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ABSTRACT

This study used Super's theory of vocational development and choice as the basis for looking at implementation of the self concept in an occupation. Focus groups were used with 123 women enrolled in science and science-related programs in Alberta colleges, technical institutes, and universities. Proceedings of each group were type recorded, transcribed, and subjected to content analysis. Questions asked during the focus group concerned the factors that influenced women's career decisions and those that either aided or hindered their progress within post-secondary education settings. They were asked whether the availability of funds influenced their decisions and whether the limited number of female role models affected their choices. The women identified factors that either enhanced or inhibited their prospect of successfully completing post-secondary education in science, engineering, and technology related fields. They spoke highly of opportunities to participate in internships, co-op programs, and practicum assignments that helped them understand the relevance of what they were learning towards career building. Difficulty understanding the transition from high school to post-secondary education and science careers; financial concerns; gender inequity; and program demands were some of the concerns inhibiting women's prospects of completing a science degree. (Author/JDM)

# I liked science, but now what do I do?



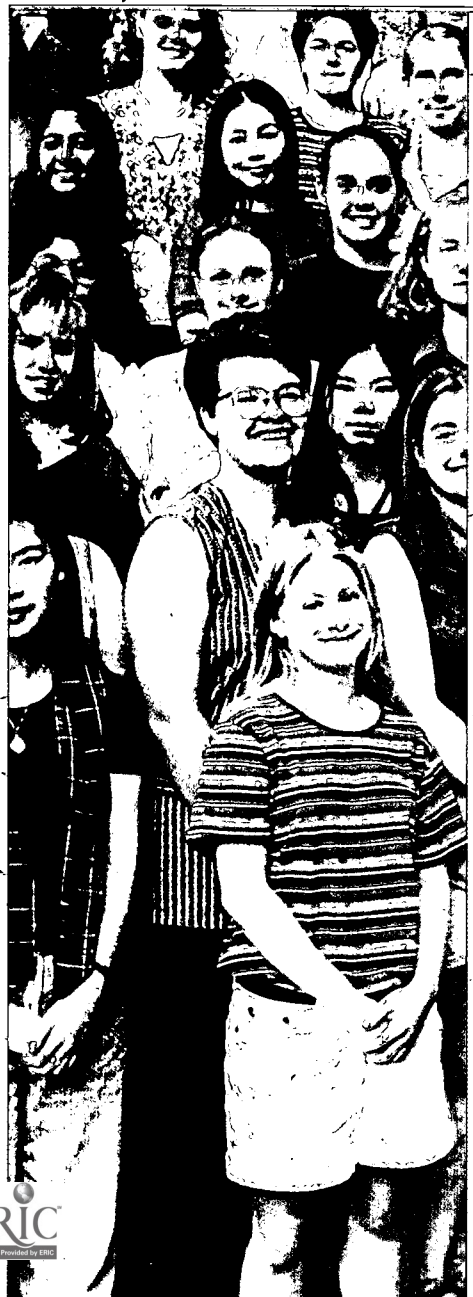
## Young Women's Perspectives Following High School

# Introduction

"I liked science, but now what do I do?" was a common response as participants told their stories or recalled their experiences. Their knowledge of the world of work was limited and although their high schools invited local members from various occupational groups to talk to students they often could not see how that information applied to them. "Information is not enough: Time perspective, a sense of autonomy, and other elements are essential to the proper use of information." (Super, 1994, p. 72).

The pressure to enter post-secondary education following Grade 12 was intense, but how an interest in some aspect of biology or chemistry could be applied in a working role or how the high school science curricula were relevant to everyday life was often missing. Participants were afraid of transitions such as the move from high school to college, technical institute, and university, or the move from the student to the working role. Perhaps given the lack of knowledge young participants expressed, this is not surprising.

Once success in post-secondary education had been achieved the feeling of accomplishment, level of confidence, and sense of knowing where to go and how to get there was empowering. However, not all transition experiences were successful; the organization of educational programs and the dictates of educational policy were often perceived as adding to participants' difficulties. At times these elements were barriers to participants' ability to reach their goals.



# Theoretical Approach

Super's theory of vocational development and choice, used as the basis for this study, takes a life span approach to the implementation of the self-concept in an occupation. Within Super's life stages, 17 year olds are likely still in the exploration phase, where they are tentatively reviewing needs, interests, competencies, values and opportunities, and doing some initial field selection. They face a transition period between 18-21 years where 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.

While getting started in a chosen field, during the educational process, and into the initial working role, an individual's career choice likely remains tentative as establishment and commitment depends upon work related experience and opportunity. "Effective choosing presupposes self-knowledge and knowledge of the critical characteristics of the role being contemplated. Neither is easily attained." (Gouws, 1995, p. 29).

# Research Plan & Methodology

A longitudinal design was used in which 26 focus groups were conducted with 123 women enrolled in science and science related programs in Alberta colleges, technical institutes, and universities. Participants were enrolled in one of six institutions situated in small towns, municipal districts, cities (under 50,000 residents) and major metropolitan areas (over 100,000 residents). Each institution was visited at least twice within the three-year period between 1997- 2000.

Participants were recruited through course instructors, course coordinators, and organizations for women in science and engineering. Their fields of study included: agriculture, astrophysics, biology, biochemistry, chemistry, computing science, engineering (chemical, material, mechanical), environmental science, forestry, general science, genetics and physics. The average group included 5 participants (range 1-10) and the majority were undergraduates in diploma or degree programs. Mature students were also represented. Each focus group was conducted by two members of the research team (either a male and female or two females) using a written protocol that was shared with each participant. The proceedings of each group were tape-recorded, transcribed, and subjected to content analysis.

# What questions were asked, and what did we find?

**1 What influences women's career decisions? When are the critical decision-making times for young women and what influences those decisions?**

Participants frequently spoke of family members (parents in particular), friends, and people in the discipline/field as important influences.

*"My brother, when I was in Grade 6, chose to go into engineering, so that was my first visualization – understanding what engineering was all about. Also my other sister chose to go into engineering. So I saw a theme there. I thought, well they're related to me. I could do it if they could do it."*

Teachers, course experiences, and special projects were also noted.

*"I trusted my teacher a lot, my biology teacher. It was my highest mark in high school in biology, and they encouraged me to take that."*

Work experience was particularly important and both positive and negative experiences were powerful influences in shaping participants' decisions. First-hand exposure to a career through working and other life experiences was invaluable.

*"I guess the most important people so far as choosing my career path have been the vets, because they've been great. I volunteer in a mixed general practice... I go out with them to farms... I can not only observe the animal surgery part, I have the gloves on, I'm in there."*

*"I took my pre-tech because I thought I was going to go into respiratory therapy, when I did my career investigation... I realized that wasn't for me."*

The ability to get a good job after graduation was particularly important to those who were in two-year technical programs. Participants in these groups presented a wider range of ages and experiences than others. The majority had entered the workforce directly from high school. Lay-offs, down-sizing, and negative work experiences had led them to "return to school" after several years of full-time employment. These mature students were often returning to science, an area they had always wanted to pursue. Unlike younger students, they reported being focused, committed to successfully completing their program, and knowing where they were heading. Similar findings were reported by the Canadian Undergraduate Survey Consortium (Walker, 1999).

*"I worked in offices for 4 – 5 years, and I didn't like it. There was something missing, but I did not know what... I had already begun in science, but I had left school and went back in accounting because my father used to always [say], 'What are you going to do with sciences? You're just wasting your time. Business is what it's all about.' So when I decided to go back in teaching, I had to choose what I wanted to teach. I decided to go back to sciences; because that was my initial love, so I'm back."*

**2 Are there factors that aid and abet young women's progress within post-secondary education settings that can be differentiated from those that are external to it? What is the relative impact of policies from both sources?**

Difficulty combining studying and working roles was a repeating theme, not simply for mature students with dependent children, but for young women in their second year and beyond.

*"[classes] are everyday pretty much from 9:00 until 4:00... and then a couple of days working until 5:00 – so close to 40 hours a week. That's not even counting time for homework and assignments"*

Honours programs are only available to full-time students, as are the limited number of scholarships and bursaries beyond the first year. Course loads in science, when each course has both a lecture/seminar and laboratory component, make part-time work virtually impossible. Participants could see no academic reason for this timetabling other than tradition.

*"... 32 hours a week, is that it? Feels like a lot more! We're actually in class for 32 hours"*

Students' perception of unreasonable work loads, the stress of large classes in the early years, repetition of high school material in general science programs, an unreasonable number of required courses in the early years, and a lack of application to those practical issues that had initially attracted participants to science were all seen as elements which detracted from the university experience.

*"I took general chemistry, biology, stuff like that - stuff I kind of touched on in high school. So this year, because... I am actually taking microbiology courses, it's been a lot more interesting, and that's what I was hoping for... more practical"*

Participants from two-year technical programs consistently spoke of the advantages of the career investigation exercise required of all entering students, but they were highly critical of the unreasonable workloads. There did not appear to be any relationship between on-the-job demands and the requirements of these educational programs. Funding envelopes and other government incentive programs most likely influenced program development and format. Student needs appeared to be secondary. Overall the smaller classes, shorter courses, and participants' belief that they would be employed at the end of these programs made it possible for them to endure the process.

Although participants in college programs consistently spoke of the advantages of small classes, they expected to, or had encountered difficulty transferring credits from college to university. Students expressed their frustration about losing valuable time and money because of the lack of transferability among post-secondary programs. Wherever this problem arose, and whatever the reason given by a college or university, it was the student who ultimately suffered.

*"I'm in forestry and university transfer. I can't take any specific forestry courses, like dendrology, because they're not recognized by any university. It's really frustrating... I'm kind of more in general sciences than I am in forestry. It can be very, very frustrating, especially the transferability. That word has been haunting me ever since I came here."*

The negative effect of large classes and the perception of an impersonal atmosphere at Alberta's research-intensive universities had a powerful impact on participants' choice of institution. Participants consistently mentioned the difference between the expectations at high school and post-secondary levels and the prospect of the transition from high school to university was overwhelming. Many spoke about feeling more comfortable attending a college or university college first as a 'stepping stone' towards university.

*"I just changed my program... to Environmental Biology because I can stay here [college] for 2 years... which is cheaper and smaller classes and probably a better learning environment helps me prepare for university where I don't get as much individual attention and those sorts of things..."*

*"I came from a small town, so just the change from a 3000 – populated town to a university... it was overwhelming and a little bit disturbing. I thought, how am I ever going to succeed in something that big? It was just hard to believe that I would be able to work with it at all."*

*"No, the Chemistry program here [college] is far better than the chemistry at [university] because its more intimate. The one-on-one instruction in the class is really helpful. I understand the concepts better now. I understand why I'm doing things in the lab... it's hard to learn in classes of 400 students. If you don't get to know the instructor well you're just a number... you really struggle to get help... there's an open door policy here."*

Participants of all ages reported not knowing what they were going to do following high school. They resented the pressure to enter university or college or to make a decision about which field they would enter as they felt ill-prepared. Things are unlikely to improve once they are in university, given Walker's (1999) finding that, overall, undergraduates were clearly dissatisfied with career counselling in Canadian universities. Common first year programs, general studies, or entering general science provided an opportunity to broaden experiences, but were often seen as adding to the cost and ultimately the debt load upon graduation.

*"I have all these things to choose from. I don't know what I want to do. I have no structure. It's basically do what ever you want. I don't care...nobody cares. That's one of the more difficult things getting just a General Science degree."*

*"I wish I'd done more research on the whole career thing before I went into university. I kind of jumped in."*

## 3 Does the availability of financial resources facilitate or compromise the attainment of career goals?

Financial concerns were consistently reported as a problem regardless of the institution, level of student, or program. Provincial scholarships and bursaries at the completion of Grade 12 enabled participants to enter post-secondary education, but these did not continue in subsequent years.

The student loan program was perceived to be inequitable. If funding was obtained, the amount was unrealistically low relative to the cost of accommodation, tuition and books. In 1999, the mean debt load for Canadian university undergraduate students was $13,322 (Walker, 1999). Summer employment was frequently hard to obtain: in the smaller, single-industry districts, hiring preference was often given to relatives of employees; in larger cities summer positions were scarce and participants sometimes resorted to not disclosing their student status to obtain a job.

*"The troubles I had with the student loan – you'd have to start a whole new tape. Basically I ended up working because I couldn't afford school, but I was making $6 an hour and when you're paying rent and the bills – like, I don't have children – that's a whole different thing. Then I applied after 3 years, when I wasn't at home, and they said, 'Well, you've been working for 3 years. You should have this much money saved.'..."*

*"I gotta have somewhere to live! The food is down the line, unfortunately. I've lived on microwave popcorn and licorice for a very long time. That's reality."*

A saga of problems with student loans, employment insurance and retraining allowances were presented by participants throughout the province. Participants perceived that they were penalized for working in the summer when gross rather than net earnings were factored into their eligibility for a student loan in the following fall and winter sessions. Having to live on one's summer earnings during the summer was not taken into account.

*"They [government] want you to go to school, but then they expect you to live off nothing, and it's hard, 'cause just the way they have things set up to apply... they say, 'Okay, how much did you make during the summer?' They don't take into consideration your living expenses, so then they expect you should have saved every little penny that you make during the summer. They deduct that from what they give you... so it's kind of twisted."*

*"Through the Health Care Referral Centre, they set us up for retraining, and offered us – they told us initially it was a $5000 grant to go back to school... and then I was notified 2 weeks before starting that my benefits were being cut off. I wasn't eligible for the fee-payer program any more because my claim was running out... That's all I have been doing, is going to government agencies and having a fight to finish my education."*

With an over-supply of student labour in the summer and an under-supply in the fall and winter, employers and students would benefit from students being able to combine part-time working and part-time studying roles throughout their programs. As work experience was a powerful factor in confirming field choice, a combination of the working and studying roles could go a long way to increasing students' knowledge of the world of work.

*"Oh yeah, I'm really glad I went to co-op... because I know kind of what I want. Although a lot of my experience has been more in labs, I've been able to see what people do and just know that I don't like working in certain environments."*

Mature students reported having to drop out mid-way through a course due to lack of funding, work in unrelated fields, and then try to return later to complete requirements. By the time they had been able to do so, those requirements had frequently changed. Employment and financial issues were the primary reasons for interrupting studying reported by undergraduate students at Canadian universities (Walker, 1999).

*"I have a degree... in Microbiology, and when I graduated there were no jobs, so I had to work in retail to get myself out of debt from the student loan I had. That took me two years."*

*"... how are you supposed to graduate if you don't have money to do so? So I'm bleeding off my Dad a little bit, and my boyfriend is helping me out whenever he can..."*

Post-secondary education, regardless of the level or institution, appears to be stuck in a program delivery model reminiscent of the 60's and 70's when a full-time studying role was the norm. That is no longer the case and science programs must change to accommodate part-time studying and working roles at all levels.

## 4 Do the limited number of female role models in science and engineering negatively affect young women's choices?

Participants who cited having female role models, either as high school science teachers, instructors, or supervisors in jobs related to their field of study noted how important those influences were, but not all were viewed as positive.

*"It almost seems they've [female instructors] got that attitude [a need to put down others, show their superiority] because they want respect, but you're never going to get the respect if you've got that attitude, especially for female students, because another female is going to look at you and say, 'I don't want to be like you!'"*

*"I had one prof that I would have actually always wanted to be like, too... every time I see that lady, I just [think] 'I wanna be like you! ...'"*

*"I select women [teachers] over men because it helps me and I approach them better."*

*"I was one of five women in my class out of – how many hundreds of students [computing science co-op program]. I found it very difficult I've had a very hard time because although I work very hard and I get just as good marks as someone else... they think I'm just a stupid girl. I've had guys say, 'Wow, you're the first woman I've seen in Computer Science who was actually, like, rather good'"*

## 5 Do factors within the science and engineering disciplines play a part in decision-making?

Some young participants appeared to resent being asked to address issues related to gender differences in science and science related programs. They seemed to believe that women might have encountered difficulties in the past, but not now.

*"Even if there was just one [female student] it wouldn't make a difference, because you're not treated differently. And this whole entire idea really bothers me. I hate being singled out because I'm a girl, [and they say] 'Oh, you're special because you're here'. Because I don't feel special. I feel anybody could come and do this too. And it really bothers me when people put emphasis on, 'Oh there's girls here...' Yeah, we're here and we're going to continue coming!"*

Participants in technical programs and those at other levels, particularly where co-op programs or summer field work were part of the requirements, had frequently encountered gender inequity, issues bordering on harassment, and different expectations from instructors. Participants in technical programs were more likely to be concerned about how women would be treated in their field once they were employed.

*"One of the things that worries me is that when you go in to get a job, they're going to look at you and say: 'mid-20s, married, she's going to have kids pretty soon' and that might stand in the way of getting hired over a man. I don't know if that's true, but that's one thing I worry about."*

*"Well, from where I'm sitting – all the guys are going to get jobs before us."*

*"Out of the males that wanted a job, only one did not get one. And out of the females that wanted a chemistry related job, only two got one..."*

Participants were frequently concerned that their status as young female professionals rove to be detrimental to either securing a position, or a promotion, or further

training. Although participants considered the combination of a career and family the norm, they were not prepared to admit in any job interview that they also desired to marry and have children for fear that this would be seen as a handicap in science and engineering fields.

*"I was told black and white, when an industry hires you, they make an investment in you. And its a dollar value... if they're going to invest $100,000 in you and you're going to get married in a year, and have kids, they just lost $100,000. If they hire a guy he might be there for a long time. He might be a lifer."*

*"...if it's a women running the lab, I think there's a better chance that a woman's going to get hired. Until more women are running labs, there's no way to prove of disprove the perception, so I don't really know what you could do about it"*

*"There was a company last year that was hiring grads that didn't even interview any women. They had eight women apply and four males, and four males got granted interviews, and not one of the women."*

## 6 What do non-science and professional fields have to offer that might make them more attractive alternatives?

Young participants in science stressed their need to see the application of what they were learning in chemistry, physics, or biology. They could not understand why first and second year courses [some even mentioned high school courses] could not be applied to issues that were currently affecting everyday life. Remaining within science, but changing to fields such as environmental science, environmental biology, and genetics was common. Many students in pre-professional programs such as pharmacy and medicine indicated that they had been attracted to these careers through personal experience and wanting to help others.

*"I was going to go into majoring in math... You really can't get a job with a Bachelor's and a major in math. So I thought, engineering has a lot of math and it's more applied, which I like more. I don't like theory. So I thought I'd go into that..."*

*"I went into pre-med not thinking that I'm going to be a physician or anything. I'm interested in the whole idea of infectious diseases... I enjoy working with people and I enjoy helping them. By doing that, I think I can contribute a lot to society"*

*"I want to go into optometry because my grandmother's now blind because she's got glaucoma and it was never diagnosed on time. That and my best friend's Dad is an optometrist..."*

*"I found that one of the really appealing things about the geology course I took was that they had this field trip, and it does feel more like a program where you're going somewhere... hands-on... that was really neat, too, because you got to know a bunch of people, it was more of a networking thing. That was really useful, and I wish they had that in more of my other courses that I'm taking and also it gives you more of a feeling of where things lead. So I found that very useful."*

## 7 What are some of the factors that influence young women who start programs leading to careers in science to opt out?

For mature students, finances again played a part. Length of programs in science and medicine were often seen as a deterrent and more affordable, shorter alternatives such as those offered in technical or college programs were perceived as achievable. Being able to obtain a job after graduation, exposure to science related opportunities, poor initial levels of understanding about the field, and a lack of interest in the subject matter led to changing their area of study.

*"I know a lot of people that have Bachelor of Science degrees and worked at Earl's for 2 years... couldn't find anything. That's why I quit" [after first year and entered a technical program]*

*"When I applied, I had every intention of going into science. Philosophy and things like that, it was more of a side interest, but because of WISEST I ended up in philosophy, which is good... I realized what about science that interested me was more the ideological sort of bigger picture, of which science provided a part."*

# Recommendations

Participants identified a number of factors that either enhanced or inhibited their prospect of successfully completing post-secondary education in science, engineering, and technology related fields.

**Transition from high school:** the pressure to enter post-secondary education following Grade 12 was intense, but many students had no idea how their interest in biology, chemistry, or math could be applied in a working role, or how their high school science curriculum was relevant to everyday life. Participants were often afraid to make the transition and chose local college programs as a stepping stone to programs in university and technical institutes. Issues surrounding transfer credit continue to add to students' difficulties and further work must be done in this area of educational policy.

**Combining studying and working roles:** post-secondary education, regardless of the institution, appears to be stuck in a program delivery model reminiscent of the 60's and 70's when full-time studying was the norm. That is no longer the case and science programs must change to accommodate part-time studying and working roles at all levels. The ability to work part-time throughout the year would benefit employers as well as students as it would provide for the continuity that both students and employers are seeking. Combining the working and studying roles must be seen as the norm, not the exception.

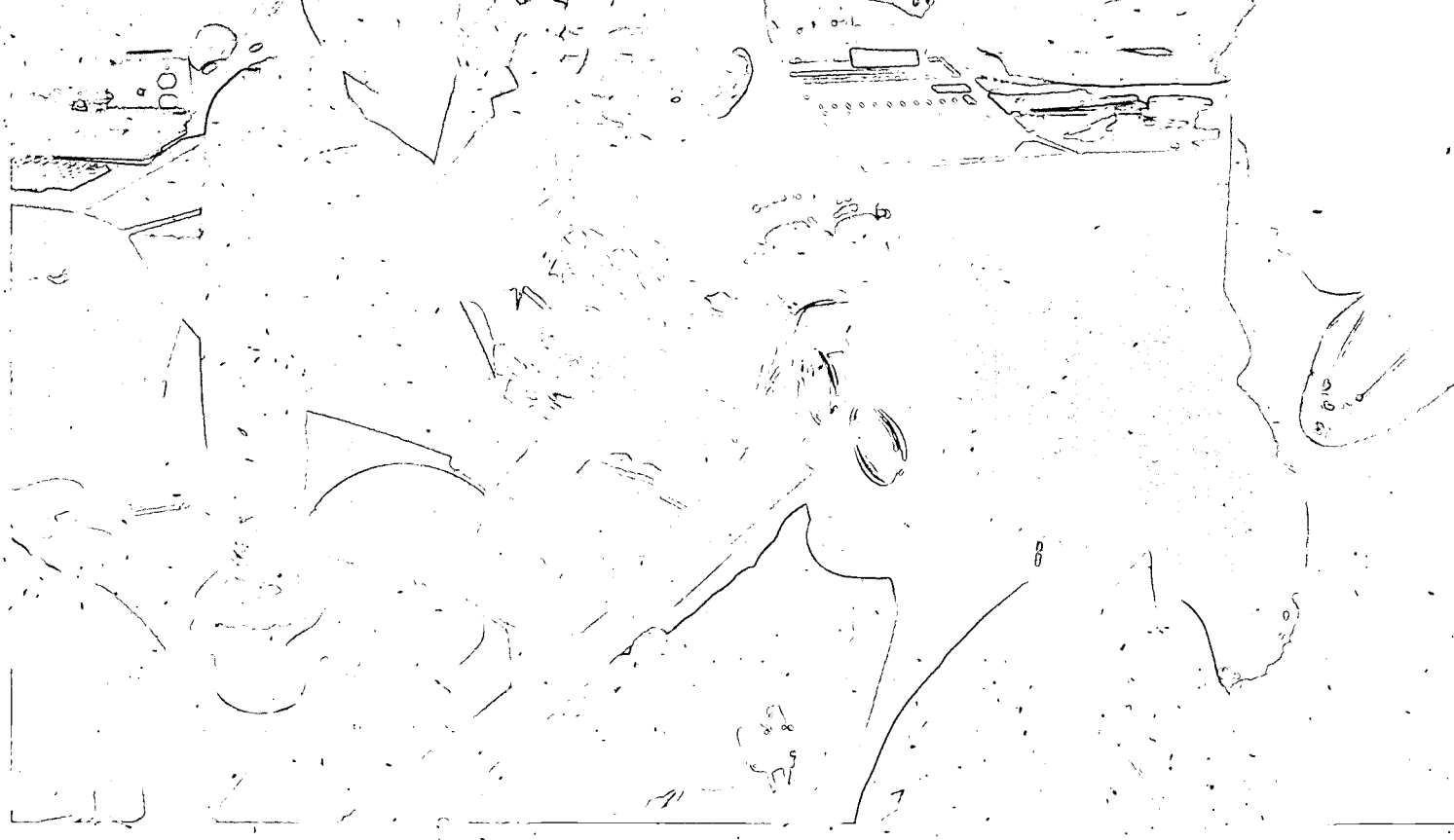
**Work experience:** participants spoke highly of opportunities to participate in internship programs, co-op programs, practicum assignments, etc. as part of their degree/diploma programs. Students stressed the need to see the relevance of what they were learning in chemistry, physics, or biology. If science programs are to attract and retain capable young women there is a need to address the issue of relevance early and consistently throughout undergraduate studies.

**Opportunity for career investigation:** it was not uncommon for science students in their second year to have no idea where their programs of study would lead to in terms of career opportunities or future employment. Participants in technical programs spoke highly of career investigations (interviews they had with professionals in their field/s of interest). Although it may not be possible for this to be used as part of the admission procedure in general science, students do need an opportunity to explore career options early in their undergraduate program.

**Financing undergraduate education:** financial concerns were consistently reported as a problem regardless of the institution, level of student, or program. Most participants with high Grade 12 averages had been awarded scholarships that made a significant contribution to their first year of study. However, there was virtually nothing available other than student loans in subsequent years. Participants perceived the student loan program to be inequitable and if funding was obtained the amount was unrealistically low. A saga of problems with student loans, employment insurance, and retraining allowances were presented by participants throughout Alberta. Finances played a major part in students having to drop out, particularly mature students. A thorough review of each of these systems is long overdue.

**Gender inequity:** participants entered post-secondary education with the expectation that they would be treated equally, expressing that women may have encountered difficulties in the past, but that things were different now. Once into co-op programs, summer fieldwork, or internships they were faced with gender inequity. Senior students and new graduates need to be able to access appropriate resources where their confidentiality is assured so that they can deal with these issues when they arise.

**Course work and program demands:** unreasonable work loads, large classes, the number of required courses in the early years, repetition of high school material in general science programs, and an inability to apply what was being learned were all seen as elements that detracted from the university experience. Competing interests and the ability to see the application of what is being learned make science-related, professional fields attractive alternatives at any time for students in general science. Science programs need to review and revise the curricula they are providing, particularly in the early years if they are going to maintain capable young women in general programs.



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## Partner Organization

**Alberta Women's Science Network**

With the assistance of the following organizations, students, and staff of the university whose names appear in alphabetical order.

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