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# Factors Influencing Successful IT Women's Career Choices: A Qualitative Study

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## Abstract

Women and minorities continue to be underrepresented in information technology (IT) career fields. In this study, we examined critical self-descriptions of women who selected and excelled in information technology careers. Analysis of six narratives revealed that family support, teachers, and hands-on learning experiences were critical sources of women's development of self-authorship leading to selection of an IT career path. Findings from this research suggest intervention strategies for parents, teachers, and counselors that will encourage more women to pursue careers in information technology.

## Factors Influencing Successful IT Women's Career Choices: A Qualitative Study

Information technology, notwithstanding the current economic downturn, will provide the greatest job growth in the coming years (Braddock, 1999; Hilton, 2001). The term information technology (IT) was coined to describe a variety of jobs concerned with the development, installation, and implementation of computer systems and applications. Careers in IT encompass occupations that require designing and developing software and hardware systems, providing technical support for computer and peripheral systems, and creating and managing network systems and databases (Governor's Commission, 1999). Despite the tremendous growth in the number of women entering the professional workforce over the last two decades, women and minorities remain underrepresented in IT jobs (Babco, 2001; Commission on Professionals in Science and Technology [CPST], 2001; Panteli, Stack, & Ramsay, 2001).

In Bureau of Labor Statistics projections (BLS, 2001), the women's labor force will grow more quickly than

men's. However, when we look at the pool from which IT workers will come, we see persistent patterns of few women and minorities in engineering, computer sciences, and other computer-related fields. A number of explanations have been offered for women's under-representation in the IT labor force (Kovalski & Behrens, 2002). While recent studies, including our own, suggest that women and girls, particularly girls in high school and younger, no longer view using computers as a particularly male activity, many studies show girls having less positive attitudes than boys about the usefulness of computers, and deriving less enjoyment from using them (American Association of University Women [AAUW], 2000; Volman & van Eck, 2001). Margolis and Fisher (2002) conclude that women's departure from IT majors during college is not explained by lack of ability, interest, or confidence. Instead, they argue, it is caused by disaffection with a culture and curriculum that enshrines male values, including a single-minded focus on technology. If we are to increase the number of girls and women in IT careers, it is important to study and expand the research documenting gender differences in attitudes, access, and use of computers and the factors influencing the choice of an IT career path for women (AAUW 1992, 1998; Badagliacco, 1990; Ray, Sormunen, & Harris, 1999; Rosser & Kelly, 1994; Rosser, 1995; Sadker & Sadker, 1995). Studying successful women in IT careers offers an opportunity to examine the events critical in their career choice and extract meanings relevant to young women today.

The research reported here is an outgrowth of a National Science Foundation (NSF) study that uses self-authorship as a theoretical framework to identify the pivotal transitions in girl's lives that lead them toward or away from careers in technology fields. Specifically, we examine the critical incidents reported by successful women in IT careers to better understand early influences on IT career decisions for women and minorities. In this paper, we outline the theory of self-authorship and its relevance to studying female non-traditional career choices. We provide information about the influences and barriers related to how women and girls approach their career choices, especially IT careers, and suggest implications for practice based on our findings.

The theoretical basis for this work is the concept of self-authorship, a constructivist developmental framework first developed by Kegan (1994) and extended by Magolda (1998, 1999). Self-authorship is the ability to reflect upon one's beliefs, organize one's thoughts and feelings in the context of, but separate from, the thoughts and feelings of others, and literally make up one's own mind. Self-authorship is a complex phenomenon involving three dimensions: (a) cognitive, (b) interpersonal, and (c) intrapersonal. The cognitive dimension is what people believe and how they make meaning and judgments. The interpersonal dimension is how people view the opinions of others in relationship to their own judgments. Identity or an internal sense of self is the intrapersonal dimension. In this paper, we advance Magolda's conceptualization of self-authorship in two important ways. First, we look at how self-authorship applies to the way adult women describe critical incidents in their past associated with their choice of a career in a non-traditional field. Second, it is our hypothesis that it is not only educational experiences that promote self-authorship, the focus of Magolda's work, but also parents and significant others who play a crucial role in the development of self-authorship in young women.

## Research Methodology

Our basic research question was: What are the critical incidents that successful women in IT careers identify as influencing their career choice?

### *Sample Selection*

Participants in this qualitative study were six women who currently hold senior level technology and science positions in government, business, and education. This includes those holding CEO or executive level positions in small IT companies, as well as those in executive-level positions in government, education, and business. Because of the underrepresentation of women in senior level positions, the proportion of women in these careers is small, making them a difficult sample to find. Participants in this study were selected by a combination of network selection and primary contacts. Women serving as an advisory committee to the NSF

funded research study being conducted by the article authors constructed an initial list of Virginia women in senior level technology and science careers. From this small group of identified women, participants were solicited via phone and/or email contact. Six women executives, five European-American and one African American, agreed to participate in the study, signed an informed consent document, completed a brief demographic questionnaire, and supplied a copy of their resume.

### *Data Collection*

To allow for the unique narrative to emerge when individuals reflect on their own development, we designed an open-ended protocol containing items inquiring about family influences and supports, influence and support of others such as peers and teachers, significant barriers and turning points that impacted their career decision, preferred learning styles, decision making processes, and advice for girls thinking about a career in technology. We conducted both telephone and face-to-face interviews. These interviews lasted from 45 to 60 minutes, were audio taped, and a verbatim transcript completed for each.

### *Analysis*

All audiotapes were transcribed by trained research team members and then imported into Atlas.ti qualitative analysis software for data management and analysis. Two team members cross-coded all interviews simultaneously and met periodically to check each other's coding to ensure consistency. They worked together to develop a list of emergent themes and to identify critical incidents.

The critical incident technique is an interpretive, qualitative research strategy that uses structured and unstructured interviewing to identify self-contained events or occurrences on a specific topic that carries a particular meaning for a participant (Chell, 1998; Tirri & Koro-Ljungberg, 2002). A critical incident is one that a participant identifies as central to understanding their experience and where the cause and consequences of the event are sufficiently clear for the researcher to draw inferences. Rather than focusing on feelings or perceptions, the interview protocol is designed to elicit descriptions of incidents that focus on behavior or an event as the unit of analysis (Carpenter, 2000; Chavez & Oetting, 1995; Flanagan, 1954). Critical incidents are used both to test and extend theory.

Table 1 summarizes key demographic characteristics of the participants, who are referred to throughout the paper by pseudonyms. Participants range in age from 29 to 60. All are married and half have children. They hold a range of different types of executive-level positions in both the private and public sectors. Only half earned undergraduate degrees in technical fields.

## Results

We asked interview participants to reflect on how a number of factors affected their decision to enter an IT career. These are described in the following section.

### *Family Support*

Family environment and family support are important factors in the positive development and socialization of women. Parents serve as significant interpreters for children of information about the world and children's abilities (Hall, Kelly, Hansen, & Gutwein, 1996). During adolescence, the family influences vocational development, identity formation, and establishing independence in a variety of ways. Experiencing a sense of unity and attachment to parents has been demonstrated to have an impact on adolescents' career development (Bregman & Killen, 1999).

All the women in our study reported receiving strong messages of support from their families. The message of "you can do anything you set your sights on" was consistently given to the women and backed up with

actions of support. Their families expected them to succeed. This support and expectation was revealed in the words of one participant who is now 29, married with no children, and the CEO of a small, private company:

I would have to say that my family has had a pretty profound affect on me in that my parents are both college educated---I am actually third generation college educated. Because of their enlightenment and their vision, I believe that my parents- the biggest thing that they did for me—they never told me that I couldn't do anything, you know what I mean? (Melissa)

The messages that the IT women executives reported receiving from their parents were not so much that they should pursue a specific career as it was a more general “can do” attitude. Lisa is a senior vice president in a large power company and is married with three children. She illustrates this attitude:

It wasn't so much the job you are going to have as you can, should, and will do anything you want. You make your own opportunities and it is important that you understand that there are all kinds of different things out there that you can do. (Lisa)

In addition to the consistent messages of support, parents also served as powerful role models of perseverance and role diversity. Their attitude was not only reflected in what they said, but also in what they did. One participant, who is now 40 years old, married with no children, and CEO of a small IT company said,

I grew up in a family that was very involved civically in lots of things. My mother and father worked together in business as far back as I can remember, and so I was used to seeing women work. I was used to seeing my father take off in the afternoons to go watch football practice with my brothers and my mother run the shop. They did buying trips together. There was nothing that they didn't in a sense do together. Therefore, I never stopped to think this was the man's role or this was the woman's role. (Vicki)

The significance of the parents' messages appears to be in their open-endedness and the absence of a prescription about the path their daughter should take while building their strong sense of identity.

## **Teachers and Others that Influenced Career Choice**

In addition to family influences, participants identified significant others in their lives who influenced their career decision and their choice to enter an IT field. Both influencers and mentors gave the women a new way of looking at themselves and their options as career seekers. The effect appeared to be deeper than merely a source of career information although that was also part of the relationship in most cases. While one participant noted female role models were important because they validated that women belonged in the field, most of the other participants found that interaction with fathers, brothers, and other male figures prepared them for a career in a male-dominated field. Supportive male teachers were equally effective in giving the women a sense of confidence in their love of math and science.

Five of our six participants identified high school teachers, often by name, which played a significant role in their choice to pursue a non-traditional career. Three specifically mentioned their middle or high school mathematics teacher, one mentioned supportive high school English and music teachers, and another was encouraged by a teacher in her high school pre-engineering class. These teachers validated them as knowers and confirmed for them that it was acceptable for a female to be good in math and science. Martha is the CEO of a small IT company. She has a master's degree in computer science and a Ph.D. in information technology. She is married and has two children. Of a high school math teacher, she said,

I have to stop and tell you about the person, a huge influence in growing up was a teacher I had in high school...She was a strong woman. She was a very accomplished individual, and she was a tough teacher, a fair teacher, but an exciting teacher for me...She confirmed for me that it was okay for a woman or girl to like



math and science. (Martha)

None of the participants identified a counselor or academic advisor as being influential to their career choice. None mentioned being part of any organized mentoring program. This may be the result of the age of our participants and the lack of these types of programs up to 15 to 20 years ago.

## **Self-Authorship and Career Decision Making**

Self-authorship is central to professional and career decision making (Magolda, 2002). Integral to complex ways of making meaning, self-authorship is "simultaneously the ability to construct knowledge in a contextual world, an ability to construct an internal identity separate from external influences, and an ability to engage in relationships without losing ones' identity" (Magolda, 1999, p. 12). A key way that self-authorship is demonstrated is when supportive messages like "you can do anything you want" are no longer accepted because they come from an authority figure, but because they are internalized and integrated as part of one's identity; they become a core self-definition.

The process of listening to others' ideas about what kind of career might suit you, weighing it against a core sense of self, and then making a decision is reflected in a critical incident described by one of our participants, Vicki. She described an incident in high school that she perceived as instrumental to her ultimate choice of a career. After she took apart and re-assembled her middle brother's stereo, he became a strong proponent that she enroll in an engineering program. Her brothers, however, had different ideas of what engineering field was most suited to her. Her older brother advocated mechanical engineering. He said, "well, maybe you should try mechanical engineering, I find it easier." She tried mechanical engineering, but ultimately settled on electrical engineering. She said,

I mean that was just not my train of thought. When I did try to go in mechanical engineering, it's just not the discipline for me. Electrical engineering was really truly much more of what I was doing. I think he was amazed. I mean, you know, considering I wasn't very old at the time. (Vicki)

We interpret this participant's words to reflect self-authorship because she considered the input of those important to her about her career choice but made a decision after considering her own skills and her interests.

Lisa, now 51 years old and the owner of her own IT company, regrets that she did not realize when she was younger that many different fields were open to someone with her skills. She was reinforced by positive feedback about her math skills and strong female role models who "confirmed for me that it was okay for a woman or a girl to like math and science," but she simply did not know how many careers were open to her. She said,

...inside of myself today there are many people. I wish that I had the options mentally that I have today. I am not sure what I would have become. I really, I might have become an architect. I might have become an electrical engineer. I might have become a mechanical engineer. I might have ended up in aerospace -- I love robotics. I often assess my life at that age and wonder why I never thought any of those could be an option for me, but I never gave them a consideration. I had been validated that mathematics was what I was good at, it was okay, but I didn't see the application of mathematics across all kinds of problems. I just went to mathematics. And I look now and say, boy, I wish I had maybe a broader influence, and that there are a lot of people inside of me that have not quite gotten out.(Lisa)

Both Lisa and Vicki actively construct knowledge by recognizing they had a number of different types of skills and there were many options for a career they might pursue, but they reached this awareness at different stages in their lives. They were not born with a sense that an IT career was their destiny -- an IT career was only one of many options open to them. Both participants initially accepted the input of significant others. Vicki quickly

saw, before finishing college, that other career paths were better suited to her, while Lisa did not come to realize this fully until she reached adulthood.

## Learning Styles

Self-authorship is also evident in the way our participants described critical incidents during their lives that they later related to their decision to pursue a career in a science, technology, engineering, or math field. Many of these were related to early interest in and exposure to hands-on activities. Hands-on activities validate students as learners and knowers. For the younger participants, these were more likely to be related to technology than for older participants.

Martha, 51, recalled a fond memory of her father and how she learned to use a slide rule. She said,

I had four younger siblings. My father did all the grocery shopping... If you were one of the older children and could mind your manners, you could go to the store with daddy. One of the things that daddy did that was entertaining was that as an engineer at that time in the 1950s and 1960s, he always had a slide rule in his pocket. He bought me a slide rule probably when I was 7 or 8 years old. I was his best grocery shopping buddy. And I tell you, as a memory, it is one of my best memories because my other siblings did not excel at all in using the slide rule. I could stand in the grocery store long before they posted price per ounce or unit price, and I could use the slide rule. I could compare 32 ounce price to the 16 ounce size and tell my father which was the better buy ounce per ounce. (Martha)

April, who earned an undergraduate degree in business, married, and now works as the chief technology architect for a school system, showed similar early aptitude and resourcefulness. In her case, her interest in an IT career seemed to be an outgrowth of an early critical incident with computers involving games:

When I was in 5th or 6th grade, my father had a computer that was something like a dumb terminal. It had a basic compiler so you could write some basic code. We wanted to play games on the computer and he said if you want to play games, you have to write the code. So I got a book, wrote code, and played Space Invaders. I could play Space Invaders and Pong on it. Since I wrote the code I knew where all the defects were or the bugs and so I knew how I could beat the computer and my brothers and sisters. (April)

These situations show participants experiencing success and being rewarded for learning situated in their own experiences. Mothers are notably absent from these accounts. Fathers played a key role in nurturing self-authorship by validating their daughters as capable. The experiences the successful IT women in our sample report contrast sharply with classroom settings where girls more often assume lower order tasks in group work (Rosser & Kelly, 1994).

## Conclusions and Implications for Practice

We began this project with the hypothesis that women who have developed self-authorship would be more likely to enter and persist in a career that is non-traditional for women, such as information technology. By examining the critical incidents that successful women in IT careers identified as influential in their non-traditional career choice, we were able to see the types of incidents and factors that shaped and developed their self-authorship. What do these findings suggest for effective interventions we might plan to insure more girls and women are prepared to choose a non-traditional IT career path?

We found that our participants were able to weigh conflicting viewpoints and come to a decision that was in harmony with an inner sense of self, a key determinant of strong self-authorship. Our women heard consistent messages from their families that they could achieve and were expected to seek education. Each of our six participants reported receiving a strong message from their family that “you can, should, and will do anything

you want.” Three stated specifically that they were raised to be independent thinkers and most had family responsibilities from a young age. Roe, an early career theorist, proposed that early childhood experiences play an indirect role in shaping later career behavior (Brown, Lum, & Voyle, 1997). Particularly significant in these women’s choice of a nontraditional career appears to be belief in the consistent statement from their family that there is nothing they cannot do if they set their mind to it. These statements of support appear to go hand in hand with real-life, everyday experiences where they saw their ability confirmed. Positive experiences both at home and at school seem to have provided the context for these women to reject stereotypical conceptions of women’s roles and to adapt a definition of self that is positive, competent, and genuine. Interventions for parents through parent education programs stressing messages of confidence, a “can-do” attitude, and a consistent message of the value of education can bolster a girl’s confidence in her ability to tackle barriers. Parents who provide opportunities for responsibility and decision-making from a young age can also help develop a set of inner beliefs and values leading to self-authorship as girls grow and develop. Parent education programs that emphasize developing partnerships between parents and teachers in the formative years when girls are growing up are also important. DeRidder (1990) suggests that teachers work directly with parents, collaborating with them, and helping them to improve their effectiveness in guiding their children. He encourages parents not only to communicate about work and careers with their children, but also to show faith in their children’s abilities to be successful, providing them with encouragement and information. Intervention strategies that build self-authorship and, therefore, self-confidence are necessary to bring more women into IT careers and retain them to high levels of success.

None of those interviewed mentioned a school counselor as being an influence on their career choice. Participants made their way through their education with the encouragement of family members and teachers but without the stated help of those whose job description included career advice and counsel. This is consistent with Burger and Sandy’s (2002) work with Virginia public school counselors in an NSF-funded project *Counseling for Gender Equity*. They found that most counselors had the same gender stereotypes of occupations – girls are nurses, boys are doctors – and of girls’ math and science abilities. Books and articles written for a counselor audience usually do not address gender while they now almost all address the needs of racial/ethnic minority populations. Only when a publication is written explicitly for girls like the book *Cool Careers for Girls in Computers* (Pasternak & Thornburg, 1999), is there any discussion of gender issues. Gender specific career materials need to be disseminated widely to parents and to teachers. Guidance counselors can help parents by meeting with them individually and sharing career resource materials as they discuss how to facilitate their adolescents’ career development. In addition to career materials, counselors can also help institute organizations such as SWE (Society of Women Engineers) and AWIS (Association for Women In Science). These groups can disseminate career information and promote networking and support for girls and women.

The teachers of our women were role models and validators of their worth as females capable of achieving. This belief in them, coupled with hands-on learning activities, whether with computers or other devices, helped them gain further confidence in their abilities.

This corresponds with the constructivist developmental pedagogy espoused by many educational researchers.

Women in this study are lifelong learners. Several did not use computers until they were out of school, while others wrote programs while still in the elementary grades. These generational differences will continue to be seen as children as young as three years old use computers for entertainment and learning. In one of our recent surveys of high school students, we found no significant difference between males and females in their computer access, use, or types of applications they used (Creamer, Burger, & Meszaros, 2004). Girls are playing games, accessing the Internet, and using instant messages as much as their male peers. The stereotypes, while they still exist, do not seem to be as strong as they once were. Both girls and boys thought of computer users as smart, good in math and science, and able to interact with others. IT career options will expand through further encouragement of a hands-on learning environment that builds on the knowledge and

experience base of the girls and provides equal access to computers for both girls and boys.

In order to satisfy the growing need for IT workers and expand women's participation in the field, it is important that we examine the experiences of those who have entered and excelled in reaching high levels of responsibility. This study helps us understand the role self-authorship and other factors play in successful IT women's career paths.

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Table 1

## Demographic Characteristics of the Participants as Adults

Name	College Degrees		Age	Children	Position
	BA/BS	Graduate			
Melissa	Journalism	None	29	0	CEO
April	Business	None	36	0	Chief technology architect
Vicki	Engineering	None	40	0	CEO
Martha	Math	MS; PhD	51	2	CEO
Lisa	Engineering	MBA	53	3	Senior VP
Pat	English & Journalism	None	60	2	CEO

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