DOCUMENT RESUME

ED 419 667 SE 061 363

AUTHOR Madill, Helen M.; Montgomerie, T. Craig; Armour, Margaret-Ann; Fitzsimmons, George W.; Stewin, Leonard L.; Tovell, Dorothy R.

TITLE Attracting Females to Science Careers: How Well Do Special Initiatives Work?

INSTITUTION Alberta Univ., Edmonton.
SPONS AGENCY Social Sciences and Humanities Research Council of Canada, Ottawa (Ontario).
PUB DATE 1997-00-00
NOTE 7p.; Funding also received from Nortel.
AVAILABLE FROM WISEST Office, University of Alberta, 252 Athabasca Hall, Edmonton AB T6G 2E8, Alberta, Canada.
PUB TYPE Reports - Research (143)
EDRS PRICE EDRS Price MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Employed Women; Females; Foreign Countries; Grade 11; High Schools; *Science Careers; Science Education; Self Concept; *Student Attitudes; *Student Surveys; Summer Science Programs; Values; *Womens Education
IDENTIFIERS Canada; *Women in Science

ABSTRACT

Although there is considerable anecdotal evidence concerning the success of a large number of programs for women in science in Canada, no well-controlled studies had been conducted. This publication reports on results from an outcome evaluation of the Women in Scholarship, Engineering, Science and Technology (WISEST) Summer Research Program for Grade 11 students at the University of Alberta. A longitudinal design involved following three cohort groups over three years--a group that participated in the WISEST summer program, a second group of WISEST applicants who participated in a one-day science career workshop, and a control cohort. Telephone surveys and inventories were used to track participants after completion of their programs. Surveys assessed choice of field, level of readiness to make career decisions, career interest, and values. Findings indicate that the value of the WISEST program rests in participants being able to confirm or reject their selection of science as their field after a short, meaningful experience on campus. Traditional course offerings (full-time study that requires daytime, on-campus attendance) are now more likely to hamper students' progress. Balancing work and study roles under these conditions was reported to be extremely difficult. (PVD)

ATTRACTING FEMALES TO SCIENCE CAREERS: HOW **WELL** DO SPECIAL INITIATIVES WORK

Research Plan & Methodology

A longitudinal design was used where three cohort groups were followed over three years. In 1994 all qualified applicants to the WISEST Summer Research Program completed several inventories. Students were randomly assigned to one of three groups: WISEST Summer Research Program cohort, Discovery cohort, or the Control cohort. The Summer Research Program cohort worked in research in the sciences and engineering for six weeks. The Discovery cohort completed a one day workshop which included laboratory visits and a discussion of their inventory results with psychologists. See Table 1.

table 1	WISEST Summer Research Program	Discovery Science Career Workshop	Control	Total
Frequency	46 (46)*	40 (39)	68 (64)	154 (149)
Age on July 1, 1994 Mean St. Dev	 16.98 0.46	 16.97 0.35	 16.94 0.40	 16.96 0.41
Grade 11 Science Average Mean St. Dev	 88.43 4.64	 88.43 4.64	 88.38 4.41	 88.38 4.41
Residence Urban Rural	 31(31) 15(15)	 29(29) 11(10)	 45(45) 23(22)	 105(102) 49(47)

There are no significant differences between the groups.
* Numbers in brackets refer to participants contacted in the 1996 phone interviews.

In 1995/96, phone surveys were used to identify each participant's educational status, summer activities, and her study and work plans. Students in the Summer Research Program cohort and the Discovery cohort were also asked to evaluate those experiences one year after completing them.

In 1996/97 the same inventories were administered, and the phone survey included questions about career plans, how previous plans had worked out, sources of income, summer activities, study plans, and current employment status. Again the Summer Research Program and the Discovery cohorts were asked to comment on the impact of those experiences on their career-planning.

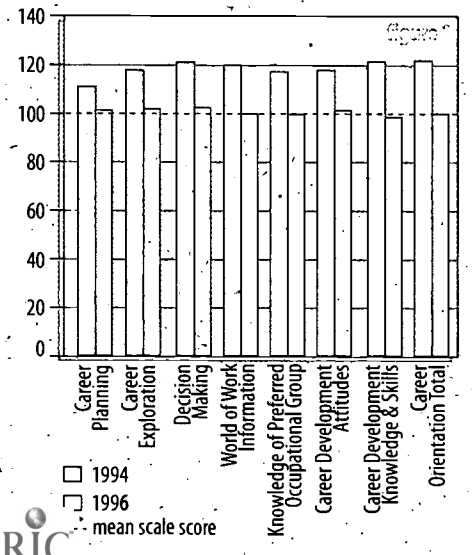
What questions were asked, and what did we find?

1 Do a higher proportion of students in the WISEST Summer Research Program enter and complete their first year in science or science related fields as measured by the phone follow-up survey?

There were no significant differences in choice of field between cohorts. The majority of participants reported they had entered science or science related fields. See Table 2.

table 2	WISEST Summer Research Program N=46	Discovery Science Career Workshop N=39	Control N=64	Total N=149
Science*	25	18	26	69
Engineering	6	12	10	28
Health Sciences**	3	4	6	13
Agriculture	0	1	2	3
Total Science Related Fields	34	35	44	113
Other Fields Arts/Business/Education	9	4	17	30
Not Studying	3	0	3	6

* Science includes computing science, pre-professional year eg. pharmacy, medicine
** Includes medical sciences eg. physiology, pharmacology



2 Are there differences in levels of readiness to make career decisions, as measured by the 1994 and 1996 scores on the Career Development Inventory, between Summer Research Program, Discovery, and Control cohorts?

In 1994, there were significant differences between the initial levels of career maturity of all cohort groups and their peers on all scales. However, in 1996 the scores of all cohort groups were almost identical with their peers. Again there were no significant differences between the cohort groups. See Figure 1.

3 Do Career Interest codes, as measured by the Strong Interest Inventory, differ between students in the Summer Research Program, Discovery, and Control cohorts? Do these change over time?

The Strong Interest Inventory is used to assess level of career interest, using codes that are comprised of the three most preferred general occupational themes (which describe types of work and work environments). There are six themes:

- (R) Realistic people have interest in nature and the outdoors; mechanical, construction, and repair activities; and military activities.
- (I) Investigative people have a strong scientific orientation and enjoy gathering information, uncovering new facts or theories, and analyzing and interpreting data.
- (A) Artistic people value aesthetic qualities and have a great need for self-expression.
- (S) Social people like to work with people and enjoy working in groups, sharing responsibilities, and being the center of attention.
- (E) Enterprising people seek positions of leadership, power, and status. They like to take financial and interpersonal risks and to participate in competitive activities.
- (C) Conventional people work well in large organizations, preferring subordinate roles. They especially like activities that require attention to detail and accuracy.

As a primary theme, Investigative traditionally has been associated with the sciences (e.g. Chemistry) and as a secondary or tertiary theme (in combination with Artistic or Social as a primary theme) has been associated with science-related professions (e.g. Chemistry teacher). The vast majority of participants had the Investigative theme within their three-letter code. No differences were found between the cohorts. In 1994, it is interesting to note that half of the participants had Investigative as their primary theme, while in 1996 less than one-third had Investigative as their primary theme. This is suggestive of shifts in career interests from science to science-related fields.

Distribution of "Holland Codes" from Strong Interest Inventory

Figures 2 and 3 represent the distribution of assigned "Holland Codes" for WISEST subjects. Percentages are proportional to percent of respondents with that high point code. Three-letter codes within circles occurred for more than 2% of respondents.

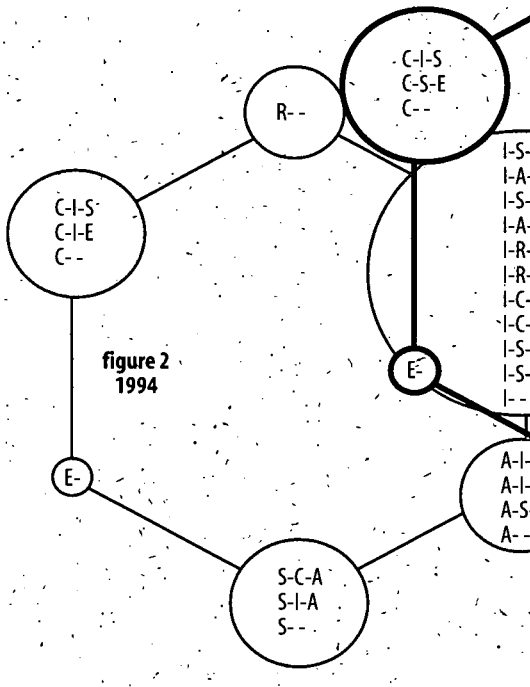


figure 2
1994

4 Are there differences, as measured by the 1994 and 1996 scores on the Values Scale and Salience Inventory, between the Summer Research Program, Discovery, and Control cohorts?

The Values Scale is used to assess values in relation to career choice. According to the 1994 and 1996 scores, values are relatively stable and therefore results of assessments completed as early as Grade XI can be used as valid estimates of career related values. Relative to their peers, all three cohorts valued more highly:

- Ability Utilization: using your skills and knowledge
- Achievement: getting results that show you have done well
- Authority: telling others what to do
- Creativity: being creative
- Cultural Identity: being accepted as a member of your race, religion, or ethnic group
- Personal Development: developing as a person

and did not value as highly:

- Economics: having a high standard of living
- Social Interaction: doing things with other people
- Social Relations: being with friends

Only Autonomy: acting on your own, changed. In 1994, Autonomy was not valued as highly by participants regardless of their cohort group. However, in 1996 all three cohort groups were now similar to their peers.

The Salience Inventory is used to assess the level of importance of five major life roles:

- Studying
- Working
- Home and Family
- Community Service
- Leisure.

Scores for all three cohorts from both 1994 and 1996 indicated that the majority of participants were heavily involved in the Studying role and saw themselves as implementing their values through that role. However, in the 1996 phone survey, participants commented on the negative effects of heavy work loads and the hectic pace that full-time study and part-time work demands of them.

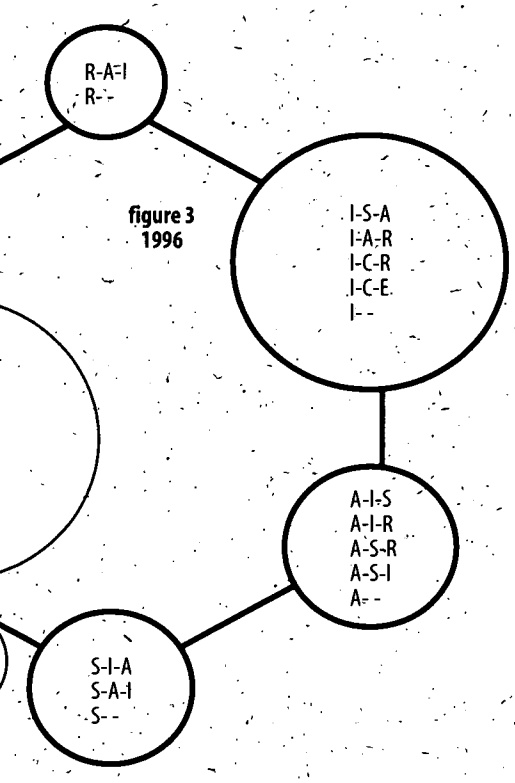


figure 3
1996

What did we learn?

Participants highly valued their experience in WISEST special initiative programs, particularly those who participated in research projects. Many reported that this six week experience was an important factor in their selection of a science field. Establishing the connection between an idealistic interest in a science career and day to day work in the sciences is one of the most important contributions on-campus programs can make.

Special initiatives for gifted and talented students in the sciences are excellent recruitment tools for universities. Other data obtained by WISEST shows that a very high proportion of WISEST Summer Research Program students subsequently attended the University of Alberta. Universities and talented science students both would benefit from earlier and longer periods of contact. Some participants indicated they transferred to a large university more easily following their on-campus experiences. Therefore formal transition programs in Canadian universities need further investigation.

The value of WISEST Programs rests in participants being able to confirm or reject their selection of science as their field after a short, meaningful experience on campus. This process usually takes at least half a year once students enter university and during that time universities run the risk of lessening a young person's desire to continue in post-secondary education. With the majority of students working to support themselves while they study, both time and money are important elements for these young consumers who are well aware of the rising cost of their post-secondary education.

Traditional course offerings (e.g. full-time study that requires day-time, on-campus attendance) are now more likely to hamper students' progress. Balancing working and studying roles under these conditions is reported to be extremely difficult. Participants in this study were not calling for less challenging courses, but they are going to demand more appropriate scheduling and greater access to financial support in the second and subsequent years of their undergraduate study. Further investigation is currently underway to look at these and other policy-related educational issues.

How Discovery Career Workshop helped career planning

"The tours were very useful and gave me an idea about science. It was very good and confirmed my interests in science."

"Opened me up to things I hadn't thought of – tour of the university really opened me up to other types of science – it was really interesting."

"It introduced me to the whole field of sciences, but it was too short."

How WISEST Summer Research Program helped career planning

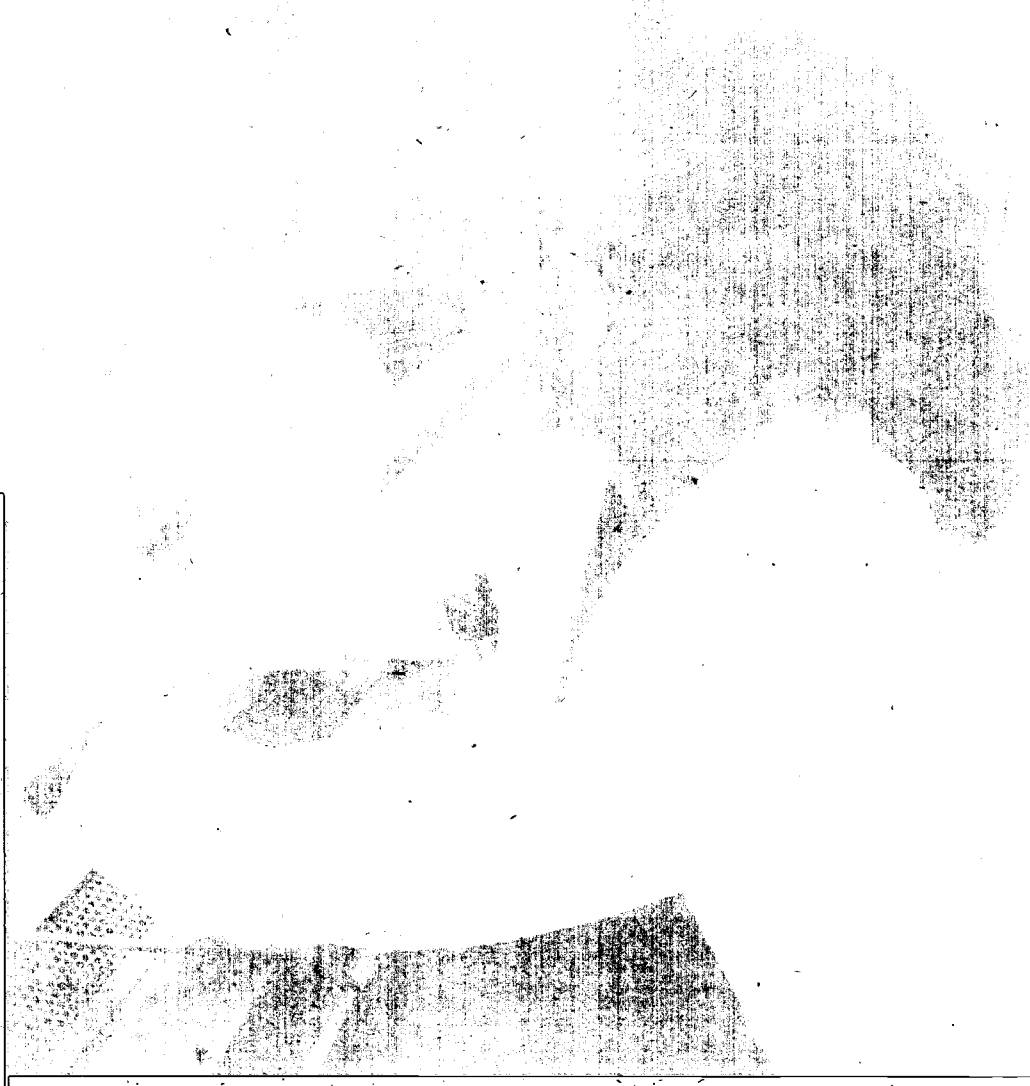
"Really helped me to know what university is like, and also what someone would do with a science degree".

"... realized that science was the wrong direction after completing the program".

"It helped me understand what research is all about. It confirmed my interest in science".

Introduction

Attracting young women to non-traditional fields such as science and engineering is receiving a great deal of attention. It is known that commitment, participation and knowledge of occupations are relatively independent of each other, especially in adolescence (Super and Sverko, 1995, p. 75). Therefore many initiatives have been designed to provide participants with relevant information and experience. Although there is considerable anecdotal evidence concerning the success of a large number of programs for women and science in Canada, well-controlled studies have not been conducted. We undertook an outcome evaluation of the WISEST (Women in Scholar-ship, Engineering, Science and Technology) Summer Research Program for Grade 11 students at the University of Alberta with the expectation that the information we gained could be utilized but by many others besides ourselves in program planning.



WISEST Programs

Over 500 students have participated in the WISEST Summer Research Program since it began in 1984. It enables young women who have finished grade 11 to spend six weeks during July and August employed as members of research groups in the sciences and engineering at the University of Alberta. Well over 200 students apply annually and up to 50 can be accommodated. In 1994, a one day science career workshop, Discovery, was offered as an alternate experience to another 50 equally qualified applicants. Participants in Discovery discussed their career interests and visited various laboratories at the University of Alberta.

Theoretical Approach

There are many theories about vocational development and choice. Super's theory, used as the basis of this study, takes a life span approach to the implementation of the self concept in an occupation. Within Super's concept of life stages, 17-year-olds are likely still in the exploration phase, 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.

References

Fitzsimmons, G.W., Macnab, D., Casserly, C. (1985). Technical manual for the Life Roles Inventory-Values and Salience. Edmonton, AB: Psychometrics Canada.

Hansen, J. & Campbell, D. (1985). Manual for the SVIB-SCII (4th ed.) Palo Alto, CA: Consulting Psychologists Press.

Super, D.E., Thompson, A.S., Lindeman, R.H., Jordaan, J.P., & Myers, R.A. (1988). Manual for the Adult Career Concerns Inventory and the Career Development Inventory. Palo Alto, CA: Consulting Psychologists Press.

Super, D. E. & Sverko, B. (Eds.). (1995). Life roles, values and careers: International findings of the Work Importance Study. San Francisco, CA: Jossey-Bass.

University of Alberta Project Team:

Helen M. Madill Ph.D.
T. Craig Montgomerie Ph.D.
Margaret-Ann Armour Ph.D.
George W. Fitzsimmons Ph.D.
Leonard L. Stewin Ph.D.

Partner Organization:

WISEST
Dorothy R. Tovell Ph.D.

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

Students:

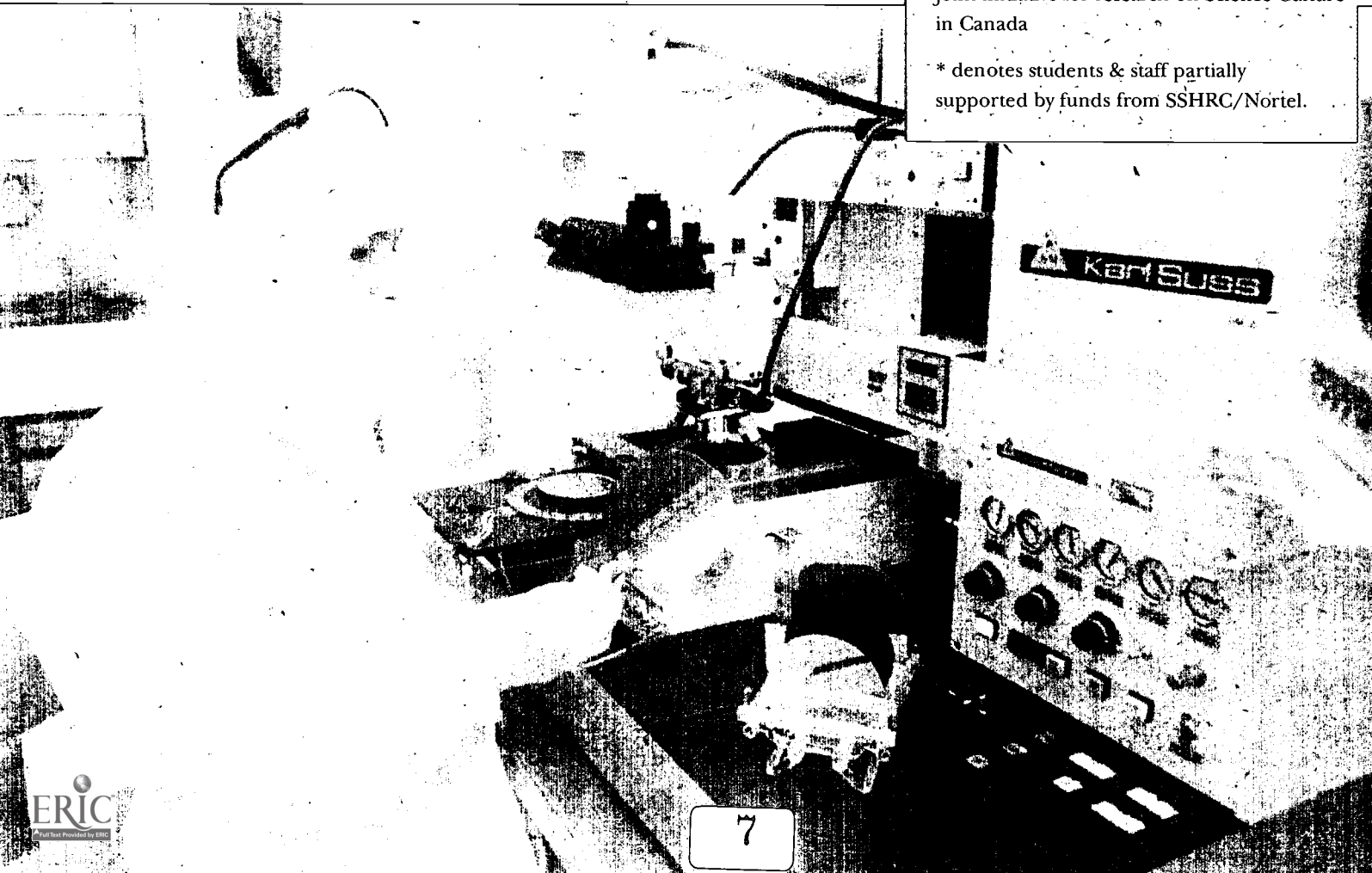
H. Bowie*, J. Browne*, M. Cahill*, A. Ciccocioppo*, O. Kotovych*, A. Madill, M. Nelson*, C. Sandulac*, L. Vaudan*, K. Zukiwski*.

Staff:

A. Colon, G. Ennis*, M. Gerber, D. Haverstock, T. Macdonald*, L. Montgomerie, & R. Perez*.

Funding was provided by the Social Sciences & Humanities Research Council of Canada and Nortel (Northern Telecom) under their joint initiative for research on Science Culture in Canada

* denotes students & staff partially supported by funds from SSHRC/Nortel.



SE061363

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: ATTRACTING FEMALES TO SCIENCE CAREERS: HOW WELL DO SPECIAL INITIATIVES WORK?	
Author(s): MADILL, MONTGOMERIE, ARMOUR, FITZSIMMONS, STELWIN & TOVELL	
Corporate Source: WISEST OFFICE, 252 ATHABASCA HALL, UNIVERSITY OF ALBERTA, EDMONTON AB CANADA T6G 2E8	Publication Date: 1997

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic/optical media, and sold through the ERIC Document Reproduction Service (EDRS) or other ERIC vendors. Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following two options and sign at the bottom of the page.

	The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2 documents	
☐ Check here **For Level 1 Release:** Permitting reproduction in microfiche (4" x 6" film) or other ERIC archival media (e.g., electronic or optical) *and* paper copy.	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY _____ _____ TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN OTHER THAN PAPER COPY HAS BEEN GRANTED BY _____ _____ TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)	☑ Check here **For Level 2 Release:** Permitting reproduction in microfiche (4" x 6" film) or other ERIC archival media (e.g., electronic or optical), but *not* in paper copy.
	Level 1	**Level 2**	

Documents will be processed as indicated provided reproduction quality permits. If permission to reproduce is granted, but neither box is checked, documents will be processed at **Level 1.**

"I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic/optical media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries."

Sign here→ please		
Signature: Helen Madill	Printed Name/Position/Title: DR HELEN M. MADILL PROFESSOR (PRINCIPAL INVESTIGATOR)	
Organization/Address: 2-64 Corbett Hall University of Alberta Edmonton Alberta Canada T6G 2G4	Telephone: (403) 492-2342	FAX: (403) 492-1626
	E-Mail Address: HELEN.MADILL@UALBERTA.CA	Date: March 23/98

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, *or*, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor: WISEST OFFICE

Address: 252 ATHABASCA HALL
UNIVERSITY OF ALBERTA
EDMONTON ALBERTA CANADA T6G 2E8

Price: NO CHARGE / HTTP://WWW.CHEM.UALBERTA.CA/~WISEST

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:

Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
1100 West Street, 2d Floor
Laurel, Maryland 20707-3598

Telephone: 301-497-4080
Toll Free: 800-799-3742
FAX: 301-953-0263
e-mail: ericfac@inet.ed.gov
WWW: http://ericfac.piccard.csc.com