Transitional Patterns of Adolescent Females in Non-traditional Career Paths

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ABSTRACT

In this study, focus groups (n = 13) were utilized to examine the factors that affected the career decision-making of adolescent females and young women in undergraduate science, engineering, and technology programs. The 51 participants included students from colleges, technical institutes, and universities in Alberta. Qualitative analysis (cf. Vaughn, Schumm, & Sinagub, 1996) was used to uncover seven themes: (a) transition from high school, (b) educational influences, (c) family influences, (d) academic issues, (e) coursework management, (f) gender issues, and (g) creating a successful student environment. Implications for career development theory, education, counselling, and for future research are discussed.

RÉSUMÉ

Dans cette étude, les auteurs ont observé des groupes de réflexion (n = 13) afin de déterminer les facteurs influençant le choix de carrière des adolescentes et jeunes femmes suivant des programmes universitaires de premier cycle de sciences, d'ingénierie et de technologie. Les 51 participants comprenaient des étudiantes inscrites dans des collèges, des instituts techniques et des universités d'Alberta. Les auteurs ont pu identifier, grâce à l'analyse qualitative, (voir Vaughn, Schumm et Sinagub, 1996) sept thèmes : (a) transition à partir de l'école secondaire, (b) influences éducatives, (c) influences familiales, (d) questions sociales, (e) gestion des devoirs, (f) questions liées aux différences entre les sexes et (g) création d'un milieu favorable au succès scolaire. Finalement, cet article discute des implications découlant de cette étude pour la théorie du perfectionnement professionnel, l'éducation, le counseling et pour les recherches futures.

Many factors are involved in career choice. The environment, the influence of parents, teachers, and peers, sex-role socialization, and heredity combine to shape attitudes toward certain occupational choices. The reality of those choices

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is then tested by experience. The career decision-making process may be different for adolescent females and young women, as factors such as their perception of combining career and family roles are additional elements in their consideration of different career options (Fitzgerald, Fassinger, & Betz, 1995). For some women, the choice of a non-traditional occupational field, such as science, confronts them with obstacles such as sexism (Kahle, 1996; Vetter, 1996). This study examined the factors affecting the career decision making of women in undergraduate science, engineering, and technology programs.

Relevance and Implications of the Study

The continued dearth of women in science, engineering, and technology requires further examination for several reasons. There is a general decline in the total number of students selecting science majors in the United States, yet there was an estimated 27% increase in the number of science-based jobs and a 36% increase in the number of jobs requiring significant math background by the year 2000 (Betz, 1997). The sciences have the highest defection rates of any undergraduate major and the lowest rates of recruitment from other fields (Betz, 1997). Previous Canadian studies have found similar patterns (Industry, Science, & Technology Canada, 1991). Betz (1997) stressed the importance of the participation of women and minorities in the sciences as they are potential sources of additional scientific talent.

Given the differential impact of home/family issues (Altman, 1997; Astin & Sax, 1996), internalized sex role stereotyping, and elimination of certain career choices (e.g., Betz, 1997), there is a need for further research. Inquiry into the complex nature of women's career decision making in science without diverting attention to a gender comparison is the focus of this study. Studies such as the one reported here still need to be done in Canada to determine the unique experience of women studying at Canadian postsecondary institutions, as much of the previous work has been conducted with males and primarily in the United States.

An examination of the themes and issues which play a paramount role in young women's decision to pursue a career in the sciences and engineering could lead to a better understanding of how to encourage more young women to pursue these fields, to determine what obstacles exist, and the options to overcome them. This, in turn, may lead to changes in educational policy. Findings may have implications for vocational guidance approaches for women, the promotion of science courses at the high school level, and accessibility to programs by women at the postsecondary level.

Theoretical Approach

Super's (1981, 1990, 1994) theory of vocational development and choice was used as the basis of this study of young women's career choices in science-related fields as the study takes a life-span approach to the implementation of the self-concept in an occupation. Within Super's concept of life stages, high school students are likely still in the *exploration* phase, during which they are tentatively

reviewing their needs, interests, competencies, values, and opportunities, and doing some initial field selection. During the transition from high school to university (18 to 21 years of age), reality is given greater weight in decision making. Individual competencies, strengths, and weaknesses are taken into account as professional education and labour market requirements are considered. A generalized field selection is converted to a specific career choice.

The purpose of this study was to answer three questions which have implications for the transition from high school to postsecondary education, and from the student to the working role:

1. What encourages the entry and persistence of young women in undergraduate science, engineering, and technology programs?
2. What prevents highly capable young women from completing their undergraduate science, engineering, and technology programs?
3. What implications are there for women's career development theory, for vocational guidance, and for decision makers in education and government policy?

METHOD

Participants

Participants were female university students recruited from second- to fourth-year science and engineering programs from various postsecondary institutions in Alberta. The institutions selected for data collection included a large university (with approximately 30,000 students) in a major city, a small university (with approximately 5,000 students) in a small city, a technical institute in a major city, a university college in a town near a large city, and a community college in a rural setting. Institutions were selected on the basis of geographic diversity and the mixture of different levels of academic programming. Instructors at the respective institutions asked interested students to provide their name and phone number to the primary researcher and to select the dates and times at which they were available to participate in a focus group. The intention of these groups was to discuss the career choices these students had made. Focus groups of approximately five to eight women were organized from this information and participants were contacted to inform them of their session.

A total of 51 women participated and focus groups were attended by one to ten participants per session. Participants came from a range of fields, including agriculture, biochemistry, biology, chemistry, computer science, engineering, environmental science, forestry, microbiology, neuroscience, physics, pre-pharmacy, and technology. Although most students were in their first postsecondary program and were in a program they entered directly from high school, the age range was quite broad with students ranging in age from late adolescence through to middle adulthood. The sample included mature students returning to postsecondary studies after several years in the workforce, now in pursuit of a career change. Five of the women indicated that they were married, and five indicated that they had children (not a direct overlap).

Procedure

Focus groups (n = 13) were held in conference room and classroom settings at the respective postsecondary institutions and ranged in length from 45 to 75 minutes. Two to five focus groups were held at each postsecondary institution for additional breadth of coverage and to observe the expected saturation of occurring themes. Each session was led by either a male-female or female-female co-facilitating dyad from the research team.

The focus groups were semistructured and guide questions were used that had been developed based on the literature on career development theory and adolescent development. The participants were not limited to discussing the issues targeted by the guide questions; they were free to digress from the guide questions and discuss issues that were important to their own career development. The focus group sessions were audio recorded and then later transcribed verbatim by a professional dictatypist. Transcripts were later reviewed for accuracy.

Data analysis

Prior to the data analysis, each focus group transcript was reviewed in detail several times by the first author and a colleague. At first, rudimentary themes were identified based on the guide questions asked of participants, e.g., "role of guidance counsellors," "educational obstacles to participation in science," "being female in my field of study." Participants' quotes were grouped according to these themes and significant ideas and phrases were noted.

Following these initial steps, data analysis was guided by the procedure outlined by Vaughn, Schumm, and Sinagub (1996). Vaughn et al. describe their procedure as an adaptation of two qualitative approaches that is useful for research in education and psychology: the Constant Comparative Method (Glaser & Strauss, 1967; cited in Vaughn et al., 1996), in which a continual process of comparison and revision of categories of data is undertaken until satisfactory closure is achieved, and naturalistic inquiry (Lincoln & Guba, 1985; cited in Vaughn et al., 1996) which unobtrusively studies real-world situations as they unfold naturally, with a lack of predetermined constraints on outcomes.

RESULTS

Seven themes resulted from the data analysis: (a) Transition from High School, (b) Educational Influences, (c) Family and Community Influences, (d) Academic Issues, (e) Coursework Management, (f) Gender Issues, and (g) Creating a Successful Student Environment. Each will be briefly discussed below in relation to the transition experienced by young women when they move from secondary to postsecondary education.

Transition from High School

A prominent overarching theme in the experience of participants' studying in science, engineering, and technology is that the transition from high school

into a postsecondary program has greatly affected their career decision making. Prominent sub-themes of discussion in the focus groups emerged in the data analysis. These included participants' choice of college versus university, cultural changes experienced as a result of pursuing a postsecondary education, the adjustment to the academic lifestyle and the consequential independence and responsibility for one's own progress, and the academic challenges that coincide with being launched into a postsecondary area of study.

Educational Influences

Educational influences were shown to have a major impact on participants' decisions to pursue a science-related field. High school teachers, postsecondary professors or instructors, teaching assistants (TAs), and guidance counsellors/ academic advisors were frequently cited as having been key factors which either encouraged or discouraged participants from continuing in their respective programs. For example, most participants described their high school and postsecondary instructors as being inspiring and encouraging, and that these instructors were approachable, knowledgeable regarding career options, and made the course material interesting and fun. In contrast, most comments about high school guidance counsellors were negative, as many participants indicated that the counsellor was either inaccessible, or biased for or against specific career options for them.

Family and Community Influences

Participants frequently mentioned the important influence of family members and others in their personal lives, on their decision to pursue a science-related field. Parents seemed to have the most influence on shaping participants' choices. For example, many participants had parents who encouraged them to pursue a science career and several of these parents were working in the same field. Fathers were the main career influence for many participants. For others, their parents' influence involved pressure to enter a specific, high status career such as medicine. Siblings, peers, extended family, and community members appeared to have considerably less influence.

Academic Issues

Academic factors, both at high school and postsecondary levels, were important to participants' career decision-making. Participants talked at length about the reasons for entering their area of specialization, such as their interest and academic strength in science, and the challenge and variety it can offer. Course scheduling and program requirements influenced their career development, including limitations encountered with prerequisites; courses and labs scheduled at inconvenient (late) hours; imbalances of course offerings over the academic school year; and the impact of coursework (continuity and transferability) on subsequent career options. They also discussed the following: (a) their dislike of the competitiveness of peers completing pre-professional requirements and its negative impact on

programs; (b) how mounting tuition costs and reduced scholarship monies are affecting their ability to persist in their programs; (c) the importance of being able to apply what is learned in school to the "real world" of work; and (d) the outlook for success for employment once they graduate. Many participants saw their education as a 'means to an end' which would directly link them to a job, but seemed to be frustrated with how much of their limited money and time was going toward seemingly non-applicable coursework, e.g., humanities, electives.

Coursework Management

Participants described very heavy courseloads in their programs. The skills learned in facilitating the management of their coursework had a major influence on the kind of experience they had as a female student in a science-related field. These included: learning efficient time management; developing academic coping skills (e.g., group work); meeting academic work requirements; and developing study skills. Time management, as well as learning how to study effectively alone and/or in a group, were important skills that had to be learned early on in the participants' academic program in order to meet the heavy program demands. Participants also described having much heavier courseloads than they were used to in high school and having to get used to the initially uncomfortable necessity of approaching their instructors for help.

Gender Issues

Participants shared a variety of opinions about how gender-related issues had influenced their coursework and career decision making. A large number indicated they were not treated differently by professors and instructors in their area of study or in their work terms because of their gender. Many of these participants were in programs with high proportions of women. Some of the women believed their gender may even be advantageous, given employment equity programs in the workforce. Unfortunately, many difficulties were described that participants attributed to their gender. Some participants worked with men (and sometimes women) who appeared to believe that women are not as capable in science as men, or with women who take on a more masculine stance in order to fit into a male-dominated field.

Creating a Successful Student Environment

Participants stressed the importance of creating a successful student environment that fosters academic excellence. Some students saw their living arrangements as a major contributor to creating a good learning environment. Others the support of spouses and relatives was critical, being able to finance their studies without having to maintain extensive commitments to part-time jobs, and being able to balance family and educational responsibilities. Ultimately, a successful student environment was viewed as including personal and social factors that go beyond the educational program.

CONCLUSION

The findings of this study highlight several factors that both encouraged and discouraged female adolescents and young adults to enter and persist in science-related programs. Consequently, the findings have implications for education and guidance counselling at the secondary and postsecondary levels that will enable us to better assist young women in this transitional period.

Factors Encouraging the Entry and Persistence of Women in Science

Participants described many helpful aspects of their experience that contributed to their persistence in their science program. Several women indicated that they developed time management skills early in their program which have positively impacted on their academic performance. The development of academic coping skills, including the establishment of peer support networks and working groups was considered fundamental to their academic success. Many women indicated that their decision to enter a science-related field was based on their academic interests and/or strengths in high school and early postsecondary study.

Many non-academic factors influenced the creation of a successful student environment and contributed to participants' career decision-making process. Several students altered their living arrangements, either moving into a residence hall, moving into an apartment, or moving out of their home town/city to create a better learning environment. In addition, having a personal support network consisting of family, spouses, and friends both in and outside of their program was important in coping with the stresses of their academic demands. This supports the findings of previous studies (e.g., Berkowitz, 1993).

Influential individuals in educational and personal networks were prominent in participants' decisions to pursue a career in science. At the high school level, teachers and guidance counsellors were described as having the most influence on students to pursue or avoid further study in science, as described by other authors (e.g., Betz, 1997; Morse, 1995). Participants indicated that they sought and often found approachable, encouraging, knowledgeable, and caring teachers. At the postsecondary level, professors/instructors were seen as very influential, and individuals appreciated professors who again were approachable, helpful, encouraging, and interesting. This was especially true among rural students and those in college programs who are used to one-on-one attention from instructors and feeling connected within small programs.

Personal factors were also influential in participants' career choices. Family members were most important, especially parents, in their decision to pursue a science field (Altman, 1997). Parents were mostly described as encouraging, but some parents insisted their daughter pursue a certain field that they had chosen for them. Siblings, peers, and the community were influential to a lesser degree.

Obstacles for Adolescent Females Studying Science

Participants emphasized the significance of negative experiences in their undergraduate science-related programs and mentioned how these experiences

have affected their attitudes and their subsequent decisions about pursuing a career in science. Many discussed experiences of difficult transitions from high school to postsecondary study where they felt intimidated by the much larger campus and classrooms. Several students, particularly those from smaller communities, indicated that they chose to attend a smaller and "friendlier" postsecondary institution in their own home community as a preliminary step to attending a university in a larger city. These young women often described themselves as happy with their decision and encouraged other women to attend smaller postsecondary institutions prior to attending a large university.

Not surprisingly, participants often spoke of being challenged with a much heavier course load when comparing their postsecondary studies to their high school experience. Many also noticed a subsequent drop in their academic performance. Their response to these lower grades varied greatly: Some students chose to switch majors, some switched academic institutions, while others learned to adjust their expectations and to take a more proactive approach by seeking the assistance they needed from professors and instructors. Some individuals expressed their disapproval of the competitive nature of their programs, often caused by pre-med requirements and other highly competitive programs, and indicated a desire for more fostering of cooperative relationships with other students, factors previously discussed in the literature on women in science (Astin & Sax, 1996).

Many individuals were dissatisfied with the guidance counselling they received or had access to in high school. Guidance counsellors were able to give practical advice about program requirements and timetable planning, but offered little career guidance and often favoured particular career choices. In many cases, the participants did not agree on the career recommended by the guidance counsellor and some found that their guidance counsellor actually discouraged them from pursuing the science-related field that interested them. They expressed concern particularly with the guidance counselling provided to young women interested in science. They indicated that gender biases were apparent and irritating.

Implications and Future Directions for Research

Implications for career development theory. The findings of this study about the experience of women in nontraditional undergraduate programs (science, engineering, and technology) are relevant to a better understanding of the career development of women in science. Socioeconomic status was shown to be very important in women's career development in science. Participants reported holding entrance scholarships that expired after their first year of postsecondary study. As a consequence, lack of funding to help with mounting tuition costs and living expenses was seen by many participants as a potential obstacle to their continuation in postsecondary studies. In examining an individual's career development, it is important to consider socioeconomic status as a variable that can deter potentially successful young scientists from entering or completing a

degree or diploma. Super (1990) and Krumboltz (1979) both emphasized the importance of the individual's environment on subsequent career development, including the role of socioeconomic status and state of the economy/labour market. Findings in the present study highlighted the relevance of factors such as steadily increasing tuition and an unstable labour market on women's career development in science.

Results of this study support Super's (1981, 1990, 1994) theory of career development. Almost all participants were in the exploration stage, between the ages of 15 and 25. Many of the participants explained that they did not appreciate being forced into making career choices that they were not ready to make, which concurs with Super's assertion that adolescents and young adults are often not ready to make definite career choices until their mid-twenties.

Implications for education. The findings of this research also have implications at all levels of the educational continuum. During elementary school, girls should be given opportunities to learn about a wide range of career opportunities, including careers in science and engineering, through exposure to good female role models, both in the classroom and in textbooks (Blaisdell, 1995). To create a lasting interest in science and math, we need to have more scientists working with teachers to make science and math exciting (Eccles, 1997). In her research on middle schools, Eccles found that hands-on instruction and the opportunity to work on real problems were helpful in encouraging girls' development in these areas. Girls must come to view math and science as tools to be used interdisciplinarily, to recognize the relevance of having this knowledge, and to see why it is important to take these courses in high school.

In the current study, the researchers also found that high school and post-secondary students value hands-on approaches to learning math and science. Many participants described themselves as having wanted more hands-on experience than they were provided with in high school or in their current undergraduate program. Opportunities for job shadowing and interviewing professionals in the field are other means of gaining practical and tangible information about a career choice. They can provide students with a more accurate perspective of the day-to-day responsibilities of the professional and may confirm or disconfirm the students' interest in that particular career field. Career investigation requirements in technical programs were seen as one example of how this might be accomplished.

The results of the present study suggest that there is more work to be done so that teacher education will reflect gender sensitivity and a 'female-friendly' approach to science education. It is crucial that both teachers and professors maintain an "approachable" stance so that students are comfortable asking for the one-on-one assistance that many participants have indicated was a helpful part of their experience. Other aspects of creating a female-friendly educational environment include minimizing the often-competitive climate in science undergraduate programs. Participants indicated they desired less grading on a curve and more collaborative educational approaches (Astin & Sax, 1996; Eccles, 1997).

Finally, the need for science and engineering programs to accommodate more than the studying role (e.g., home/family, working) through greater flexibility of course offerings and timetabling would help eliminate some obstacles for women (Blaisdell, 1995).

The transition between high school and postsecondary education has been a particularly difficult process for many first-year postsecondary students. Several measures can be taken to alleviate the stress of going through such a major transition. Firstly, to meet the career planning needs of high school students, guidance counsellors need to provide information regarding the process of applying to and registering in postsecondary programs. Secondly, the creation of a support network such as a mentorship program for new postsecondary students is an excellent way to help students adjust to their new surroundings and create a social network. This would seem especially helpful for students who are away from their family and other support systems in their community. A third way of easing the transition into postsecondary studies from an academic standpoint is to increase the emphasis on developing study skills and time management skills. Students should be encouraged to take advantage of the academic support services that are usually offered through their institutions.

Implications for counselling. Closely associated with the implications for young women's education in nontraditional fields are the implications for counselling that arose from this study. Students' interactions with guidance counsellors and academic advisors had a major impact on their attitudes toward science. In many cases, the guidance counselling received was described as inadequate or inappropriately biased towards or away from certain career choices, including science, engineering, and technology fields.

Guidance counsellors may benefit from an increased occupational knowledge base and a greater knowledge of career development theory. According to Super (1990), high school and undergraduate education usually takes place during the exploration stage of career development. During this period, students are learning more about their abilities and interests and should be exploring diverse occupational options. Guidance counsellors may then wish to encourage students to explore various careers rather than attempt to narrow them down into a single career choice. Academic advising was mentioned as problematic in scenarios where the same advisors tried to accommodate students from every faculty on campus. Academic advisors who can specialize in certain faculties may be more knowledgeable and helpful to students with specific questions regarding their program.

Directions for further research. The present study has revealed many factors important to women's career decision making in nontraditional fields that have not been prominant in the literature (e.g., the transition from high school to postsecondary studies). New insights into young women's undergraduate experience in science, engineering, and technology reinforce other researchers' calls for more qualitative research into the nature of their experiences in courses and majors (Astin & Sax, 1996).

One area of inquiry needing further investigation is the role of student-faculty interaction and how it impacts on students' educational development. A second area for future research is an examination of students' financial circumstances and the effect on academic success. With more and more students needing to find at least a part-time job to supplement their educational and living costs, there is a need to examine how working while in university, career-related or not, affects academic success (Astin & Sax, 1996). Another area for future research is an examination of cross-cultural issues and their effect on women's decisions to pursue science, engineering, and technology.

The current study utilized focus groups for collecting data on the career decision making of adolescent females in nontraditional fields. Future research may benefit from the use of in-depth, phenomenological individual interviews with a small number of participants in order to gain greater insight into the experience of becoming and being an undergraduate woman studying in science, engineering, or technology. This different qualitative approach may reveal different aspects of the student's experience that might not be discussed in a focus group setting.

There is more work to be done to understand the complexities of how to encourage more young women to choose and remain in a science, engineering, or technology career. Despite significant effort, women are still underrepresented in many majors and in the corresponding high-demand, high-pay occupations. In order for research and practice in these fields to be fully informed, it is necessary for women to become more involved in science, in education and industry. A larger presence of talented women in these areas is needed as we enter the 21st century, where the demand for scientists, engineers, and technologists can only increase.

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