GENDER DIFFERENCES IN JUNIOR HIGH SCHOOL STUDENTS TOWARDS FUTURE PLANS AND CAREER CHOICES

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ABSTRACT

A research project is underway at the University of Calgary to investigate the personal and educational factors that contribute to junior and senior high school participation and high achievement in the sciences for both males and females. In addition, the study will identify the factors that most directly contribute to decisions on the part of males and particularly females to pursue programs and careers in science and related disciplines, and will explore roots of differences and similarities for males and females in early decisions about adult life-role and career choices.

The first phase of the project is utilizing an adapted version of the Eccles Michigan Study of Life Transitions Questionnaire (MSALTQ), which is based on a theoretical model that has been developed and validated in the mathematics area. The adapted questionnaire includes questions relating to science and computers to investigate the sources that contribute to the dynamic interaction of achievement-related decisions and participation in science activities and careers. Using this approach, the key sociological and psychological influences on students' choices for particular activities, courses and careers in the sciences can be determined. In the first phase of the study, an initial sample of approximately 1,000 Grade 7 and 1,000 Grade 10 students have been identified and are being administered the adapted questionnaire. This paper is based on data already collected on approximately 600 of the initial sample of Grade 7 students.

A first analysis of the results will be presented and will focus on questions about computers, questions about the students' futures and their career choices, as well as questions about perceptions of adult roles in society. The results will discuss the similarities and differences between the males and females in the Grade 7 student sample.

INTRODUCTION

Education, business, industry and science professionals have expressed major concerns about the underutilization of personnel, particularly females, in careers dependent on science expertise. Concerns are twofold: First, there is a growing recognition that future economic prosperity and global competition depends on our scientific progress and our adaptability in the fields of science, technology and engineering. These fields are clearly linked to national-level growth and change and serve to drive and dominate social and economic trends (Sheriff & Svenne, 1993). Second, our society is presently experiencing a technological shift from a resource-intensive to a knowledge-intensive economy and it is critical that all citizens have the knowledge and skills to contribute positively to the continued prosperity of our country. As we progress toward the "information age" leading educators warn that society can no longer be complacent about the development of the learning potential of any of our students (Keating, 1996), and schools can no longer be indifferent about what kinds of living and working await their students when they make the transition to the adult world (Hargreaves & Fullan, 1998).

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Knowledge of mathematics and the sciences is an essential prerequisite in the pursuit of high-status and well-paid jobs in a technologically advanced workforce. However, there is increasing evidence that this kind of expertise will not keep pace with the demands anticipated in the 21st century. For example, recent data reveal that graduate enrollments in the natural sciences and engineering have been leveling off in terms of studies of post-secondary program selection, and adult career choice, along with a significant under-representation of females in fields like engineering (CCPE, 1998). Moreover, long term studies of gifted females and other subgroups of "hidden gifted" indicate that the potential of many students, male and female may be significantly under-developed (Kerr, 1994; Lupart & Barva, 1998; Lupart & Pyryt, 1996; Subotnik & Arnold, 1995). Contemporary research has suggested that the roots of these adult life-role and career choice disparities may be formed in the junior and senior high school years (Eccles, 1994; Eccles et al., 1993).

In order to better understand these issues, and to provide the necessary information to develop targeted intervention strategies, a research program is now underway at the University of Calgary to investigate the relation between school culture, socialization, ability, gender and values and the relative degree of influence on adolescent student choice in courses, programs, activities in general, and in science and technology specifically. This is a three year project of which the first phase is the administration of a survey to over 2,000 male and female students in Grades 7 and 10 in the Calgary region. This questionnaire is a modified version of an instrument developed by Eccles over a twenty-year period, and is based on the Eccles model on achievement-related choices in education and career decision making**.**

The focus of this paper is to present some preliminary findings for a subset of 600 Grade 7 students who participated in the survey in February to April, 2000. The focus areas are computer usage and preference, important characteristics of future career, future plans, career choices and perceptions of adult roles in society.

Eccles' Model of Achievement-related Choices in Education and Career Decision Making

Traditional studies to address the under-representation of females in science and math-related careers have approached the problem from a deficit model. Accordingly, the under-representation of gifted females in the sciences has been widely attributed to a number of internal and external barriers (Kerr, 1994). Moreover, traditional theories on the nature and process of career choice and development over the life span have been focused primarily on the career development of men and have similarly been limited to paid work as indicative of career achievement (Hashizume & Crozier, 1994). However, the past fifteen years have seen the rapid growth of a lively new field of gender-roles and achievement studies that attempt to address the unique personal values of females, their sense of connection and the interrelatedness and interdependence of multiple life-role development and choices (Belenky et al., 1986; Eccles, 1994; Gilligan, 1982). The extensive work of Eccles and her colleagues has particular relevance for the study of educational and vocational choices in the mathematics/science domains. The Achievement-Choice Model (Eccles, 1985, 1986a, 1986b, 1987, 1994; Eccles & Jacobs, 1986) features the interrelationship of psychological factors and social factors and their impact on student enrollment in programs and courses, and achievement-related decisions. The model is shown in Figure 1.

Expectations for success and subjective task value within a particular field of study or work are the central constructs of this model. Accordingly, these constructs are hypothesized to most directly influence achievement behaviors and to mediate the influence of all related constructs. The model proposes that expectancy for success is affected by the individual's specific beliefs and interpretations of ability, aptitude, the tasks and past events. Everyday choices such as what courses to pursue, and how much effort to allocate to a specific task may be consciously or unconsciously determined. In turn, these choices are directly or indirectly influenced by attitudes, interests, sex-role stereotyping, and self-concept. Values are mediated by the person's goals, self-schemata, perceptions of needs, role identity, and input of significant others. This interactive framework emphasizes that each of the psychological variables, and their determining factors, are shaped by social forces and cultural conditioning.

The Eccles Model is unique in comparison to previous models for understanding gender differences in educational and vocational decision-making. Based on studies spanning more that twenty years, Eccles and her colleagues have attempted to synthesize what is known about decision-making, achievement theory and attribution theory to bring to the literature, a gender-neutral, integrative framework to guide research in the area of achievement -related choices.

Importantly, Eccles (1994), points out that definitions of achievement have characteristically been based upon male standards, while neglecting or devaluing the achievements more typical of females. Consequently, information on female issues, values, perceptions of achievement and life-role choices is extremely limited. Developed as an alternative approach to help bridge this information gap, instead of posing the traditional research question "How are

females different from males?", Eccles model takes us to a new level of inquiry by posing the question "What influences male and female achievement behavior?" Using this framework, some initial work has been carried out by Eccles and her colleagues at the junior high and high school level, however, there has been minimal replication of this work in Canadian research literature.

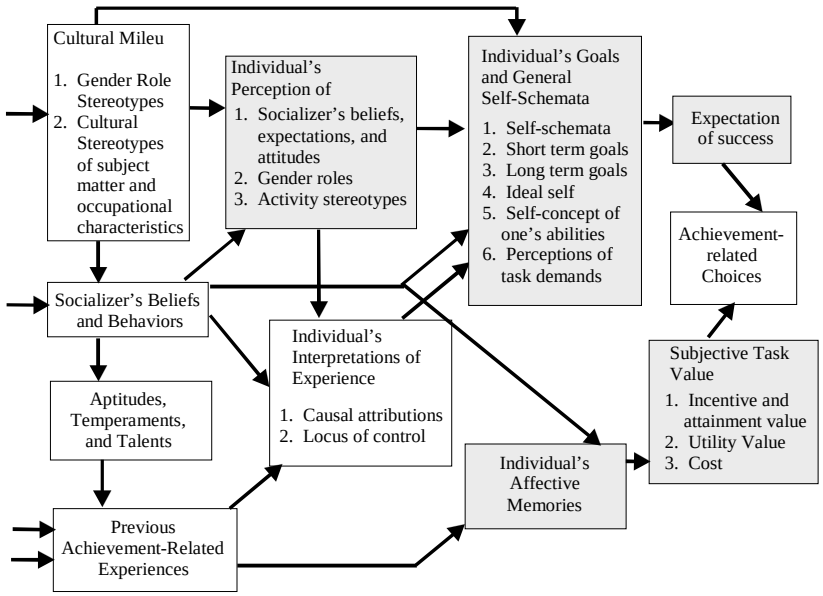

FIGURE 1: ECCLES' MODEL OF ACHIEVEMENT-RELATED CHOICES IN EDUCATION AND CAREER DECISION MAKING (ECCLES, 1985)

Thus, the objective of the current research project is to apply the Eccles framework to determine whether it is the case that the roots of the well-documented educational and vocational differences of men and women and the sciences can be linked to the institutional, and differing psychological and sociological influences in the choices of adolescent boys and girls in Canadian schools. Given the complexity of the model, five specific areas have been targeted and are highlighted in Figure 1. These areas were selected because of the interest in determining how the more immediate factors contribute to adult life role and career choices. In addition, our own previous work has indicated the strong links between student achievement in the sciences and personal support networks (Blair & Lupart, 1996). For this reason, we include the examination of parental, educator, and school counsellor influence in adolescent student achievement-related choices in the research project

To accomplish the above, the three year research project was subdivided into three phases, namely (i) a survey (based on the Eccles Michigan Study of Life Transitions Questionnaire - MSALTQ) of over 2,000 males and females in Grades 7 and 10 and the correlation of the students' answers to achievement data, (ii) a longitudinal component whereby 100 Grade 7, and 100 Grade 10, males and females would be tracked, through interviews and achievement data, for a three year period, and (iii) interviews with parents, teachers and guidance counselors. The methodology and some preliminary results for a sub-sample of the Grade 7 students from Phase I will be presented in the following sections.

DATA COLLECTION AND METHODOLOGY

Grade 7 and 10 schools in Calgary, and the surrounding area, were identified for participation in the research project. These schools were selected to give representation across different socio-economic strata and also to provide representation between rural and urban schools. The high schools were selected first, and then junior high schools that fed into these schools, were approached to seek their participation. In total, four school boards are participating in the project, two rural (Rocky View and Foothills) and two urban (Calgary Public and Calgary Catholic) and there are a total of 27 junior high schools and 14 senior high schools. From these schools, parents of over 6,000 students were sent information and release forms. The positive response rate is approximately 40% with a balance between males and females.

Students with permission to participate in the project were given a 45-minute survey which was conducted during class time. Data collection is ongoing, and to date, approximately 850 surveys have been administered. The survey consists of 209 questions and contains the following sections (i) background information (e.g. family status, parental education, language spoken at home), (ii) general (e.g. about schoolwork, leadership interests, self-esteem), (iii) relationship with mother and/or father, (iv) interest and value of math, science and English, (v) computer usage and interest, (vi) future plans and career choices, (v) adult roles in society, (vi) friends, and (vii) family attachment. Most of the questions had responses that used a five point scale (typically ranging from strongly disagree to strongly agree), which were then coded to scores of 1 (strongly disagree) to 5 (strongly agree).

This paper will focus on a subset of the sample, namely 585 Grade 7 students. Of this sample, 301 (51%) are female and 284 (49%) are male. In addition, 418 (71%) are from Calgary (urban) with the remaining 168 (29%) from rural areas surrounding Calgary. For this paper, comparisons will only be done between males and females, such that the urban and rural students will be considered together. Gender comparisons will be done for the variables of interest using a t-test of significance. The t-test evaluates the mean scores (value between 1 and 5) for the male and female groups. A statistically significant t-test indicates that there is a significant difference between the average score of the responses of males and the females in the sample. This will be indicated in the relevant table with an asterisk. A 'greater than' (>) or 'less than' (<) symbol will also be used to indicate if the mean score of the female group is less than or greater than the mean score of the males.

RESULTS AND ANALYSIS

Computers

The survey contained 11 questions relating to computer usage and affinity. The motivation for posing these questions was to assess the level of interest students had in computers and to eventually relate this to science and math interests as well as future career selection.

Interestingly, about 94% of the students responded that they, or their family, owned a computer, compared to 45% of Canadian households reporting having a computer in 1998 (http://www.statcan.ca/Daily/English/991213/d991213a.htm). This difference may be due to the dramatic decreases in computer costs and also a tendency for families with children to purchase a computer for educational purposes. There was no significant difference between the males and females in terms of computer ownership. About 65% of the females reported using a computer for the first time when they were between the ages of 6 and 10, while 59% of the males started between those ages. Of the females, 28% started using computers when they were five or under, compared to 34% of the males. Overall, there was no significant difference between the ages of when the two groups started using computers. This may be due to the fact that most of the homes have computers, and not surprisingly, 50% of the females and males responded that they first used a computer at home. The second most frequent first experience with a computer was at school, with 38% of the females and 27% of males selecting this response.

Table 1 shows the responses to questions regarding perceived ability when using a computer and the affinity students have for computers in general. The results show that both the males and females like computers since they have mean scores of 4.26 and 4.62, respectively, which means on average they agree to strongly agree. However, the results also show that there is a significant difference between the males and females, with the male students liking computers significantly more than the females. This trend also carries over to their perceived ability with computers. The females, on average, agree that they are good at doing things on computers, but their mean score is significantly lower than that for the males. This is an interesting finding and warrants further investigation, as well as comparison with the Grade 10 sample.

TABLE 1. PERCEIVED ABILITY IN, AND AFFINITY FOR, COMPUTERS (N=585)

Perceived ability in, and affinity for, computers:	Female Students		Male Students	
I like computers	4.26	<	4.62	*
I am good at doing things on the computer	3.99	<	4.38	*

* Values are significantly different for male and female students ($p<.01$)
Values range from 1 (strongly disagree) to 5 (strongly agree).

In terms of computer usage, Figure 2 shows the responses for the males and females in terms of the number of minutes per day that they used computers. As can be seen, about 35% of the males use computers for more than one hour per day. The students were not asked where they use the computer (e.g. at home or school). When coding the responses to values between 1 and 5 (1 meaning less than 15 minutes per day and 5 meaning more than 1 hour per day), the mean response for the males is 3.39 compared to 2.73 for the females, which is statistically significant. It can therefore be concluded that in this sample of Grade 7 students, the males utilize computers significantly more than their female counterparts.

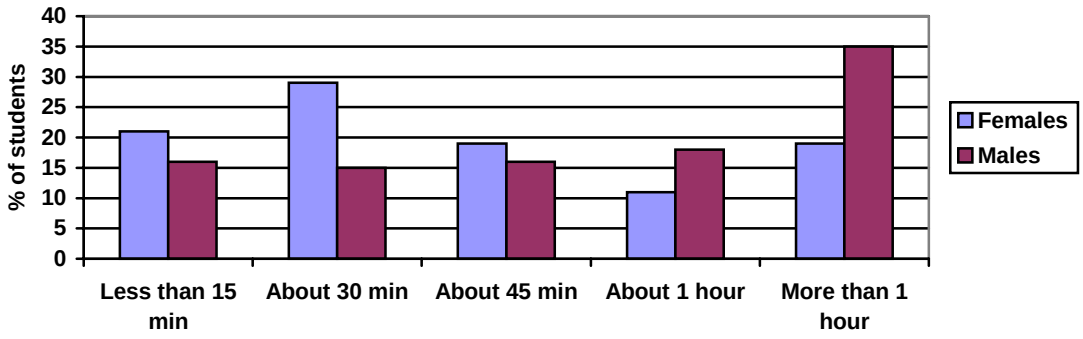

FIGURE 2. COMPUTER USAGE PER DAY (N=585)

The acitivities performed when using computers is important to assess the relative importance and value placed on the computer. In that context, students were asked to rate a number of activities for the amount of time they spend on it. Table 2 shows the results for each activity. As can be seen, the highest scores for both males and females is playing games, with a mean score of 3.01 for females (which translates to about half of the time playing computer games) to 3.75 for males (which translates to almost more than half of the time). Although it is clear that all of the students enjoy playing computer games, there is a difference between the males and females, with the males playing computer games significantly more than the females.

TABLE 2. TIME SPENT ON COMPUTER ACTIVITES (N=585)

When you are on a computer, how much time do you spend doing each of the following activities?	Female Students		Male Students	
Email	2.35	>	2.07	*
Surfing the 'net	2.54	<	2.82	*
Assignments/work on the computer	2.90		2.72	
Programming	1.50	<	2.15	*
Playing games	3.01	<	3.75	*

* Values are significantly different for male and female students ($p<.01$)
Values: 1=none of the time; 2=less than half the time; 3=half of the time; 4=more than half of the time; 5= all of the time.

For the females, the second most popular activity is using the computer for assignments/work. For the males, the second most popular activity is surfing the net, followed by assignments/work. The relatively high score for assignments/work is not that surprising given the relatively high percentage of students who started using computers at school. Email was used by the females significantly more than the males, and this may be due to the value placed on the computer to allow communication with friends and family members.

Overall, the results reinforce the generally held belief that the students are integrating computer technology into their school and home lives.

Future Career Characteristics and Plans

Previous research conducted on engineering students (Wallace et al., 1999), showed that female engineering students had some different perceptions about important characteristics of a future job. Specifically, the female

engineering students rated the ability to contribute to society significantly higher than their male counterparts, while the male engineering students rated 'to be paid well' significantly higher than the females.

Similar questions were posed to the Grade 7 students and the reponses are shown in Table 3. In this case, the males rated 'earning a great of money' and 'high status in society' as important for a future job that they would like. However, it should be noted that both of the groups of students rated this as being important as shown by the average response scores. The results of the 'earning a great deal of money' are consistent with Wallace et al. (1999).

Both the males and females felt that working on challenging projects and learning new skills and new things were important for a future job that they would like. In addition, they both felt equally strong about having a job that provides an opportunity to make the world a better place, and also a job that gives them the ability to combine career and family. This last point is interesting as it suggests that both the males and females are concerned about their futures and balance between work and family.

TABLE 3. IMPORTANCE OF CHARACTERISTICS FOR FUTURE CAREER CHOICES (N=585)

In the future, I would like a job that:	Female Students		Male Students	
Allows me to earn a great deal of money	4.20	<	4.49	*
Has high status in society	3.91	<	4.21	*
Provides enough money to support me and my family	4.59		4.71	
Gives me a chance to work on challenging projects	4.13		4.12	
Allows me to be my own boss most of the time	3.81		4.00	
Gives me a chance to learn new skills and new things	4.25		4.25	
Gives me an opportunity to make the world a better place	4.21		4.06	
Gives me the ability to combine career and family	4.13		4.09	

* Values are significantly different for male and female students ($p<.01$)
Values range from 1 (strongly disagree) to 5 (strongly agree).

Questions were posed to the students about their future educational and family plans and the results are given in Table 4. Both the males and females felt that it was likely that they would finish high school then go to university or college, although a significantly higher number of female students felt it was likely. Similarly, significantly more females thought it likely that they will do more than one university degree. The higher interest in post-secondary education by the females is consistent with the trend of increased representation of women in university programs, and this may suggest that the trend may continue (http://www.statcan.ca/english/Pgdb/People/Education/educ03b.htm).

TABLE 4. FUTURE PLANS (N=585)

As things stand now, it is likely that I will:	Female Students		Male Students	
Finish high school, then go on to University or College	4.63	>	4.45	*
Do more than one University degree (e.g. Master's, PhD, become a medical doctor, lawyer)	3.95	>	3.66	*
Get married	4.21		4.29	
Have children	3.99		4.12	

* Values are significantly different for male and female students ($p<.01$)
Values range from 1 (strongly disagree) to 5 (strongly agree).

There is no significant difference between the males and females when they respond to how likely they are to get married and have children. Both groups had high mean scores in these two questions which shows that most of them consider it likely that they will get married, and slightly less think that they will have children.

Career Choices

The students were given 13 career options and they were asked how likely it is that they would choose each one of them. There were five possible responses for each career option, ranging from strongly disagree (value of 1) to strongly agree (value of 5). Table 5 shows the top six career choices for the female and male students along with the

mean response for each group. For the females, the career with the highest rating (3.41) was artist, which had identifiers of designer, interior decorator, musician and actor. In contrast, the highest rating for the males (3.41) was information technology (IT), which had identifiers of computer engineering and computer scientist. These two selections are in stark contrast to one another and fall into traditional career patterns for both groups. Although there are numerous efforts to attract more women into IT fields, the mean response from the female group to this career option was 2.52. This may be in part due to the relatively narrow definition given to IT in this study.

The second highest rating for the females was given to health professional (3.16). This is not too surprising given the percentage of women studying medicine has increased sharply and is at least 50% in most medical programs. Health professional was the seventh highest selection for men with a mean response of 2.44 (not shown).

The third highest selection for the females is 'other professions' which includes lawyer, accountant, architect and stock broker. This is the second choice for the males, and in fact, there was no significant difference in the responses from the females and males for this particular career option. As in the health professional case, these professions have been relatively successful at attracting women into their programs, and in law programs in particular, there is a strong balance between men and women. The third highest choice for the males was science or math-related professional, which is consistent with traditional career choices of men. The mean scores of the career options that were ranked fourth, fifth and sixth for the females and males fall below 3, which means that they are starting to disagree with this as a career choice in general.

Although not shown, the percentage of females that selected 'agree' or 'strongly agree' to the information technology career option was 25%, compared to 59% of the males. For the science or math-related professional, the percentages are 28% and 50%, respectively. This particular group will be further studied to assess the relationships with achievement data and their responses to the math, science and English questions.

Other than 'other professional', the only other career option that did not have a significant difference in the responses between the males and females was farmer. The mean score for this career was the lowest for both the males and females (1.80 and 1.62, respectively). This career option will be further studied with respect to the urban and rural student groups. Finally, although 'full-time homemaker' was listed as a career option, it was rated as the third lowest (2.15) by the females (farmer and trade ranked lower), with 61% disagreeing or strongly disagreeing that they would like homemaker as a career option. The mean response from the males for this career was 1.65, which was significantly lower than the females, and it received the second lowest score (tied with clerical).

TABLE 5. TOP SIX CAREER CHOICES (N=585)

Rank	Female Students Career (identifiers) (mean score)	Male Students Career (identifiers) (mean score)
1	Artist *(like designer, interior decorator, musician, actor)* (3.41)	Information Technology *(like computer scientist, computer engineer)* (3.41)
2	Health professional *(like doctor, dentist, veterinarian)* (3.16)	Other professions *(like lawyer, accountant, architect, stoke broker)* (3.24)
3	Other professions *(like lawyer, accountant, architect, stoke broker)* (3.07)	Science or math-related professional *(like engineer, architect, geologist)* (3.18)
4	Environment-related *(like forestry, marine biologist, environmental engineer)* (2.88)	Protective or military service *(like police, officer, firefighter, military)* (2.68)
5	Human services *(like teacher, social worker, counselor)* (2.74)	Artist *(like designer, interior decorator, musician, actor)* (2.52)
6	Science or math-related professional *(like engineer, architect, geologist)* (2.71)	Environment-related *(like forestry, marine biologist, environmental engineer)* (2.45)

Values range from 1 (strongly disagree) to 5 (strongly agree).

Perceptions of Adult Roles in Society

In order to assess the students' perceptions of adult roles in society, several questions were posed relating to work/family balance, roles of mothers and fathers in child rearing, and the perceptions of men and women in science and engineering. Only a few of the results will be presented herein.

Table 6 gives the mean scores of responses to four questions. The first two pertain to work/family balance, and show that both the males and females do not agree that it is difficult for both women and men to have a successful career and to raise a family. There is no significant difference between the responses of the females and males. This

finding is interesting, in that it appears as though the students feel that both men and women can balance a successful job and a family. This may be influenced by their own upbringings, where both their mothers and fathers may be working outside of the home. A correlation of these factors will be further investigated.

The remaining questions in Table 6 relate to the students' perceptions of how good men and women are at science and engineering, as well as math. Although the males and females tend to disagree that men are better than women in science and engineering, there is a significant difference between the two, with the females disagreeing with this statement significantly stronger than the males. This is an interesting finding compared to the last question which is related to math and is reversed in the way that it is posed (i.e. women are better than men). In this case, both the males and females disagree with this statement, and there is no significant difference between the mean responses. These findings will be further studied relative to other questions in the survey, along with achievement data.

TABLE 6. PERCEPTIONS OF ADULT ROLES IN SOCIETY (N=585)

Perceptions of adult roles in society:	Female Students		Male Students	
It is difficult for women to have successful careers and raise a family	2.58		2.52	
It is difficult for men to have successful careers and raise a family	2.40		2.24	
In general, men are better than women in science and engineering	1.83	<	2.40	*
In general, women are better than men in math	2.04		2.15	

* Values are significantly different for male and female students ($p<.01$)
Values range from 1 (strongly disagree) to 5 (strongly agree).

CONCLUSIONS

This paper presented some initial findings from a research project being carried out to investigate the personal and educational factors that contribute to junior and senior high school participation and high achievement in the sciences for both males and females. The aim of the study is to identify the factors that most directly contribute to decisions on the part of males and particularly females to pursue programs and careers in science and related disciplines, and will explore roots of differences and similarities for males and females in early decisions about adult life-role and career choices.

A sample of approximately 600 males and females from urban and rural backgrounds was selected and analyzed with respect to computer usage and affinity, characteristics of a job that the students would like, future plans, career choices and the perceptions of adult roles in society.

In terms of computer ownership, about 94% of the males and females owned computers (or a computer was owned by the family), and most started using computers at home between the ages of 6 and 10. Although both the males and females liked computers and felt that they were good at doing things on them, the male group had a significantly higher mean score compared to the females. Males also used computers significantly more than the females, with the highest usage for both males and females being for computer games. Using computers for assignments ranked second for females, while surfing the net was the second highest choice for the males.

Both the males and females would like a job that challenges them, allows them to make the world a better place and to balance work and family. In addition, although both groups agree that earning a lot of money and high status is important, it is significantly more so for the males. In terms of going to university or college, and getting more than one degree, the females rated significantly higher than the males, while there was no significant difference in their plans to get married and have children.

For career choices, the top ranked choice for females was artist, while for males it was information technology. The career selections generally followed traditional paths with health professional and 'other professional' (e.g. lawyer) being ranked second and third for the females. For the males, 'other professional' ranked second, followed by science or math-related professional (e.g. engineer).

Finally, in terms of perceptions of adult roles in society a few questions were analyzed with respect to work/family balance and ability of men and women in science and engineering, as well as math. There was no significant difference between the males and females with respect to the difficulty of men and women having successful careers and raising a family. Both groups were in general disagreement that this is a difficult thing to do. When looking at the ability of men and women in science and engineering, the females disagreed that men are better

than women. Although the males also slightly disagreed, there was a significant difference between the two which needs to be further investigated. Both the males and females disagreed that women are better than men in math.

The preliminary findings discussed in this paper show some interesting trends and motivation for further analysis. The dataset being collected is rich in information and requires the further development of key constructs to tackle some of larger issues surrounding perceptions and success in math and science, and their related careers. This information, combined with the additional data to be collected in Phases 2 and 3 of the study, will provide an excellent framework to develop insight and direction as to the development of targeted programs and initiatives.

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REFERENCES

Belenky, M. F., Clinchy, B. V., Goldberger, N. R., & Tarule, J. M. (l986). *Women's ways of knowing: The development of self, voice and mind.* New York: Basic Books.

Blair, V., & Lupart, J.L. (1996). A study of female persistence and withdrawal from university mathematics programs. *Exceptionality Education Canada, 6(2),* 51-73.

Canadian Council of Professional Engineers (1998). *National survey of the Canadian engineering profession.* CCPE, October, 124 pp.

Eccles, J. (1985). Model of students' mathematics enrollment decision. *Educational Studies in Mathematics, 16,* pp. 311-314.

Eccles, J. (1986a). Social forces shape math attitudes and performance. *Signs, 11,* 367-380.

Eccles, J. (1986b). Gender-roles and women's achievement. *Educational Researcher, 15*(6), 15-19.

Eccles, J. (l987). Gender roles and women's achievement-related decisions. *Psychology of Women Quarterly, 11,* pp. 135-172.

Eccles, J. (l994). Understanding women's educational and occupational choices: Applying the Eccles et. al. model of achievement-related choices. *Psychology of Women Quarterly, 18,* 585-609.

Eccles, J., & Jacobs, J. (1986). Social forces shape math attitudes and performance. *Journal of Women in Culture and Society, 11,* 367-380.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & MacIver, D. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families. *American Psychologist, 48,* 90-101.

Gilligan, C. (l982*). In a different voice: Psychological theory and women's development.* Cambridge, MA: Harvard University Press.

Hargreaves, A., & Fullan, M. (1998). *What's worth fighting for out there?* Mississauga, ON: Ontario Public School Teacher's Federation.

Hashizume, L., & Crozier, S. D. (1994). A female definition of career achievement. (pp. 106-120). In J. Gallivan, S. D. Crozier, & V. M. Lalande (Eds.), *Women, girls, and achievement.* North York, ON: Captus Press.

Keating, D. P. (1996). The transformation of schooling: Dealing with developmental diversity. J. Lupart, A. McKeough, C. Yewchuk (Eds.) *Schools in transition: Rethinking regular and special education.* Toronto: Nelson Publishing.

Kerr, B. A. (l994). *Smart girls two: A new psychology of girls, women, and giftedness.* Dayton: Ohio Psychology Press.

Lupart, J. L. (1992). The hidden gifted: Current state of knowledge and future research directions (pp.177-190). In F. J. Monks & W. A. M. Peters (Eds), *Talent for the Future.* Van Gorcum, Assen/Maastricht, The Netherlands.

Lupart, J. L. & Barva, C. (1998). Why do our "bright light" girls become a "faint glimmer" as adults? (pp. 161-168). In J. R. Epp (Ed.) *Proc. of the Second Bi-Annual Canadian Assoc. for the Study of Women and Education Symposium: Centering on the Margins: The Evaded Curriculum.* Ottawa, ON: The University of Ottawa.

Lupart, J. L. & Barva, C. (1998). Promoting female achievement in the sciences: Research and implications. *International Journal for the Advancement of Counselling, 20,* 319-338.

Lupart, J. L., & Pyryt, M. (1996). Identifying the hidden gifted. *Journal for the Education of the Gifted, 20*(1), 7-16.

Sheriff, B., & Svenne, J.P. (1993, Winter). Are women excluded from careers in science? *Women's Education,* 7-10.

Subotnik, R. F., & Arnold, K. D. (1995). Passing through the gates: Career establishment of talented women scientists. *Roeper Review, 18*(1), 55-61.

Wallace, J.E., Haines, V., & M.E. Cannon, M.E. (1999). *Academic Choices of Engineering Undergraduates.* Final Grant Report to Imperial Oil, University of Calgary, 29 pp.