Women and Information Technology

Research on Underrepresentation

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Examining the Gender Gap in IT by Race: Young Adults' Decisions to Pursue an IT Career

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By the year 2010, it has been estimated that 25 percent of all new jobs created in the private and public sectors will be technologically oriented (American Association of University Women 2000). Yet access to IT is highly skewed by race, gender, and income, favoring males over females, whites over African Americans, and wealthier sectors in comparison to less privileged populations (Cooper and Weaver 2003). Although representing 46 percent of the total workforce, women account for less than 30 percent of the IT workforce (U.S. Department of Commerce 2003) and only 10 percent of executives in Fortune 500 computer companies (Xie and Shauman 2003). Despite the growing need for qualified applicants for IT positions, the number of women in advanced IT careers actually continues to decline (Information Technology Association of America 2003; Panteli, Stack, and Ramsay 2001). Likewise, blacks, who make up more than 12 percent of the U.S. population, only represent 5 percent of the IT field (U.S. Department of Commerce 2003); their proportion in IT to their presence in the national population is well below average. The purpose of the current investigation is to examine factors that might be influential in developing individuals' IT career aspirations, and how they may differ by race and gender, in order to gain a greater understanding of the gender and race gaps in the computer industry.

Inequality in the labor force results from a process of differentiation that begins and accumulates in the earlier stages of life decisions. Thus, decisions made regarding schooling and choices of course work may well determine whether or not you pursue a college education and the particular major you choose to complete. For example, families who provide early access to computers are more likely to have children, both boys and girls, who pursue math, science, and computer-related courses (Simpkins, Davis-Kean, and Eccles 2005). Research has begun to uncover factors that are necessary to increase equity in IT, such as providing youth greater access

to computers (National Center for Education Statistics 2003; U.S. Department of Commerce 2003), creating computer programs that appeal to all children, and getting key socializers involved (parents, teachers, etc.) who can help change girls' and boys' attitudes toward computers and who encourage youth to perceive themselves as good at computer tasks (American Association of University Women 2004). But more work is needed in order to delineate the specifics of what works and for whom.

Although trends found for the underrepresentation of women and blacks in IT run parallel, research that has investigated these groups independently suggests that many of the underlying barriers that prevent women from entering IT are different from those that create disparities in IT by race (Garcia and Giles 2003). Little attention has been paid to the intersectionality of these group identities (interaction of race and gender) as they are related to pursuing a career in IT. In this chapter, we attempt to address these issues by examining factors that might be influential in developing individuals' IT career aspirations, and how they may differ by race and gender. Utilizing the Eccles model and theory on the development of expectations and values (Eccles et al. 1983), the current investigation examines adolescents' pursuit of IT as a dynamic process that includes the consideration of multiple social, psychological, and structural factors in adolescents' developmental trajectories that are influential to their educational and occupational choices.

The Expectancy-Value Model

According to the Eccles expectancy-value model, achievement motivation (performance, persistence, and task choice) is directly linked to two primary components: a person's expectations for success and the value that the individual attaches to various options. Expectancies and values have consistently been shown to predict both academic success (Eccles et al. 1983; Eccles, Adler, and Meece 1984; Meece, Wigfield, and Eccles 1990) and academic and occupational choices (Eccles, Barber, and Jozefowicz 1998). Previous research indicates that both expectancies and values may be key components of youths ultimately deciding to pursue a career in IT. That is, males and females have been found to differ on measures directly assessing expectations for success in computer-related tasks, and this might be a primary factor influencing women's choice to pursue an occupation other than one in the IT field. For example, among college students in Canada, Brosnan (1998) found that female students reported being less comfortable and confident with the computer than male students. They also felt more inhibited about pursuing IT careers because of the anxiety they experienced whenever they had to work with computers. This

gender disparity was also found in Spain (Farina et al. 1991), Great Britain (Colley, Gale, and Harris 1994), Australia (Okebukola and Woda 1993), and the United States (Reinen and Plomp 1997).

In addition, males and females have been found to differ on the interest they have toward computers and the value they place on entering the IT field. The American Association of University Women (2000) captured this premise best when it stated in a report, "Girls are engaged with the world, while boys are engaged with computers." The association found that many girls insist on their computing abilities and skills, while simultaneously describing their disenchantment with the field, its careers, and its social context (ibid.). It is unclear, however, how perceptions of value and ability as well as its influence on individuals' IT pursuits may differ by the intersection of race and gender. Therefore, we believe that in order to understand youths' IT career decisions, it is important to not only consider the direct influence of early social psychological factors on adolescents' IT aspirations but also to examine how these early experiences indirectly influence youths' later career considerations through how they shape youths' expectancies and values regarding computer-related careers three years after high school (see appendix 2.1 for a modified Eccles expectancy-value model).

Determinants of Pursuing an IT Career

In addition to youths' socioeconomic status and academic achievement as measured in the eighth grade, early determinants thought to play a key role in adolescents' later IT-related career pursuits three years after high school included: access to a home computer, perceptions of ability and interest in math, concerns about race and gender discrimination, and academic expectations for IT's general influence on youths' later career decisions (Simpkins, Davis-Kean, and Eccles 2004; Vida and Eccles 2003). Moreover, both the positive and negative attitudes that youths held toward computers and the advice and encouragement they received from others about pursuing IT three years after high school were also considered.

Home Resources Research suggests that having early and consistent access to a computer is at least one means of nurturing individuals' interest and feelings of competency in computer tasks in addition to advancing one's computer skills. Nelson and Cooper (1997) found that the more experience a child had with computers, the more competent they felt and the more positive their attitude was toward computer-related tasks. By age ten, boys had significantly more access to and experience with

computers than did girls, and this seemed to translate into differential feelings of competence by the fifth grade. Access to a home computer has also been thought to play a major role in blacks' underrepresentation in IT (Papadakis 2000; National Center for Education Statistics 2003).

Although the gap between those who have access and those who do not has decreased in recent years, there still remains a major divide in computer and Internet use along demographic and socioeconomic lines in which blacks and Hispanics are still among those with the least amount of access (National Center for Education Statistics 2003; U.S. Department of Commerce 2004). According to the Department of Commerce Census Bureau Survey of September 2001, 60.2 percent of blacks were still not connected to the Internet (and 68.4 percent of all Hispanics) (posted November 2004). The U.S. Board of Education attributes much of the later racial/ethnic differences in computer skill and use to this difference found in home access. When only looking at the children who had access to a computer at home, few of the differences found between black and white youths remain (National Center for Education Statistics 2003). Access to home computers may also be an issue for children from lower socioeconomic backgrounds. The National Center for Education Statistics (2003) found that children with more highly educated parents as well as those living with higher family incomes have greater access to computers than those of less-educated and/or lower-income households.

Having a computer in the home has not only been found to be related to interest and feelings of competency toward computers but appears to be highly influential for keeping youths in the pipeline. Access has been found to relate to higher achievement in math and reading (Atwell and Battle 1999), the choice of math and science courses in high school (Simpkins, Davis-Kean, and Eccles under review), and achievement in college-level programming courses (Bunderson and Christensen 1995; Byrne and Lyons 2001). With this research in mind, we examined our sample of youths to determine if similar race differences existed in access to computers in the home.

Math Self-Concept and Values Despite strides in girls' participation and performance in math and science courses in the past decade, gender gaps in adolescents' confidence and value/interest in mathematics and physical science remain (Margolis and Fisher 2002; Fennema 2000; Xie and Shauman 2003; Linver and Davis-Kean forthcoming). In studies of normative populations, Eccles and her colleagues have found consistent evidence of gender differences in expectations for success and con-

fidence in one's abilities for math (especially among junior and senior high school students) (e.g., Eccles et al. 1993; Linver and Davis-Kean forthcoming). Consistent findings, detected as early as among first graders, suggest that boys are more confident and interested in math than are girls. Therefore, because computer science is commonly grouped with math and science (both informally and organizationally) (Margolis and Fisher 2002), a lack of confidence and interest in math early on may lead individuals to opt out of more advanced math-related courses like computer science.

Race and Gender Discrimination Wilder, Mackie, and Cooper (1985) looked at a sample of women who attended Princeton University and not only had advanced mathematics preparation (80 percent of the sample studied calculus in high school) but also had as much experience and knowledge of programming languages as the male students examined. Despite the fact that the women's computer skills and knowledge were not objectively different from the males, the researchers discovered that the women perceived themselves as less capable of computer tasks than the males. Even more surprisingly, when Wilder, Mackie, and Cooper explored perceived computer competence by computer experience, they found that females who had computer experience in high school rated themselves as less comfortable or competent than did the males who had no high school computing experience. These findings were only to be replicated once again at Princeton seventeen years later (Cooper and Weaver 2003) and elsewhere (Beyer et al. 2003), suggesting that the digital divide results from more than just gender differences in experience or skill, and highlighting the persistence and cultural embeddedness of what defines the computer industry.

Some researchers (American Association of University Women 2000, 2004; Cooper and Weaver 2003) assert that the computer gender disparity and its persistence is primarily a result of the genderization of the IT profession. Girls and boys alike tend to view the computer world/professionals as male (Nelson and Cooper 1997; American Association of University Women 2000). For example, the American Association of University Women (2000) found that although its sample of middle school girls rarely reported overt discrimination (they were not told they were less competent than boys at computer-related tasks or discouraged from enrolling in computer-related courses), when asked to describe a person who "is really good with computers," they consistently described a man. Chappel (1996) and others (Cooper and Weaver 2003; American Association of University Women 2000,

2004; Kaiser Family Foundation 1999) explain that the idea of the "computer as male" likely emerges because computer programs and games favor male interests as well as male identification. Girls, in response, are likely to feel greater anxiety or reticence toward an activity that has been clearly delineated as one that is not for them.

The message relayed to women that they are "outsiders" in the IT profession is only further reinforced in the workplace by the sheer lack of women in the field. Not only are women underrepresented in the field but those women who persist in IT are often found in the lower-status and lower-paying IT jobs. In the United Kingdom (Panteli, Stack, and Ramsay 2001) as well as the United States and Europe (Tijdens 1997), women in the IT profession were found to be markedly underrepresented in the higher levels of IT (management, hardware, and systems and software design were almost exclusively male) and vastly overrepresented at the lower levels (customer service and support fields). These statistics lead us to ask if the underrepresentation of women and blacks in IT might be due, at least to some degree, to an awareness of overt forms of gender and race discrimination that are known to exist in the higher echelons of such (prestigious) professions as IT. Further research is necessary to decipher whether women's underrepresentation in the higher levels of IT is due to differences in course work or other preparation to enter the field or to the basic discrimination that occurs in the computer industry and its prerequisites. In the current investigation, we examined how adolescents' expectations concerning their experience with gender discrimination may influence their decisions to pursue an IT career and/or its impact on the expectancies and values they have toward the field. Youths' feeling of inefficacy to combat race discrimination was also assessed as another type of discrimination that may help explain the underrepresentation of blacks in IT-related careers.

Attitudes toward Computers We also explored adolescents' attitudes toward the IT field as another way to determine whether women disidentify with "male" characteristics often attributed to the computer field (and its employees). For example, Eccles, Barber, and Jozefowicz (1998) found that female students were more likely to value people-oriented careers than male students, and that male students placed a higher value on wealth and competitive positions and were generally more interested in careers that involved the use of machinery, math, and/or computers. Likwise, Margolis and Fisher (2002) found that among college students' interested in computer science, undergraduate women were interested in computer science as a

"tool" to solve real-world problems (e.g., in biomedical research), while the men tended to value computers and computing for their own sake. Although computing is an integral part of medical research, environmental science, art, music, famine control, and so on, the way in which computer science is portrayed in the classroom and by the wider society as a solitary field primarily focused on technical detail may be a major reason why women opt out of the IT field (Margolis and Fisher 2002; American Association of University Women 2000). In the current study, youths' attitudes toward the technology field was examined by asking them whether they agreed with some of the common positive and negative attitudes that exist toward computers.

Others' Encouragement and Advice Previous research has shown that when children receive different feedback on their performance in various school subjects, different advice regarding the importance of certain subjects, different information about the occupational opportunities they should be considering, and different opportunities for developing various skills, then it is likely that they will develop different self-perceptions and expectations for success as well as different ideas for which domains they are best suited (Jacobs and Eccles 1992; Eccles, Barber, and Jozefowicz 1998). With continued reinforcement for traditional gender role behaviors and values by parents, teachers, peers, and other socializers, the likelihood that youths will acquire nontraditional skills and values or pursue such long-term goals is diminished. Therefore, we asked youths whether they received supportive advice and encouragement from others about pursuing an IT career to determine whether groups differed in the degree of support they received from others dependent on their gender and race as well as how this support might be influential on youths' IT-related occupational attitudes (expectancies, values, and aspirations).

Summary of Research Questions

Consistent with previous research concerned with keeping women (and minorities) in the math and science pipeline (Eccles 1994; Eccles, Barber, and Jozefowicz 1998; Margolis and Fisher 2002; Xie and Shauman 2003; Garcia and Giles 2003), the current investigation examines how earlier psychological and sociocultural factors, measured when participants' were in the eighth and eleventh grades as well as three years after high school, relate to adolescents' aspirations to pursue an IT career three years after high school both directly and indirectly, through their relation to youths' expectancies and values of computer occupations (see appendix 2.1 for

the research model). Our main focus is to understand the gender and race gap in the computer industry, so we pay close attention to how these early factors may differentially affect adolescents' occupational pursuits dependent on their race and gender.

Sample and Methods

Participants are from the Maryland Adolescent Development in Context Study (MADICS) (P. I. Jacquelynne Eccles and Arnold Sameroff), a community-based longitudinal study of adolescents and their families aimed at examining the influences of social context on the psychological determinants of behavioral choices and developmental trajectories during adolescence. The sample is a purposive subsample (based on the parents' willingness to participate and a stratified sampling procedure designed to get proportional representations of families from each of the twenty-three middle schools being studied) of the Comer and Cook school evaluation study, which included all enrolled seventh graders in the district in September 1991. Although the participants are not a random sample of their cohort, there is little systematic bias in the MADICS sample when compared to the larger Comer and Cook sample.

The sample of 1,482 adolescents (49 percent female) and their families is unique in that it includes a large proportion of African American families (61 percent African American and 35 percent Euro-American), with as broad a range of socioeconomic status as the Euro-American families (mean pretax family income in 1990: $42,500–52,500; range $5,000–75,000). The sample is drawn from an eastern U.S. county composed of rural and urban settings, and both low- and high-income neighborhoods.

Longitudinal data were collected at six time points. The first four waves of data were collected from multiple informants (parents, youths, and school record data) and included demographic information from the parents. Wave 1 was collected in fall 1991 (when the adolescents were in the seventh grade and the first year of middle school); wave 2 was collected in summer 1992; wave 3 was collected in summer/fall 1993 in conjunction with the transition into high school; wave 4 in 1996 when the youths were in the eleventh grade; wave 5 in 1998—one year after most of the youths had graduated from high school; and wave 6 in 2000—three years after high school. Waves 1, 3, and 4 involved in-home interviews and self-administered questionnaires. As often as possible, the interviewer's race was matched to that of the

primary caregiver. Wave 2 was a telephone interview designed to get specific information on parents' family management strategies and goals for their children. Waves 5 and 6 were mailed questionnaires to the adolescents only.[1]

Using a combination of mailed surveys and telephone interviews (coupled with a variety of tracking strategies, including earlier parent contacts, the State Motor Vehicle Department records, social security numbers, and forwarding address information available from the post office), MADICS retained at both waves 3 and 4 over 70 percent of the original wave 1 sample. At wave 5, the retention rate for the target youths was still about 62 percent of the original wave 1 sample. At wave 6, it was about the same.

For the present investigation, we report on information collected at three time points: after adolescents completed the eighth grade (mean age = 14.2) (wave 3: spring 1994), when they were in the eleventh grade (mean age = 17.1 years) (wave 4: 1996), and when they were three years post high school (wave 6: 2000). The longitudinal sample (that participated at each of these waves *and* responded to all our measures) included 118 African American males, 147 African American females, 80 Euro-American males, and 98 Euro-American females. Other ethnic groups were not included in the analysis due to the small sample size (e.g., 25 youths self-identified as Asian American or a mixed ethnic group).

In order to determine how the indicators studied differed by groups, univariate analyses of variance were run separately for each indicator of IT pursuits examined. Including the whole sample to get the most power out of our analyses, we used post hoc contrasts for comparisons between groups. All reported findings of differences between groups were significant at the $p < .05$ level according to Bonferroni standards.[2] Second, bivariate correlation analyses were used to look at the direct relation between the social psychological indicators and the IT aspirations as well as their indirect relation to the IT aspirations through examining how they related to youths' IT expectancies and values.[3] These analyses included only the longitudinal sample.

IT Aspirations In order to assess adolescents' potential to pursue an IT career three years after high school, we asked them, "Have you ever considered getting a job in IT? If so, which ones?" Jobs in IT fields were coded into two categories: "soft" and "hard" computer jobs. Soft computer jobs included such occupations as Internet journalism, research, telecommunications, help desk, resource guides, teaching, and "statistics." Some adolescents reported already being in the IT field,

but needing training. They were mainly in audio/stereo sales or secretarial work, coded as soft IT occupations. Hard computer jobs included network/systems administrator, information systems/technology, programmer/computer engineer, and so forth. Responses were then coded as 1 = no consideration, 2 = considering pursuing a soft IT career, and 3 = considering pursuing a hard IT career. Adolescents' who reported pursuing a college major in the computer science field were coded as having the highest potential for considering and eventually establishing themselves in a computer-related occupation (coded as 4). A college major in IT included such fields as computer programming, computer science, and computer art.

IT Expectancies Eccles and her colleagues (1983) define expectancies as individuals' beliefs about how well they will do on upcoming tasks (with a specific focus on personal efficacy expectations). Therefore, in the current study, expectations for success were measured by asking participants to consider "how good they thought they would be at an occupation that used computers for hard computer tasks" (hard computer jobs consisted of developing hardware, software, Web sites, graphic arts, media interface, or programming) as well as soft computer tasks (such jobs as communications, accounting, word processing, business related/inventory maintenance, etc.). (See appendix 2.2 for sample item, scale means, and alpha.)

IT Values The value component of the model is defined by four components: attainment value, intrinsic value, utility value, and cost. In the current study, we will be focusing specifically on intrinsic value, or the enjoyment the individual gets from performing the activity and/or the subjective interest the individual has in the domain. Sample items, scale means, and alphas of these and other indicators used in our analyses are included in appendix 2.2.

Results

IT Expectancies, Values, and Career Aspirations

According to the Eccles expectancy-value model, adolescents' task-specific expectancies of success and interest are important predictors of their academic and occupational pursuits. Therefore, we first examined how IT expectancies and values, as measured three years after high school, related to youths' IT-related career considerations. In support of the Eccles model, the current investigation found that adoles-

cents' expectancies of success and interest in the computer field three years after high school were strongly related to their IT career aspirations.

Expectancies of success (self-concept of ability) at hard computer tasks were related to IT aspirations for all groups examined (BM, $r = .28$; BF, $r = .33$; WM, $r = .31$; WF, $r = .39$) as were expectations of success at soft IT jobs for all groups except white males (BM, $r = .25$; BF, $r = .32$; WF, $r = .24$). That is, for the groups explored, the belief that they would be good at IT tasks resulted in the pursuit of an IT career. These findings support our premise that self-concept of computer ability is a primary factor that promotes the gender differentiation of those who consider pursuing IT from those who do not.

Although the valuing of hard computer tasks was *not* related to males' IT career, it seems to be a primary factor in women's decisions to pursue an IT career. The more that the females believed they would enjoy a computer-based job, the more likely they were to aspire for a career in IT (hard jobs: BF, $r = .21$; WF, $r = .21$; and soft jobs: BF, $r = .21$; WF, $r = .19$). These findings suggest that the development of adolescents' expectancies and values are as important to consider as youths' aspirations, if we are to gain further understanding of adolescents' occupational decisions/pathways into and out of IT.

Who Is Pursuing an IT Career?

Second, we looked at how these expectations, values, and career aspirations differed by race and gender. Gender by race differences in youths' aspirations to pursue an IT career and the level of advancement in the career (soft, hard, and computer science major) were examined using chi square analyses. A gender difference was found: black and white males were more likely to consider pursuing an IT career than white and black females ($\chi^2[3, N = 762] = 21.22$, $p = .00$). Black males were most likely to report that they are considering a career in advanced (hard) IT (adjusted standardized residual [asr] = 2.6). White males, however, were most likely to major in IT (asr = 2.3) and thus held the highest potential to pursue the field. White females were least likely to pursue an IT-related career, with 62.2 percent indicating no consideration of IT careers, and were least likely of any of the other groups to be majoring in IT (asr = −2.5). Black females, given their proportion in the sample, were most unlikely to pursue a career in hard IT (asr = −2.3) ($\chi^2[9, N = 700] = 26.03$, $p = .01$). Interestingly, for each group examined, those youths who reported considering an IT career were most likely to consider pursuit

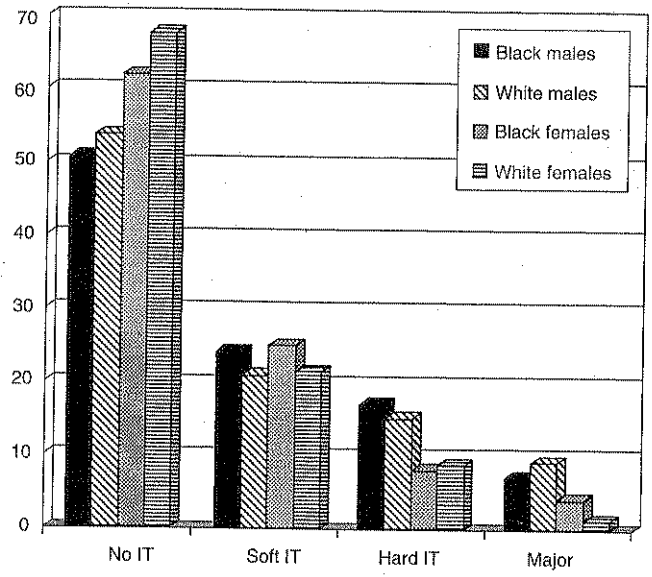

Figure 2.1
Comparison of IT career aspiration percentages between groups

of a soft IT profession. In fact, among soft IT careers, no differences between groups were found: Both black and white females were as likely to aspire to a soft IT career as were the males (see figure 2.1). These results suggest that although gender differences exist in considerations of pursuing an IT career in the higher echelons of the IT industry, females *do* consider pursuing careers in the IT field, but ultimately they aspire to pursue the less profitable, less prestigious soft computer professions.

IT Expectancies Youths reported their perceived ability at using the computer as a tool (what we refer to as soft computer jobs) and their abilities at tasks that are considered more advanced, or hard, computer skills (such as programming, software development, etc.). When we looked at soft computer jobs (e.g., communications, accounting, word processing, etc.), no difference between groups was found ($F[3, 530] = .861$, $p = .461$). On the other hand, when asked to consider how good they would be at an occupation that used computers for hard computer jobs (e.g., developing hardware and/or software, programming, etc.), differences between the groups were apparent ($F[3, 784] = 12.37$, $p = .000$). By Bonferroni standards, black males rated themselves as more capable than both black and white females.

White males rated themselves as more capable than white females, but *not* black females. Rather, black females, perceiving themselves as good at hard computer jobs as white males, rated their ability at hard computer jobs significantly higher than did white females (see table 2.1 for means).

IT Values/Interest When we looked at whether the groups differed in their interests in soft or hard IT careers, our findings suggest that there were no differences in their preferences for soft IT careers ($F[3, 525] = 1.37$, $p = .250$), but preferences for hard computer careers were somewhat differentiated by group ($F[3, 784] = 3.08$, $p = .027$). Black males reported they would enjoy hard computer jobs significantly more than white females. All other groups reported similar levels of enjoyment (see table 2.1 for means). Interestingly, however, when we split the sample into college and noncollege youths, we found that black females' higher computer interests were most represented by the noncollege sample.

What May Be Influencing the Pursuit of an IT Career?

Our findings above highlight the gender disparity in IT career goals among young adults three years after high school. Similar to previous research and national statistics, our findings suggest that the males held much greater potential and higher aspirations for pursuing an IT career than the females. Once we looked at differences by race, though, a different and possibly more nuanced story about women's IT career pursuits emerged. In consideration of these findings, we next examined factors thought to influence youths' IT career decisions to determine the impact they had on youths' IT career-related decisions, and how these factors and their influence differed by race and gender.

Among the indicators we studied there were similarities, but also major differences in what contributed to adolescents' IT career pursuits (their expectancies, values, and aspirations) dependent on their gender and race.

Black Females Although white women reported feeling the least competent (expectancies) and least interested in computer tasks, and were not at all on track to pursue an IT career, the story for black females shows quite the opposite. Black females were as confident and interested in computer tasks as the males (see table 2.1 for means), and although not on track for hard computer careers, they were highly likely to consider a career in the soft computer sciences.

Table 2.1
Means and standard deviations of independent variables by race and gender

Independent variable	Race by sex group	Mean	SD	N
Parent education				
	Black males	14.17	2.44	470
	Black females	14.19	2.45	424
	White males	15.27	2.92	223
	White females	14.98	2.88	237
Parent occupation				
	Black males	67.58	21.25	292
	Black females	66.99	22.37	239
	White males	70.00	21.25	132
	White females	68.40	21.05	149
Family income				
	Black males	11.29	5.07	295
	Black females	11.02	5.37	253
	White males	12.92	4.87	151
	White females	12.62	4.62	173
Home resources				
	Black males	1.58	1.34	201
	Black females	1.63	1.38	282
	White males	2.17	1.28	126
	White females	2.24	1.34	177
Child achievement				
	Black males	−.53	.92	367
	Black females	.08	.92	363
	White males	.29	.93	165
	White females	.61	.85	182
Math self-concept				
	Black males	4.91	1.41	299
	Black females	4.61	1.59	299
	White males	4.91	1.58	152
	White females	4.81	1.66	164
Math value				
	Black males	3.02	1.00	252
	Black females	2.85	1.15	253
	White males	2.61	1.02	127
	White females	2.79	1.02	134
Education expectations				
	Black males	5.49	1.63	275
	Black females	6.28	1.59	275

Table 2.1
(continued)

Independent variable	Race by sex group	Mean	SD	N
	White males	5.58	1.61	153
	White females	6.17	1.50	162
Gender discrimination				
	Black males	1.95	.55	258
	Black females	2.36	.70	261
	White males	1.63	.38	143
	White females	2.06	.54	154
Race discrimination				
	Black males	2.36	.64	259
	Black females	2.25	.62	265
	White males	2.17	.73	146
	White females	2.24	.77	154
Computer self-concept hard				
	Black males	3.89	1.24	201
	Black females	3.48	1.45	280
	White males	3.78	1.17	126
	White females	3.11	1.29	177
Computer self-concept soft				
	Black males	4.53	1.50	109
	Black females	4.75	1.22	207
	White males	4.66	1.06	70
	White females	4.59	1.14	144
Enjoy computers hard				
	Black males	4.03	1.40	201
	Black females	3.74	1.57	281
	White males	3.78	1.26	126
	White females	3.59	1.49	176
Enjoy computers soft				
	Black males	3.95	1.75	109
	Black females	4.01	1.67	205
	White males	4.41	1.50	69
	White females	4.02	1.44	142
Positive computer attitude				
	Black males	3.42	.76	201
	Black females	3.26	.71	281
	White males	3.39	.69	125
	White females	3.40	.65	175

Table 2.1
(continued)

Independent variable	Race by sex group	Mean	SD	N
Negative computer attitude				
	Black males	4.16	.64	201
	Black females	4.17	.63	281
	White males	3.96	.71	126
	White females	3.92	.63	176
Others influence				
	Black males	1.78	.69	198
	Black females	1.81	.77	277
	White males	1.78	.72	125
	White females	1.73	.75	176

Similar to all other groups examined, black females' attitudes about computers (both positive, $r = .14$, and negative, $r = -.21$), and the encouragement and support of others ($r = .35$) three years after high school were found to be directly predictive of their aspirations to pursue an IT career during this time (see table 2.2). There were some early factors in black females' adolescent development, however, that were important for setting them on course to pursue a career in IT (or keep them out of IT) through the influence they had on the development of black females' IT-related expectancies and values (see tables 2.3 and 2.4 for relation indicators to values and expectancies, respectively). These factors included having access to a home computer during childhood (preschool through high school), high eighth-grade academic achievement, valuing math, and holding high educational expectations as measured during the eleventh grade.

Consistent with national trends, the black youth in our sample were also less likely to have had computer resources than the white adolescents ($F[3, 786] = 12.57$, $p = .000$), with black females being the least likely to have had computer resources in their home (from preschool through high school) than all other groups examined (see table 2.1 for means). Crucially, our data suggest that having access to a home computer during childhood was related to black females' expectation that they would perform well in soft IT careers (e.g., word processing, communication) ($r = .14$).

Although black females (similar to white females) expected to attain higher levels of education than did the males ($F[3, 865] = 14.80$, $p = .000$) (see table 2.1 for

Table 2.2
Correlations of independent variables with IT job potential

	IT job potential whole sample	IT job potential black males	IT job potential black females	IT job potential white males	IT job potential white females
Parent education	.048	.225**	−.085	.013	−.040
Parent occupation	.063	.132	.046	.113	.016
Family income	.038	.085	.039	−.037	.089
Race	−.05	—	—	—	—
Sex	.16***	—	—	—	—
Child aptitude	.067	.163*	.102	.056	.076
Math scores	.164**	.213*	.107	.142	.164
Math value	.103*	.074	.110	.264*	.101
Academic expectations	−.023	.034	−.085	.128	−.026
Race discrimination	.089*	.188*	.080	.111	.000
Sex discrimination	−.010	.195	.035	−.012	.009
Home resources	.045	.105	.056	−.091	.099
Computer self-concept	.283***	.340**	.257**	.298*	.267**
Computer hardware	.346***	.275***	.328***	.308**	.390***
Computer software	.232***	.252*	.322***	−.041	.236**
Positive computer	.161***	.191*	.141*	.204*	.019
Negative computer	−.212***	−.198**	.207**	.272**	.212**
Enjoy hard computer	.191***	.086	.205**	.133	.212**
Enjoy soft computer	.130**	.070	.211**	.086	.188*
Others' influence	.294***	.258**	.352***	.363***	.282***

Notes:
*$p < .05$
**$p < .01$
***$p < .001$

means), it was those who had lower educational aspirations who were most likely to enjoy a career in the hard computer sciences ($r = -.16$). These findings stand in contrast to our findings for all other groups where having high academic expectations at grade eleven was related to later having a high self-concept of ability in soft IT careers (BM, $r = .36$; WM, $r = .28$; WF, $r = .26$). In fact, the majority of the black women who reported considering soft IT were among the noncollege bound youths. Thus, the more education black females expected to attain when they were in the eleventh grade, the less interested they were in hard computer science careers three

Table 2.3
Correlations of independent variables with enjoyment in computers (value IT)

	Computer value black males		Computer value black females		Computer value white males		Computer value white females	
	Hard	Soft	Hard	Soft	Hard	Soft	Hard	Soft
Parent education	−.015	−.141	−.027	.011	.061	−.015	.046	.001
Parent occupation	−.058	.110	−.009	.098	.017	−.254+	−.032	.051
Family income	−.092	−.174	−.022	−.103	.008	−.104	.196*	.193*
Child aptitude	.112	.132	−.063	.134	.078	.015	.036	.051
Math scores	.042	.034	.035	.003	.114	−.001	−.035	.063
Math value	.019	.014	.180*	.141	.020	.027	−.029	−.048
Academic expectations	−.005	.080	−.157*	−.103	−.008	−.095	−.051	−.104
Race discrimination	−.021	−.059	.069	.067	.108	−.133	−.036	.039
Sex discrimination	−.040	−.020	−.074	.012	.053	−.091	−.115	−.179+
Home resources	.033	.044	.002	.007	.145	−.127	.014	.073
Positive computer	−.012	−.028	−.044	−.085	.011	−.118	.137	.070
Negative computer	−.056	−.101	−.108+	−.159*	−.051	.023	−.128+	−.222**
Hardware computer	.071	.065	.389***	.136	.311***	−.059	.297***	−.001
Software computer	.100	.098	.226**	.251***	.141	.293*	.219**	.366***
Others' influence	.042	.088	.079	−.006	.173+	.161	.230**	.020

Notes:
*$p < .05$
**$p < .01$
***$p < .001$
+$p < .10$

Table 2.4
Correlations of independent variables with perceived computer ability (IT Expectancies)

	Computer self-concept black males		Computer self-concept black females		Computer self-concept white males		Computer self-concept white females	
	Hard	Soft	Hard	Soft	Hard	Soft	Hard	Soft
Parent education	.124	.237*	−.007	.059	.097	.268*	.006	.077
Parent occupation	−.016	−.035	−.055	.005	.188+	.208	.139	.118
Family income	−.015	.047	.034	−.013	−.003	.216	.222**	.357***
Child aptitude	.002	.195	−.024	.244**	.001	.409**	.078	.145
Math scores	.074	.220*	.076	.231**	.178+	.273*	.187*	.328***
Math value	.144	.247*	.105	.099	.166	.087	.061	.104
Academic expectations	.072	.359**	.035	.146	.118	.282*	.058	.258**
Race discrimination	−.075	−.135	−.040	−.094	.002	−.174	−.049	−.071
Sex discrimination	−.081	−.018	.075	.132	−.120	−.105	.049	−.110
Home resources	.057	.064	.079	.144*	.080	.118	−.039	.066
Positive computer	.142*	.125	.049	.049	.209*	−.127	.181*	.164
Negative computer	−.315***	−.318***	−.136*	−.270***	−.158+	−.149	−.206**	−.399***
Enjoy hard computer	.071	−.100	.389***	.226**	.311***	.141	.297***	.219**
Enjoy soft computer	.065	−.098	.136	.251***	.059	.293*	.001	.366***
Others' influence	.215**	.225*	.174**	.184**	.123	.011	.370***	.219**

Notes:
*$p < .05$
**$p < .01$
***$p < .001$
+$p < .10$

years after high school. Although measures of socioeconomic status were not related to black women's feelings of competence around computers, their valuing of computers, or their career aspirations in IT, this finding suggests that pursuing a soft IT profession might be a viable career option for those black women who lack the resources to pursue further education or higher-prestige careers.

Black females' academic achievement was, however, important for ensuring that black females were at least on track for later considering the pursuit of an IT career. The higher the achievement in grade eight, the more black females expected to do well in a soft computer job three years after high school ($r = .24$). This is especially significant to note because black females' achievement was only higher than that of black males (see table 2.1 for means).

Additionally, we found that black females' perceptions of ability and valuing of math were indirectly influential on their IT aspirations through its relation to black females' later IT-related expectancies and values. Valuing math in eleventh grade may not have a major impact on white females' decisions to pursue an IT career but might be a prominent factor for black females' IT pursuits. Black youths were more likely to report math as interesting or important than the white youths examined ($F[3, 766] = 4.54$, $p = .004$) (see table 2.1 for means), and this valuing of math was predictive of black females' enjoyment and interest in hard computer jobs ($r = .18$). Similar to all other groups, black females perception of their math ability in eleventh grade was positively predictive of how good they thought they would be at soft computer jobs when asked three years after high school (.23). All groups held similar views of their ability at math as measured in the eleventh grade (math self-concept).

Therefore, black females who enjoyed and felt they would be good at hard or soft IT job components when asked three years after high school, were those who (likely) had access to a computer throughout their childhood, had high eighth-grade achievement, and valued and felt they were good at math, but had low academic expectations in eleventh grade. In turn, black females who enjoyed (valued) and believed in their computer competence (expectancy), as well as those who had been given advice to pursue this choice and held more positive and less negative attitudes about computers, ultimately aspired to pursue an IT-related occupation.

White Females Whereas black females seem to be somewhat invested in the computer field, white females are clearly disenchanted by the computer industry. As reported earlier, white females expressed the least enjoyment (value) and confidence

(expectancies) in computers in comparison to all other groups according to Bonferroni standards (see table 2.1). We found that there were some early determinants indirectly influential on white females' later IT aspirations through their relation to white females IT-related expectancies and values (see tables 2.3 and 2.4). Similar to the other groups examined, white females' math self-concept was a major positive predictor of their IT pursuits through its influence on their expectancies of success in the field (hard, $r = .19$; soft, $r = .36$), as was their family's socioeconomic status. Family income was positively related to whether white females enjoyed both hard and soft computer jobs ($r = .20$ and $r = .19$, respectively) and whether they thought they would be good at either ($r = .22$ and $r = .36$). Although Bonferroni post hoc contrasts indicated that white females had the highest eighth-grade achievement scores in comparison to all other groups, their high achievement was not at all related to their IT career considerations. Similar to the males, though, having high academic expectations at grade eleven was related to later having a high self-concept of ability in a soft IT career (WF, $r = .26$).

Distinctly unique to white females was the importance of expectations concerning gender discrimination as a deterrent from an IT profession, although according to Bonferroni standards, white females did not expect to experience as much gender discrimination as black females did ($F[3, 816] = 51.40$, $p = .000$). White females' expectations about gender discrimination are predictive of their aspirations to pursue an IT career indirectly through their influence on girls' interest/enjoyment in computers ($r = -.18$). Essentially, the more that white females expected to experience gender discrimination when asked in eleventh grade, the less they thought they would enjoy a soft computer job three years after high school. Such findings suggest that white females' expectations of facing gender discrimination in the pursuit of an IT career may be a primary reason why they opt out of persisting in that direction.

Similarly to black females, determinants measured three years after high school that were found to be directly influential on white females' IT aspiration included the positive and negative attitudes these females held about computers as well as the encouragement and/or advice they received from others about the IT field (see table 2.2). It should be noted that none of the groups differed in their endorsement of positive attitudes about computers (e.g., interesting people work with computers) ($F[3, 782] = 2.60$, $p = .051$) (see table 2.1 for means), and positive attitudes were related to having IT aspirations either directly (BM, $r = .19$; BF, $r = .14$; WM, $r = .20$) or indirectly through the youths' expectations of success at hard computer

jobs (BM, $r = .14$; WM, $r = .21$; WF, $r = .18$) for all the groups. Groups did differ on their endorsement of negative attitudes about computers (e.g., computers are a waste of intelligence) ($F[3, 784] = 8.11$, $p = .000$), and white females were the most likely to endorse these negative attitudes three years after high school (significantly different than black youths' attitudes by Bonferroni standards; see table 2.1 for means). This is especially important because the endorsement of negative computer attitudes was related to IT aspirations for all groups in the expected direction: adolescents who held negative attitudes toward computers were not aspiring to pursue an IT career (BM, $r = -.20$; BF, $r = -.21$; WM, $r = -.27$; WF, $r = -.21$). Additionally, the more that the youths endorsed negative attitudes about the IT profession, the less capable they felt they would be at any computer-related occupation (BM, $r = -.32$; BF, $r = -.14$; WM, $r = -.16$; WF, $r = -.21$), and among the females, those who held negative attitudes about IT were less likely to value soft IT careers (BF, $r = -.16$; WF, $r = -.22$).

As mentioned previously, our findings indicate that receiving encouragement and advice from significant others—like parents, teachers, and peers (socialization)—is an important factor in all youths' decisions to pursue an IT career. Receiving encouragement and advice from others was directly related to youths' considerations of pursuing an IT career for all groups examined (BM, $r = .26$; BF, $r = .35$; WM, $r = .36$; WF, $r = .28$). This socialization was also evident for adolescents' career aspirations through the influence it had on adolescents' perceptions of ability in both hard and soft computer jobs (range of correlations [r] from .17 to .37). These findings are especially noteworthy for white females who reported receiving the least amount of advice in comparison to all other groups (see table 2.1 for means).

Thus, while most white females shun IT as a career choice, those who aspire for an IT career three years after high school are those who have been influenced by their family and friends to go into the field, and held less negative preconceptions about the type of people who go into the field, in addition to valuing and feeling competent at hard as well as soft computer job aspects by the time of their college years. Furthermore, findings suggest that some early determinants are critical for decisions to pursue IT through their influence on the development of white females' positive IT-related expectancies and values. White females who during the eleventh grade perceived themselves as good at math, had high educational expectations, and had less of an expectation that they would experience gender discrimination in the future were more likely to aspire to an IT career because they enjoyed both hard and soft computer jobs, and believed that they would be good at them.

Black Males Interesting findings concerning black males' IT career aspirations are also important to note here and should be considered in future programs for promoting blacks to pursue careers in IT. Black males were found to hold high regard for the computer field (positive attitudes), were confident about their computer abilities when asked three years after high school, and had equally high values for prerequisites of this field (math) as measured in the eleventh grade, yet they are still not present in the IT industry. Among black males, there were multiple early determinants found to be directly related to their later IT aspirations three years after high school, including family income, eighth-grade academic achievement, concerns about race and gender discrimination and math ability in the eleventh grade, as well as the more recent advice and encouragement that black males received about pursuing IT as measured three years after high school (see table 2.2). How much black males valued math and how far they planned to go in school (academic expectation) in the eleventh grade were also influential on their later IT aspirations through the impact these factors had on black males' perceived ability at soft IT jobs (see table 2.4).

Although black males may express similar levels of interest in pursuing an IT career as white males do, concerns about race and gender discrimination may be one reason black males eventually opt out of these occupational pursuits. Surprisingly, black males who had higher expectations of experiencing gender discrimination and greater feelings of inefficacy in combating race discrimination were more likely to aspire to an IT-related career ($r = .20$ and $r = .19$, respectively).[4] Black males' level of concern regarding their future experiences of discrimination may be dependent on their chosen career paths. Those who are pursuing more prestigious careers may be more vigilant (or simply more realistic) about the race and gender discrimination they may face as one of only a few black males to pursue employment in the field. Therefore, although black males may express similar levels of interest in pursuing an IT career as white males, concerns about or experiences of race discrimination may be one reason black males eventually opt out of these occupational pursuits.

It is also just as likely that the IT field is known to be less traditional, and thus less discriminatory, than other industries and therefore appears a promising career option to black males who are concerned about facing discrimination at work. In fact, black males in our sample held highly positive attitudes about computers and the IT field in general. According to Bonferroni standards, black males were least likely to endorse negative attitudes about computers and most likely to enjoy

a computer career in comparison to all other groups examined (see table 2.1). Likewise, similar to the other groups, the advice and encouragement that black males received from others about pursuing an IT career was as predictive of later IT career decisions ($r = .26$) as for black females and white males, and they received as much of this support as did black females and white males. As previously mentioned, along with the influence of math self-concept in the eleventh grade on later IT pursuits found for all groups (BM, $r = .21$), black males' belief in the importance of math (math value) was related to black males' expectations of success at soft computer jobs ($r = .25$). This is promising because black males reported valuing math significantly more so than the white youths. Although the Eccles model and previous research findings would suggest that youths continue pursuit (and achieve) in tasks that they like and feel that they are good at (Jacobs et al. 2002), future research is needed to confirm how the math values of the black males in our sample map onto their chosen course work.

Although black males held high aspirations to pursue an IT career, their lower academic achievement in comparison to all other groups may be the primary reason black males are underrepresented in the IT industry (see table 2.1). In support of this assertion, we found that achievement was directly related to IT aspirations for black males ($r = .16$). Therefore, although black males may hold high regard for the computer field and its prerequisites, their performance in computer-related course work and exams may not be up to the standards required to successfully qualify for a job in the IT field (or continue successfully pursuing the field). In support of this premise, research by Katz et al. (2003) suggests that black males enter undergraduate computer science programs with lower math SAT scores than white and Asian males.

Other forces that may have kept our sample of black males out of IT is that they came from families with slightly lower education (in comparison to white males and females, but similar to that of black females) and held lower academic expectations themselves (lower in comparison to white females, but similar to that of white males). Black males who came from more educated families were more likely to consider pursuing a profession in IT ($r = .23$).[5] Similar to white males and white females, having high academic expectations at grade eleven related to black males later having a high self-concept of ability in a soft IT career ($r = .36$).

Hence, while it is unclear how race discrimination plays a part in black males' IT career-related pursuits, there are some factors that seem to put them on track for pursuing a career in the computer industry. They tend to hold highly positive atti-

tudes about computers and the IT field, receive encouragement and advice from others to pursue IT, and enjoy and feel they are good at math. For these youths, it seems the major forces that work against their later IT pursuits are their lower academic achievement and academic expectations, along with, possibly, their lower socioeconomic status.

White Males Many of the predictive factors of white males' IT pursuits were those that they reported having equal or greater access to in comparison to all other groups examined (see table 2.1): receiving encouragement and advice from others, and holding less negative attitudes about the computer field were directly related to white males' IT aspirations ($r = .36$ and $r = -.16$, respectively). In contrast, white males' value of math in eleventh grade, although significantly lower than that of black males, was directly related to their later aspiring to an IT-related career three years after high school ($r = .26$) (see table 2.2). Of the other early indicators measured when youths were in the eighth and eleventh grades, parent education ($r = .27$), academic achievement ($r = .41$), math self-concept ($r = .27$), and academic expectation ($r = .28$) were all indirectly influential on white males' IT aspirations through their positive relation to these youths' perceptions of their soft computer abilities three years after high school (see table 2.4).

Although white males, similar to black males, held lower academic expectations than the females did, having higher academic expectations at grade eleven was related to white males later having a high self-concept of ability in a soft IT field three years after high school ($r = .28$). Therefore, encouraging males to hold higher educational goals may help promote a growth in the number of males who pursue an IT career, although this intervention would likely not have much of an effect on getting more females to pursue IT.

Indeed, among white males most likely to aspire to an IT career are those who were influenced by their family and friends to do so; who held some positive, but also considerably more negative perceptions of IT workers than those who didn't go into the field; and who valued math in high school in addition to valuing and feeling competent in hard or soft IT job components. Additionally, white males who came from families that were more educated and had high academic achievement and expectations themselves early on (eighth and eleventh grades, respectively) as well as believed that they were good at math in the eleventh grade were likely to believe they were good at soft computer skills, and thus held a higher likelihood that they would ultimately aspire to an IT-related career.

Conclusions and Implications

The current findings suggest three major points concerning the differences found for IT occupational choices by gender and race: early psychological, social, and academic experiences help shape/guide youths' later career decisions; there appear to be some real-world limitations that keep some youths out of the IT pipeline; and stereotypes and discrimination, whether existent in either blatant or more subtle ways, operate to discourage underrepresented groups from pursuing an IT career.

First, our findings suggest that a strong relation exists between early psychological and sociocultural factors and the later aspirations youths have regarding the computer industry mainly through their influence on youths' development of expectancies and values regarding the field. For example, adolescents' interest in and feelings of competence toward math by the eleventh grade is important for their later enjoyment in and/or feeling of competency toward computer-oriented tasks. This finding has critical implications for future interventions. Whereas earlier experiences and attitudes may not be found by researchers to directly influence later occupational and academic behaviors/decisions (in this case, IT-related aspirations), they play a key role in shaping important precursors to youths' career decisions—namely, youths' interest/enjoyment and feelings of competency in computers. Thus, early interventions are more significant than perhaps youths have "let on" in previous research. It is also important to note that the influence and input of socializers such as parents, teachers, and peers were important factors for all the groups examined, and hence should be a focal point for promoting youths to pursue IT. Therefore, interventions focused on such issues as stressing the importance of early encouragement of children's interest and confidence in math and technical/physical sciences (because of their later influence on occupational choices), increasing computer provisions, and teaching parents to make computers a priority and value in the home are as essential as the interventions instilled in schools.

This leads to our second point: that there appear to be some real-world limitations that keep some youths from pursuing a computer science career. Socioeconomic status (parent education, occupation, and family income) was a key predictor of later IT career pursuits. These findings raise greater concern for black youths who come from families with slightly lower education and income. But it is also troublesome that we still found deficits in the amount of computer resources provided in the home for black youths in a normative sample. This racial differential between who has access to computer resources and socialization and who does not

can only perpetuate the race disparities found in the IT industry. This gap between those who have access to technology and those who do not—as mentioned earlier, commonly referred to as the digital divide—only exacerbates existing social gaps in our society: those already excluded become further disadvantaged from higher positions in the U.S. economy (Latimer 2001).

Differences by race in adolescents' achievement are also an important limitation to youths' IT career pursuits, especially for black males. The black males in our sample appear to really want to establish themselves in the IT field, but many have not reached the academic achievement levels necessary to go to college and successfully pursue such a career. Computer companies, along with school counselors and parents, need to do more outreach that focuses on informing youths about what it takes to successfully pursue an IT career. For black females, future research and policy need to explore ways in which we can promote these youths to strive for the more prestigious and economically promising hard computer professions. We must encourage black females in the belief that they have a place in the upper echelons of the computer industry by providing them with greater provision of resources and more opportunities for an education after high school to realize their IT goals.

Lastly, our findings suggest the necessity for future research to address how race and gender discrimination contribute to the underrepresentation of women and blacks in the advanced computer sciences. A significant body of research documents how gender and race schemata along with stereotyped expectations are detrimental to the academic as well as career pursuits of both females (Heilman 2001; Jacobs and Eccles 1992; Wigfield et al. 2002) and some racial minorities (Powell and Butterfield 1997; Steele 1997). Overall, the current study, along with others (American Association of University Women 2000, 2004; Xie and Shauman 2003; Margolis and Fisher 2002; Cooper and Weaver 2003), strongly suggests the need to change the "face" of the computer world as to who is considered the "ideal" IT professional in order to appeal to and meet the needs of underrepresented groups. For white females especially, we need to begin by focusing on how to promote computer science as an attractive, enjoyable career option that serves multiple purposes, including those that contribute to the greater social good and the larger community.

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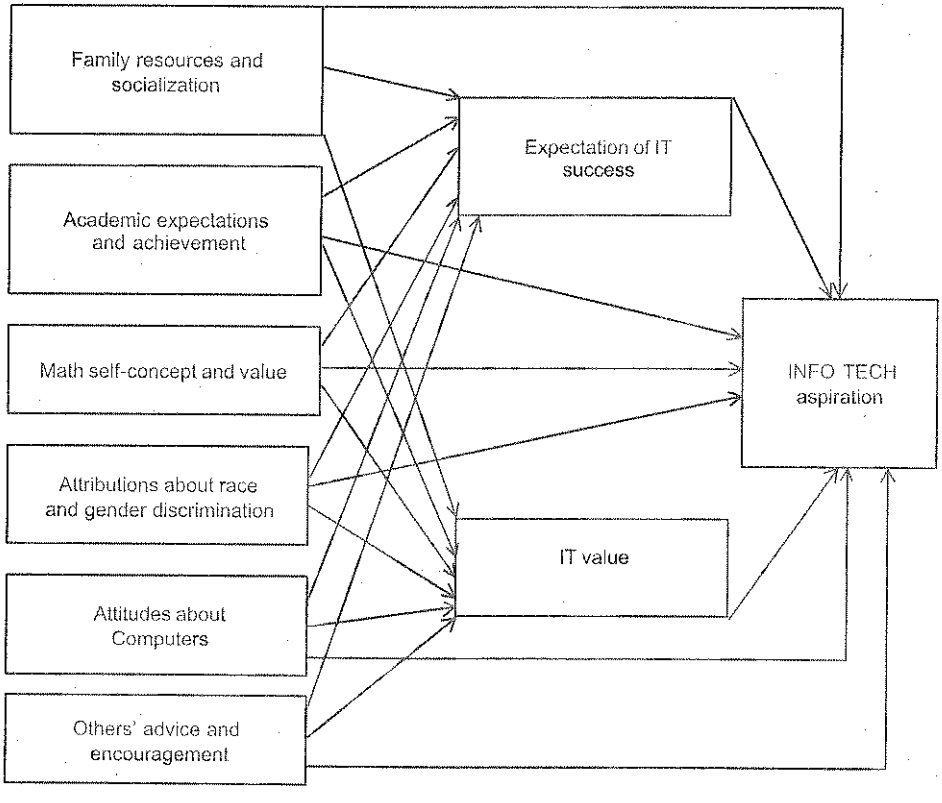
Appendixes

Appendix 2.1
Modified Expectancy-Value Model



Appendix 2.2
Constructs and Measures

Scale	Reliability (Cronbach alpha)	Example item
I. Family and youth 8th grade		
Family income*	Single item	From all sources of income you mentioned, tell me your total family income before taxes in 1993.
Parents' occupational status*	Open ended	Status classified using the Nam and Powers (1983) scoring system.
Parents' education*	Single item	The highest level of education across mothers and fathers (in years).
Home resources	Single item	Did you have computers at home while you were: (asked in the pre-elementary, elementary, middle school, and high school years) (yes/no). Sum score of home resources was used.
Youth's academic achievement*	NA	A standardized score of the mean of youths' course grades and Maryland subject achievement tests.
II. Youth 11th grade		
Math self-concept	.89	How good are you at math? (1 = not at all; 7 = very good)
Value of math	.63	Do you learn things in math that help with your everyday life?
Academic expectation	Single item	How far do you think you will actually go in school? (1 = 11th grade or less, 6 = graduate from a 4-year college, 8 = earn a doctorate)
Expectations of gender discrimination	.67	Do you think it will be harder or easier for you to get ahead in life because you are a (boy/girl)? (1 = a lot easier; 5 = a lot harder)
Inefficacy to combat race discrimination	.83	There is little you can do to avoid racial discrimination at the job you will have in the future. (1 = strongly disagree; 5 = strongly agree)
III. Youth 3 years post–high school		
IT career aspirations	Single item	"Have you ever considered getting a job in information technology? If so, which ones?" (1 = none, 2 = soft IT, 3 = hard IT, 4 = IT as college major)

Appendix 2.2
(continued)

Scale	Reliability (Cronbach alpha)	Example item
Self concept of ability at hard computer jobs	.93	How good would you be at an occupation that used computers for "hard" IT jobs (e.g., developing hardware, developing software, programming, etc.)?
Self concept of ability at soft computer jobs	.80	How good would you be at an occupation that used computers for "soft" IT jobs (e.g., word processing, accounting, etc.)?
Enjoyment of hard computer tasks	.92	How much do you think you would enjoy a job that used computers for "hard" IT jobs (e.g., developing hardware, developing software, programming, etc.)?
Enjoyment of soft computer tasks	.84	How much do you think you would enjoy a job that used computers for "soft" IT jobs (e.g., word processing, accounting, communications, business-related, etc.)?
Positive computer attitude	.62	Computers can solve social problems. (1 = disagree; 5 = strongly agree)
Negative computer attitude	.78	Working on computers is isolating and deprives people of social interaction. (1 = strongly disagree; 5 = strongly agree)
Influence of others	Single item	Adolescents reported how much encouragement and/or advice they received. (1 = none, 2-advice *or* encouragement, 3 = advice and encouragement)

*Parents reported family income, parents' occupational status, and parents' educational attainment. Youths' academic achievement was obtained through school archival records. All other measures were based on youth reports.

Notes

1. For more information about the MADICS data, please refer to our Web site, ⟨http://www.rcgd.isr.umich.edu/garp/⟩.

2. Exact *p* values and further details of the Bonferroni contrasts are available by contacting the first author of this chapter, who can be reached at ⟨nzarrett@umich.edu⟩.

3. For the combined effect of key indicators used in the current chapter on IT career pursuits (hierarchical regression analyses), see Zarrett and Malanchuk (forthcoming).

4. Additional analyses using hierarchical regression indicate that black males' inefficacy in fighting race discrimination remains significant even once accounting for the shared variance of other indicators ($B = .14$, $p < .05$). Gender discrimination findings are explained once more promixal determinants (three years after high school) are entered into the model. For more details, see Zarrett and Malanchuk (forthcoming).

5. There is a significant zero-order correlation between parents' education and IT aspirations, but the effect disappears in a multiple regression when youths' academic achievement is entered into the equation. This suggests that black males who rise above their socioeconomic status and are high academic achievers themselves are those most persistent in the IT field. For more details, see Zarrett and Malanchuk (forthcoming).

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