

Career Barriers among Information Technology Undergraduate Majors

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Structural changes in the economy have created an employment environment that dictates hiring selectivity within the information technology (IT) field. Higher employer expectations combined with a tighter career market have introduced challenging career barriers for IT undergraduate majors. Swanson and Woitke (1997) defined career barriers as “events or conditions, either within the person or in his or her environment, that make career progress difficult” (p. 434). The purpose of this study was to examine the perceived likelihood of encountering certain career barriers and, if the barriers were encountered, the degree to which the barriers would hinder undergraduate IT majors’ career progress. The findings of this study support recent research (Luzzo & McWhirter, 2001) that found women perceived significantly greater career barriers than men did, especially for career choice. Ethnic minorities perceived greater barriers to finding a job, job performance, and career balance than non-minorities.

Introduction

Structural changes in the economy have created an employment environment that dictates hiring selectivity within the information technology (IT) field. Higher employer expectations combined with a tighter job market have introduced challenging career barriers for IT undergraduate majors. Elevated qualifications and economic fluctuations combined with internal (psychological) and external (environmental) interferences in choosing a career, finding a job, performing a job, and balancing career and family can make career initiation and advancement problematic.

Swanson and Woitke (1997) defined career barriers as “events or conditions, either within the person or in his or her environment, that make career progress difficult” (p. 434). Individual career choices often depend on personal appraisal of and the response to perceived career barriers (Lent, Brown, & Hackett, 1994, 1996, 2000). Barriers may have an impact on emotions, thoughts, and actions during the career selection process (London, 2001). Career plans may be altered if individuals believe they are likely to encounter career-related barriers or if they feel they are unable to overcome certain barriers if encountered (Swanson, Daniels, & Tokar, 1996). Even if individuals possess high levels of confidence and interest, perceived obstacles to career entry or

advancement may influence career selection (Albert & Luzzo, 1999; Brown & Lent, 1996).

Recent research indicates that undergraduate students perceive substantial barriers to career goals (Luzzo & McWhirter, 2001; Swanson, Daniels, & Tokar, 1996; Swanson & Tokar, 1991a, 1991b). Barriers are viewed as contextual factors that can explain restrictions to women’s career aspirations and women’s ability-achievement gap (Lent, Brown, & Hackett, 2000; Swanson & Woitke, 1997). In addition, the current system of discrimination presents even more obstacles to women’s career choices (Fassinger, 2000; Heymann, 2000; Reich, 2001).

Under-representation of women and ethnic minorities in the field of information technology may compound career barriers for these groups (Margolis & Fisher, 2002). According to the Census Bureau (2000), women represent 46 percent of the total workforce but only 30 percent of the IT workforce. African Americans fill only eight percent of IT professions, while making up 12 percent of the U.S. population. Nearly 13 percent of the population is Hispanic American, but makes up less than 5 percent of the IT workforce. In May

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2003, the Information Technology Association of America released a study that found the percentage of women and minorities in the information technology field decreasing. The report found that the percentage of women in the IT workforce decreased from 41% to 34.9% from 1996 to 2002. There was also a decrease among African Americans, from 9.1% to 8.2%. The IT field experienced a slight rise in the presence of Hispanic Americans (0.9%) and Native Americans (0.4%). Asian Americans had an increase of 2.9% in the IT field in the same period and are three times more prevalent in the IT workforce than in the overall U.S. workforce (Information Technology Association of America, 2003). Lent, Brown, and Hackett's (1994, 1996) social cognitive career theory asserts that women perceive more barriers to career goals than men and that ethnic minorities perceive more barriers to career goals than whites.

The purpose of this study is to examine the perceived likelihood of encountering certain career barriers and, if the barriers are encountered, the degree to which the barriers hinder career progress among undergraduate IT majors. Based on theoretical implications that career barriers play an instrumental role in the career development process, this study seeks to determine a) the perceived likelihood of encountering career barriers, b) if encountered, the degree to which the barriers hinder career progress, c) whether perceived likelihood and hindrance of career barriers vary by gender, and d) whether perceived likelihood and hindrance of career barriers vary by ethnicity.

Related Literature

The literature review is an overview of research studies that have observed career barriers with a special emphasis on the examination of gender and ethnic differences. Swanson and Tokar (1991a) investigated types and gender differences in perceptions of career-related barriers among college students. Barriers to six common career-related experiences were examined: academic major and career choice, obtaining training or degree, first career after college, career advancement, balancing career and family, and special concerns for women.

The study found that the greatest obstacles were not being informed, not being capable, current and future financial concerns, and significant others' influence on academic major and career choice. Although no statistically significant gender differences were found, women were more concerned than men about balancing career and family, sexual harassment, equity income, and advancement opportunities.

Using an undergraduate student sample, Luzzo (1996) examined the role of perceived career barriers in the career decision-making (CDM) process. The results indicated no relationship between the number of past career barriers and CDM attitudes, CDM knowledge of principles, or CDM self-efficacy. The study also did not find a relationship between the number of future career barriers and CDM attitudes. In addition, the study did not find a relationship between the number of future career barriers and CDM knowledge of principles. An inverse relationship was found between future career barriers and CDM self-efficacy, indicating that perceptions of future related career barriers resulted in lower CDM self-efficacy. Students who perceived past family-related barriers exhibited more mature attitudes toward the CDM process and higher levels of CDM self-efficacy than students who did not perceive obstacles due to family issues.

McWhirter (1997) examined ethnic and gender differences in perceived educational and career barriers among Hispanic and white high school juniors and seniors. The career barriers investigated were ethnic and sex discrimination, and the educational barriers were financial problems, family attitudes, perceived lack of ability, fit, and interest. The results indicated that Hispanic students were more likely to encounter ethnic and sex discrimination and had less confidence in their ability to overcome barriers to their future careers than white students. Hispanic students were also more likely to experience negative family attitudes and to be perceived as lacking ability and not fitting in. Although not statistically different, women in the study believed they were more likely to encounter sex discrimination and less likely to encounter ethnic discrimination than the male participants. The only statistically significant gender

difference found in the study was in the lack of interest barrier among the women who did not plan to attend college, because they believed education would not help their future. A gender difference did not exist for the lack of interest barrier between the men and women who planned to attend college.

Luzzo and McWhirter (2001) administered a measure of perceived education and career barriers and a measure of coping efficacy to 286 college students to examine gender and ethnic differences. Women perceived greater career barriers due to sex discrimination, negative verbal comments about their gender, and difficulty in obtaining employment due to their gender than the male students. Ethnic minority students perceived career barriers related to their ethnicity and expected to experience negative verbal comments about their ethnicity more than non-minority students. In addition, ethnic minority students perceived more career-related barriers due to financial and family issues than white students. Although no significant gender differences were reported in confidence to cope with and manage perceived career barriers, ethnic minorities reported significantly lower coping efficacy for perceived career barriers than white students.

Perrone, Sedlacek, and Alexander (2001) found gender and ethnic differences in perceptions of barriers to career goals among 2,743 college freshmen. Women in the study reported more barriers to career choice goals than men did. Gender differences were not found for academic resilience and career-related help-seeking behavior. Ethnic differences were found for career choice goals, barriers for attaining career goals, academic resilience, and career-related help-seeking behaviors. Native Americans were more likely than others to possess academic resilience. White, Asian Americans, and Native Americans were more likely to exhibit career-related help-seeking behaviors than were African Americans or Hispanic Americans.

Method

This section discusses the participants, research instruments, procedures, and data analysis used in the study. Data were collected each semester for two years beginning in the fall of 2000 through the

spring of 2002. Participants included 247 (104 female and 143 male) undergraduate students attending two large Midwestern universities. All the participants were business information technology majors, comprising management information systems (n= 133, 54%) and business information systems (n= 114, 46%). Participants' grade classification was as follows: 44% seniors, 34% juniors, 13% sophomores, and 9% freshmen. Ages of the participants ranged from 18 to 34, with a mean age of 21.7 years. The racial/ethnic composition was classified according to their representation within the field of information technology. The first group, classified as ethnic groups considered represented within the field of information technology, was composed of European Americans (n= 154, 62%) and Asian Americans (n= 50, 20%). The second group, classified as ethnic minorities considered underrepresented within the field of information technology, was composed of African Americans (n= 31, 13%), Hispanic Americans (n= 9, 4%), and Native Americans (n= 3, 1%). The percent and placement of each racial/ethnic group used in the present study coincides with nationally reported statistical information about racial/ethnic representation within the information technology field (Information Technology Association of America, n.d.; 2003).

To elicit students' perceptions of potential career barriers, a modified version (Byars, 1997) of Swanson and Tokar's (1991b) Career Barriers Inventory (CBI) was administered. The 34-item measure is divided into two subscales: the likelihood of encountering barriers, and the degree to which the barrier would hinder career progress. Each category contains the same questions and is divided into four topics: (a) choice of career, 6 items, (b) finding a job, 8 items, (c) performing your job, 14 items and (d) balancing your career with other aspects of your life, 6 items. The measurement is 7-point Likert-type scales ranging from 1 (very unlikely) to 7 (very likely). Students completed the questions about the likelihood of barriers before they completed the same questions about hindrance to career progress.

The data were analyzed using repeated measures (MANOVA) to determine model effects. The dependent variables were the career choice,

Figure 1: Model of Repeated Measure MANOVA

Factor 1	Factor 2
Within Subject - (dependent variables)	
<i>Likelihood</i>	<i>Hindrance</i>
Career Choice	Career Choice
Job Search	Job Search
Job Performance	Job Performance
Job Balance	Job Balance
Between Subjects - (independent variables)	
<i>Gender</i>	<i>Ethnic Identity</i>
1. Female	1. Well represented groups (White/Asian)
2. Male	2. Ethnic Minorities (Black/Hispanic/Other)

job search, job performance, and career balance scales, each measured at two levels, once to assess the likelihood of a particular barrier and once to assess how much hindrance such a barrier would present. In addition to this within-subjects factor, the between-subjects factors of gender and ethnic

identity were included in the model as the independent variables.

A series of factor models were tested to determine validity using confirmatory factor analytic (CFA) procedures. In the present study, the goodness of fit index (GFI) (Bentler, 1990) was the fit statistic used in the CFA. For the likelihood category topics the GFI measures were Career Choice (.93), Finding a Job (.86), Job Performance (.70), and Career Balance (.80). For the hindrance category topics, the GFI values were Career Choice (.91), Finding a Job (.82), Job Performance (.70), and Career Balance (.85).

Results

The descriptive statistics and reliability coefficients for the two categories (likelihood and hindrance) and the four topics (career choice, finding a job, job performance, and career balance) are presented in Table 1.

Table 1: Descriptive Statistics

			Career Choice		Job Search		Job Performance		Career Balance	
			Likelihood	Barrier	Likelihood	Barrier	Likelihood	Barrier	Likelihood	Barrier
	Cronbach's Alpha		.67	.82	.80	.88	.92	.95	.71	.82
Female	Non-minority	Mean	2.17	2.76	2.41	3.07	1.80	2.63	3.28	2.97
		n	80	80	80	80	80	80	80	80
		S. D.	.963	1.312	.949	1.355	.891	1.335	1.042	1.288
	Ethnic Minority	Mean	2.28	2.84	2.64	2.92	2.00	2.65	2.58	2.25
		n	24	24	24	24	24	24	24	24
		S. D.	1.019	1.292	.913	1.335	.961	1.267	1.264	1.427
	Total Female	Mean	2.20	2.78	2.46	3.03	1.84	2.63	3.12	2.80
		n	104	104	104	104	104	104	104	104
		S. D.	.972	1.302	.941	1.345	.907	1.314	1.131	1.349
Male	Non-minority	Mean	1.78	2.31	1.88	2.79	1.22	2.38	2.89	2.82
		n	124	124	124	124	124	124	124	124
		S. D.	.864	1.294	1.004	1.342	.853	1.505	1.012	1.245
	Ethnic Minority	Mean	1.68	2.40	2.04	2.61	1.52	1.83	2.22	2.04
		n	19	19	19	19	19	19	19	19
		S. D.	1.017	1.497	.901	1.226	.965	1.239	1.258	1.332
	Total Male	Mean	1.76	2.33	1.90	2.76	1.26	2.31	2.80	2.72
		n	143	143	143	143	143	143	143	143
		S. D.	.882	1.318	.990	1.325	.871	1.481	1.068	1.280
Total	Non-minority	Mean	1.93	2.49	2.09	2.90	1.45	2.48	3.05	2.88
		n	204	204	204	204	204	204	204	204
		S. D.	.922	1.32	1.013	1.351	.910	1.443	1.039	1.261
	Ethnic Minority	Mean	2.02	2.65	2.38	2.78	1.79	2.48	2.42	2.16
		n	43	43	43	43	43	204	43	43
		S. D.	1.049	1.387	.946	1.282	.981	1.443	1.259	1.373
	Total	Mean	1.95	2.52	2.14	2.88	1.51	2.44	2.94	2.76
		n	247	247	247	247	247	247	247	247
		S. D.	.945	1.327	1.006	1.337	.930	1.420	1.104	1.307

A between-subjects multivariate analysis of variance (MANOVA) was performed on the four dependent variables, career choice, job search, job performance, and career balance. With the use of Wilks' criterion, the combined dependent variables for both gender [$F(4, 240) = 2.81, p < .05$] and ethnic identity [$F(4, 240) = 6.49, p < .01$] were significant. The within-subjects effect [$F(4, 240) = 20.23, p < .001$] for the scale total and the within-subjects interaction for ethnic identity were significant [$F(4, 240) = 3.70, p < .01$]. Table 2 presents the multivariate results of estimating the model.

Using a univariate ANOVA, between-subjects gender differences were found for three of the four topics: career choice [$F(1, 243) = 9.27, p < .01$], job search [$F(1, 243) = 6.67, p = .01$], and job performance [$F(1, 243) = 10.02, p < .01$]. Ethnic differences were found for the career balance topics [$F(1, 243) = 18.42, p < .001$]. Within-subjects differences were found for all four topics: career choice [$F(1, 243) = 26.49, p < .001$], job search [$F(1, 243) = 30.78, p = .001$], job performance [$F(1, 243) = 45.77, p < .001$], and career balance [$F(1, 243) = 4.12, p < .05$]. Within-subjects ethnic differences were found for the job performance topic [$F(1, 243) = 5.70, p < .05$]. Table 3 gives the univariate results of the model estimation.

Discussion

This study was designed to examine the perceived likelihood and hindrance of career barriers among undergraduate IT majors. In general, IT majors did

not believe career barriers were likely to occur. Moreover, even if a barrier occurred, IT majors did not think the encounter would hinder their career. IT majors, however, did consider the hindrance of a career barrier more serious than the likelihood of encountering a barrier.

Examination of gender and ethnic identity differences revealed significant scale differences among IT majors for both gender and ethnic identity. Based on gender, there were differences between the career choice, job search, and job performance scales. Women consistently assessed barriers as being more problematic than men. Women were more likely than men to perceive the likelihood of encountering barriers to career choice, for finding a career, in job performance, and balancing a career with other aspects of their lives. Consistent with prior research, the finding that women perceived more barriers to career choice goals suggests that women believe they lack information about careers, expect career choice limitations, and are discouraged from pursuing careers in technology (Perrone et al., 2001). Within the hindrance category, only the career choice topic produced a gender difference. Women perceived that if they encountered career choice barriers (e.g., being limited to certain career choices because of gender), those barriers would hinder career progress. The findings of this study support recent research (Luzzo & McWhirter, 2001) that found women perceived significantly greater career barriers than men did.

Most notably in this study, there were differences among IT majors of different ethnic identities in their perceptions of the likely

Table 2: Results of Multivariate Tests of the Repeated Measures Model; Wilks' Lambda for Model Effects

	Effect	Lambda	F	Degrees of Freedom		
				Hypothesis	Error	Sig.
Between Subjects	Gender	.955	2.81	4	240	.026*
	Ethnic Identity	.902	6.49	4	240	.000***
	Gender x Ethnic Identity	.996	.226	4	240	.923
Within Subjects	Scale	.748	20.23	4	240	.000***
	Scale x Gender	.981	1.16	4	240	.331
	Scale x Ethnic Identity	.942	3.70	4	240	.006**
	Scale x Gender x Ethnic Identity	.966	2.12	4	240	.079

p* < .05 p** < .01 p*** < .001

Table 3: Results of Univariate Tests of the Repeated Measures Model; ANOVA Table

Source	Measure	SS	df	Mean Square	F	Sig.
Between Subjects						
<i>Gender</i>	<i>Career Choice</i>	7.579	1	7.579	9.27	.003**
	<i>Job Search</i>	6.357	1	6.357	6.67	.010**
	<i>Job Performance</i>	9.770	1	9.770	10.02	.002**
	<i>Family</i>	2.638	1	2.638	2.69	.102
<i>Ethnic Identity</i>	<i>Career Choice</i>	.076	1	.076	.09	.760
	<i>Job Search</i>	.009	1	.009	.01	.922
	<i>Job Performance</i>	.003	1	.003	.00	.958
	<i>Career Balance</i>	18.066	1	18.066	18.42	.000***
<i>Gender x Ethnic Identity</i>	<i>Career Choice</i>	.082	1	.082	.10	.751
	<i>Job Search</i>	.023	1	.023	.02	.877
	<i>Job Performance</i>	.476	1	.476	.49	.485
	<i>Career Balance</i>	.001	1	.001	.00	.970
<i>Error</i>	<i>Career Choice</i>	198.695	243	.818		
	<i>Job Search</i>	231.731	243	.954		
	<i>Job Performance</i>	236.918	243	.975		
	<i>Career Balance</i>	238.302	243	.981		
Within Subjects						
<i>Scale</i>	<i>Career Choice</i>	25.175	1	25.175	26.49	.000***
	<i>Job Search</i>	25.358	1	25.358	30.78	.000***
	<i>Job Performance</i>	37.772	1	37.772	45.77	.000***
	<i>Career Balance</i>	3.414	1	3.414	4.131	.043*
<i>Scale x Gender</i>	<i>Career Choice</i>	.052	1	.052	.05	.816
	<i>Job Search</i>	1.268	1	1.268	1.54	.216
	<i>Job Performance</i>	.002	1	.002	.00	.957
	<i>Career Balance</i>	.670	1	.670	.81	.369
<i>Scale x Ethnic Identity</i>	<i>Career Choice</i>	.110	1	.110	.12	.734
	<i>Job Search</i>	2.236	1	2.236	2.72	.101
	<i>Job Performance</i>	4.700	1	4.700	5.70	.018*
	<i>Career Balance</i>	.061	1	.061	.07	.787
<i>Scale x Gender x Ethnic Identity</i>	<i>Career Choice</i>	.182	1	.182	.19	.662
	<i>Job Search</i>	.012	1	.012	.02	.903
	<i>Job Performance</i>	1.927	1	1.927	2.34	.128
	<i>Career Balance</i>	.036	1	.036	.04	.836
<i>Within Subjects Error</i>	<i>Career Choice</i>	230.964	243	.950		
	<i>Job Search</i>	200.166	243	.824		
	<i>Job Performance</i>	200.530	243	.825		
	<i>Career Balance</i>	200.792	243	.826		

P * < .05 p *** < .01 p **** < .001

occurrence of a barrier and in whether a barrier would hinder their careers if encountered. Differences among those of different ethnic identities were found in respect to barriers presented by trying to balance a career with family. Ethnic minority IT majors considered both the

likelihood of a family barrier and the hindrance presented by such a barrier to be lower than non-minorities. Examination of the questions listed under the career balance topic revealed a significant difference for two of the six questions. Non-minority IT majors indicated they were more likely

to encounter career barriers due to getting married and having a career/family conflict than ethnic minority IT majors did. This finding may suggest that ethnic minority families are more likely than non-minority families to assist with work-related issues, such as child care (Shellenbarger, 1993). Non-minority IT majors perceived a greater hindrance to career progress for each of the six career balance questions than ethnic minority IT majors did. The question that referenced having a career/family conflict was the only question that indicated a statistically significant difference, however. According to Reich (2001), young college graduates are delaying plans for combining work and family. The work-family conflict has been attributed to pressures from handling financial hurdles associated with child care, working long hours, and difficulties blending work and family (Heymann, 2000; Reich, 2001). The finding that non-minority IT majors perceived more difficulties balancing work and family is in contrast to previous findings (Luzzo & McWhirter, 2001).

Ethnic minority IT majors considered the likelihood of finding a job and performing a job a greater obstacle than non-minority IT majors. Job performance due to racial discrimination in promotions and lack of respect was considered a greater hindrance to ethnic minority IT majors than to non-minority IT majors.

Information technology educators must encourage students to identify all of the potential barriers to the pursuit of career goals. Students need to distinguish realistically between the likelihood of encountering barriers and how barriers can hinder career progress. Knowledge about students' perceptions of career barriers could enhance IT educators' ability to assist students with developing strategies that will help them overcome obstacles. Students also need career development that optimizes skills and abilities related to potential barriers. Educators should concentrate on providing guidance that will help individuals surmount career barriers.

Examination of gender and ethnic differences in career barriers can help clarify the role that perceptions and reality play in the career development process. Recognition of gender and ethnic differences may also help highlight the

special needs of individual groups and lead to awareness that can facilitate in the elimination of career impediments. Although a limitation of this study was the use of subjective, self-reported measures of career barriers, the findings signify the need for educators and employers to institute policies and practices that embrace inclusion, equity, and diversity.

New directions in the economy along with continuously changing work environments present numerous career barriers for IT graduates. The examination of perceived career barriers is one approach to understanding the more concrete effects of factors that contribute to varying career barriers. It is critical for individuals to target career barriers directly to produce changes that can make the field of information technology a more viable career option.

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