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## Employment of Persons with Disabilities in Information Technology Jobs: Literature Review for ‘IT Works’

Kevin Schartz, Ph.D., M.C.S.\*,  
Helen A. Schartz, Ph.D., J.D., and  
Peter Blanck, Ph.D., J.D.

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This article reviews relevant literature as to the labor pool of qualified individuals with disabilities and employment in information technology (IT) sector jobs. First, the article reviews the empirical literature on barriers to employment in IT for persons with disabilities. The examination then is extended to studies of barriers to employment for individuals with disabilities in other employment sectors. Findings illustrate the limited experiences that IT and non-IT companies have in employing and accommodating employees with disabilities. Implications are discussed for enhancing the employment of qualified workers with disabilities in IT through research, education, training, and mentoring programs. Copyright # 2002 John Wiley & Sons, Ltd.

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\*Correspondence to: Kevin Schartz, Ph.D., M.C.S., Law, Health Policy and Disability Center, University of Iowa College of Law, Iowa City, IA 52242, U.S.A. E-mail: kevin-schartz@uiowa.edu  
Kevin Schartz, Ph.D., M.C.S., is Assistant Research Scientist, Law, Health Policy, and Disability Center (LHPDC), University of Iowa College of Law. Helen A. Schartz, Ph.D., J.D., is Associate Director of Research and Associate Research Scientist, LHPDC, University of Iowa College of Law. Peter Blanck, Ph.D., J.D., is Charles M. and Marion Kierscht Professor of Law and Professor of Public Health and of Psychology at the University of Iowa, and Director of the LHPDC.

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## INTRODUCTION: THE IT INDUSTRY

### Demand for Qualified Workers

According to the U.S. Department of Commerce (Henry *et al.*, 1999), by 2006 almost half of workers in the U.S. will work in industries that either produce information technology (IT) products or use IT products extensively. The Bureau of Labor Statistics (December 2001) projects that eight of the top ten fastest growing occupations between 2000 and 2010 will require significant computer skills (see Figure 1).

Even with revised projections because of a downswing in the overall US economy, demand for IT workers continues to exceed supply. Based on a survey of 532 IT hiring managers, ITAA (the Information Technology Association of America) predicts a shortfall of almost 600,000 skilled workers in 2002 (ITAA, 2002), positions that will go unfilled because of a lack of qualified applicants.



Figure 1. Estimated labor force demand for computer related jobs (Bureau of Labor Statistics, December 2001).

ITAA has commissioned studies of hiring managers at IT and non-IT firms in the years 2000, 2001 and 2002. All three ITAA studies confirm that IT employees comprise a substantial portion of the labor force in IT firms, which create and sell commercial IT solutions to customers, and non-IT firms, which use IT solutions to assist in business operations but do not develop solutions for commercial sales. IT employees accounted for 9.9 million employees in 2002, 10.4 million in 2001, and 10 million in 2000 (see ITAA, 2002).

Although the projected demand for IT employees decreased during the years 2000 to 2001, the market appears to have rebounded somewhat in 2002 (see Figure 2). Demand for new IT employees was estimated at 1.6 million for 2000, 0.9 million for 2001, and 1.1 million for 2002. Of those positions in 2002, more than half (52.6%) are expected to go unfilled because managers will be unable to find qualified employees.

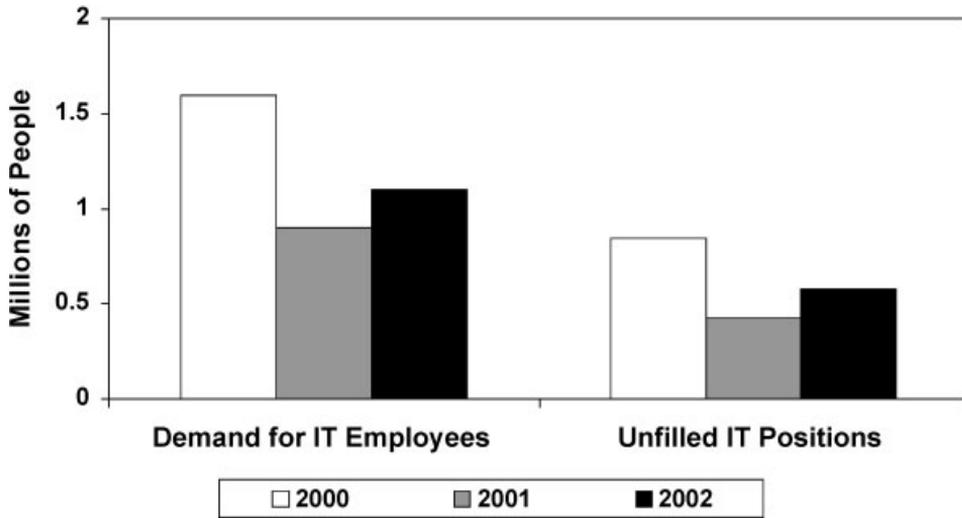


Figure 2. Demand for IT employees 2000 - 2002 (ITAA, 2000, 2001, 2002).

### Labor Force Participation of Individuals with Disabilities

A corresponding employment-related need affects the majority of individuals with disabilities (Blanck, 2000). Despite nearly a decade of Harris polls citing that more than two-thirds of individuals with disabilities who are not employed say that they would prefer to work, the 2000 Harris poll commissioned by the National Organization on Disability (NOD) found, once again, that only 32% of individuals with disabilities between the ages of 18 and 64 work full- or part-time compared with 81% of people without disabilities—a difference of 49%.

Even with years of sustained economic growth, people with disabilities remain poorer than the rest of the population and continue to face overwhelming discrimination in the workplace (Schwochau & Blanck, 2000). Depending on age and definition of disability, the poverty rates of people with disabilities range from 50 to 300% higher than the general population. More than one-third (34%) of people with disabilities live on a household income of less than \$15,000 per year, compared with 12% of people without disabilities (Harris & Associates, 1994, 1998).

Poverty is significantly negatively correlated with the ability to work. Although one in ten working-age adults with no work limitations live in poverty, the rate is three times greater for those with some work limitations, and rises to 38.3% for working-age adults with a 'severe disability.' Part of this difference is because individuals with disabilities are more likely to be working in part-time and temporary jobs. Yet, the poverty rate among full-time, year-round workers with disabilities still is 60% higher than among their counterparts with no disabilities (Kaye & Longmore, 1997).

Significant income discrepancies exist between Americans with and without disabilities, regardless of gender and age (Baldwin, 2000). Those with disabilities who are employed earn only 72% on average of what workers without disabilities earn annually. Comparing full-time, year-round workers, average monthly earnings for males with disabilities are \$1,560 and those for females are \$1,100, while males

without disabilities average \$2,190 and females \$1,470 (U.S. Census Bureau, 1994 – 1995). Two of every five Americans with disabilities report that their disability has prevented them from working (Harris & Associates, 1994, 1998).

For a variety of reasons, people with disabilities have a much lower chance of finding and keeping fulfilling employment. Estimates of 20% and higher of employed people with disabilities report difficulty in getting the kind of job they wanted because of their disability (Harris & Associates, 2000; see also Blanck, Sandler, Schmeling, & Scharzt, 2000). Fewer than half (40%) of those employed full-time believe their job requires their full talents and abilities (Harris & Associates, 2000).

The barriers people with disabilities face in finding satisfactory employment are numerous, the most significant being low pay (47%), poor access to public facilities and transportation (27%), and inadequate health insurance (23%) (Harris & Associates, 1998). Approximately two-thirds (67%) of adults with disabilities report their disability has prevented them from 'reaching their full abilities as a person' (Harris & Associates, 1994, 1998).

People with disabilities who are employed often are forced to work fewer hours than their peers; well under one-fifth (17%) work full-time, compared with the nearly two-thirds (63%) of people without disabilities (Rehabilitation Research and Training Center on Workforce Investment and Employment Policy for Persons with Disabilities, n.d.).

The ongoing, robust demand for IT workers in IT and non-IT industries— as well as the difficult economic conditions affecting a majority of individuals with disabilities—suggest that IT and non-IT firms would attract the attention of individuals with disabilities, as well as other populations underrepresented in the IT field. However, in this field, as in many others, people with disabilities are underrepresented. The National Science Foundation (2002) estimates that individuals with disabilities account for only 5.8% of the science and engineering labor force, despite the fact that they make up at least 20% of the U.S. population.

This article reviews relevant empirical literature as to why the labor pool of individuals with disabilities has not been tapped by the IT industry, in light of the high demand and limited supply of qualified workers. Our focus is on empirical studies that serve to inform policymakers, practitioners, and individuals with disabilities about factors that have been shown to influence the employment of individuals with disabilities (Blanck & Scharzt, 2001).

Our review is guided by a theoretical framework, presented in Figure 3 (and discussed *intra*), of the potential barriers and opportunities in hiring, retention, and advancement of persons with disabilities in the IT industry. The theoretical framework is based on empirical research on employment outcomes for individuals with disabilities outside of the IT industry (see Hahn, 2000; Blanck, 2000).

Hahn (2000) postulates that factors and forces in society, and at the individual level, contribute to the integration of persons with disabilities into society. These factors, in combination and alone, determine the integration of individuals with disabilities into society; for instance, organizational culture (internal to an organization) and an individual's type and severity of impairment would contribute to integration and success in IT work.

First, we examine the limited literature on barriers to employment in IT. Second, we extend our investigation into empirical studies on the barriers to employment for individuals with disabilities, across employment sectors. Finally, we suggest ways in

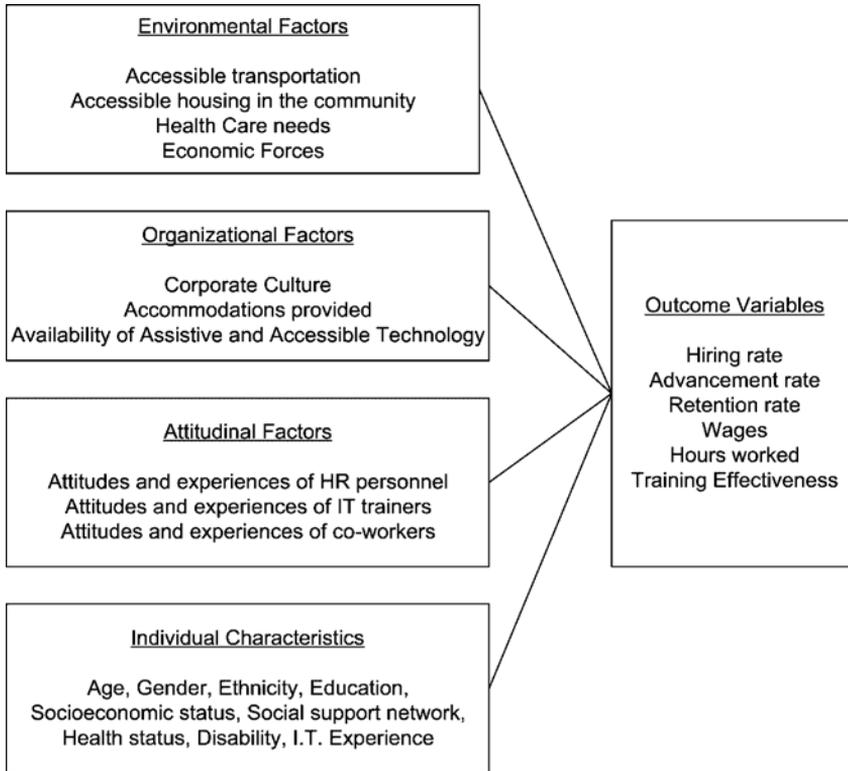


Figure 3. Theoretical model.

which the findings might relate to the IT industry and discuss means for enhancing the employment of qualified workers with disabilities in IT through research, education, training, and mentoring.

## BARRIERS TO EMPLOYMENT SPECIFIC TO IT

In examining factors that affect the number of individuals with disabilities considering IT careers, the ITAA Task Force on Recruiting Underrepresented Groups (ITAA, n.d.) reviewed the literature and identified five barriers that may apply to underrepresented groups, including people with disabilities. These barriers include the image of the IT field, lack of encouragement, lack of opportunity and access, lack of appropriate skills, and broader socioeconomic issues.

The ITAA Task Force suggests that the image of the IT field as the domain of the highly educated and technical elite and the lack of appropriate role models keep members of underrepresented groups, particularly women and minorities, from pursuing training and education required for IT positions. Lack of opportunity and access to accessible technology for individuals with disabilities as well as lack of opportunity and access to computers in general for members of groups with few economic resources limit computer-related education (see also Blanck & Sandler, 2000).

Lack of appropriate skills and rapid technological change are barriers to many people— even those already in the IT field. Finally, the ITAA Task Force reviewed the broader socioeconomic context, finding that students in under-resourced or rural areas have limited access to the educational resources that prepare them for IT careers.

Our review identified one study specific to employment of individuals with disabilities in IT jobs. The study— From Promising Practices to Promising Futures: Job Training in Information Technology for Disadvantaged Adults (Chapple, Zook, Kunamneni, Saxenian, Weber, & Crawford, 2000)— looked at 26 IT training programs in six high-technology regions. The 26 IT training programs surveyed were selected on the basis of recommendations from 70 key informants (program directors, new media and IT professional associations, job training oversight agencies, and academics), and the programs met the following criteria:

- (i) free or low cost;
- (ii) serve disadvantaged or unemployed adults;
- (iii) focus on advanced computer training, in digital media, networking, and help desk support; and
- (iv) focus on workforce development rather than extended learning.

Chapple *et al.* (2000) identified five factors that successful IT training programs had in common. Successful programs

- (i) provide soft skills training (motivation, flexibility, and social interaction skills) in the form of job search techniques and peer support groups;
- (ii) place individuals in jobs related to their training;
- (iii) target jobs with a career trajectory and make it possible for trainees to obtain additional skills while working;
- (iv) pay careful attention to the quality of their teachers, particularly their links to the IT industry; and
- (v) reshape curricula and maintain state-of-the-art equipment to keep pace with the changing needs of the industry.

The study identified, as one of its four principles of development for IT workforce training programs for disadvantaged adults, that the ‘treatment of an incentive structure that encourages industry participation in workforce development for IT’ was key, as was ‘improvement of communication and partnering efforts among different stakeholders’ (executive summary).

## EMPIRICAL STUDIES OF BARRIERS TO EMPLOYMENT FOR INDIVIDUALS WITH DISABILITIES

We expand our review here to include empirical studies of employers’ attitudes about employees with disabilities. We focus on the attitudinal factors that serve as facilitators and barriers to the hiring, retention, and advancement of these individuals (Blanck & Marti, 1997; Blanck & Scharzt, 2001).

Attitudinal factors comprise one component of the over-arching theoretical model of barriers to employment presented in Figure 3. The review focuses on attitudinal factors as a necessary first step in the process of understanding and potentially improving the employment of qualified individuals with disabilities in IT jobs. A summary of the literature review is presented as the appendix to this article.

A variety of research tools and search engines were used to identify relevant empirical studies, including PsycINFO, EBSCOhost, ERIC, and Social Science Citation Index, as well as Google and Yahoo Internet search engines. The following terms were searched for: technology, industrial technology, computers, computer technology, employer, employee, employment, disability, disabilities, disabled, attitudes, attitude, survey, surveys, instruments, questionnaire, and questionnaires, and Section 508 of the Rehabilitation Act.

If Hahn's (1987) notion is correct, that changing public policy will alter negative attitudes that nondisabled people have towards people with disabilities, then the attitudes of employers toward individuals with disabilities may be qualitatively different since the passage of the ADA. Therefore, we limited the scope of our review to articles on attitudes published subsequent to the effective implementation of the ADA in 1992.

Although some of these studies collect data prior to 1992, employers in the studies likely were aware of the ADA and likely to have considered it in their responses. Several prior literature reviews were identified, but most of the articles reviewed were published prior to the passage of the ADA (e.g., Wilgosh & Skaret, 1987; Greenwood & Johnson, 1987; Roessler & Schriener, 1997; Kilbury, Benschoff, & Rubin, 1992) or included articles prior and subsequent to the ADA's passage (e.g., Yunker, 1994; Hernandez & Keys, 2000; Unger, 2002).

We also limited our review to empirical studies of actual employers, excluding those studies in which the participants were students, for instance, role-playing as employers. Because labor force participation of individuals with disabilities is reliant on employers hiring these individuals, employer attitudes and related concerns were our primary focus.

Our review identified 20 empirical studies of employers since the 1992 initiation of the ADA. No studies specifically surveyed IT firms or inquired about IT positions in non-IT firms. Three of the studies (Kregel & Unger, 1993; Nietupski, Hamre-Nietupski, VanderHart, & Fishback, 1996; Petty & Fussell, 1997) focused on employer attitudes about supported employment programs (e.g. the use of a job coach).

Almost half of the studies (nine) used mail surveys, four used telephone interviews or surveys, four used in-person interviews; there was a record review, a focus group study, and one experimental study that used a hypothetical applicant. Sample sizes varied across the studies, from nine employers (Price & Gerber, 2001) to 418 employers (Levy et al., 1993).

Most studies developed their own idiosyncratic survey instrument or interview protocol. The two studies conducted by Levy and colleagues in 1992 and 1993 use the Attitudes Toward the Employability of Persons with Severe Handicaps Scale (Schmelkin & Berkell, 1989) and the Attitudes Toward Disabled Persons Scale (ATDPS; Yunker & Block, 1986). The ATDPS also is used by Walters and Baker (1995). Satcher and Hendren (1992) employ their Americans with Disabilities Act Survey (Satcher & Hendren, 1991).

## THEMES FROM POST-ADA EMPIRICAL STUDIES AND IMPLICATIONS FOR IT

After reviewing the study methodologies and results, we identify three themes relevant for the employment of individuals with disabilities in IT.

### Positive Employment Experiences

Consistent with previous reviews, five of the empirical studies (Levy *et al.*, 1992, 1993; Walters & Baker, 1995; Diksa & Rogers, 1996; Nietupski *et al.*, 1996) report that employers' positive experiences hiring or working with employees with disabilities are associated with more favorable attitudes about employing other individuals with disabilities. The mail surveys by Levy and colleagues (1992, 1993) of Fortune 500 companies and New York businesses find that employers express generally favorable attitudes about the employability of persons with severe disabilities. Employers who had hired and worked with individuals with disabilities report more favorable attitudes about disabled employees than employers without these experiences. This finding is reiterated by the mail survey by Walters and Baker (1995), which also uses the ATPWD scale to assess general attitudes about individuals with disabilities.

These findings are confirmed in studies of specific types of disability. Based on phone interviews, Diksa and Rogers (1996) found that employers who had hired individuals with mental disorders had more favorable attitudes about the employment of individuals with these types of disability than employers without those experiences. Employers whose companies had specific policies about hiring individuals with disabilities, possibly an indication of corporate support, also expressed more favorable attitudes.

In contrast, interviews of employers by Kregel and Tomiyasu (1994) failed to find a significant relationship between prior positive experiences with employees with disabilities and employer attitudes about disabled workers. In part, the failure to find a correlation may be related to the high frequency of positive experiences with disabled individuals that these employers reported. Almost three-fourths (75%) of the employers had experience with a disabled worker at their company, the majority rating that experience as positive. In addition, over one-third (37%) had a close relative of working age with a disability, and two-thirds (66%) had at least one friend who lived with a person with a disability. Thus, these respondents had substantial contact, and knowledge about, individuals with disabilities. Employers in the focus groups of Fabian, Luecking, and Tilson (1995) cited lack of knowledge about and experience working with individuals with disabilities as major barriers for hiring individuals with disabilities.

Employer lack of knowledge may be particularly profound for less obvious disabilities. The employer interviews by Price and Gerber (2001) revealed that employers' knowledge about learning disabilities was so limited that they often confused learning disabilities with mental retardation or Attention Deficit Disorder. They also perceived their ADA responsibilities to be primarily for accommodating physical disabilities. In part, because of their lack of knowledge and experience with individuals with learning disabilities, these employers expected applicants and

employees with learning disabilities to be proactive and to advocate for the accommodations that they would need.

### Concerns about Providing Reasonable Accommodations

Five studies (Gilbride, Stensrud, & Connolly, 1992; Moore & Crimando, 1995; Roessler & Sumner, 1997; Trach & Mayhall, 1997; Price & Gerber, 2001) suggest that a barrier to employment of individuals with disabilities is employers' concerns about the types and costs of workplace accommodations. In telephone interviews (Gilbride et al., 1992), employers reported that their greatest concerns about the ADA were with restructuring jobs and accommodating workers in a cost-effective way. These same concerns are echoed in a 1995 mail survey (Moore & Crimando, 1995) where members of the state chamber of commerce believed that employers would face high costs for providing accommodations for disabled employees (cf. Blanck, 1991, finding contrary evidence with small and large employers).

The mail survey of business personnel by Roessler and Sumner (1997) shed light on what accommodations employers are willing to provide, at least for individuals with chronic illnesses. The majority of the respondents were willing to pay between \$501 and \$5,000 for accommodations. Most reported that flexible scheduling, purchasing assistive or adaptive equipment, special parking, physical changes to the office space, temporary reassignment of duties to a colleague to accommodate sick leave, physical modification of the facility, and job sharing are reasonable accommodations.

The employers of Roessler and Sumner (1997) were less likely to consider as 'reasonable' providing support persons (e.g. readers, interpreters, or personal attendants), transportation to work, or allowing employees to work at home. The results of Roessler and Sumner should be interpreted with caution, taking into consideration the low response rate (21%) and the fact that the participants were not necessarily in charge of hiring at the companies that they represented.

A lack of knowledge about appropriate accommodations may, in part, be fueling employers' fears about the costs of accommodations. Price and Gerber (2001) report that the employers that they interviewed had little to no knowledge about accommodations for workers with learning disabilities and expected these applicants and employees to provide them with necessary information about accommodations to do their jobs. Employers surveyed by Trach and Mayhall (1997) report that the most important element to successful supported employment for them is a planning meeting with key stakeholders to educate the employers about the employee's needs and to identify supports that meet those needs.

### Hierarchy of Disability Prejudice

A third theme raised by the empirical studies is employers' responses by type of disability. Scheid's (1999) telephone surveys asked employers to rate how uncomfortable they would be with disabled employees. The majority of employers report that they are uncomfortable with employees who have a history of substance abuse (68.9%), are currently taking anti-psychotic medication (67.1%), or have had a

previous hospitalization in a mental facility (52.1%), almost rising to the frequency of employers who are uncomfortable with employees who had a juvenile criminal record for petty theft (71.6%).

Fewer employers report being uncomfortable with employees who are in treatment for depression (43.8%), have learning disabilities (24.3%), or have physical disabilities (16.2%). Employers are more comfortable with employees who have not completed high school or have no prior work experience than ones who have a sporadic work history (20.3 and 33.8 versus 83.3% reporting being uncomfortable, respectively).

Individuals with physical disabilities appear to be the least subject to prejudice (cf. Blanck, 2001). As Price and Gerber (2001) report, employers were particularly focused on ADA compliance for individuals with physical disabilities. Bell and Klein (2001) also report that employers rated a hypothetical applicant with a physical disability (paraplegia) more favorably than applicants with hidden disabilities (i.e. epilepsy or depression). Employers also rated the paraplegic applicant more favorably than the application that did not disclose any disabling conditions, perhaps related to social desirability factors.

## DISCUSSION

### Challenges Ahead

Limited experiences with disabled employees will continue to confront qualified applicants in the IT industry. Because individuals with disabilities represent less than 6% of the science and engineering labor force (National Science Foundation, 2002), it is unlikely that IT and non-IT companies have experience working with or accommodating employees with disabilities. Thus, one tactic is to identify individuals with disabilities in the industry as role models and spokespersons.

This limited experience also continues to fuel concerns about the types and costs of accommodations. IT companies need to be provided with empirical information on appropriate accommodations and expected costs and benefits for hiring and retaining qualified individuals with disabilities. Studies of accommodation costs (Blanck, 1997) reveal that most are moderate, often costing less than \$500 and well within the range that the employers of Roessler and Sumner (1997) were willing to pay.

Research suggests that employers have more favorable attitudes about accommodations to retain employees rather than for new hires (see, e.g., Dowler & Walls, 1996). Gunderson and Hyatt (1996) find that injured Canadian workers who return to their pre-injury employer and who receive workplace accommodations do not suffer substantial wage reductions, relative to those who switch to other employers.

IT employees and applicants face challenges in regard to the types of accommodation that employers will consider to be reasonable. Although employers may be willing to allow flexible scheduling and pay for assistive technology, they are less likely to agree to tele-work, telecommuting, or providing support persons. Individuals with psychiatric disorders or hidden disabilities face different and sometimes more difficult barriers than those with obvious physical disabilities (Blanck, Schur, Kruse, Schwochau, & Song, 2003; for a historical perspective of this issue, see

Blanck, 2001). IT employers need to be educated about appropriate accommodations for qualified workers with these types of disability.

### ‘ IT Works ’ Demonstration Project

The research literature is sparse and does not directly address the employment or potential employment of qualified individuals with disabilities in IT jobs. To begin filling that gap, the Law, Health Policy, and Disability Center (LHPDC) at the University of Iowa, under a grant from the U.S. Department of Education's National Institute on Disability and Rehabilitation Research (NIDRR), has established the ‘ IT Works ’ project.

IT Works explores the interfaces among IT training programs, individuals with disabilities who participate in these programs, and employers who have hired individuals with disabilities for IT jobs. The project is guided by a diverse expert panel that brings together representatives from education and training sectors, employers and representatives from the IT industry, individuals with disabilities working in IT, and representatives of federally funded IT training projects. Individuals with disabilities are included in the research design, data collection, and analysis processes in ways that foster autonomy and maintain scientific rigor and relevance (Blanck & Schartz, 2001). The ITAA is a partner in the grant, representing IT employers and providing access to companies.

A primary goal of IT Works is to identify barriers and seek solutions to enhance hiring, advancement, and retention of individuals with disabilities in the IT workforce. The theoretical model for the project is illustrated in Figure 3. The model in Figure 3 provides a framework for understanding the effects of these barriers on and opportunities in the hiring, retention, and advancement of persons with disabilities in IT jobs. In the model, we develop four primary categories of predictor variables (e.g. independent measures) for the major outcome measures related to the hiring, advancement, training, and retention of individuals with disabilities in IT jobs.

Figure 3 illustrates the types of factor we predict, *a priori* and based on the prior empirical literature, that influence the integration of individuals with disabilities in IT jobs. Our conceptualization results in four classes of predictor factors:

- (i) *environmental factors*— external to the organization, such as accessible transportation to work, health care provisions, possibility of telecommuting, micro- and macro-economic forces, labor supply/labor force demand, and market sector;
- (ii) *organizational factors*— internal to the organization, such as corporate culture, accommodations provided, and availability of assistive and accessible technology;
- (iii) *attitudinal issues* —external to the worker/individuals with disabilities such as individual attitudes of managers, co-workers, and hiring staff; and
- (iv) *individual characteristics*— internal to the individuals with disabilities, such as nature, type, or severity of the disability; health status, age, gender, ethnicity, wealth, family supports, and education.

The categories of factors, and other measures within each class, serve as predictor variables in subsequent multivariate regression analyses. The criterion or outcome

variables include hiring, retention, and advancement rates, wage levels, and number of hours worked for individuals with disabilities. One goal then is to determine over time the extent to which the predictor variables alone and in combination are related to the criterion variables.

The types of research question we address include the following.

- (i) Is the availability of IT in an organization related to the advancement of individuals with disabilities within the organization?
- (ii) Are IT organizations that are aware of issues related to the employment of individuals with disabilities (corporate culture factors) more successful in hiring, retaining, and advancing individuals with disabilities?
- (iii) Are IT companies that provide and encourage the use of assistive and accessible technology and follow-up with appropriate training and evaluation more successful in hiring, retaining, and advancing individuals with disabilities?
- (iv) Are IT organizations with larger budgets for assistive and accessible technology more successful in hiring, retaining, and advancing individuals with disabilities?
- (v) Are individual differences (e.g. disability type and severity, age, and gender) a determining factor regarding the hiring, retaining, and advancing of individuals with disabilities?
- (vi) Are IT organizations with mentoring/internship programs for individuals with disabilities more successful at hiring, advancing, and retaining individuals with disabilities?

The factors identified in Figure 3 will be assessed through survey and focus group techniques. IT Works will assess barriers to employment for individuals with disabilities by surveys and interviews of human resource managers of IT and non-IT firms, individuals with disabilities, managers of Federal training projects (e.g. Department of Labor Employment and Training Administration (DOL-ETA) technology grantees), IT trainers, and entrepreneurs to assess attitudes and experiences.

In another aspect of the IT Works project, the LHPDC and ITAA have created a national awards program to honor and disseminate information about IT firms that develop strategies to enhance employment of individuals with disabilities. The goal of the awards program is to highlight to employers and persons with disabilities best practices in employment in the IT sector.

In addition, the awards program is to stimulate interest by IT companies in employing individuals with disabilities and to give public recognition to large and small IT firms that have developed effective strategies that promote the employment and advancement of people with disabilities. There are six categories of awards: recruiting, hiring, accommodations, retention, training, and career advancement.

### Increasing Importance of IT to Persons with Disabilities

The importance of IT and computers in the workplace has implications for the future workforce of people with disabilities (Klein *et al.*, 2003; Ritchie & Blanck, 2003). IT accommodations help compensate for the physical limitations inherent in some disabilities—for example, those without finger dexterity use voice-recognition software to run a computer, and those with severe speech impediments use software to ‘speak’ through the computer (Blanck, 2002; Blanck *et al.*, 2003).

In addition, under Section 508 of the Rehabilitation Act, government agencies are required to purchase accessible technologies for their employees with disabilities (see Mason & Lint, 2000). Nevertheless, one U.S. Court of Appeals has concluded that a private newspaper employee's inability to engage in use of computer and continuous keyboarding as part of her job was not a substantial limitation on performing the major life activity of manual tasks under the American with Disabilities Act (*Thornton v. McClatchy Newspapers, Inc.*, 2002). Therefore, she was not entitled to an IT accommodation under the law.

Apart from accommodations, IT plays a role in increasing the productivity levels of people with disabilities. Lack of IT computer skills restricts occupational options for people with disabilities. Among people with spinal cord injuries (SCIs), those using computers prior to the SCI had more rapid returns to work. Among the employed, there was no earnings gap between computer users with and without SCIs, while non-users with SCIs earned significantly less than non-users without SCIs (Kruse & Krueger, 1995; Kruse, Krueger, & Drastal, 1996).

Despite potential advantages, evidence indicates that people with disabilities are less likely to be IT proficient (e.g. computer users). Kaye (2000) found that less than one-quarter (23.9%) of individuals with disabilities had access to a computer at home, compared with more than half (51.7%) of individuals without disabilities.

The analysis by Schur and Kruse (2002) of the 1999 Survey of Income and Program Participation (SIPP) shows that among full-time workers, almost half (46%) of those without disabilities use computers at work, compared with one-third (35%) of those with disabilities. An additional 43% of full-time employees with disabilities do not use computers at work but regularly use computers elsewhere or report they could do so without difficulty, compared with 39% of those without disabilities. Among working-age people with disabilities who are not employed, 16% report they use computers regularly and an additional 29% say they could do so without difficulty. Therefore, Schur and Kruse (2002) conclude that nearly half report they are capable of computer use, indicating substantial potential for increased employment of qualified people with disabilities given the importance of IT skills in the workplace.

The growth of IT also increases the prevalence and productivity of home-based work (Berven & Blanck, 1998; Doherty, Andrey, & Johnson, 2001). This is of special benefit to people with impairments that make travel to a work site difficult. Studies confirm that people with disabilities are more likely than other workers to do work for pay at home (Blanck et al., 2000; Kruse & Hyland, unpublished manuscript). Research on IT and organizational barriers to home-based work, and on IT accommodations that increase the ease and productivity of job training strategies and telecommuting, will be valuable to assess future employment options for qualified people with disabilities.

Lastly, economic incentives in federal and state tax policy for the provision of IT as workplace accommodations may be addressed to enhance the employment of qualified individuals (Blanck, 2002). Tax policy is a crucial yet understudied strategy for facilitating IT accommodations. Tax credits, deductions, and other treatments influence employer behavior in connection with costs they incur in the conduct of their activities.

At federal and state levels, tax policy encourages the provision of IT for workers with disabilities. Relevant federal eligible access expenditures include removing

communication or physical barriers for an employee with a disability and modifying assistive technology. Despite this activity, there are no studies to date assessing whether tax policies are accomplishing their intended purposes from employer and employee perspectives.

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## APPENDIX: EMPIRICAL STUDIES OF EMPLOYER ATTITUDES ABOUT EMPLOYEES WITH DISABILITIES PUBLISHED AFTER ADA IMPLEMENTATION

Authors	Year	Sample (response rate)	Method	Instrument	Target disability	Key findings
Gilbride, Stensrud, and Connolly	1992	80 companies in RSA region VII with 2: 200 employees (62%)	telephone interview	10 questions about employment related ADA issues	not specified	1. Employers greatest concern with accommodating workers in a cost-effective way.
Levy et al.	1992	341 human resource managers or vice presidents at Fortune 500 Companies (30%)	mail survey	A; B	severe disabilities	1. Favorable attitudes about employability of persons with severe disabilities; 2. more favorable attitudes expressed by participants with positive work experiences with employees with severe disabilities.
Satcher and Hendren	1992	85 employers in three county area of Mississippi (34%)	mail survey	C	not specified	1. Moderate agreement with the ADA; 2. employers agreed with employment provisions of the ADA significantly less than the transportation, telecommunications, and public services and accommodations areas of the ADA.
Kregel and Unger	1993	46 employers of supported employment program participants	in-person structured interview	attitude scale and open ended questions	supported employment	1. Employers had favorable attitudes about employment potential of participants in supported employment program and the programs; 2. less favorable attitudes about their own experiences with supported employment programs, particularly concerned with the quality of work product.
Levy et al.	1993	418 companies doing business in NY (6.2% return rate)	mail survey	A; B	severe disabilities	1. Favorable attitudes about the employability of persons with severe disabilities; 2. more favorable attitudes expressed by participants with positive work experiences with employees with severe disabilities, and those working in government compared to profit or not-for-profit agencies.

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APPENDIX: CONTINUED

Authors	Year	Sample (response rate)	Method	Instrument	Target disability	Key findings
Kregel and Tomiyasu	1994	170 employers in the Richmond, VA, metropolitan area (70.8%)	in-person structured interview	D	not specified	<ol style="list-style-type: none"> <li>1. Most employers had some previous experience with an employee with a disability (73%), and many had family members or friends with disabilities;</li> <li>2. employers had favorable attitudes about employment of individuals with disabilities;</li> <li>3. employer attitudes did not significantly correlate with number of employees, type of business or satisfaction with prior experiences with disabled workers.</li> </ol>
Fabian, Luecking, and Tilson	1995	13 employers (65%) and 11 rehabilitation personnel (73%)	focus group study	three open ended questions	not specified	<ol style="list-style-type: none"> <li>1. Both groups reported that negative attitudes and prejudice were the greatest barriers to job placement; employers also cited lack of knowledge about disabilities and little or no experience working with people with disabilities;</li> <li>2. employers reported that increased support from top management and corporate commitment, role models within the organization, training to understand disability issues, and more qualified job applicants are factors needed to improve job placements.</li> </ol>
Moore and Crimando	1995	178 state chamber of commerce (48%); 164 state rehabilitation association (60%); and 186 state coalition for persons with disabilities (52%)	mail survey	32 questions regarding attitudes toward Title I of the ADA	not specified	<ol style="list-style-type: none"> <li>1. Chamber of commerce members believed, in contrast to rehabilitation association and coalition members, that compliance with Title I of ADA would present high costs for employers.</li> </ol>
Walters and Baker	1995	69 employers and 31 recruiters (61%)	mail survey	Acceptance of Individuals Scale (including B)	not specified	<ol style="list-style-type: none"> <li>1. More favorable attitudes were expressed by respondents whose companies employed at least some full-time employees with disabilities;</li> <li>2. more favorable attitudes were expressed by recruiters at a job fair for individuals with disabilities.</li> </ol>

Diksa and Rogers	1996	373 employees in charge of hiring at companies (68%)	telephone interview	Employer Attitude Questionnaire	psychiatric disorders	<ol style="list-style-type: none"> <li>1. Employers in social services expressed less concern about symptomatology affecting work than employers in other industries;</li> <li>2. more favorable attitudes by employers who had hired an individual with a mental disorder and at companies with policies about hiring persons with disabilities.</li> </ol>
Dowler and Walls	1996	392 job accommodation cases from JAN concerning workers with hearing impairments	record review	records coded for job type, essential functions, career progression, and suggested accommodations	hearing impairments	<ol style="list-style-type: none"> <li>1. Employers most frequently sought assistance in order to retain or improve conditions for a current employee.</li> </ol>
Nietupski et al.	1996	98 Iowa businesses whose trade associations working with Iowa CEO supportive employment program (49%)	mail survey	48 items concerning supported employment benefits and concerns	supported employment	<ol style="list-style-type: none"> <li>1. More positive attitudes were reported by employers who had hired supported employees and by larger businesses;</li> <li>2. type of business was not related to attitudes;</li> <li>3. benefits to the company of supported employment included dedication of the employee, community image, and personal satisfaction;</li> <li>4. concerns with supported employment included extra training and supervision, whether the employee had necessary job skills, and the quality of the employee's work.</li> </ol>
Gordon, Feldman, Shipley, and Weiss	1997	141 individuals with disabilities (37%)	mail survey	items concerning health, types of assistance needed, employment, accommodations, and knowledge of ADA	multiple sclerosis	<ol style="list-style-type: none"> <li>1. Approximately 65% were unemployed and 95% had worked prior to diagnosis;</li> <li>2. major impediment to employment was physical condition, secondary barriers were transportation, work schedules, employer attitudes, and ability to find a job;</li> <li>3. majority of unemployed respondents used assistive devices for mobility;</li> <li>4. employed respondents noted that environmental factors, accommodations, flexibility and assistive technology had allowed them to maintain employment.</li> </ol>

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## APPENDIX: CONTINUED

Authors	Year	Sample (response rate)	Method	Instrument	Target disability	Key findings
Petty and Fussell	1997	47 employers of supported employment program participants in Tennessee	in-person structured interviews	Items from D and additional items about supported employment	supported employment	<ol style="list-style-type: none"> <li>1. Employers had favorable attitudes about supported employment workers and programs;</li> <li>2. employers reported that there were few opportunities for supported employment workers to gain promotions or jobs with benefits.</li> </ol>
Roessler and Sumner	1997	83 business personnel (21%)	mail survey	22 items survey including experiences working with people with disabilities and employment problems	chronic illness (e.g., multiple sclerosis, cancer, diabetes, arthritis, and epilepsy)	<ol style="list-style-type: none"> <li>1. Employers considered the following accommodations as reasonable: flexible scheduling, assistive/adaptive equipment, special parking, physical change of office space, temporary reassignment of work for sick leave, physical modification to facility, job sharing. Employers did not consider providing support persons (e.g. readers, interpreters, or personal attendants), transportation to work, or allowing employees to work at home reasonable accommodations;</li> <li>2. majority of respondents willing to pay \$501 – \$5,000 for accommodations;</li> <li>3. employers most concerned about cost of accommodations, perceived inability to work at a hectic pace, and frequent or chronic absences.</li> </ol>
Trach and Mayhall	1997	19 participants in a training program that focused on developing natural supports	document review, phone survey	phone survey regarding natural supports and employment	severe disability	<ol style="list-style-type: none"> <li>1. Most frequent types of support were training, physical and social;</li> <li>2. employers reported that a planning meeting with key stakeholders was the most important step in identifying supports that met employee needs.</li> </ol>

Scheid	1999	117 businesses in a southern metropolitan area (61.6%)	telephone survey	custom questionnaire on business responses to ADA, satisfaction with employees with disabilities	mental disabilities	<ol style="list-style-type: none"> <li>1. More than one-third (37.6%) of respondents had hired an individual with a mental disability since the ADA went into affect, 70% were satisfied with these employees;</li> <li>2. primary reasons for not having hired applicants with mental disabilities were a lack of qualified applicants, a perception that these applicants might be a safety risk to themselves or others, and an absence of job openings;</li> <li>3. employers were most uncomfortable with employees who had a sporadic work history or a juvenile criminal record for petty theft, a history of substance abuse, or were taking anti-psychotic medication; employers were less concerned about applicants in treatment for depression or applicants who had a learning or physical disability.</li> </ol>
Clarke and Crewe	2000	53 rehabilitation counseling grad. students (26%); 62 students with disabilities (17%); 83 employers from companies with 50 or fewer employees (13%)	mail survey	ADA-IS (indirect measure of attitude toward Title I of the ADA)	not specified	<ol style="list-style-type: none"> <li>1. Employers had the least positive attitudes about individuals with disabilities.</li> </ol>
Bell and Klein	2001	98 students and 88 employees	experiment: hypothetical applicant	Heilman' s scales for hiring recommendation, competence, starting salary, activity, and potency	none, paraplegia, epilepsy, and depression	<ol style="list-style-type: none"> <li>1. Respondents rated applicant with paraplegia significantly more favorably than other applicants;</li> <li>2. authors' note the limitations of the study, including potential social desirability factors, the use of students, and the small sample size.</li> </ol>
Price and Gerber	2001	9 employers in PA and VA with some previous experience of or familiarity with the ADA and disabilities in the workplace (36%)	in-person interview	knowledge of ADA, learning disabilities, and accommodations for learning disabilities	learning disabilities (LD)	<ol style="list-style-type: none"> <li>1. Employers were concerned with complying with the ADA but were focused on physical disability issues;</li> <li>2. respondents had little if any experience with employees with LD, knowledge of LD or knowledge of appropriate accommodations. Half of the employers confused LD with MR or ADD;</li> <li>3. respondents expected individuals with LD to be proactive and self-advocate.</li> </ol>

A. Schmelkin and Berkell (1989), Attitudes Toward the Employability of Persons with Severe Handicaps Scale.

B. Yunker and Block (1986), Attitudes Toward Disabled Persons Scale.

C. Satcher and Hendren (1991), Americans with Disabilities Act Survey.

D. Kregel and Tomiyasu (1994), Scales of Employer Attitudes Toward Workers with Disabilities.