# RETAINING GIRLS IN SCIENCE: EXPLORING THE EFFECTS OF THE OPERATION MINERVA PROGRAM

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## ABSTRACT

THIS PAPER PRESENTS FINDINGS FROM THE FIRST YEAR OF A THREE YEAR STUDY EXPLORING THE IMPACT OF A JUNIOR HIGH SCIENCE INTERVENTION PROGRAM FOR GIRLS. THE PURPOSE OF THE STUDY IS TO EXPLORE THE EFFECTS OF THE OPERATION MINERVA PROGRAM ACROSS EDUATIONAL SECTORS (PUBLIC, CATHOLIC, ALTERNATIVE) WITH RESPECT TO THE INTERVENTION EXPERIENCE, COURSE AND CAREER PLANS, AND ATTITUDES AND FACTORS INFLUENCING FEMALE SCIENCE RETENTION. FINDINGS SUGGEST THAT THE OPERATION MINERVA PROGRAM IS EFFECTIVE AT ENCOURAGING GIRLS TO PURSUE SCIENCE AS EVIDENCED BY 66% OF PARTICIPANTS REPORTING PLANS TO ENROL IN AT LEAST THREE (LEVEL 30) SCIENCE AND MATH COURSES, 92% REPORTING PLANS TO PURSUE POST-SECONDARY SCIENCE AND 90% REPORTING PLANS TO PURSUE A CAREER IN SCIENCE. AN EXPLORATION OF ATTITUDES AND FACTORS INFLUENCING SCIENCE RETENTION REVEALS CONTINUING CONCERNS RELATED TO FAMILY-CAREER BALANCE AND THE POSITIVE IMPACT OF INTEREST AND ABILITY, FEMALE SCIENCE ROLE MODELS, APPLIED SCIENCE EXPERIENCES, AND PARENTAL SUPPORT. FINDINGS ARE DISCUSSED AS THEY RELATE TO INTERVENTION PROGRAM ORGANIZERS, FEMALE SCIENCE MENTORS, EDUCATORS, AND STAKEHOLDERS FROM INDUSTRY AND GOVERNMENT.

## INTRODUCTION

Driven by concerns over junior high girls losing interest in science, the Operation Minerva Program was established to provide girls with hands-on experience in various fields of science and engineering. The program, now in its 15th year in Calgary, has expanded to urban and rural areas across Alberta (e.g. Red Deer, Medicine Hat, Fort McMurray, Athabasca, Grand Prairie and Pincher Creek). Approximately 90 girls and 30 female science mentors participate in the one-day Calgary Operation Minerva Program in May of each year. Student participants job-shadow their mentor and participate in hand-on activities that bring out special aspects of the job. For example, a mentor in the oil and gas industry demonstrated how one can drill for oil by removing chocolate from a cake "ground". Students have also utilized three-dimensional software for generating geological models and examined mutations in fruit flies through the use of a specialized microscope.

The purpose of the study is to explore the effects of the Operation Minerva Program across educational sectors (public, catholic, alternative) with respect to the intervention experience, course and career plans, and attitudes and factors influencing female science retention. The experiences of both students and science mentors are explored. Recommendations are provided for intervention program organizers, educators, women scientists, and stakeholders from industry and government. This paper presents findings from 2005, the first year of the 3-year study.

## LITERATURE REVIEW

### Science Attrition: Achievement, Enrollment & Employment

Literature outlining gender differences in science achievement, enrollment, and employment reinforce the need to focus efforts on attracting and retaining females in science. At the elementary and junior high levels, literature reveals that girls perform as well as their male counterparts until age 13, when they begin to slip behind in science achievement. (Connolly, Hatchette & McMaster, 1999) This gap increases each year until senior high, when females select few relevant electives, exhibit more negative attitudes and, by the end of high school, score considerably lower than boys in math and science. (Oakes, 1990)

Enrollment patterns at the secondary, post-secondary and graduate levels of education reveal a similar trend. Compared to males, females enroll disproportionately more in senior high biology courses while avoiding other sciences, especially physics. (Johnson, 1987) By university, women comprised only 22% of full-time students in engineering and applied sciences in 1997-98, up from 3% in 1972-73. Enrollment in mathematics and physical sciences rose from 19% in 1972-73 to 29% in 1997-98. By the graduate school level, the gender gap increases with women comprising only 23% of doctoral mathematics and physical science students, and only 16% of those in engineering and applied sciences. (Statistics Canada, 2000, 87) Women remain the minority in science careers, representing 21% of engineering, mathematics and natural science professionals. And regardless of educational attainment across all disciplines, female university graduates employed full-time earned 73% of what men earned in 1997. (Statistics Canada, 2000, 141)

### Factors Influencing Science Retention

Females decide not to pursue science courses and careers as a consequence of a combination of factors. Biological influences alone do not exclude girls from science; sociological and educational influences represent spheres that can have a significant impact on retention. Nevertheless, some scholars continue to look to biology to explain science attrition. Feminist scholars critique these efforts by highlighting the ways in which biological determinism has dictated and ultimately distorted findings. As Kaplan and Rogers (1994) note, a desire to prove gender and race differences in brain functioning is an attempt to provide an apparent scientific rationale for the existing social order. Research on spatial ability however, offers some insight into the influence of 'nature'. Although gender differences in visual-spatial abilities are minimal, (McArthur & Wellner, 1996) research suggests cognitive abilities are not entirely shaped by socialization. (Grugeon, 1993) Accepting that science aptitude and interest is influenced somewhat by biology, it must also be recognized that not all females, or males for that matter, are destined to be scientists. Of concern however, are those talented females who have science aptitude and interest who leave science as a result of limited opportunity and lack of necessary supports.

Feminist scholars highlight the influence of factors other than biology on female science retention as well as the impact of sociological and educational influences in retaining girls in non-traditional fields of study. Research examining early childhood play reveals that boys are more competitive, confrontational and individualistic, while girls are more cooperative, accepting, sociable, and intimate. (Grugeon, 1993) As children mature, a greater number of boys than girls report having participated in science-related activities. Although girls desired more involvement with science activities, they lacked previous experience. (Kahle & Lakes, 1983) This lack of experience may be correlated to gender differences with respect to interest in science. Differences in psychological development may explain girls' focus on relationships as opposed to competition. (Gilligan, 1982) Girls are particularly vulnerable during adolescence due to a strong relationship orientation, coupled with low autonomy and self confidence. This susceptibility greatly impacts a girl's construction of herself and significantly impacts her life choices. Science experiences that do not nurture these aspects of girl's psychological development can be enough to deter her from selecting science courses in high school and in turn, narrow her science course and career options in the future. Psychological differences and access to science-related activities highlight the importance of providing girls with meaningful science opportunities starting at an early age, especially the junior high level.

Student –teacher interaction, teaching approach, and classroom / school culture each have significant educational influences on science attrition. Research exploring student-teacher interaction in science classrooms reveals that females are at a disadvantage in terms of teacher time, (Haggerty, 1991) opportunities to carry out demonstration, (Jones & Wheatly, 1989), and engagement in higher order questioning. (Shakeshaft, 1986) In terms of teaching approach, gender inclusive strategies, including an emphasis on relationships, resonate with girls' interest in the connections to life, ownership of learning and

a feeling of efficacy. In addition, facilitating learning through relational knowing does not deter male students from liking science. (Hutchinson, 1996) Classroom culture also has a significant influence on science attrition. An inquiry into graphic representations of scientists in classrooms reveals males made up 93% of images. (Jones & Wheatly, 1989) Science textbooks may contain subtle forms of sexism in the selection of language, images, and curricular content. (Potter & Rosser, 1992) Student-teacher interaction, pedagogy, and classroom culture each represent areas for improvement in the arena of educational influences.

## METHODS

In 2005, 89 students participated in the Operation Minerva Program with 82 students completing the questionnaire (response rate of 92%). Of the 82 questionnaire respondents, 27 were from the public sector, 29 were from the Catholic sector, and 26 were from the alternative sector (drawn from public, catholic, charter and independent schools), A total of 27 female science mentors participated in the program with 23 completing the mentor questionnaire (response rate of 85%).

Survey questions related to the Operation Minerva experience were imported from the previous 2004 survey. Questions related to plans for science studies and career choice were imported from MacDonald. (2000) The exception is question seven which explores senior high science courses. This question was revised to gather more specific information on science course choice in the Alberta context.

Questions relating to attitudes influencing science retention were taken from Smith & Erb's (1986) Women in Science Sclae (WiSS), a tool used to measure attitudes of adolescents toward women in science careers. Five attitudinal statements from the twenty-seven item scale were chosen for inclusion in the current research as a follow-up to a retrospective study of 1991 Operation Minerva program participants. (MacDonald, 2000) MacDonald discovered that while former Operation Minerva participants (six years following their participation in the program) were found to possess very positive attitudes toward women and science according to Likert scores, five of the twenty-seven statements revealed less positive attitudes. These five statements are presented in both student and mentor questionnaires in order further explore these controversial attitudinal statements. While these statements do not relate specifically to science careers, they do focus on statements related to family – career balance from the female perspective. Statements related to factors influencing science pursuits were generated from a literature review including qualitative findings from MacDonald. (2000, 2004) Quantitative data is analyzed according to descriptive statistics and qualitative data is analyzed using grounded theory. (Strauss & Corbin, 1990)

## RESULTS

### The Operation Minerva Experience

Participants indicated the most enjoyable and interesting features of their job shadowing experience were *hands on activities (35%), exposure to applied science examples (22%), learning about science careers (13%), visuals & presentations (12%), exposure to female science role models (10%), exposure to new technologies (7%), games (7%),* and *interacting with other students (5%).* The least enjoyable aspects of the job-shadowing experience included: *lectures & meetings (20%), certain aspects of specific science applications (11%), disorganization / transportation (7%), presentations (6%), amount of information (4%),* and *not enough hand-on / applied science activities (2%).*

Participants recommended the following improvements to the Operation Minerva Program*: lengthen the experience (18%), more hands-on / applied science activities (16%), match student preferences to type of job shadowing experience (11%), smaller participant groups (9%), more diversity of job experiences (9%),* and *improved coordination of transportation (5%).*

### Plans for Science Studies and Career Choice

66% of Operation Minerva participants plan to pursue at least three Level 30 senior math and science courses. As outlined in the table below, 77% of Operation Minerva participants plan to enroll in Pure Math 30, 67% plan to enroll in Chemistry 30, 66% plan to enroll in Biology 30, and 48% plan to enroll in Physics 30. These findings suggest that Operation Minerva is effective at encouraging girls to enroll in senior high school science and math courses. Level 30 science and math courses are a requirement for most post-secondary science programs and as such are critical to the pursuit of a career in science. The lower percentage of students planning to enroll in Physics 30 is consistent with Johnson's (1987) finding

that girls enroll disproportionately more in senior high biology courses while avoiding other sciences, especially physics (Johnson, 1987).

According to educational sector representation, the highest number of Operation Minerva participants planning to enroll in Pure Math 30 (85%) and Physics 30 (56%) were from the public sector. The highest number of Operation Minerva participants planning to enroll in Biology 30 (73%) and Chemistry 30 (67%) were from the alternative sector. As presented in the table below, a high number of Operation Minerva participants from the Catholic sector also indicated plans to pursue senior high science and math courses.

TABLE 1. PLANNED ENROLLMENT IN SENIOR SCIENCE & MATH COURSES (%)

| Senior High Courses | All Sector Average | Public Sector | Catholic Sector | Alternative Sector |
|---|---|---|---|---|
| Pure Math 30 | 77 | ***85*** | 72 | 73 |
| Chemistry 30 | 67 | 67 | 66 | ***69*** |
| Biology 30 | 66 | 67 | 59 | ***73*** |
| Physics 30 | 48 | ***56*** | 41 | 46 |

61% of Operation Minerva participants planned to pursue a post-secondary science degree or diploma, 31% of participants planned to pursue at least one post-secondary science course, and 4% planned *not* to take a post-secondary science course. Considering 92% of participants planned to pursue either a science degree / diploma or at least one post-secondary course reveals that Operation Minerva is effective at encouraging girls to pursue science at the post-secondary level.

TABLE 2. PLANNED ENROLLMENT IN POST-SECONDARY SCIENCE BY SECTOR (%)

| Post-Secondary Science Choices | All Sector Average | Public Sector | Catholic Sector | Alternative Sector |
|---|---|---|---|---|
| post-secondary science degree or diploma | 61 | 67 | 52 | 65 |
| post-secondary science course | 31 | 26 | 45 | 23 |
| no post-secondary science | 4 | 4 | 0 | 8 |
| none of the above | 4 | 4 | 3 | 4 |

A comparison of educational sectors reveals a high number of public (67%) and alternative (65%) sector participants indicated plans to pursue a post-secondary science degree. A significant number of Catholic sector participants (52%) also indicated plans to pursue a post-secondary science degree or diploma.

TABLE 3. CONSIDERATION OF A SCIENCE CAREER(%)

| Career Plans | All Sector Average | Public Sector | Catholic Sector | Alternative Sector |
|---|---|---|---|---|
| Science-related career | 90 | 93 | 90 | 88 |
| Non science-related career | 10 | 7 | 10 | 12 |

90% of Operation Minerva participants indicated plans to pursue a science-related career. This finding suggests that Operation Minerva is very successful at encouraging girls to pursue science careers. Sector comparisons reveal minimal deviation. Themes from qualitative data included comments related to *preferred occupations (52%), the influence of interest in science & career opportunities (32%), uncertainty over career choice (12%), and the positive impact of the Operation Minerva Program (9%).*

## Attitudes Influencing Science Career Choices

As stated in the methodology, questions relating to attitudes influencing science retention were taken from Smith & Erb's (1986) Women in Science Sclae (WiSS), a tool used to measure attitudes of adolescents toward women in science careers. Five attitudinal statements from the twenty-seven item scale were chosen for inclusion in the current research as a follow-up to a retrospective study of 1991 Operation Minerva Program participants. (MacDonald, 2000) A 6-point Likert scale was used for each statement (strongly disagree to strongly agree; 1 - 6). While these statements do not relate specifically to science careers, they do focus mainly on attitudes related to family – career balance from the female perspective. The table below presents levels of agreement (including somewhat to strongly agree) for each statement.

TABLE 4. AGREEMENT WITH WOMEN IN SCIENCE ATTITUDINAL STATEMENTS (%)

| Attitude Statements | All Sector Average | Public Sector | Catholic Sector | Alternative Sector | Mentors |
|---|---|---|---|---|---|
| Careers are good for women as long as they are not the boss. | 2 | 7 | 0 | 0 | 0 |
| A woman's basic responsibility is raising children. | 6 | 11 | 3 | 4 | 14 |
| Getting married is the most important thing in a woman's life. | 12 | 7 | 17 | 12 | 3 |
| For a woman it is more important to be a successful wife and mother than it is to be successful in a career. | 16 | 22 | 21 | 4 | 3 |
| It is better for a woman to study home economics than chemistry. | 6 | 4 | 10 | 4 | 0 |

16% of Operation Minerva Participants (all sectors) agreed that *for a woman it is more important to be a successful wife and mother than it is to be successful in a career.* 12% of participants agreed that *getting married is the most important thing in a woman's life.* Mentors strongly disagreed with four out of the five attitudinal statements. However, 14% of mentors agreed that *a woman's basic responsibility is raising children.* Mentors' priority on motherhood is an interesting contrast to girls' continued concerns related to getting married and family – career balance. While the above statements were described by participants (students and mentors) as *outdated* and *archaic*, it is a useful exercise to explore controversial attitudes related to career choices, marriage and family.

## Factors Influencing Science Retention

Potential factors influencing science pursuits were generated from a literature review and qualitative findings from MacDonald. (2000, 2004) The table below presents levels of agreement (including somewhat to strongly agree) for each factor across sectors and also includes mentor responses. Strongest reported influences include: *interest in science (84%), impact of female role models / mentors (82%), science ability (79%)* and *impact of classroom learning (76%).* A high number of participants also reported *parental influence (69%), impact of 'out of school' science experiences (67%)* and *impact of the peer network (60%).* 35% of participants reported *media* and 18% of participants reported *traditional stereotypes* as factors influencing their decision to pursue (or not to pursue) science.

TABLE 5. FACTORS INFLUENCING SCIENCE RETENTION (%)

| Factors Influencing Science Attrition | All Sector Average | Public Sector | Catholic Sector | Alternative Sector | Mentors |
|---|---|---|---|---|---|
| interest in science | 84 | 81 | 79 | 92 | 93 |
| impact of female role models | 82 | 81 | 79 | 85 | 41 |
| science ability | 79 | 89 | 72 | 77 | 79 |
| impact of classroom learning | 76 | 89 | 65 | 73 | 83 |
| parental influence | 69 | 85 | 51 | 73 | 69 |
| impact of 'out of school' science experiences | 67 | 78 | 58 | 65 | 76 |
| impact of peer network | 60 | 59 | 52 | 69 | 41 |
| impact of media | 35 | 41 | 38 | 27 | 17 |
| traditional science stereotypes (scientists are men) | 18 | 26 | 13 | 15 | 14 |

Qualitative comments reinforce the impact of the following factors on science choices: *science interest (11%), impact of the Operation Minerva Program (6%), school influences (5%), media and stereotypes (5%), applied science experiences (2%), peer network (2%), parents,* and *other (12%).* Results support findings from MacDonald's (2000, 2004) retrospective study of Operation Minerva participants highlighting influences on science career choice including: *parental influences, the positive impact of the Operation Minerva Program, interest and ability, experiential learning,* and *the negative influence of 'chilly' secondary and post-secondary chemistry learning climates.* Also of interest are influences indicated by mentors in comparison to Operation Minerva participants. Findings suggest that mentors underestimate the potential influence of *female role models / mentors, girls' peer networks,* and *media.*

## RECOMMENDATIONS

Findings from this evaluation suggest that the Operation Minerva is effective at encouraging girls to pursue science as evidenced by 66% of participants reporting plans to enroll in a minimum of three senior (Level 30) science and math courses, 92% reporting plans to pursue post-secondary science and 90% reporting plans to pursue a science career. An exploration of attitudes and factors influencing science retention reveals continuing concerns related to family-career balance and the positive impact of interest and ability, female science role models, applied science experiences, and parental influence.

Operation Minerva improvement efforts should be aimed at lengthening and diversifying job shadowing experiences, continuing to work with mentors to ensure girls are engaged in applied and hands-on science activities, ensuring mentors address concerns over family-career balance, matching job shadowing placements with student preferences, and implementing the Operation Minerva Program in other jurisdictions. The success of Operation Minerva Programs rests on community commitment, regardless of stakeholder affiliation. From educator to scientist to parent to concerned citizen, everyone has an important role to play. Each city or town that hosts Operation Minerva is responsible to recruit volunteers and mentors, solicit funds for project costs, locate space and necessary equipment, and coordinate publicity. The growth of the program across Alberta indicates that communities are willing to support young women in their scientific pursuits.

Intervention programs such as Operation Minerva Program positively impact attitudes toward science, secondary and post-secondary science course enrolment, and the consideration of a science career by females. However, some areas of concern continue to persist, including the compatibility of a science career and family life, the persistence of 'chilly' academic and professional climates, contradictory cultural messages, and the adherence to traditional science teaching methods. Recent science retention strategies have employed single-sex classrooms / schools designed to encourage girls' self-esteem in non-competitive and inclusive environments. The Internet is also being utilized to foster mentorship relationships through

programs like the SCIberMENTOR Program in Alberta that links girls aged 11 to 18 with female university science students in order to encourage the pursuit of a career in science, math or engineering. Other initiatives are directed at boys' underachievement based on an understanding of gender differences. Boys' (under) achievement is grounded in power, achievement and behaviour as defined by the local community and peer groups, opposed to the influence of low self esteem on girls' science attrition. (Younger, Warrington, McLellan, 2002). These new insights expose the importance of giving careful consideration to gender concerns, as applied to both males and females, especially during adolescence. Adolescence is a time when peer group and social pressures become extremely influential for both genders, while at the same time academic choices definitively open (or close) career paths.

The success of future science retention efforts rests on the understanding and contribution of a cross-section of stakeholders, including educators, intervention program organizers, women scientists, and stakeholders from community, industry and government. Women scientists should make themselves available to intervention programs. Within these programs, role models should continue to address concerns related to family-career balance and engage girls in applied science experiences. Educators should continue to encourage girls in science through the use of hands-on, applied learning experiences and use of 'female friendly' examples and applications in order to address persistent stereotypes. Parents should continue to encourage their daughters in science by engaging in 'out of school' applied science experiences, encouraging secondary and post-secondary science enrollment, and discussing science career options. Other stakeholders from industry and government should continue to support science intervention programs through continued funding support, job shadowing opportunities, and encouraging employees to become mentors. While the Operation Minerva Program envisions a future full of possibilities for females in science, it is up parents, schools and science communities to work together to ensure that this vision becomes a reality.

## References


Connolly, J., Hatchette, V., & McMaster, L. (1999). Academic achievement in early adolescence: Do school attitudes make a difference? *Education Quarterly Review, 6*(1), 20-29.

Donaldson E. L. (1995). Women in Education. *Applying Research to the Classroom, 13*(1), 3.

Gilligan, C. (1982). *In a different voice: Psychological theory and women's development.* Cambridge, Mass.: Harvard University Press.

Grugeon, E. (1993). Gender implications of children's playground culture. In P. Woods & M. Hammersley (Eds.). *Gender and ethnicity in schools: Ethnographic accounts.* London: Routledge. 11-33

Guppy, N., & Davies, S. (1998). *Education in Canada: Recent trends and future challenges.* (Catalogue no. 96-321-MPE1998003). Ottawa: Industry Canada.

Haggerty, S. (1991). Achievement and participation in Canada. *American Journal of Educational Research, 37*(3), 195-208.

Hutchinson, N.L. (1996). Creating an inclusive classroom with young adolescents in an urban school. *Exceptionality Education Canada, 6*(3,4), 51-67.

Johnson, S. (1987). Gender differences in science: Parallels in interest, experience and performance. *International Journal of Science Education, 9*(4), 467-481.

Jones, M.G. & Wheatly, J. (1989). Factors influencing the entry of women into science and related fields. *Science Education, 72*(2), 127-142.

Kaplan, G. & Rogers, L.J. (1994). Race and gender fallacies: The paucity of biological determinist explanations of difference. In M. Lederman & I. Bartsch (Eds.). *The gender and science reader*. London: Routledge

Kahle, J.B., & Lakes, M.K. (1983). The myth of equality in science classrooms. *Journal of Research in Science Teaching, 20*(2), 131-140.

Keller, E. (1982). Feminism and science. *Signs: Journal of Women in Culture and Society, 7*(3), 589-902.

Klekamp, J., Riedel, A., Harper, C. & Kretschmann, H.J. (1991). Morphometric study of the postnatal growth of the hippocampus in Australian Aborigines and Caucasians. *Brain Research, 549*, 90-94.

Lederman, M., & Bartsch, I. (Eds.). (2001). *The gender and science reader*. London: Routledge.

MacDonald, T. (2000). *Long-term effects of a junior high school science retention program for girls.* Unpublished masters thesis, University of Calgary, Calgary, Alberta.

MacDonald, T. (2004). *Attracting & retaining girls in science: The success of the Operation Minerva project.* In E.L. Donaldson (Ed.), Coming of Age: A Century Educating Girls and Women in Alberta.

McArthur, J. & Wellner, K. (1996). Reexamining spatial ability within a Piagetian framework. *Journal of Research in Science Teaching, 33*(10), 1065-1082.

Moir, A. & Jessel, D. (1991). *Brain sex: The real difference between men and women.* New York: Bantam Doubleday / Dell Publishing.

Oakes, J. (1990). *Lost talent: The underparticipation of women, minorities, and disabled persons in science*. National Science Foundation. NSF R-3774.

Operation Minerva Project. http://www.awsn.com/opmin.htm. Contact Joyce Luethy (awsn@awsn.com). Medicine Hat – contact Patty Rooks (mhpraxis@telusplanet.net)

Potter, E.F. & Rosser, S.V. (1992). Factors in life science textbooks that may deter girls' interest in science. *Journal of Research in Science Teaching, 29*(7), 669-686.

SCIberMENTOR Program. www.scibermentor.ca. Contact Tamara McCarron (sciber@ucalgary.ca) or Alby Pei (sciber@ualberta.ca)

Shakeshaft. C. (1986). A Gender at Risk. *Phi Delta Kappan, 67*(7), 499-504.

Smith, W. & T. Erb. (1986). Validation of the attitude toward women in science scale for early adolescents. *Journal of Research in Science Teachers, 21* (4), 391-397.

Statistics Canada. (2000). *Women in Canada 2000: A gender-based statistical report.* (Catalogue no. 89-503-XPE). Ottawa: Minster of Industry. 294 pp.

Statistics Canada. (2003). *Women in Canada:: Work chapter updates.* (Catalogue no. 89F0133XIE). Ottawa: Minster of Industry, 24pp.

Strauss, A. & J. Corbin. (1990). *Basics of qualitative research.* Newbury Park, SAGE Publications.

Younger, M., Warrington, M., & McLellan, R. (2002). The 'problem' of 'under-achieving boys': Some responses from English secondary schools. *School Leadership & Management, 22*(4), 389-406.