems and accounting. We administered the DPI to approximately 100 students enrolled in a core IT subject: database systems. Participants in the study included undergraduate students who had chosen IT majors. The survey was also administered to approximately 60 accounting majors enrolled in an accounting information systems course.

About two-thirds of IT participants were male. All accounting majors were male. Ethnic groups included White (65%), Black (14%), Asian (8%) and Hispanic (5%). The majority (78%) were between the ages of 18 and 24, with approximately 15% in the age bracket of 25-34. Approximately 11% of participants reported having registered disability status at their university.

### **Analysis Procedures and Results**

A sample of  $n=165$  undergraduate students in database or accounting information systems courses at three universities completed the Diversity Perceptions Inventory (DPI). Responses to the 30-item DPI were subjected to an orthogonal exploratory factor analysis (EFA) using squared multiple correlations as prior communality estimates. Twelve responses were missing one or more data points, and individual average responses were used to replace the 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.

In interpreting the rotated factor pattern, an item was said to load on a given factor if the factor loading was 0.30 or greater for that factor. Using these criteria, five items loaded on the first factor, which was labeled “Motivation.” All of these items capture individual reasons or motivations for pursuing a career in IT:

- It is important to me that work in the IT field is useful to society.
- It is important to me that work in the IT field allows me time for family.
- Family obligations sometimes interfere with my school work.
- It is important to me that work in the IT field is well-paid.
- It is important to me that work in the IT field is interesting.

**Table 1. Variables and Factor Loadings for the Revised 17-Item Diversity Perceptions Inventory (DPI)**

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 school work. *	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 = Motivation; ICR = 0.81				
Factor 2 = Teamwork; ICR = 0.82				
Factor 3 = Experience; ICR = 0.63				
Factor 4 = Diversity of perspective; ICR = 0.68				

Four items loaded on the second factor, which was labeled “Teamwork.” These items capture the individual’s team preferences:

- I prefer to work in a group on school-related projects.
- I prefer to work alone on school projects.
- I prefer to work alone on work-related projects.
- I prefer to work in a group on work-related projects.

Six items loaded on the third factor, which was labeled “Experiences.” This factor includes previous computing experience, along with experience with mentors, experience in the workplace, and experience in the classroom.

- I have experience using tools such as the Microsoft Office.
- I know a number of people working in the IT field.
- I prefer to let other students ask questions during class.
- I have a mentor (faculty, professional, or peer) in the IT field.
- I have work experience in the IT field.
- I have experience with computer games.

Two items loaded on the fourth factor, which was labeled “Diversity of perspective.” These items captured the individual’s beliefs about working on diverse teams:

- I prefer to work with people of different backgrounds.
- Teams that have more diversity are more creative.

Scale reliability was assessed by calculating coefficient alpha (Cronbach, 1951). Reliability estimates were 0.81, 0.82, 0.63, and 0.68, for the Motivation, Teamwork, Experiences, and Diversity of perspective scales, respectively. Individually, the factors each accounted for a significant proportion of the common variance, with Motivation accounting for 31.2%, Teamwork 31.1%, Experiences 21.6%, and Diversity of perspective 16.1%.

## Discussion

We completed an initial validation of the Diversity Perceptions Inventory (DPI). Exploratory factor analysis revealed 18 items loading on four factors, which we labeled Motivation, Teamwork, Experiences, and Diversity of perspective. These four factors form the basis of individual perceptions of diversity in IT. While this initial analysis supports the usefulness of DPI, further research is clearly warranted. Confirmatory factor analysis (CFA) with an independent sample could provide further validation of the survey. Moreover, researchers wishing to test the differences in perceptions of groups, such as women, the disabled, and other underrepresented groups, could use DPI to develop research questions. For example, do women and men differ in their perceptions of motivation? How might this difference impact diversity in the IT workforce? If women are motivated to pursue a career in IT for different reasons than their male counterparts, in what ways can we encourage them to enter the IT profession? The same questions might be asked about other underrepresented groups, including the disabled, African-Americans, older workers, and the like. The DPI may serve as a starting point for determining if there are differences between groups, and if so, providing insights into how to reach underrepresented groups and encourage them to enter and succeed in the IT workforce.

This study is not without limitations. This study takes a positivistic approach and will benefit from future research plans to examine the issues through the lens of social construction. As with any factor analysis, the results may be due to chance rather than a true effect. However, we attempted to minimize this limitation in a number of ways. First, we collected data from three independent universities to gather a diverse set of data. Second, we had a fairly large sample size ( $n=165$ ). We recognize, however, that future research needs to confirm the results of this study to further validate the DPI.

Any study that uses self-reports to gather data runs the risk of common method variance (Woszczyński and Whitman, 2003). However, 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. Further, since we had a multi-factor solution, it did not appear that a common method was the predominant reason for the results obtained. CFA with explicit modeling of method bias should shed more light on this potential limitation.

Finally, our survey used only student participants. Although we believe that the results are generalizable to other populations, particularly workers in IT, future studies should include a wider range of respondents to make the results more generalizable. However, even when the current survey is used specifically with students, it is still useful in identifying students’ perceptions and awareness of diversity dimensions.

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## Appendix A. Diversity Perception Inventory (DPI)

Student ID (last 5 digits only):

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.