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**FAMILY, HOME, AND THE SCHOOL ENVIRONMENT'S
INFLUENCE ON GIFTED GIRLS' PERCEPTIONS OF CHOICE TO TAKE
EXTRACURRICULAR SCIENCE CLASSES**

© Shaunda L. Wood

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in partial fulfillment of the requirements
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ABSTRACT

Does gender determine the choice to take science? When participation rates of men and women in scientific and mathematical fields are compared, all countries with statistical information have reported significantly lower participation rates for women (Heller& Ziegler, 1996). This was not shocking news. Under representation of women in sciences has been the norm since society frequently views women as lacking in ability, although there is no convincing evidence for different abilities in boys or girls (Bandura, 1997; Joyce & Weil, 1996; Weiner, 1985)

Gifted girls face many obstacles in their academic careers The literature review deals with two main areas, parental support and school attitude. The first area relates to parental support that includes parental expectations, gender roles, parental encouragement, and encouraging agency. Then school attitude, including socializing agents, attributional feedback, self-efficacy, self-concept, equity, teachers, fun and prior experience, and peers was examined.

This study attempted to explore the perceptions of gifted girls regarding school environment and parental support influencing their choices to take extracurricular science classes. This will add knowledge to the field of gifted education, specifically that of within-gender differences of gifted girls. Moreover, by knowing influential factors within the school environment and parental realm, educators and parents will be better equipped to nurture these in other gifted girls, thus, changing these 'obstacles' into positive challenges.

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FAMILY, HOME, AND THE SCHOOL ENVIRONMENT'S INFLUENCE ON GIFTED GIRLS' PERCEPTIONS OF CHOICE TO TAKE EXTRACURRICULAR SCIENCE CLASSES

Does gender determine the choice to take science? When participation rates of men and women in scientific and mathematical fields are compared, all countries with statistical information have reported significantly lower participation rates for women (Heller & Ziegler, 1996). This is not surprising news. Under-representation of women in sciences has been the norm because society frequently views women as lacking in ability, although there is no convincing evidence for differing abilities in boys or girls (Bandura, 1997; Joyce & Weil, 1996; Weiner, 1985). Where does this view originate?

Correlative studies sometimes make indirect suggestions as to similarities and differences within a gendered group regarding the selection of science. However, is it ability or societal pressures that influence these choices? Lubinski, Benbow, and Saunders (1993) believe that even if differences in gender related ability in math or spatial thinking is a fact, this would not explain girls not choosing or succeeding in physics courses. The main source of knowledge about girls' abilities in physics, frequently seen as a prejudice judgement, disagrees with their potential ability determined by empirical studies (Weiner, 1985). As Bandura (1997) explains the belief in one's ability affects not only our choices, but as well the success with which chosen courses of action are executed.

Of course, there are different levels of ability. Many high-achieving, high potential girls are labeled 'gifted' which may have different meanings to many people. Clark (1997) defines gifted individuals as those who perform or show promise of performing in any such areas and due to advanced and accelerated development, require opportunities not ordinarily provided by schools. It is society's responsibility to ensure their growth rather than the loss of their abilities.

This definition is general and could possibly be used to exclude individuals from gifted programs who have learning disabilities or who are underachieving. Accurate assessment and provision of choice are essential to providing for the gifted individuals' needs.

It is difficult, in examining science choices of gifted girls, not to include math as well. Mathematical skills are used increasingly in science class as one is promoted in the school system. Bandura (1997) believes girls have a lower opinion of their abilities for mathematical activities than do boys, even though they perform equally well in this subject. Females also attach declining usefulness of quantitative skills for their future pursuits (Bandura, 1997). Betz and Hackett (1981) posit that children's beliefs about their capabilities and their career aspirations are shaped by the family, the educational system, the mass media, and the culture at large. Boys' beliefs are positively influenced towards science while girls' beliefs are negatively shaped related to what they are taught in science class, how they perceive its usefulness, and the ways they're evaluated (Gilligan, Lyons, Hanmer, 1990; Tobin & Garret, 1987).

During this decade, gifted girls still find themselves divided because femininity and giftedness are often viewed as incompatible characteristics (Guzzetti & Williams, 1996; Howard-Hamilton, 1991). Weiner (1985) also notes that physics is often considered unfeminine by western societies. What does being feminine have to do with logical-mathematical intellectual pursuits? Howard-Hamilton and Robinson (1991) find girls who do not follow prescribed traditional sex roles utilize higher intellectual ability than those who accept feminine sex-role characteristics by being nurturing, kind, and gentle. This conflict between sex-role characteristics and intellectual ability decreases self-concept, IQ scores, and the estimation of achievement related behaviors during adolescence (Howard-Hamilton & Robinson, 1991).

In the search for literature regarding gifted girls, only one out of ten studies related to giftedness concerns gifted girls, while even fewer mentions gifted girls and science (Callahan, 1979; Eccles, 1985; and Reis, 1987). Moreover, it does not appear to be a major concern as the field of researchers in North America is not rapidly expanding. From 1996 to date, there have been only two new dissertations listed on ProQuest Dissertation Abstract regarding gifted girls and science. There appears to be approximately 12 scholars who work consistently in the field such as Benbow, Callahan, Dweck, Eccles, Howard-Hamilton, Kerr, Lent, Leroux, Lubinski, Raymond, Reis, and Silverman. Almost thirty years has gone by since researchers have made suggestions for further study and still these suggestions go unanswered. Achenbach (1970) thought questions must be raised about how and when the cycle of lower female achievement and fewer accomplishments begins because females attain higher grades than males throughout elementary, high school, and college. What factors affect this lower cycle of female achievement in relation to science?

CHAPTER ONE LITERATURE REVIEW

There are factors within the realm of family and school that have an effect on girls' attitudes toward science. In turn, these attitudes towards science impact gifted girls' choices to take extracurricular science classes. This notion of attitudes toward science influencing choice is generally accepted by most researchers. Environmental factors are the emphasis of this study but further investigation into influences of other factors is warranted.

Factors

In relation to the family and home environment, the sub-headings will include parental support, parental expectations and gender roles, parental encouragement, and agency. School attributes deals with socializing agents, attributional feedback, self-concept, promotion of self-efficacy, equity, the power and style of discussion, teachers, fun and prior experience, and peers. Next, the three research questions that drive the study are discussed. Finally, a connection between the conceptual framework and the literature reviewed is presented.

Family and Home Environment

Parental Support

How can parental support influence gifted girls' choices to take science? Parents are the child's first educator, "responsible for their early socialization, and for laying down a mental and emotional framework which can be built on by school and community when they move out into the world" (Centre for Educational Research and Innovation, 1997, p.15). For this reason, it is almost impossible to separate home and school as each contributes to the child's learning experience. According to Kellaghan, Sloane, Alvarez, and Bloom (1993), the home environment

is a powerful component in determining the success of students including their level of school achievement, their interest in school learning, and the number of years of education they will attain. In addition, the American Association for University Women completed the Greenberg-Lake (1991) study and concluded that family and schooling have a greater impact on self-esteem than do peer groups. As well, pride in schoolwork, the belief that one is able to do many things well, and the feeling of being important in one's own family were the major contributions to self-esteem in this study (Kerr, 1994).

While it is important for normal child development that children have their needs recognized and met by parents or another significant adult, Louis and Lewis (1992) found that parents are good judges of giftedness in their preschool children. They found that 61% of parents who brought their child in for testing had children with a superior IQ (130-140+). This parent identification rate agrees with past research of Jacobs (1971) and, Silverman, Chitwood, and Waters (1986). More currently, Kerr (1994) concluded that parents who suspect their child is gifted are correct 99% of the time. This accuracy makes parental assessment one of the best means of screening for giftedness. An accurate parental perception of their child's abilities can circumvent boredom or frustration, as well as underachievement, on the part of the child (Louis & Lewis, 1992).

Parental Expectations and Gender Roles

Parents of gifted children appear to have different expectations than do parents of non-gifted children. The former expect a greater sense of independence in terms of self-care and achievement (Karnes, Shwedel, & Steinberg, 1984). In Bandura (1997) asserts, however, that parental beliefs about their children's capabilities differ depending on the sex of the child. Hence, parents frequently have different expectations for gifted females which may influence

their decision not to enroll them in a gifted program when the child has been tested and accepted. Parents often fail to inscribe a daughter because of sex-typed values that reinforce conformity, docility, and other sex role characteristics in girls such as love of children, gentleness, and understanding (Bem, 1974). The more strongly girls adopt gender-roles that are stereotypically feminine, the more frequently they underestimate their capabilities (Bandura, 1997; Kerr, 1994).

How are parental expectations transferred to their children's behavior? Girls and boys appear to have different patterns of self-appraisal whose origins are partly in their parents' gender-linked beliefs about the capabilities of children (Phillips & Zimmerman, 1990). Hence, even when equally competent, boys exaggerate their sense of competence and girls generally disparage their capabilities (Phillips & Zimmerman, 1990). Parents view school as more difficult for their daughters despite evidence of high academic achievement (Hollinger & Fleming, 1992; Phillips & Zimmerman, 1990). Similarly, girls often perceive that mothers have lower academic expectations and allow lower grades and achievement for them compared to boys (Phillips & Zimmerman, 1990). Is it any wonder then that females tend to decline the opportunity to engage in science or math related activities?

The very characteristics that some parents value, model, and teach to their daughters may cause them to perform poorly and avoid 'masculine' subjects such as math and science. Howard-Hamilton and Robinson (1991) believe that boys are encouraged to develop adventure, independence, and risk-taking abilities. Conversely, girls are not being provided similar social learning experiences but may be encouraged to underestimate their own intellectual, psychological, and emotional abilities.

Parental Encouragement

Raymond and Benbow (1989) investigated differences in parental encouragement for math and science-oriented children compared to children with a strength in verbal areas. Differences for parental gender preferences were also studied. This study failed to find significant gender differences in parental encouragement. It was not what the parents said but, perhaps, what they modeled that instilled stereotypical ideas. A previous study, collected from the children themselves, agreed with the finding that parental encouragement and gender expectations did not correlate with gender differences in math and science ability of the students (Raymond & Benbow, 1986).

From the aforementioned data, it appears that stereotypical expectations may be the root of the problem, although parents intended to be encouraging. Because fathers were involved in math and science areas and mothers in verbal areas for the most part, this role-modeling might develop the idea of math and science choices being more appropriate for males. Thus, sex role awareness is an important consideration for parents and teachers as behaviors can communicate messages to gifted young women in subtle ways that affect their achievement motivation (Bandura, 1997; Raymond & Benbow, 1989). It appears that the saying, 'actions speak louder than words,' may be appropriate in this situation.

Agency

According to Bandura (1997), the level of efficacy-promoting influences in the home environment plays an important role in searching for a link between socioeconomic (SES) background and level of cognitive functioning. From the Barber and Eccles' (1992) study, scholastic performance of children's in intact families were compared to children from single parent homes. They found that children in divorced and never-married families generally

showed lower levels of cognitive performance and self-esteem and higher levels of delinquency. The differences, however, tended to be small and disappear when other variables were taken into account such as maternal employment and family dynamics.

On the other hand, Lam (1997) concluded that children from single-mother families with a high SES background and authoritative parenting, which included parental monitoring, parental supportiveness, and psychological autonomy, did not show lower academic achievement when compared to intact families of similar SES. So, in a sense, efficacious parents influence self-efficacy in their children. Martinez-Pons (1996) believes children who are good at managing their own learning activities have parents who encourage such capabilities by modeling, guiding, and rewarding self-directedness. But does parental influence transcend gender?

Because parents generally spend more quantitative and qualitative time with their daughters, special care needs to be given to encourage the development of characteristics that promote ability in their formative years. Parents should encourage independence, self-confidence, and self-assertiveness, but not to the exclusion of feminine attributes (Bandura, 1997; Gilligan, Lyons, Hanmer, 1990; Hollinger & Fleming, 1992). Role-modeling and encouragement are ways parents can help encourage agency. As well, correlations found while investigating agentic self-perceptions in gifted females suggest that involvement in athletics and mastery of other opportunities may contribute to the development of agency (Hollinger & Fleming, 1992). The importance of other socializing agents are mentioned in the literature, but parents are only one aspect of this.

School Environment

Socializing Agents

The school environment is the next largest contributor to learning experiences that help to mold gifted girls' self-concept. Diener and Dweck (1980) believe that young women's prior experiences in the home and the characteristics adopted from significant persons or other socialization agents during regular social interactions contribute to the development of specific attributional patterns. Therefore, how gifted girls see themselves depends both on reinforcement behaviors of teachers (Bandura, 1997; Dweck, Davidson, Nelson, & Edna, 1978; Gilligan et al., 1990; Kerr, 1994) and the relationship with their parents (Bandura, 1997; Gilligan et al., 1990; Kerr, 1994; Phillips & Zimmerman, 1990; and Yee & Eccles, 1988). Gifted girls' attributions mean that gender-related attribution patterns are, at the very least, partially learned (Bandura, 1997; Heller & Ziegler, 1996).

The quality of acceptance appears to be learned well by gifted girls. Kerr (1994) believes that in schools today, girls' contributions are treated as less important than boys. In addition, the intellectual and emotional needs of gifted girls are often not addressed because the family has other priorities and because gifted girls are so accepting of these other priorities (Kerr, 1994). When tracing the paths of successful, eminent women, the contributions of helpful individuals are frequently acknowledged but who stands accountable for the underachievement of gifted girls?

Attributional Feedback

Because girls attribute their successes frequently to external factors (e.g. luck, easy task) and failures to their own lack of ability, a pattern may be created that leads to learned helplessness (Ryckman & Peckham, 1987). Self-evaluation style is dependent upon experiences

in and reinforcement from the educational environment which may influence future motivation (Ryckman & Peckham, 1987). As Bandura (1997) states, “attempts to explain the motivational sources of behavior must specify the determinants and intervening mechanisms that govern the three main features of motivation: selection, activation, and sustained direction of behavior toward certain goals” (p.228). Motivational factors and gifted girls’ perceptions of self seem to play a key role in explaining gender differences in choice, performance, and sustained scholastic careers in science (Heller & Ziegler, 1996; Leung, Maehr, Harnisch, 1996). Can girls’ perceptions of self be changed to provide greater probability of science selection?

Until the sixth or seventh grades, few gender differences have been recorded involving external factors, since this is when learned helplessness patterns of girls in math and science may develop as a result of conflicting role models (Cooper et al., 1981; Gilligan et al., 1990; Wright & Leroux, 1997). The literature suggests that gifted girls should be evaluated differently in math and science (Bandura, 1997; Heller & Ziegler, 1996). Gifted girls should receive attributional feedback after success and variable feedback after failure (Bandura, 1997; Heller & Ziegler, 1996). In this way, failure would be considered bad luck or lack of effort while success would be credited to talent and ability.

Heller & Ziegler (1996) completed a study of middle school students with the hope of re-training gifted girls’ self-evaluation style. Because of the impressive improvements in self-concept and achievement related to math and science, the authors suggest that retraining may be more effective as prevention rather than remediation. And so, reducing the cause of decreased self-confidence, anxiety, and interest may help to eliminate gender differences in relation to selection and achievement in science courses in secondary grades or later.

Self-Concept and Self-Efficacy

Interactions within the social milieu accumulate and contribute to the development of self-concept in gifted girls which may serve to discourage them from choosing science. Hard work and persistence are attributes that teachers and parents cite most frequently when describing girls' success in science, while boys' successes are credited to special abilities (Bandura, 1997; Chipman & Thomas, 1987; Yee & Eccles, 1988) and their scholastic failures are thought to be due to lack of effort and disruptiveness (Bandura, 1997). Chipman and Thomas (1987) believe these attitudes not only influence parents' and teachers' behavior, but they also adversely affect the development of girls' self-concept about their giftedness.

Does a girl's self-concept influence her choice to take science? According to Greenberg-Lake (1991), there appears to be a circular relationship among liking math and science, self-esteem, and career aspirations. In her opinion, it seems that girls who enjoyed math and science had higher self-esteem and aspirations and vice versa. But what about self-concept?

It appears that some researchers, prior to Bandura (1997), did not clearly define the terms self-concept, self-esteem, and self-efficacy, in fact, they were often used interchangeably. Bandura (1997) claims that efficacy beliefs, rather than self-concept, may be highly predictive of behavior. Self-concept is a combination of views about oneself that is thought to be formed through direct experience and evaluations adopted from significant others (Bandura, 1997). Moreover, Bandura (1977; 1997) defines self-efficacy as the expectation that one has the capacity to complete a given task or goal. Thus, the strength of girls' self-efficacy will determine whether they will select to study science, as well as the amount of effort that will be devoted to pursuing the goal and the degree of goal persistence in the face of barriers (Bandura, 1977). The study by Lent, Brown, and Larkin (1984) supports this in that students with high self-efficacy in

science tended to achieve high grades in science courses and remain science majors. Thus, self-efficacy appears to explain more of the difference in academic success and persistence than career interests do for both men and women (Bandura, 1997; Lent et al., 1984).

According to Bandura (1997), “perceived self-efficacy is an often better predictor under variable conditions than past performance, because efficacy judgement encompasses more information than just the executed action” (p.81). However, this same pattern of findings was reversed in two studies by Lent et al. (1986 & 1987) where significant gender differences in career self-efficacy expectations were not found among college women and men. This contradicts research findings that even young gifted women give greater weight to the gender appropriateness of careers than they do to their abilities and interests in career decision making (Betz & Hackett, 1981& 1983; Post-Krammer & Smith, 1985; Kelly, 1993). It is possible, therefore, that lack of self-efficacy is most prevalent in adolescent girls (Post-Krammer & Smith, 1985). Hence, the college population of young women in Lent et al. (1986; 1987) may have had higher self-efficacy than those women who chose not to attend college. It appears that self-concept and self-efficacy should be enhanced differently with younger gifted females since this has been identified as a major component of underachievement.

Equity: Equality

Evaluation of classroom environments by teachers is needed to ensure equity, or fairness, and to provide gifted girls with active participation in the learning process (Hollinger & Fleming, 1992). Bandura (1997) believes that “unless [teachers] are proactive in promoting equal gender opportunities to learn science and math, the [already] more skilled male students come to dominate these instructional activities, which further entrenches differential development of quantitative competencies” (p.431). To address equity issues would include assessing factors like

the enrollment patterns of gifted girls, curriculum, textbooks, posters, and educational materials to promote “agentic self-perceptions”(Hollinger & Fleming, 1992, p.156) that would include self-assertion, active independence, decisiveness, and self-confidence (Hollinger & Fleming, 1992).

Crombie, Bouffard-Bouchard, and Schneider (1992) examined the overall enrollment in gifted programs in the Ottawa area. The authors found a greater number of gifted girls (20%) did not enroll in a gifted program after being accepted. This agrees with Bem (1974) who noticed that if a child did not enroll in a gifted program after being accepted, the child was almost always a girl. Crombie et al. (1992) also noted that there are more gifted boys enrolled than gifted girls, and that more girls did not score high enough on achievement tests after being identified as gifted by the teacher. These findings reveal a discrepancy between the ideology of equality, equity, and the actual results achieved.

An ideology of equality permeates teacher training, parental statements, school mandates, curriculum guidelines, as well as publishers of textbooks, and distributors of educational materials. Many of these governing bodies truly believe they are conveying gender and racial equality. However, there appears to be a hidden curriculum in schools that includes the verbal and nonverbal messages students receive about themselves and others of their gender and race through illustrations, language, content of books and film, and feedback from the teacher regarding appropriate gender behavior (Bandura, 1997; Howard-Hamilton and Robinson, 1991).

In addition, Tavis (1991) posits that equality is based on status, not always on gender. Those who are different from the average are those often making the greatest adjustments (Evans, 1996; Tavis, 1991). Hence, gifted girls are of low status based on their gender, and different by virtue of their intelligence. With the burden of this double adjustment, they may

have been required repeatedly to adjust to the dominant group, thus using or wasting their giftedness on these adjustments instead of their goals.

Equity: The Power and Style of Discussion

Girls and women are placed in inferior positions in discussion with males who seldom give females a chance to talk, who regard what they say as unimportant, and consider women to be unequal participants in the discussion (Bell, 1989; Guzzetti & Williams, 1996; Leroux, 1997). Bernstein and Gilligan (1990) believe girls think fairness and listening are intimately related concepts. Furthermore, Cherryholmes (1988) claims that hidden rules govern discourse, establishing who can speak, when, and with what authority. It is not necessarily what is being said, but who is doing the talking that reflects the 'power' in a relationship (Guzzetti & Williams, 1996). Tobin and Garrett (1987) believe that the tendency for boys to achieve more than girls in science results from greater opportunities to engage in academic activities, such as discussions.

Why is discussion so important in the learning process? Alvermann and Hynd (1989) think that depriving females of discussion is especially harmful in science because it is important to discuss ideas when students' theories are contradicted by scientific thought. Guzzetti and Williams (1996) examined the perceptions of students who participated in science class discussions. Because young women frequently expressed their opinions in the form of questions, males in this study thought that girls' questioning indicated a lack of knowledge that was consistent across sections of physics (Evans, 1996; Guzzetti & Williams, 1996).

However, "girls' explanations for their differential participation in whole class, refutational discussions alluded to issues of self-confidence and social norms" (Guzzetti & Williams, 1996, p.41). Is it any wonder that girls decide not to participate in science class discussions? Gilligan et al., (1990) states:

As girls themselves say clearly, they will speak only when they feel that someone will listen and will not leave in the face of conflict or disagreement. Thus, the fate of girls' knowledge and girls' education becomes tied to the fate of their relationships (p.25).

Gilligan found that girls use different approaches to understand and master information that is traditionally used in science classes. For example, many girls need to see the social relevance of the scientific concepts taught. This may be another reason why girls did not choose or excel in science and math in the past, and may stem from the way materials of such courses have been presented (Gilligan et al., 1990). Teachers should be aware of these different approaches, as it is they who decide how information is presented and how learning takes place.

Are there still gendered social norms permeating the school system in this decade? The young females in the Guzzetti and Williams (1996) study complied with socially learned norms of gender-appropriate language by refuting less often and by posing refutations as a question. These young women who are self-confident enough openly express themselves as "feeling ineffectual and having their opinions dismissed by the boys" (Guzzetti & Williams, 1996, p.41). By the time girls' reach science classes at the high school level, they have already learned when women speak and when they are silent. Gilligan et al., (1990) think society sends a clear message, "keep quiet and notice the absence of women and say nothing" (p.26).

Equity: Teachers.

What instructor/teacher would allow the aforementioned opinions to be dismissed? Perhaps the teacher models dismissive behavior for the boys to learn, or fails to correct these inequities. During large-group discussions concerning scientific concepts, science teachers will take males' arguments more seriously and will elaborate more on males' responses (Gaskell, McLaren, & Novogrodsky, 1989; Jones & Wheatly, 1990; Lemke, 1990; Leroux, 1997). "Many

teachers are gender blind, believing that the equity issues in science teaching are resolved” (Bailey, Scantlebury, & Letts, 1997, p.29).

Is this treatment of girls intentional or related to lack of awareness? Research reports that teachers are usually unaware of gender bias in classroom discussions and activities because they only look for gender bias in their own attitudes and behaviors (Gaskell et al., 1989; Jones & Wheatly, 1990; Leroux, 1997; Tobin, 1988). Female students attributed gender inequity to the male students in the class, and not the teacher. Results of this study also indicate that students who do not recognize gender inequities are most often male (Guzzetti & Williams, 1996).

Not all teachers are able to address multi-faceted issues in the classroom. With the increase in technology coupled with ever increasing social pressures and responsibilities, many teachers do not think they can fulfill teaching expectations. Bandura (1997) believes “teacher efficacy in science education is of particular concern, given the increasing importance of scientific literacy and competency in the technological transformations occurring in society” (p. 242). It has been suggested that making the science classroom more girl-friendly would be one way to address the different learning styles and experiences of girls (Belenky, Clinchy, & Goldberger, 1986; Gaskell et al., 1990). A girl-friendly environment is one where teachers must think they are able to intervene to ensure equal participation, where women scientists are discussed, and where social issues associated with scientific discoveries are examined (Gaskell et al., 1990). Such small changes in teaching style may help some girls see the social significance and the meaning in the science lessons they are taught.

Fun and Prior Experience

Between 1980 to 1983, Raymond and Benbow (1986) identified a subgroup of exceptionally talented students who scored over 700 on the reasoning ability section on the SATs

for students less than 13 years of age. Results showed 268 boys and only 23 girls scored over 700 (Raymond & Benbow, 1986). Does that ratio of 11:1 indicate a higher reasoning ability in males or has the assessment tool taken advantage of the experiences and learning styles of most boys. It has been thought, as far back as the Terman studies [1947], that I.Q. and other standardized tests emphasize training more often received by boys than girls (Kerr, 1994). Heller and Ziegler (1996) think prior experiences with mathematical, physical, or technological problems, games, or learning opportunities influence gender differences. Boys are positively influenced and girls negatively with regard to the development of interests in such areas (Farenga & Joyce, 1998; Heller & Ziegler, 1996). But what influences boys and girls to have different scholastic interests?

Examining gifted elementary and junior high school students' ideas of academic fun, Middleton, Littlefield, & Lehrer (1992) found that ideas of fun are common across age and gender as seen in Figure 1. Fun activities require a high level of arousal, a high level of perceived control, more challenge, and tasks tailored to personal interests (Middleton et al., 1992). Bandura (1997) believes people show enduring interest in activities at which they feel efficacious and from which they derive self-satisfaction. More specifically, the Middleton et al. (1997) study reports that boys find gym, lunch, and computer technology the most fun. On the other hand, girls find art, spelling, and being in the gifted program to be the most fun. Fun in science and computer technology courses peak in grade five for both genders and resembles a 'bell-curve', although boys think these two courses are more fun. Interestingly, children in grades six and seven place socializing with friends as the most fun. This applies to both genders (Middleton et al., 1992). Middleton's definition of fun should be seen as one of the most important attributes of gifted education, as it motivates students to seek intellectual challenge

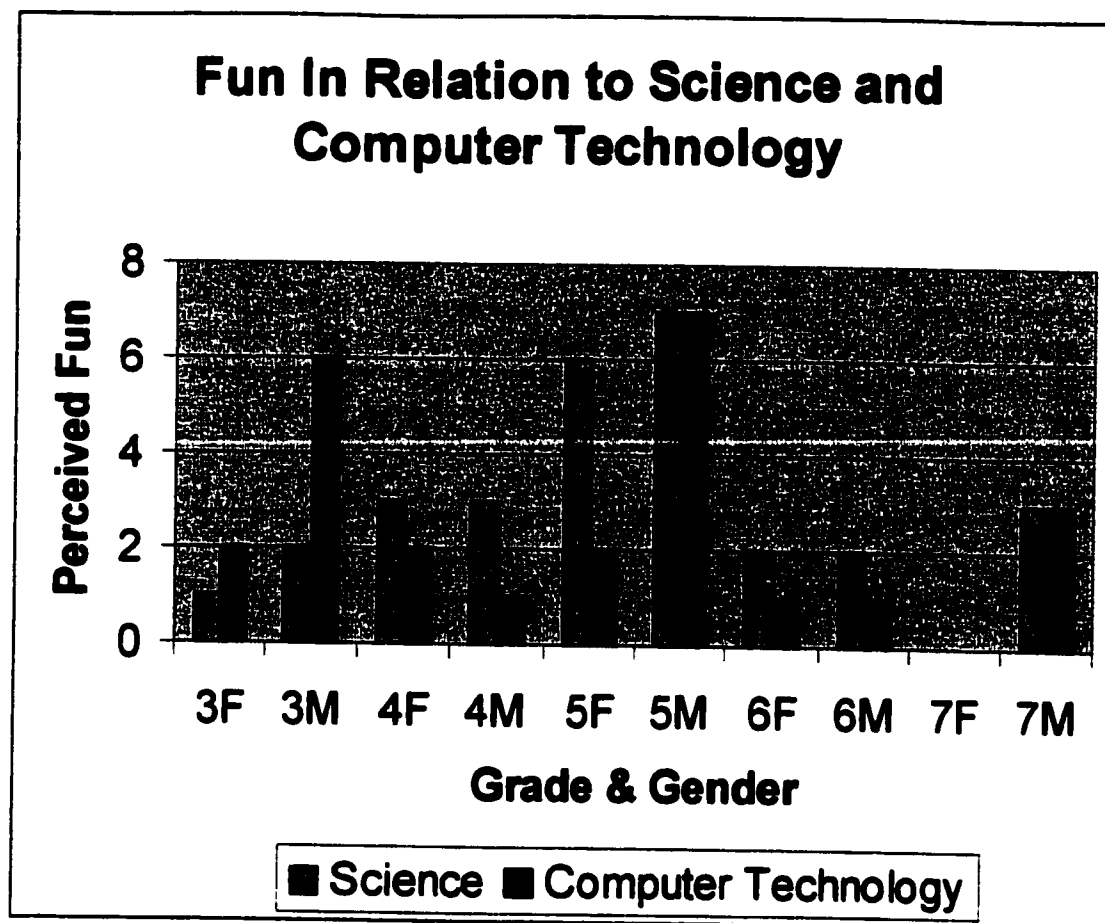


Figure 1 Middleton's et al. (1992) most fun aspects of school related to gender in science and computer technology.

throughout their lives. Changes in perceptions of fun and the need to socialize could vastly affect choices of young gifted females to take science classes (Bandura, 1997; Middleton et al., 1992).

Peers

Believing that children choose or gravitate toward others who share similar interests and values, Bandura (1997) attributes this to perceived self-efficacy. Efficacy experiences begin in the family but as the child's social world enlarges, peers become more important in their "development of self-knowledge of their capabilities" (Bandura, 1997, p.169). "Children are especially sensitive to their relative standing among peers with whom they affiliate in activities that determine prestige and popularity" (Bandura, 1997, p.173). This appears to be a vicious circle. If a child is not highly self-efficacious, he/she may choose less efficacious friends who perhaps promote negative behaviors that make one less accepted and popular. This decrease in popularity further lowers the child's self-esteem and perceived self-efficacy.

Peer pressure appears to be a very real problem within schools today as it influences underachievement within the gifted population. Clasen and Clasen (1995) attempted to understand underachievement within a gifted population aged 11 to 16. Over half of the students thought peer pressure from other children was the primary force against striving for good grades. The second factor was friends who demand an excessive amount of time be spent on non-academic activities. Interestingly, some students thought their friends were a buffer against peer pressure from 'other kids' and shared the need to get good grades (Clasen & Clasen, 1995). These findings support Bandura's (1997) belief that children will choose friends who share similar interests and values.

What if one can't choose their social group? Unfortunately, Bandura makes it sound as if everyone is free to choose what he or she wants and achieve it. Gilligan et al. (1990) thinks,

however, that girls are not really free to choose anything due to societal pressure and expectations related to gender. Luftig and Nichols (1990) investigated the social status of gifted children with same aged, non-gifted peers. Gifted boys were thought to have the highest social status. On the other hand, gifted girls were regarded by peers as having the lowest social standing. They were not actively disliked but perhaps misunderstood.

School and society send mixed messages concerning the role of gifted females. They are encouraged to utilize their abilities and talents academically but are not expected to be assertive in social situations (Luftig & Nichols, 1990). No one explains this duplicity of roles. According to Gilligan et al., (1990), gifted girls have not observed and learned when to be silent; hence, they are not readily accepted by many of their peers. Gifted students need to resolve the perceived conflict between scholastic achievement and belonging to the peer group by striking a balance between the two options (Clasen & Clasen, 1990). For these researchers, raising the self-confidence and self-efficacy beliefs of gifted girls with mastery experiences may improve this conflict between achievement and affiliation, a view that is also supported by Bandura (1997).

Some students use strategies to deflect attention from their academic achievement by: keeping their grades or school work to themselves (Clasen & Clasen, 1990; Bell, 1989), participating in sports (Bandura, 1997; Clasen & Clasen, 1990; Hollinger & Fleming, 1992), or demonstrating negative behaviors such as acting out, drugs, ... (Clasen & Clasen, 1990). Obviously, these temporary strategies do not solve the problem.

The differences among gifted girls are great. Whether students and parents choose gifted programs, public or private schools, same gendered schools, or home schooling, the question remains. Should gifted girls be sacrificed for the good of others? While Bandura (1997) believes that ability grouping is harmful to those students lacking in ability, atmospheres of cooperative

learning and individualized programs are the answer. Conversely, gifted students are frequently annoyed and bored with the slowness and repetition that is needed by slower learners (Clark, 1997). Less self-efficacious students would probably be assigned menial tasks by the more able students during mixed ability group work, which would further lower their perceived self-efficacy (Evans, 1996).

Leroux (1997) found that gifted students value competition and leadership skills learned in their groupwork with able peers. These students also thought it important to be in the gifted class because of the understanding and support they gave each other (Leroux, 1997). Although this study included the combined opinion of both genders, it is not known if both genders value competition, leadership, understanding, and support equally. It is apparent that gifted girls have different needs within their own population. There is no universal remedy for these inequities except, perhaps, a less gender-restrictive society that truly allows choice and voice.

Research Questions

The purpose of this research is to explore how school attributes and parental support impact gifted girls' choices to take science classes. Why do some girls continue to take extracurricular science classes and others do not? Also, what role does parental support play with girls taking science classes?

Many parents of gifted girls enroll their children in Saturday Gifted Programs to enhance their learning. The Extracurricular Saturday Program offers challenging workshops with different types of subject matter for various age groups. The researcher has noted that during extracurricular science class, grades three to six, that attendance of girls' past grade five is minimal. As well, the parents who attend the science classes with their children often do so with only girls' in grades three and four. Gifted girls in elementary school must follow the set

curriculum, but their choices of extracurricular activities may indicate future subject preferences. Kerr (1994) concluded that choices made in adolescence create clear limits on adult attainments. It is important, therefore, to investigate at what age does the cycle of lower achievement begin, as suggested by Achenbach (1970). The following are research questions that will guide this study:

- 1) What do girls, grades 4-6, perceive as the reasons within the school environment that influence their choices to take extracurricular science classes?
- 2) From the girls' perspectives, how can parents' best support and encourage their daughters, grades 4-6, to take extracurricular science classes?
- 3) What are the attitudes toward science held by girls in grades 4-6?

The Conceptual Framework in Relation to the Factors Identified From the Literature Review

The research questions were studied in light of Bandura's Social Cognitive Theory. From this theory and the review of literature, the factors influencing girls to choose extracurricular sciences were grouped in three categories: personal characteristics, behavioral characteristics, and environmental characteristics.

From the review of literature, the researcher identified 21 factors from the main and sub-headings of the text. When searching for a conceptual framework to express the relationship among these 21 factors organized into three themes, Bandura's Triadic Reciprocal Causation appeared to be a suitable choice. Bandura (1997) posits that humans act intentionally in an interdependent 'cause and effect' structure that involves a three way relationship as seen in Figure 2.1.

The three determinants of reciprocal interactions just mentioned interact and influence one another bi-directionally (Bandura, 1997). Bandura's three determinants need not be of equal strength and their influence may vary in given circumstances and activities. These determinants influence and affect each other, but not necessarily at the same time. Moreover, the mutual influences of the individuals' and their reciprocal effects do not all happen simultaneously but take time to exert their control. Bandura (1997) concludes that it is possible to gain an understanding of how different parts of this 'cause and effect' relationship functions without having to assess every possible interacting factor at the same time. Thus, the 21 identified factors can be arranged under each of Bandura's three 'triadic reciprocal causation' categories as seen in Figure 2.2.

Seven factors are attached to each of the above three categories that include: (1) Personal characteristics: self-concept, self-efficacy, self-agency, motivation, ability, self-appraisal, and self-evaluation. (2) Specific behaviors: choosing science classes, non-traditional sex-roles, achievement, voicing opinion, independence, confidence, and assertiveness. (3) Environmental characteristics: equity, role models, expectations, attributional feedback, peers, encouragement, and fun. It is possible, of course, that other factors may emerge from this study as it aims to explore what influences gifted girls' choices to take extracurricular science classes. A major goal for the individual is to self-regulate behavior, or in other words, to control the sources of personal, behavioral, and environmental influences that affect learning and performance (Bandura, 1986 ; 1997).

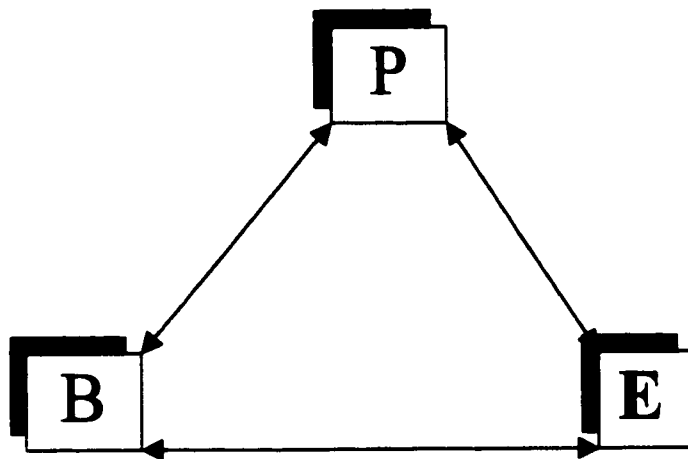
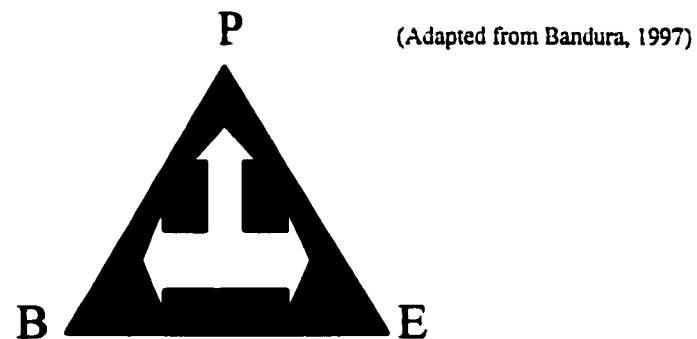


Figure 2.1 The relationship between the three major classes of determinants in triadic reciprocal causation. B= behavior; P= internal personal factors in the form of cognitive, affective, and biological events; and E = the external environment (Bandura, 1997).

Bandura's Triadic Reciprocal Causation : A Model



Self-concept	Choosing science classes	<u>Parental support and school</u>
Self-efficacy	Non traditional sex roles	<u>environment</u> : Equity
Ability	Achievement	Role models
Self-appraisal	Voicing opinion	Expectations
Agency	Independent	Attributional feedback
Self-evaluation	Confident	Peers
Motivation	Assertive	Encouragement
		Fun

Figure 2.2 The 21 pre-identified factors organized under the three determinants of Bandura's triadic reciprocal causation. B= behavior; P= internal personal factors in the form of cognitive, affective, and biological events; and E = the external environment (Bandura, 1997).

Gifted Girls' Attitudes Towards Science

It is generally agreed that the promotion of positive attitudes toward science should be a necessary aim of science education. But what does that entail exactly and how can it be measured? Recently a study by Farenga and Joyce (1998) examined the correlation between science-related attitudes and course selection with high-achieving students between the ages of 9 and 13. The participants in this study were required to choose five courses from a course selection sheet for the following year. In addition, the Test of Science Related Attitudes (TOSRA) was used to measure the "attitudes toward science". Much of the confusion occasioned by the possibility of multiple meanings for 'attitude toward science' is alleviated by the creation of Fraser's (1981) seven categories that comprise the TOSRA. The conceptually different categories of 'attitude toward science' include: a) Social implications of science, b) Normality of scientists, c) Attitude to scientific inquiry, d) Adoption of scientific attitudes, e) Enjoyment of science lessons, f) Leisure interest in science, and g) Career interest in science. A measurement is given for each of the different categories.

Validity and Reliability of the TOSRA Relative to Attitudes toward Science

The TOSRA was accompanied by information by the author regarding validity and reliability of the instrument. The norm sample was composed of 1,337 students in metropolitan Sydney, Australia in years 7-10 of the Australian school system. This was similar to the junior high to high school years in the United States and Canada. Internal consistency by way of Cronbach's alpha ranges from .64 to .93 across the subscales and grades in Australian schools and from .68 to .91 for a sample of grade 9 girls in two urban Catholic schools in Philadelphia. Test-retest reliability ranges from .69 to .84 after two weeks. Discriminant validity for the

TOSRA was based on the uniqueness of each subscale since scale intercorrelations were low, that is, of .10 to .59. These results were important because they supported the validity of the TOSRA for use with Australian students and the cross-cultural validity of the TOSRA for the United States. There were no Canadian findings that reported using the TOSRA in the same manner as this study but it was assumed that based on the similarity of Canadian/American school systems, the validity would be similar.

The results of the study by Farenga and Joyce (1998) suggest that science-related attitudes are important predictors for the number of science courses selected by girls at school. Positive attitudes and perceptions of science among females translate into greater interest in science classes. For boys, science-related attitudes are not factors related to science course selection at school. In addition, girls who are more likely to view the role of the scientist in a traditional manner are less likely to select future science courses. Farenga and Joyce (1998) suggest that the relationship of science-related attitudes and gender, at macro and micro levels, be examined as well as instruction and assessment. They also recommend that parents provide opportunities for informal leisure interest in science at home, such as exposure to scientific media (e.g. video, computer software, periodicals), family vacations (e.g. visits to zoo, parks, science museums), and by helping their children to recognize science everywhere in their environment (Farenga & Joyce, 1998).

Justification For Further Research

This study will examine parental support and the school environments' influence on gifted girls' perceptions of choice to take extracurricular science classes. An interview will provide the data; and in addition, the participants' attitudes toward science will be measured.

Although the age group is similar to Farenga and Joyce's (1998) study, this study will concentrate on within-gender differences.

While Farenga and Joyce's (1998) study compares the results of both genders by using data from the TOSRA and a school course selection sheet, no other studies reviewed took into consideration the selection of science courses and attitudes toward science. In the other studies already mentioned in this chapter, it is older females who participated in the within-gender investigation of differences performed by Greenberg-Lake (1991) and Lent et al. (1984; 1986; 1987). Because no studies were found that involved examining gifted girls' selection of extracurricular science classes, it was expected that this study will add knowledge to the field of gifted education, specifically that of within-gender differences of gifted girls. Moreover, by knowing influential factors within the school environment and parental realm, educators and parents will be better equipped to nurture them in other gifted girls, thus changing these 'obstacles' into positive challenges.

The next chapter will discuss how the study is to be carried out. Data collection will be introduced including participants, instruments, and procedure. This will be followed by a description of the methodological considerations and constraints.

Chapter Two: Methodology

This chapter addresses how the study was conducted. A mixed methodology was adopted: qualitative, to understand the girls' perceptions of influence; and quantitative, to measure the girls' attitudes toward science. Data collection introduces the participants, instruments, and procedure. Then, a description of the methodological considerations and constraints is presented.

Participants

For this study, twelve girls were recruited who attend an extracurricular Saturday gifted program during the past year. The girls range in age from nine to twelve, and were in grades four to six. The participants are receiving various types of schooling including public, private mixed gendered schools, and a same gendered private school. All are in some sort of gifted program ranging from pull-out enrichment to a congregated gifted class. One participant, who attends a private school for girls, had her curriculum tailored to her needs.

Instruments

Two data measuring instruments were used: a structured questionnaire was used to ascertain perceptions of students and a closed standardized test, to measure attitudes towards sciences.

Semi-structured interviews.

The research questions were studied in light of Bandura's Social Cognitive Theory. This theory and subsequent review of literature permitted the regrouping of factors influencing girls to choose extracurricular sciences into three categories. The literature review identified 21 factors that were thought to have an impact on girls' decisions to study sciences. They can all be

attached to one of the above three dimensions of human agency, namely: interpersonal, behavioral, and environmental. These factors led to the preparation of questions that formed the basis for the interview protocol.

The interview questions previously mentioned were pilot-tested with two girls to ascertain if the questions would elicit clear responses with the goals of the study. Then they were submitted to the critical evaluation of three experts in the field of feminist studies, learning, and education in order to confirm their internal validity. Because the interview questions were composed of open-ended questions, the researcher could probe further and obtain new and complimentary factors. The interview questions' validity was ensured by procuring pilot testing, experts critically evaluating the questions, and open-ended structuring of questions to allow for further probing.

Test of Science Related Attitude.

Designed by Barry Fraser (1981) in Australia, the Test of Science Related Attitudes (TOSRA) was used with middle to high school students. (see Appendix A). Recently, Farenga and Joyce (1998) used this tool successfully with a similar gifted age group [9-13]. Although the test is designed for a population two to three years older, gifted children are frequently more mature than their same-aged peers (Clark, 1997; Farenga & Joyce, 1998) and can successfully understand and complete the test.

There is substantial consensus of opinion that the promotion of positive attitudes toward science is a necessary aim of science education but there is much confusion about the meaning. Much of the confusion is due to the multiple meanings of 'attitude toward science' and has been clarified with the creation of Fraser's (1981) seven categories of the TOSRA. The instrument measures conceptually different categories of "attitude toward science" including: a) social

implications of science, b) normality of scientists, c) attitude to scientific inquiry, d) adoption of scientific attitudes, e) enjoyment of science lessons, f) leisure interest in science, and g) career interest in science. The response format invites the students to judge their degree of agreement with each statement on a five-point scale that is: strongly agree, agree, not sure, disagree, and strongly disagree.

Fraser (1981) posits the TOSRA can be used with individuals but is, perhaps, more useful for examining the attitudes or performance of groups of students. One reason for this is the possibility of faking responses. Although the use of the TOSRA in this study had nothing to do with grading, nonetheless it is still possible to predict obvious intentions and fake responses that appear more positive or negative than they really are. To determine the relevance of using the TOSRA, the researcher conducted a pilot test of this instrument with two girls ages 10 and 11 prior to completing the study. In addition, the participants' responses to the TOSRA are compared to the answers of the interview questions for correspondence. The TOSRA, according to its author (Fraser, 1981), has a validity coefficient of 0.33 and a reliability coefficient of 0.82; thus, it seems appropriate for use.

Procedure

Experimental and Analysis Procedure.

The nature of the research was explained at the beginning of a science class during the Association of Bright Children's Saturday Take-Off Program (ABC). First, the interested participants took home an information letter and return the consent form signed by their parents (see Appendix C & D). Next, parents were contacted by phone to confirm consent, set up a time to administer the Test of Science Related Attitudes (Fraser, 1981) and schedule an interview. In

some cases, the participants were not actually taking a science class at that time but have taken one during the past year. Either the participant or their parents approached the researcher to participate in the study.

Once a time was agreed upon, parent(s) and participant met with the researcher after a scheduled science class. At these meetings, the purpose of the study was explained and the researcher received permission from the participant and her parent(s) to tape the interviews. As well, the researcher read the consent form orally to participants and their parent(s) to ensure that all understood the nature of the study and the measures taken to ensure confidentiality (see Appendix D). After both parent(s) and participants signed the consent forms in duplicate, each party was presented with a copy for future reference.

Test of Science Related Attitudes.

Participants were asked to complete the Test For Science Related Attitudes (TOSRA) which took approximately 20-25 minutes, although the test had no time limit. The participants read the five point Likert scale questionnaire and circled their response on the sheets (see Appendix A). Later, the researcher transferred the participants' choices to an answer sheet and checked the accuracy of transfer three times. Any omitted answer or invalid response received a 'N' or a numerical value of three on the scale when checked by the researcher. A transparent 'hand score key' was placed over the participants' answer sheet so that the lines corresponded. The number on the transparency that matched the participants' circled response, was the score. The ten scores in each category were added together amounting to a total of 70 possible responses. This was done for each of the seven conceptually different categories.

The results of the TOSRA were listed, as well as a mean for each of the seven categories. This mean was then compared to the mean provided with the instrument [TOSRA] for students

in year 7 by Fraser (1981). Year seven in Australia corresponds approximately to grade 6 or 7 in Canada. A comparison of the two means was made.

Interviews.

Following the administration of the TOSRA, interview questions were asked and consisted of twenty-one open-ended questions developed from the literature review. Each interview lasted approximately forty minutes (see Appendix B). When the taped interviews were transcribed, they were sent to the individual participants for further clarification. "Both the interviewer and the interviewee attempt to interpret the significance of the preliminary themes in the light of the original question. Is this what the experience is really like?" (van Manen, 1992, p.99) In addition, the results of the TOSRA were sent to the participants in appreciation for their participation.

Each interview was transcribed verbatim and was read three times. And during the analysis phase, the material gathered during the interview sessions was constantly compared to uncover emerging themes and patterns. "Early and continuing analysis typically leads to a reshaping of your perspective and your instrumentation for the next pass" (Miles & Huberman, 1994, p.65). A beginning list of twenty-one factors was created "[which] forced the analyst to tie research questions or conceptual interests directly to the data" (Miles & Huberman, 1994, p.65). However, as suggested by Miles and Huberman (1994), the factors were redefined and added when they appeared to be inapplicable or did not fit. Pre-identified standardized coding units were formulated from the literature review and the interviews. Using NUD*IST 4.0 (1997), the data was entered into the computer. Computer assisted reading, highlighting, grouping of data, and frequency counts were used to analyze themes that emerge, to verify the researcher's semantic analysis, and to initiate the interpretation of the students' perceptions and lived

experiences. In other words, the researcher first completed a content analysis looking for pre-identified factors and possible emerging ones that were then submitted to a mechanical analysis to corroborate the findings. This permitted identification of factors within the school environment and the parental behaviors which girls in grades 4-6 perceive as influential to their participation in extracurricular science activities.

As noted in the literature, gifted girls face many obstacles in their academic careers. This study attempts to understand the perceptions of gifted girls regarding school environment and parental support as influences to their choice to take extracurricular science classes. This adds knowledge to the field of gifted education, specifically that of within-gender differences among gifted girls. Moreover, by knowing influential factors within the school environment and parental realm, educators and parents are better equipped to nurture these in other gifted girls, thus changing these obstacles into positive challenges.

Methodological Considerations and Constraints

To understand the methodological choices made by the researcher, literature concerning methodology is revisited. This study attempts to understand how parental support and the school environment affects gifted girls' perceptions of choice to take extracurricular science classes. Similarly, qualitative research is concerned with the participants' perceptions and how they make sense of their lives (Bogdan & Bilken, 1998; Fraenkel & Wallen, 1996). Therefore, a mixed methodology involving content analysis was adopted because of the rich descriptive language that lends insight into girls' perceptions of influences.

Bogdan and Bilken (1998) posit that qualitative research requires that "the world be examined with the assumption that nothing is trivial, that everything has the potential of being a clue that might unlock a more comprehensive understanding of what is being studied" (p.6). This searching for clues to reveal an understanding was an important aspect of choosing content analysis as a qualitative data analysis method. Carney (1972) believed an advantage of content analysis was the sureness of the facts because the emphasis of the technique was on the investigative recording of individual details that seemed insignificant until all the facts were gathered. At that time, the researcher could decide which facts or themes were emphasized most, least, or not at all (Carney, 1972).

Another reason for choosing content analysis was that of its data-reduction process by which many words were classified into fewer content categories (Weber, 1985). This classifying process was aided by the use of the computer. The computer listed units by their frequency of occurrence and then located them based on a priori theory according to which units were thought to be more important than others (Krippendorff, 1980; Weber, 1985). This process was performed for meaning and classification both subjectively by the researcher, and objectively by the computer software. Therefore, content analysis was a method to quantify the presence of themes which the literature review had shown to be an influence on girls' choosing science classes.

Fraenkel & Wallen (1998) suggested that "data analysis in qualitative research relied heavily on description, even when certain statistics were calculated, they tended to be used in a descriptive rather than an inferential sense" (p.445). Similarly, most researchers agree that description adds meaning and significance to data. Carney (1972) posits that in content analysis, when significance was increased there was usually some loss of validity because qualitative analysis of latent content involves "compounding one act of subjective judgment with another"

(p.47). Conversely, when text-units were directly processed by computer, identified, and classified algorithmically, without human judgment, reliability was no longer a problem. What was questionable, perhaps, was the validity of the semantic analysis process (Krippendorff, 1980).

To summarize the researchers mentioned, reliability, validity, and significance are increased when: (1) the researcher objectively used the computer for frequency of occurrence and classification; (2) the researcher coded and classified the data, during semantic analysis, with pre-identified codes from the literature and then independently checked for meaning; (3) the researcher constructed a descriptive narrative that reflected an understanding of the participants' perceptions; and (4) the researcher checked for agreement between the participants' statements and a measured instrument. In this study, the participants' subsection scores on the Test of Science Related Attitudes validated the findings of the interviews.

Finally, this was in agreement with Carney (1972) who thought "content analysis was indicated when source material was used to complement some other kind of data during an inquiry into attitudes" (p.64). This triangulation of design, coupled with the choice of content analysis as a data analysis method, ensured both reliability and significance of the research as seen Figure 2.

The following chapter will: first, examine the perceptions of the participants; next, the participants' attitudes towards science are presented; and then, attempt to relate the findings of both methodological approaches.

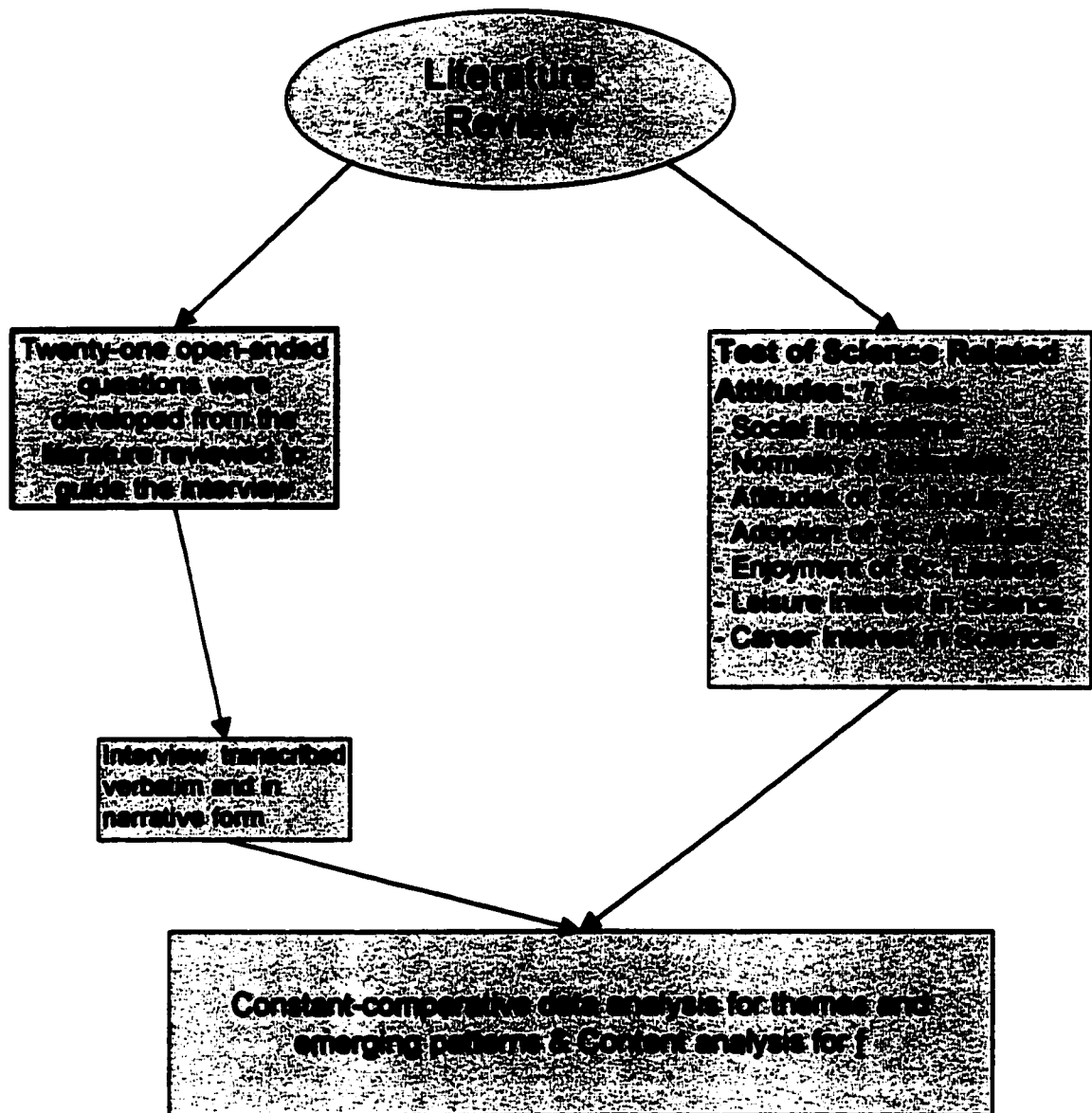


Figure 3 Research Design

CHAPTER THREE

PRESENTATION OF FINDINGS AND ANALYSIS

This chapter presents an analysis of the data that relates to the three research questions:

- What do girls, grades 4 to 6, perceive as the characteristics or factors within the school environment that influenced their choices to take extracurricular science classes?
- From the girls' perspectives, what were the parental behaviors that supported and encouraged their daughters to take extracurricular science classes?
- What were the girls' attitudes towards science?

The reader is reminded that prior to collecting and analyzing the data, the research questions were studied in light of Bandura's Social Cognitive Theory. This theory and subsequent review of literature permitted a regrouping of factors influencing girls to choose extracurricular sciences in three categories: personal characteristics, specific behaviors, and environmental characteristics.

The literature review identified 21 factors that are thought to have an impact on girls' decisions to study sciences. Identification of these factors led to the preparation of 21 open-ended questions that formed the basis for the interview. The open-ended questions afforded a probing of new and complementary factors.

This chapter presents firstly, the characteristics of the participants; secondly, the factors that girls perceived as influencing their choice to study sciences; thirdly, the attitudes of the same girls towards science; and lastly, a link between these factors identified and the attitudes towards science of the participants. The results of section two, will permit the answering of the first two

research questions; those of section three, will permit the answering of the third question and serve to further probe the relationship and contribute an additional element in the validation of the procedure.

Characteristics of Participants' in Relation to Presentation of Findings and Analysis

All participants were enrolled in an extracurricular science class during the 1998-99 Saturday Program. Participants in this program do not need to be tested for giftedness but pursued advanced subject material. Some participants were enrolled in other types of classes as well as their science class at the Saturday program. Two participants also joined science classes at the Museum of Science and Technology. Others have selected a science class when their first choice was cancelled due to low enrollment.

The participants were registered in various types of school programs: the majority of participants, (42%), were in a full-time gifted program while 25% were in a "pull-out" program and received enrichment twice a week for two hours. As seen in Figure 4, another 25% were in a regular classroom because their schools did not offer any enrichment programs. These latter children received high marks at their schools. One of the participants was privately tested and her parents convinced the school board to provide individual enrichment for the following year. Thus, although the participants came from schools in the same school board, the type and perceived quality of programs offered were widely divergent. In all cases, identifying learners for available programs tended to be consistent with school board policies. There was one exception in the case of a participant who was enrolled in a private school for girls that offered programs more tailored to her needs.

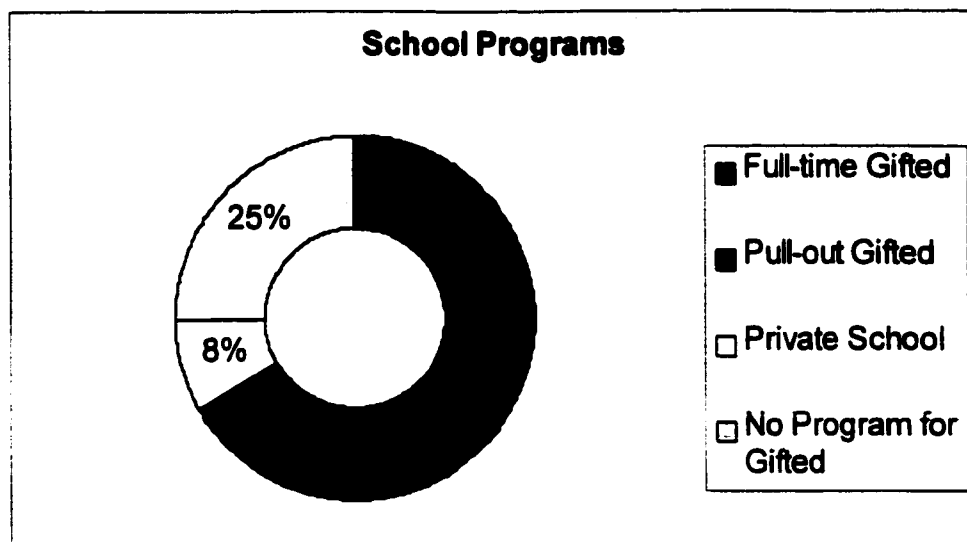


Figure 4. Registration of various school programs of the 12 participants.

All participants lived in the Ottawa area. Their ages ranged from nine to twelve years. Most participants were in age-appropriate grades except for two (see Figure 5). The names of the participants were changed to ensure confidentiality. Lisa had skipped a grade in her gifted class as she was working at a higher level than her age-appropriate peers while Anna had been enrolled in private schools and had a program more tailored to her needs and progression.

The marital status of the participants' parents appeared quite consistent as 84% lived with both parents. However, one participant's parents were divorced and she lived with her mother, while another participant made no mention of her father but commented on the support of her older brother (see Figure 6).

The girls' perceptions of their parents' occupations varied. Some participants did not know what their parents' occupations were or did not answer the question as asked. Those parental occupations reported by the participants included: science teacher, teacher, engineer, accountant, government employee, computer interface architect, computer consultant, interior decorator, housewife, office manager, nurse, and business person. Hence, there was a wide range of occupations most of which required post-secondary education.

To summarize, all the participants were enrolled in an extracurricular science class during the past year, lived in the Ottawa area, and experienced different types of schooling. The ages of participants ranged from 9 to 12 years and almost all of the participants lived with both parents. Although parental occupations generally required post-secondary education, there was a wide range of occupations. Participants' characteristics, therefore, indicated significant similarities while presenting subtle differences which will become evident in the next section.

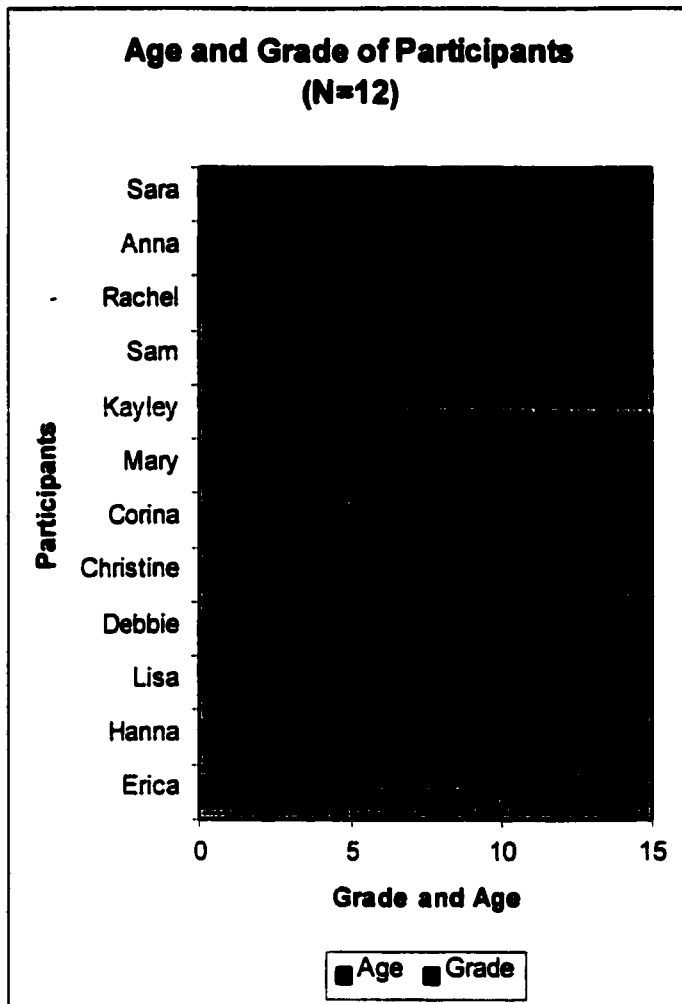


Figure 5. The age and grade of the 12 participants.

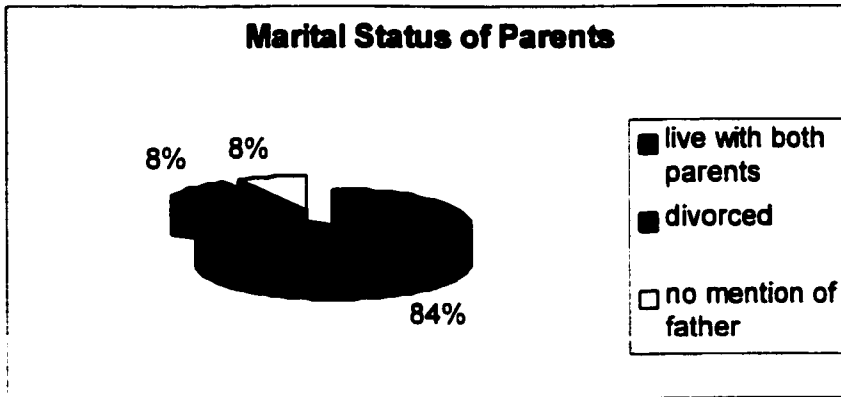


Figure 6 Marital status of the 12 participants' parents.

Factors That Influenced the Choice of Science Activities

The 21 questions served as a sounding board to explore the factors that influenced the selection of science activities which were derived and analyzed using two different approaches: to grasp the meaning and to identify factors, a non-mechanical analysis was performed by the researcher for meaning; and afterwards, a mechanical analysis using content analysis software (Nudist) was performed. In other words, a semantic analysis (coding based on researcher's interpretation) was done by the researcher first, and secondly a frequency count for occurrence of the factors was conducted using qualitative analysis software.

These 21 factors were organized into 10 larger themes that simplified the analysis and interpretation of the data. During the interviews, the participants were frequently encouraged to elaborate on their answers. If a new or different concept emerged frequently and appeared related but different, it was tagged as a sub-factor. All answers were transcribed verbatim. The material gathered throughout the interview sessions was constantly compared during the analysis phase. When the interview process had ended, the 21 factors were maintained and four new ones had emerged. This procedure permitted identification of factors in both the school environment and related to parental behaviors that girls, in grades 4-6, perceived as influential in their participation in extracurricular science activities.

This section is divided into the following sub-sections: (a) the themes, comprised of the factors that emerged, are presented in decreasing order of importance; (b) validation of interview analysis where the findings of the two different methodologies are compared in order to validate the results; (c) how the factors and resulting themes relate to the first two research questions; and finally, (d) a summary of emerging factors in relation to conceptual framework.

The Themes in Decreasing Order of Importance

In this section, the ten themes and embedded emerging factors that resulted from the semantic analysis are presented in descending order of frequency. The description of each theme will follow this table.

Table 1.
Organization of Themes and Factors in Relation to f .

Themes and factors	Frequency of occurrence	Mean occurrence per participant
How science is taught (HST)	<u>Total HST = 97</u>	
- Self-agency	34	2.9
- Self-efficacy	30	2.5
- Boredom	20	1.2
- Groupwork	13	0.4
Voicing of opinion and Beliefs (VO)	<u>Total VO = 93</u>	
- Expressing opinion	57	4.5
- Confidence	3	0.2
- Assertiveness	3	0.2
- Self-doubt	30	2.2
Fun (FT)	<u>Total FT = 86</u>	
- Fun	86	7.2
Career Interest (CI)	<u>Total CI = 75</u>	
- Traditional sex role	28	2.2
- Non traditional sex roles	22	1.7
- Motivation	17	2.8
- Self-appraisal	8	0.6
Peer (PR)	<u>Total PR = 70</u>	
- Peer influence	51	4.1
- Independence	12	0.8
- Choosing Sc.	7	0.5
Feedback (FB)	<u>Total FB = 68</u>	
- Attributional Feedback	8	0.4
- Self-evaluation	27	2.2
- Achievement	20	1.6
- Ability	13	1.1
Encouragement (ET)	<u>Total ET = 57</u>	
- Support	48	3.9
- Expectations	9	0.7
Role Models (RM)	<u>Total RM = 55</u>	4.1

Extracurricular activities (EA)	<u>Total EA = 19</u>	
- Self-concept	19	1.6
Equity in school (EQ)	<u>Total EQ = 13</u>	1.0

How Science Was Taught (HST) Theme

How science was taught may have had lasting impressions which affects its selection as an extracurricular activity, a subject in high school, and a future career option. Participants had many perceptions of how they were taught science at school. The most prevalent methods for being taught science were experiments, research projects, building 'stuff', and taking notes from the board. This theme explored the participants' understandings of methods and activities but only two reported science as their favorite subject at school related to research question one (see Figure 7).

The most commonly mentioned activity was experiments. Not all participants had the opportunity to do experiments at school. Lisa explained:

We can't do any experiments at all at school and hands on stuff. I think it is because it would make too much of a mess. And it may also be because we don't have the right chemicals that they need. And they were thinking of putting in a lab but they didn't have enough money to do it. That's a shame. For science at school we have been classifying mammals, reptiles, fish, and birds.

Another participant had the chance to do experiments but she was concerned with the quality of the content. Sara asserted, "I like hands-on experiments the most, things that you can explore and that are not all planned and everything". Science experiments that were more discovery-based provided an opportunity for the participants to work on areas of interest and thus, increase their motivation.

What participants perceived as the best and least liked activities in science class.

The activity mentioned most often by the participants regarding science in schools was also the activity reported as being liked the best. Seventy-five per cent of the participants said

they liked experiments best in science class. Other reported activities included research projects, trying new things, and fun science.

On the other hand, participants reported many dislikes. Reading from the textbook and science tests topped the list (see Figure 8). The common element of these disliked features was that they were not motivating and did not include active participation. When the participants did not receive the science activities they expected and required, they or their parents sought other means of science instruction. Two participants have participated in a science program for girls at the Museum of Science and Technology. Sara took a Saturday program for girls once a month and Lisa missed Tuesday mornings at school to attend the Morning Program at the same museum. Moreover, all participants in this study have taken science courses with the Association for Bright Children (ABC) during the past year.

Lisa affirmed:

At ABC, I like that it is new and different not like the same old thing that you hear at school. You hear new things, you find out new concepts. You might find out something that you thought was this way is different. That's interesting because you are corrected, you find out something new.

ABC offered some participants what they lacked in the school system. Although in many ways Anna praised her private schools, these schools did not have facilities to do experiments. Anna asserted, "Until grade six I didn't actually have a real science lab or get real science lessons. So, that's why I really wanted to take ABC science because it is something I never really got to do". Similarly, Kayley disclosed, "At ABC, you always get to use stuff. Where at school you just learn from a textbook".

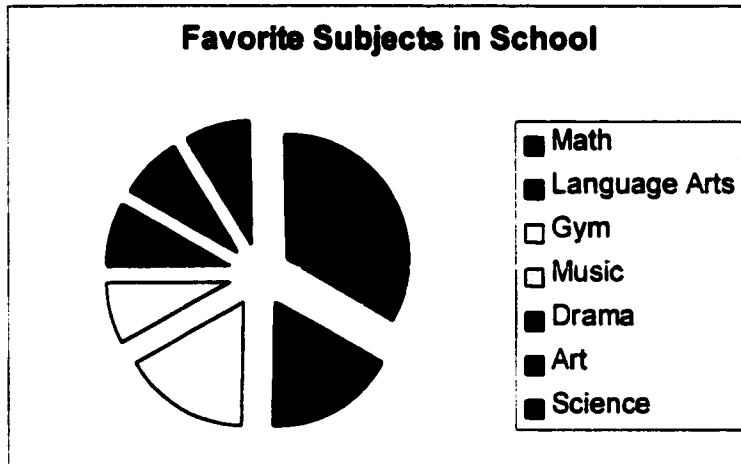


Figure 7. The favorite subjects in school of the 12 participants.

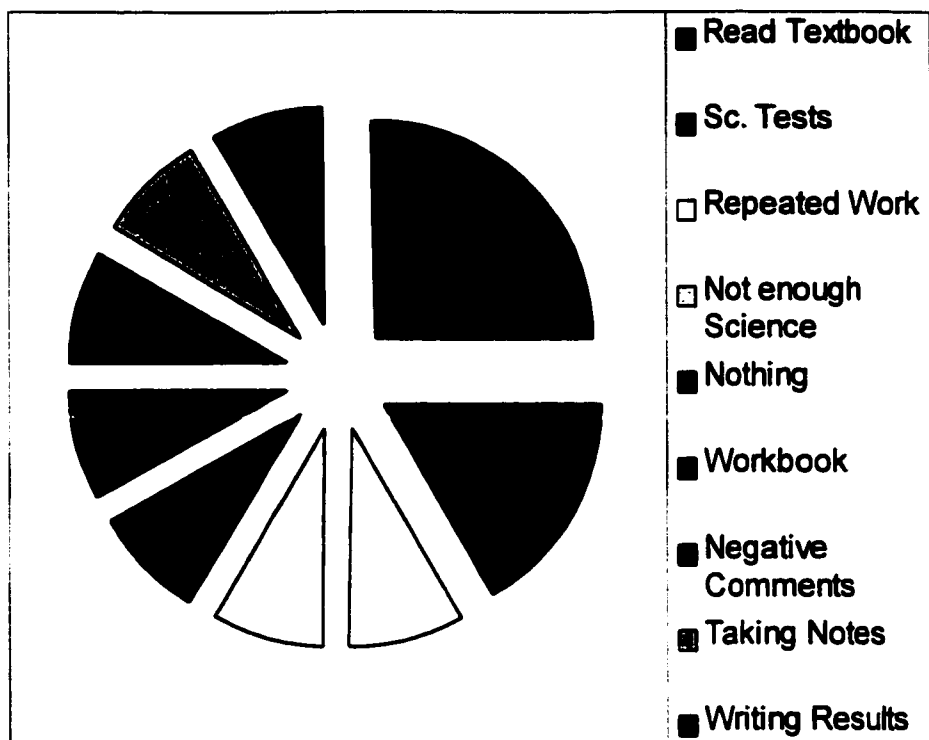


Figure 8. The least liked activities during science class.

Another source of information that compensated for areas lacking in the school was the help of her parents. Lisa confided:

But even books and movies do not always explain clearly so my parents often explain things to me. And when I was doing a project on Albert Einstein, they explained to me the whole Theory of Relativity. That was really interesting. And then I understood it.

Not only did these parents take their daughter to two extracurricular science classes and provide books for her areas of interest, they took the time to teach her concepts at a level she could understand. In addition, when the school would not make allowances for her advanced abilities, her parents were advocates. Lisa explained, "If I am really far ahead well, I should do something else during that time. We did that during English last year, but we actually had to fight for me to be able to do my own thing".

Three participants reported problems with the schools facilities. Sara affirmed, "I think it is probably the lack of facilities because we don't really have anything to do experiments in. It is mostly at home that we do hands on things". Similarly, lack of interest in what was being taught coupled with the absence of air conditioning decreased learning for Corina. She commented, "Sometimes when science class is really getting boring, and sometimes when the classroom is really hot in the summer, then you really don't want to do anything". Moreover, the scheduled 'pull-out' enrichment classes caused problems for some of the participants. Students were required to complete classwork that was not done. Erica stated, "The only thing that really stops me in science is when I am not there".

Some aspects of how science was taught at school had similarities and differences. Experiments were judged as the best way to learn science. Reading science from textbooks was thought to be the worst way to learn science. Even the schools themselves were a problem for

some participants. Participants and their parents, as one solution, sought extracurricular science classes to supplement school activities.

Self-efficacy and self-agency in science classes in HST Theme.

For the purpose of this study, self-efficacy "refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1998, p.3). Thirty instances (mean of 2.5 per interview) of self-efficacy were identified in these interviews. When asked if they ever thought they couldn't "do" a science lesson, 83% of the participants indicated that they believed they always could understand the lesson. Anna asserted, "No, not really because sure some of the [science lessons] are challenging but that's what makes it interesting". Similarly, Mary reported, "No, not really. Not exactly that I couldn't do science because you have to try it first before you know you can't do it. I give it a try first". In addition, Lisa explained:

No, I don't think I have felt that I haven't been able to. There have been difficult things. But then all you have to do is ask, you have to see if you can learn about it. You can go on the internet. You can go to the library, the museum, there are tons of things you can do if you don't understand it. It is not a reason to feel you have to quit.

Self-efficacious participants attempted a difficult lesson. In fact, the difficulty and challenge made the task interesting. In addition, science lessons with no appropriate challenge were considered boring and failed to motivate students. Moreover, they didn't just think they could do it, they acted. According to Bandura's (1998) definition, self-agency was the personal execution of action for an intended outcome intentionally done. The frequency of occurrence of self-agency comments was 34 times in the interviews. All participants were coded for self-agency with the mean being 2.9 times per interview. It appears self-efficacy and self-agency are

inter-related. Both are needed to attain a goal: participants believed they could do a science lesson and acted on their belief.

Boredom in HST Theme.

Boredom was defined as an activity that is weary, dull, repetitious, or uninteresting (Collins dictionary, 1996). Boredom was reported 20 times in the interviews. Only six participants spoke of boredom (mean being 1.2 times per interview). Lisa stated, "I actually find science at school rather boring. We are doing stuff that I already know and have heard of. And we do a lot of it so it gets boring". Similarly, Corina explained:

At school, one science teacher just tells you to write everything down. Another one tells me this is the experiment and you have to figure out what to do. That's kind of boring after about three weeks. And sometimes when science is made fun it is a lot easier to pay attention.

Both of the former two participants had little choice in the selection of learning activities. Also, none of the activities would be considered to stimulate high arousal. One difficulty in teaching gifted students is providing intellectual stimulation for such a diverse group. Corina asserted, "At ABC, we are making things and that's fun. But sometimes you already know what is going to happen and that's boring". Even within the gifted class at school and extracurricular science, not all activities met the individual needs of the participants.

In addition, girls and boys were perceived to react to boredom differently. Corina affirmed:

Sometimes the teacher in science will give you lessons and two weeks later they will give you the same lesson again. And since the boys only listen for about the first half of the first lesson, then the second lesson they are listening while all the girls are bored. The teacher does three or four lessons on the same thing and it gets really, really boring. I know a lot of kids in my class are just put-out with science because they are really bored of it.

Boredom leading to behavior problems tended to occur especially with boys in Corina's class.

Did punishment resolve the problem? Corina continued:

There are a lot of boys in our class that blurt out things, talk, do weird things when they are not suppose to and the teacher has to make out behavior things. So that's probably part of the reason why girls drop science because they are not doing anything. And the teacher is just trying to fix the other people while you are just waiting. A lot of the time they are just bored and that is when the boys get fiddling.

Boredom was a factor that affected learning in the class, as well as Corina's attitude toward science. For her, there was just cause to dislike learning science.

Generally, the participants showed high self-efficacy, in fact ten participants reported that they always thought they could complete the science lesson. Moreover, an appropriate challenge stimulated interest, thus motivating the participants to try the activity. In addition, science lessons without challenge were thought to be boring by half of the participants while boys and girls tended to react differently to boredom. Boys developed behavioral problems and girls became "put-out" with science. The classroom environment appeared to directly and indirectly affect the participants' attitude toward science.

Groupwork in science class in HST Theme.

Eight participants discussed groupwork 11 times as it was used in science class. Some of these participants felt the teacher chose mixed ability groups as a way to ensure the completion of work. Debbie explained:

What we do in science class, we split up in mixed groups not with gifted. That is what we do for most projects in regular class. Sometimes we each pass in a report and sometimes we get marked together. We are marked also on how we behaved. I would prefer to choose my own group but she puts us in groups. Right now I am working with two boys and one of them is totally uncooperative and one of them thinks he is the boss. And he gets into everything. Probably, I would rather work with girls or someone who is more cooperative because some of the girls aren't very cooperative either.

In Debbie's science class, working groups seemed to be formed arbitrarily and in such a manner that they were often paired with participants who were uncooperative. Similarly Rachel affirmed:

I usually choose to work with friends unless the teacher chooses. Sometimes I have to work with boys and it can be difficult because you might get a noisy boy and it is impossible to work. The noisiest boy in the class is the shortest. And the teacher says maybe that is why he is so noisy and he kicks you and stuff when we are trying to work.

Although Rachel is in a congregated gifted class, they were grouped based on behavior and work habits. It was hoped that the well-behaved girls would influence or police the boys.

When the teacher allowed choice, many chose people who worked well or learned with their friends. Corina asserted:

When I pick my group, I usually choose my best friends because they are really hard workers. So it's good to work with them. When the teacher chooses, we usually get a lazy worker and maybe one of the smartest in the class.

This participant worked with her focused friends when it was possible. In contrast, Erica had to deal with noisy friends when she chose her partners. She reported, "The teacher chooses them for us because whenever we choose our own groups it's always really loud and stuff. I'd rather work with my friends".

Another participant, when involved in groupwork, worked with peers or alone depending on the level of difficulty of the assignment. Sam reported:

We have a choice for our projects. We can either have a partner or work by ourselves. If I think it is going to be really hard, then I ask for a partner. But if it is something easy like researching on somebody then I could do that myself. Also, we don't really get along very well with the boys because they always want to do everything by themselves. And they usually don't listen to us. In the gifted program, the boys are a little easier to get long with. And some of them are still improving.

This last activity did not stimulate cooperative learning strategies. Perhaps, proper group training as well as consistent follow-up would be more conducive to learning not having to deal with hassles.

Discussion and the HST Theme.

Four participants mentioned discussion in class or in groups as being important to learning. Some of the participants' reported that their teachers incorporated discussion into the science assignment. Sam disclosed, "We just finished a project with [our teacher]. We had to choose to do a science experiment and say why we were doing this experiment and whether it would be good for society and how". Similarly, another teacher proposed the science topic and allowed the students to choose components. As well, the students were required to present their findings to the class. Rachel asserted:

It might be the way science is taught because in my other classes every subject is taught out of the book. And if we did a project, we all did it the same way at the same time. Now that I am in the gifted program, it is a lot more fun because the teacher chooses the subject for us to do, then each of us does a different part. And each of us presents it to the class. So it might just be that girls' science classes are so boring that they just don't like it.

Choice of subject and the opportunity to talk about their research was stimulating and fun for this participant. When asked why discussion was important, Debbie explained:

Instead of just reading about it, sometimes words just come in and you process them. Like reading, if you process them as unimportant garbage, then out the other ear. But talking is this expression. You are actually hearing it from somebody. That's why I think oral presentations and talking about it is really important.

According to this participant, talking and discussion improved the retention of information.

The participants perceived groupwork as common in science class. Groupwork was used to help other children who had difficulty, to monitor students with behavior problems, and to share equipment when there wasn't enough for everyone. Some participants were allowed to choose their groups, most often they picked their friends. Other participants were placed in groups by mixed ability and mixed work habits so the 'positive' students could influence the others. Lastly, discussion was planned into some learning activities to increase interest and retention. How science was taught in school was very complex. Teachers' intended goals were not always learned and resulted in some participants viewing science negatively.

In summary, attitudes towards science appeared to be influenced by the many subtle occurrences mentioned in this theme. The participants reported that it was not only how science was taught but also the environment in which it was taught, with the biggest complaint being the disturbance of boys in the classroom. Although same-sex schooling may not be appropriate for all girls, the gifted girls who were 'put out' by science and the teaching environment, perhaps, would benefit in a same-sex environment and develop a more positive attitude towards learning in general.

Voicing of Opinion and Beliefs (VO) Theme

The voicing of opinion and beliefs (VO) theme initially included: expressing what the participants thought, as well as confident and assertive statements. This theme was expressed through "I think" or "in my opinion". All participants voiced their opinion and collectively this theme appeared 47 times. The mean for VO was 4.5 times per participant with a range of frequencies between two and ten times per interview. Debbie claimed, "in my opinion, we should have a congregated gifted class" while Lisa stated that, "science is really useful. I think without

science I don't know where the world would be right now". Finally, Mary commented, "I think science is very useful because it helps us discover new things".

Interestingly, the former three participants manifested the highest frequency of occurrence (f) for the VO theme and were the only ones to express themselves confidently. The f for confidence and assertiveness numbered only three. The definition of confidence used in this study was being 'sure of oneself' while assertiveness reflected a more direct confidence in dealing with others. It was difficult to distinguish between the two qualities. Lisa demonstrated confidence and assertiveness when she replied, "if someone is distracting me, I would tell them to be quiet. And if they are not quiet, I would go to my teacher and tell her those people are not being quiet!". When asked if anything distracts her in class, Debbie was equally confident, and responded "but for me, nothing stops me". Furthermore, both of these confident and assertive statements were related to coping with classroom disturbance which will be further discussed in another theme.

Of particular interest, another factor, self-doubt, emerged in this theme often in place of or before the participants' voicing of opinions. Approximately 60% of the participants made doubtful statements such as "I don't know" and "I am not sure". These two statements appeared 32 times in the interviews with the range of doubtful statements expressed by the participants from one to eight per interview. As well, there were different ways of expressing doubt. Christine reported, "I don't know. I guess I am good at reading. I don't like arithmetic. I don't know why I don't like Math. I just don't. I am not very good with numbers". Similarly, Corina replied, "I am not sure. I usually watch Anne of Green Gables. I like pioneer books and books from the past". Finally, Anna responded, " I don't know. Science helps with making new medications and stuff". They did know and they expressed their opinion well. Hence, these

statements appeared to be self-doubt regarding how receptive their opinions would be received rather than doubt about their ability to answer the questions.

In summary, the participants expressed what they thought quite frequently and often explained their beliefs. These participants with the highest f on the VO theme were also those who manifested confidence. As well, over half of the participants made statements indicating self-doubt before expressing their opinions. However, because they then proceeded to offer complete and interesting comments, statements indicating self-doubt may have many levels of meaning.

The Fun Theme (FT)

For the purpose of this study, the fun theme was defined as activities that required a high level of arousal, a high level of perceived control, and tasks tailored to personal interests (Middleton et al., 1992). Fun was counted 86 times in the interviews. Because fun was the factor most frequently coded, it was made into a theme on its own. In addition, no other coded factors were combined into this theme. Every participant mentioned fun on average 7.2 times per interview.

Different activities created a high level of arousal for the participants. When asked why they liked certain activities, many of the answers were similar. Things reported as being fun but not related to a particular subject or activity included: learning and doing new things, creating new things, and being active. Of course, certain subjects or activities provided more perceived fun and tasks tailored to personal interests. Lisa stated:

I enjoy math because this year we are doing interesting things. We are learning new things in math that I didn't know before. And in, grade three, I was doing division and they were learning how to subtract. This year I find math fun. And I enjoy French too because I enjoy composing text and there is a lot of that in French. And science is not great this year because we are not doing much. We are

doing vertebrates and invertebrates which I did in grade three so it is not very good.

Another component of fun was the pleasure of feeling a high level of perceived control of the activities. This refers to the ability to choose what one was doing. Rachel stated, "I like to choose something and then do the experiment or read on it or ask my parents. I want to figure it out first". Control also means directing one's actions. Soteira explained, "I like hands on experiments the most, things that you can explore and that are not all planned and everything". This data supports the three criteria for Middleton et al.'s (1992) definition of fun.

Naturally, the participants identified favorite subjects at school that they particularly enjoyed. Erica asserted, "I like math because I am good at it. Because I study, get high marks, and I enjoy it". As well, Debbie affirmed, "English is my favorite because you get to write and create things. I like creating that fantasy world when you write. You can make it whatever you want and you can escape from reality". While the favorite subject was Math (33%), two girls mentioned Language Arts, and gym was also popular with two other participants. Although five of the girls indicated more than one favorite subject, we tabulated only the 'most' favorite.

There are many similarities among this population's idea of fun. The action words reported by the participants to describe fun included learning, doing, and creating. Although most participants found different activities fun, all activities mentioned supported Middleton's et al. (1992) definition. The importance of fun in learning was clearly stated by the participants 86 times, and thus, was made into a theme on its own.

The Career Interests (CI) Theme

Career interests related to science was very complex as most pre-adolescents have not

fully realized their capabilities and are not fully aware of the career possibilities available to them. Embedded in this theme was non-traditional sex-roles, which was a pre-identified factor. In addition, a factor that emerged during content analysis was traditional sex-roles in relation to the participants' motivation to pursue future career choices. What influence do these two factors have on the participants' choices?

Although the participants were pre-adolescents, many expressed future career goals. Five participants (42%) stated they aspired to a career in science (see Figure 9). Lisa reported, "I think science would be an interesting career. Although I am not sure yet because science has a lot of different branches". Other participants had more specific career interests in science. Mary mentioned being, "either an engineer or a teacher. I would want to be a teacher because I simply like to teach children even in high school. An engineer because at school we are learning about pulleys and gears, and we are building things and how to find the best ways to make it. And I really like doing it. It is fun and it is like solving a problem." This participant was interested in two separate careers for completely different reasons. Which one will have more influence in the future? Similarly, Anna asserted. "I think I want to be a doctor that works with kids. Because I like science and I like working with kids". Anna had combined her desire to work with children and her interest in science into an appropriate career that would more fully realize her abilities.

In contrast, some participants gave up one desire to satisfy another. Sara affirmed, "for awhile I sort of wanted to be a teacher, but I changed my mind on that. Lately, it has been marine biology because I have been fascinated with whales for as long as I can remember. I am really interested in studying them. That's why I like science a lot". The desire to work with children was mentioned by 33% of the participants, but was it a personal aspiration? Could role-modeling or a sex-role expectation have motivated this selection?

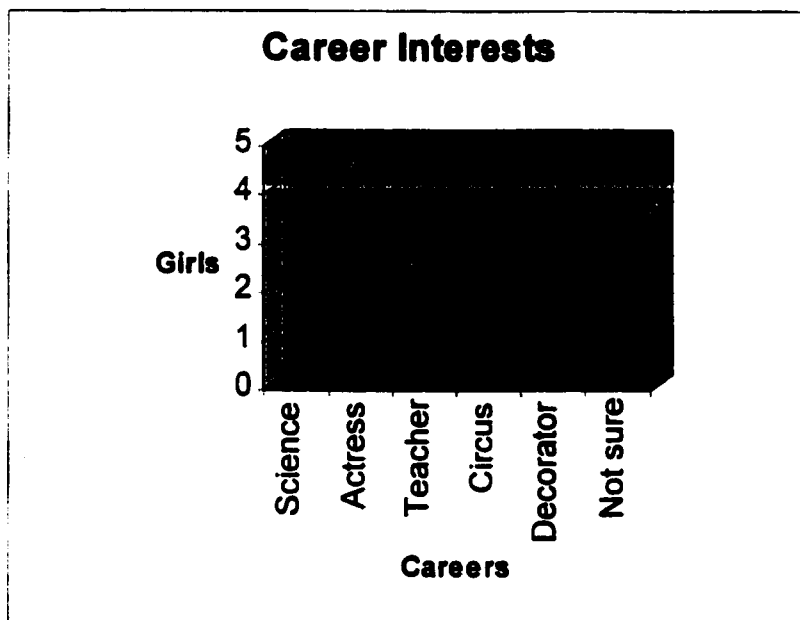


Figure 9. The perceived future career interests of the 12 participants.

Traditional and non-traditional sex-roles factor in CI Theme.

A sub-factor of the CI theme, sex-role was defined as tasks or functions assigned to males or females. The f for the traditional sex-role factor totaled 28 times in the interviews. Eighty-three per cent of the participants made statements that referred to traditional sex roles (mean of 2.2 times per interview). An example of this was Hanna's perceived career interest in, "being a teacher because I like to teach younger children and help them do crafts. I'm a helper in senior kindergarten and I take them to the bus. Whenever they see me they just run up and hug me".

On the other hand, the non-traditional sex-role factor appeared 22 times in the interviews. Moreover, all participants mentioned non-traditional sex-roles in their interviews (mean of 1.7 times per interview). In spite of a higher f count for traditional sex-roles, five participants reported a career interest in science. In addition, the belief that some occupations are male-dominated inspired one participant. Mary asserted, "Another reason I want to be an engineer is a lot of people think that only guys can make great engineers."

In light of this factor, however, a career interest in science seems to be a complex decision. Five participants expressed an interest in a science career as well as the desire to work with children. Some participants, however, had already chosen one option over the other. On the other hand, a few participants wanted to combine the desire to work with children and an interest in science in the future. All participants spoke of traditional sex-roles as influencing the career choices of some. Conversely, these traditional sex-roles motivated one participant to want to be an engineer and dispel the myth of male domination in some occupations. Various aspects of the participants' perceptions of choice to take science classes had similarity, while other aspects were very personal.

The Peers (PR) Theme

Participants reported peers as having both positive and negative influences on learning as well as decision making. The reported influences of peers were divided into peer influence in the classroom and peer influence on choices to take science. This theme consisted of three factors as seen in Table 1.

Peer influence in the classroom

The peers theme (PT) affected the girls in various ways. The frequency of 'peers' was counted 51 times in the interviews. Fifty-eight per cent of the participants said peers interfered with their performance in science class. The gender of the peers who disturbed participants was more often males. Participants mentioned seven girls compared to twelve boys as distracting them. Christine asserted, "There are four or five boys and one girl that are really mean. They all hang out together and they are kind of like a gang. They are all basically troublemakers. They are almost always talking together even if they are not suppose to." Christine, a gifted student in the regular stream, reported the largest number of disturbing peers. When asked what stopped her from doing her best Rachel confided:

Well, my own work habits usually because I usually get side-tracked if I do not find it very interesting or of it is something I have already learned. Then I really get side-tracked and I dream. There are three boys and sometimes there are two girls that talk a lot. The three boys talk mostly during science in between themselves. I think it is because they don't like science so they just don't want to pay attention. When I hear noise, I just look over because I want to hear what they are saying because they automatically do that.

Although Rachel was in a gifted program, it was as much of a challenge for her to focus as it was for the other students in the class.

Peer influence on choice to take science.

Peers seemed to directly and indirectly influence some girls to stop taking science. Fifty per cent of the participants stated that peers can have a negative influence. Only three participants considered female friends as a positive influence. Lisa explained, "I think girls are actually more social than boys. So, if one girl stops, the whole group of them might stop". Similarly, Mary disclosed, "I think maybe one of their friends says science is dumb or science is stupid or boring. They don't want to look dumb even if they like it. So they just stop taking it".

Two participants concluded that some girls stopped taking science because boys would think them too smart. Each these participants remembered at least one specific girl from her school. Sam asserted, "in my old school there was one girl who all she was interested in was boys. And usually they just think science isn't cool and they don't want to go into it. She didn't want to do science because she thought that all the boys would think she was too smart and they would just go away. I don't know why she thought that." Although Sam thought she knew what the girl believed, she didn't know why the girl reasoned that way. Similarly Erica explained:

[Some girls] will think the guys won't like them if they act too smart so they pretend they are stupid. They act stupid on a test by not writing the correct answer. When the teacher asks a question, they either don't raise their hands or answer wrong. One of my friends does it. She gets B's and C's when last year she got A's and B's.

The beliefs of these two participants' were easily identified, but neither mentioned where this perception came from. Are young females aware of stereotypical messages?

On the other hand, another participant could easily identify the message and the sender of stereotypical messages. She tried to answer why girls thought science wasn't for them. As Debbie affirmed:

Girls stop because probably all the messages and stereotyping they find in magazines and also peer pressure such as "you're a girl and science isn't for you".

While these messages seldom come from parents or teachers because they are sort of immune to that sort of stuff, they probably derive from friends and magazines in which super skinny models promote the idea that "I am so pretty. I don't have to do anything for a living. Someone will come along and give me a million dollars just for being beautiful.

This participant knew about stereotyping and could identify it in media messages. Debbie continued:

This happens around preadolescence, like 10 or 12 which is probably grades five or six. And some kids are like immune to this stuff because they know it is not true. I am kind of immune because my mother, whenever I get an Archie Comic, she has to read it first and write down little notes on where it is sexist and everything. And when I watch t.v. shows, she will come and say, "that is a sexist message, and so is that and that". And she will see if I can identify them all. So she is sort of training me to be immune.

As this participant so clearly articulated, not all girls are directly affected by peer pressure. Many have other influences counteracting negative stereotyping.

Influences counteracting gender-role stereotyping seems somewhat contradictory to the definition of 'independence' adopted in this study. Independence was defined as free from the influence or control of others; capable of acting for oneself or on one's own (see Appendix E). It is improbable that a pre-adolescent would be completely free from the influence of others. Perhaps this state of freedom is an ideal to strive for, regardless of age. In the course of the interviews, many participants demonstrated characteristics of self-regulation. The frequency count for independence totaled 12 in the interviews. Eight participants made independent statements (mean being 0.8 times per interview). In some instances, 'acting for themselves' was manifested in their areas of interest and choice of extracurricular activities.

Another reason participants' perceived girls as stopping science classes was related to a change in interest. Fifty per cent of the participants suggested that as a reason. Many personal factors enter in a change of interest. Soteira explained:

Maybe they would take a different course opposed to science if it is optional and if a lot of people don't enjoy it. Some girls may find it like "ooeoh, you have to stick your hands in things". I don't like that fact but yeah, that's probably the best reason I could come up with. In our science club on Saturdays at the museum, there are probably 50 girls and they are really into it. But I guess it depends. Our science classes at school are not really that interesting, it could be that.

Another participant found peers helpful, because of her placement in the 'pull-out' enriched program. Erica asserted:

[My regular class] did all the science on Mondays when I was at my enrichment class. I usually had to catch up at home and a lot of people in my family don't speak French. I usually called my study-buddy and she would tell me everything or my friends.

Moreover, this participant did not see boys negatively but allowed a boy into her inner circle of friends. Erica disclosed, "When we are doing Math in computer class, one of my friends, Joey, [and I] competed to see who could get the highest. Joey had been my friend for two years. I like him because he is funny". This participant found her interactions with peers helpful and enjoyable.

In summary, peers were perceived to affect some of the girls' learning in the classroom and selection of science classes. Every participant mentioned peers as playing a role in 51 occurrences that were identified in the interviews. Peers could play a negative or positive influence: negative when this disrupted learning, influenced choices to not take science class, exerted pressure to conform to stereotyping, and positive when they provided assistance in learning. This fifth theme appeared to be an important function in the lives of gifted girls. If pre-

adolescent peers can affect girls' selection of extracurricular science classes, how much greater will the pressure be in secondary school?

The Feedback (FB) Theme

For the purpose of this study, attributional feedback was defined as information on improving performance and verifying correctness (Bandura, 1997). Only eight attributions were coded and the frequency count was 8 in the interviews. This theme was divided into two sub-themes: attributional feedback and self-evaluation.

Participants stated receiving feedback, but it was usually in the form of a grades or outcomes. Mary asserted, "I think I am really good at probably everything at school because I get good marks on my report cards". Other participants received feedback in the form of winning contests. Anna explained, "I am good at math, I can catch onto things easily. And it's my highest score. Also there was a contest and I got 32/40 and supposedly even getting 15 is really good. So now I am first and going to the 'math olympics' at Laurentian High School". None of the participants mentioned being informed on what they needed to improve on, or if they were told how to improve it.

It appears that some participants combined self-evaluation with their grades and awards. Self-evaluation was defined as the individuals' emotional reactions to the quality of the performance (Bandura, 1998). Lisa asserted:

When my report cards come in and I have straight A's then I think that's good, let's keep going at this. I have won a few medals in swimming competitions and so I like that. Say I've just done something and I think I have done good work, it could be any school work

This participant has moved toward self-evaluation from what appeared to be solely positive

feedback. Similarly, Sara reports, "Probably achieving certain goals and improving my marks and things like that. Little things but it makes me feel good to achieve those sorts of things". Although she mentioned improving her marks, she also set personal goals and attained them. Self-evaluation occurred 27 times in the interviews. Older participants seemed to adopt this as part of their assessment strategies.

In self-evaluation, an individual's perception of the situation may or may not be accurate.

When asked on what she had done in the past to make her feel proud, Sam asserted:

No, not really because my parents and my teachers say I am really good at everything all I have to do is stop being so hard on myself. And other than that I am really not quite sure. I don't think I am hard on myself but I am not exactly sure what it means.

It appeared Sam often blames and depreciates herself despite good performance. In addition,

Sam appeared to take even constructive criticism negatively. Sam asserted:

What I like least is when they tell you that you are wrong about something. More than one person did the same project. And I said something that in my project it proved right. And I started saying the different things and my teacher said at the end of it, "I'm sorry but I have done this sort of thing before and it can't do that". And I would feel discouraged.

This participant's perception of positive and negative feedback was inadequate as it left her confused and discouraged. Other participants received positive feedback usually in the form of grades or awards. Thus, achievement was equated with positive feedback and failure with any type of negative feedback.

The Encouragement (ET) Theme

Encouragement was defined in this study as approval or help, including reinforcement and feedback (see Appendix E). Interviews have revealed that encouragement comes from four

different sources : family, school, expectations, and activities. Thus, this section will present the perceptions of the participants on these sub themes. As can be seen in Table 1, encouragement appeared 48 times in the interviews (mean being 3.9 times per interview). Encouragement was divided into two categories, school and family support. Family encouragement appeared twice as often as that of the school (see Figure 10).

Family support in the ET Theme

Encouragement to do well in science or schoolwork in general requires help, approval, and knowledge of school life. Although there were exceptions, contact time with the child was essential and increased when a child lived with both parents. Incredibly, 83% of the participants lived with both parents. One participant's parents were divorced with the father living a four hours drive away. Another participant did not mention her father at all. Ten participants stated that both parents encouraged them to do well in science. These same ten participants lived with both parents. The other two participants thought their mother encouraged them.

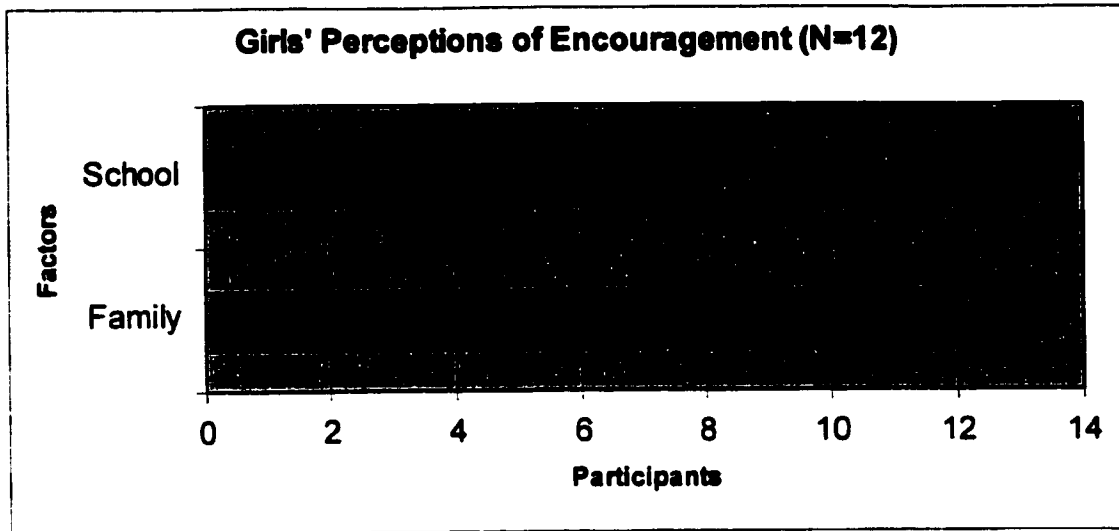


Figure 10. A comparison of the 12 participants' perceptions of encouragement.

The participants had definite perceptions of how their parents encouraged them to do well in science. Eight participants thought that ABC encouraged science. Two participants also took another extracurricular science class as well as this Saturday program. Sara explained, "My parents encourage me quite a lot. I am in a science club for girls at the Museum of Science and Technology on Saturdays once every month. I also come to [this program]. [My parents] are really supportive".

Three participants thought that books, obtained by parents, encouraged them to do well in science. Two participants thought their parents were encouraging when they helped. Rewards were also reinforcing. Lisa affirmed, "I have been encouraged. My parents help me, they explain things to me, and they encourage me to do well. Sometimes when I get good marks, they give me rewards like outings and stuff". Only one participant said that science museums encouraged them to do well in science.

Furthermore, the participants perceived other members of the family as encouraging them to do well in science. Corina asserted, "My grandpa has a doctorate degree in science. It was mostly my grandpa who got me interested in science". Similarly, Mary explained, "I would say my big brother. He is always encouraging me to try and be what I want to be when I grow up. To try to be the best at school. He is 16". Although high parental involvement appeared to be essential, encouragement from others in the family had great influence on some participants as well.

The perception that parents stimulated an interest in science by providing help and support appeared to be present in 31% of the interviews. These participants went to both parents when they needed assistance. The next largest category (25%) was that of obtaining help from

the mother. Three of these participants said they did so because their mother was usually at home when they were doing their homework.

In contrast, those who chose to ask their father for help with homework did so because of his perceived expertise. Anna stated, "For math and science I go to my Dad because he says he is best, those are his strong subjects". Similarly, Christine disclosed, "My Dad helps me with arithmetic because he has a degree in mathematics. I don't normally ask Mom". Of course, help with elementary school mathematics does not require a degree in Math. This mindset could have instilled the idea that ability is based on gender as Christine said she is not good in math but doesn't know why.

Siblings provided another avenue for perceived help. Three of the participants said they went to their older siblings first before asking their parents for help. In addition, one participant received help from the babysitter as she was expected to complete her homework before her parents arrived home from school. Interestingly, both of her parents held degrees in science and her father was also a science teacher. Erica asserted, "My babysitter, she helps me and always tells me to do it right when I get home from school so that I don't forget to do it. My homework is usually done when my parents get home".

Sometimes those who provided support modeled attitudes and influenced major aspects in a child's life related to the amount of contact. Erica disclosed, "I would like to be an interior decorator because it might be fun and I like decorating things. My babysitter and everyone tells me that I am really good with colors'. This appeared to be the complete opposite of what she thought encouraged her to do well in science. Erica reported, " My Dad is a science teacher and he encourages me a lot to keep going in science". It is possible that encouragement in science was not directly translated into future career interests in science.

Family activities in the ET Theme.

A family activity that increased contact time and possible fun was that of vacations and weekly outings. Fifty-eight per cent of the participants reported that they have extensively traveled. In addition, 75% have visited most or all of the museums in the Ottawa area. Sam explained:

We usually travel around the world. We have been to many places. Lately, we have gone to New Zealand and China. We get to meet new people. On the weekend, we usually stay at home but sometimes we go to museums with our friends that come from a different country, either the Museum of Civilization or the Museum of Nature.

Not all participants have as much contact time with parents because of hectic schedules. Erica remarked:

We always go to my grandma's after my science class. And on Sunday, to my other grandparents in Cantley. Well, sometimes my Dad, my brother, and me go out to dinner when my Mom goes to meetings and isn't coming home. Sometimes we go to different museums but not usually. We don't have a lot of time. We are very busy. In the summer, we go camping a lot.

Family schedules, however, become more relaxed during the summer for this family since both parents are teachers. Hence, many family differences among participants were noted such as priorities, contact time, work schedules, travel, and other sources of learning.

Attending science class with the participants at ABC provided an opportunity for the parents to show interest and support their daughters. Fifty per cent of the participants said their parents frequently attended class with them. Only 21% dropped-off the participants and went elsewhere. Almost 30% of parents attended meetings for parents of the gifted. Seminars included topics such as schooling, parents' rights, and other ways to help their gifted child. Mary affirmed, "Sometimes my Mom goes to class with me and other times she goes to the lectures for parents".

Expectations in the ET theme.

Did parental encouragement in extracurricular science lead to an expectation for academic excellence in science? For the purpose of this study, 'expectations' was defined as the belief that particular actions will produce specified outcomes. Expectations was noted 9 times in the interviews (mean being 0.7 times per interview).

The participants reported that their parents encouraged them to take ABC science classes for different reasons. Sam asserted, "I think [my parents] thought that I was bright so I should take ABC science lessons so I would learn more and get better marks or something". On the other hand, Soteira explained, "My mom and dad support me in what I want to do. And I am not going to be forced out of something that I like". These two participants' perceptions of parental expectations were quite different, while the other five participants' perceptions fell in between these two extremes. For the most part, it appeared that the participants' choices to take extracurricular science were supported by their parents in various ways although, the participants' perceptions of intent may have been different.

School support in the ET theme.

Fifty-eight per cent of the participants perceived school as encouraging them in science. For some participants, encouragement emerged as a complex question. Some spoke of direct influences, the lack planning in science, and no perceived encouragement. Sara explained, "There are not many science programs at school actually. We do more workbook science. And I don't enjoy it at school because we don't have labs or anything to do experiments in". For Lisa, intrinsic motivation was intermingled with school encouragement. Lisa asserted, "At school you are encouraged to do your best at everything. The teacher doesn't really say to you to do your best and stuff like that. You aim for good marks anyway". After she thought about her first

statement, she clarified her answer which reflected intrinsic motivation not encouragement. Perceptions of encouragement were very individual.

One school provided encouragement in science through extracurricular activities. Erica remarked, "In school we have science clubs and stuff like that. We do science experiments and we made cheese once". The choice of science activities was perceived as an encouragement by five participants. Three participants spoke of experiments as encouraging them in science. In addition, two participants thought research projects were also stimulating.

The most salient activity that encouraged science in the school was that of inviting a guest scientist, preferably one who allowed hands-on activities. Hanna explained:

We had this geologist come in and talk to us about rocks. It was during science class and I guess we had a couple of guest speakers. It was fun. He showed us slides of when he went climbing in Alaska looking for rocks. It was pretty neat. He brought in rocks, we got to do stuff. It was pretty cool.

This one guest made science fun, neat, and cool for this participant. Guest scientists brought their area of expertise to the class. Thus, thirty-three per cent thought this encouraged science at school.

In conclusion, there were many components to the participants' perceptions of encouragement. The school attempted to provide encouraging events such as guest scientists, experiments, science clubs, and research projects. Some participants thought their schools lacked encouraging activities. Parents showed encouragement by bringing the participants to ABC science classes and other extracurricular science classes, providing them with books, and assisting them with schoolwork. In addition, other opportunities provided increased family time such as vacations, weekly outings, and the attendance of ABC science classes with the participants.

The Role Models (RM) Theme

For the purpose of this study, a 'role model' was defined as a person regarded by others as a good example to follow. A role model could be real or fictitious, famous or intimate, aware or oblivious to their role model status. The selection of a model was a personal one. The f obtained was 55 mentions of modeling in the t interviews. Each participant identified with a model with a mean of 4.1 times per interview. The participants' perceptions, concerning the influence of role models, were organized into three sections: Role models and the media, Role models in school, and Role models outside of school. In addition, some of the role models' attributes, as perceived by the participants, were mentioned.

Role models and the media.

The participants were asked who their favorite character was on television. Many selected characters whose attributes they admired. Lisa asserted, "I only watch one television show which is Emily of New Moon. So then it would be Emily and she is ten years old. In school she likes learning and is really serious and that's a good thing". Similarly, Kayley stated, "I like Lisa Simpson from the show The Simpsons. Because she is smart".

Of course, not everyone admired the same qualities. Debbie explained, "It would probably be Topanga from Boy Meets World because she is so free spirited, politically correct, and like she is fun and wild". Similarly, Christine admired the non-traditional sex-role of her chosen role model. "Well, I think one of them would be Annie Oakley. I guess because she was unusual because women didn't usually do those kinds of things". This same participant also admired or identified with the physical characteristics of her another model. During this self-

appraisal she stated, "There is a new show called Anamorphs. And Rachel is my favorite because she is blond and blue-eyed like me. She always kicks butt".

Some participants didn't have a favorite t.v. role model but described a character from a book instead. Erica reported, "My favorite character is in a book. I read Ella Enchanted because she was really brave and stuff. She had some kind of curse on her. And it was really hard for her to break it". Moreover, Rachel admired many of the same characteristics with the addition of the 'female caregiver role'. She explained:

What I really like is Angelina in the book called The Curse of the Viking Grave. She is a young woman that is from a Cree tribe. In the book she does a lot of stuff. She makes sure that they eat well. Two friends that are boys come along with her. She really does a lot to help them. Without her, they probably would have died.

Four participants said they did not have a favorite character or that they were not sure. Although no one chose the same role model, common qualities were: being brave, smart, fun, and physically similar.

Role models in school.

Suggestions for positive role models at school were convergent. Fifty-eight per cent of the participants thought teachers were positive role models at school. Soteira affirmed, "I think our homeroom teacher is. He is really nice and he is fair to everyone. He finds neat ways to do things". Similarly, Debbie said, "My English teacher is number one because she knows how to get kids involved. Some teachers are really good at that. I like my French teacher because she is good at taking charge but is not really bossy".

Peers were suggested as positive role models for many different reasons. Lisa explained:

There are some kids in my class that are good in different subjects. If you see that there is a certain trick that they have for being good, but not cheating. A trick that they have for being good at it in their subject, you might try it. Say you never go to the library, and you notice that this person who is doing it well is going to the library, then you might want to go to the library also.

As Lisa already stated, she admired serious learners and classmates who she could look up to. On the other hand, Haley affirmed that she admired "friends that are girls because they don't smoke [and] don't take drugs". It was interesting to note that Haley's father is an R.C.M.P. officer who perhaps, encouraged his daughter to admire another type of 'good' example. Mary mentioned a role model that was both a family member and a peer at school:

Probably my cousin is a positive role model because she is really good at building things like pulleys and gears, we usually do experiments like that. And she helps others. She is never mean to others, and that is good, even to people who don't have many friends.

It was interesting that she considered her cousin a good example to follow for what appeared to be two completely different reasons. Perhaps, the selection of role models was best explained by Corina:

Usually it depends. I am not sure. A lot of the time, if you are interested in sports, I guess Michael Jordan would be a good role model. If you are interested in science, Marie Curie would be a good role model. Or if you are interested in Math, Pascal would be a good role model. So, it depends what you are interested in.

If the participants had multiple interests, it appeared possible to have multiple role models or role models that provided more than one example to follow. It appeared, for these participants, that the selection of role models was based on personal interests.

Role models outside of school.

Comparable findings regarding positive role models outside school were identified. Parents were mentioned in 50% of the interviews as positive role models. When asked to name a positive role model, Soteira asserted, "My mom and dad. They are ready to support me in what I want to do. And I am not going to be forced out of something that I like and that sort of thing". Similarly, Mary reported, "I would say my big brother because he is always teaching me new things that he never had a big brother or sister to teach him about". It was clear, from the

numerous times that it was reported, that this relationship with her brother was very important to Mary.

Two participants thought the ABC instructors were positive role models. Lisa remarked, "There might be other teachers [for example] at the museum that you really like and are really smart and are really nice. Maybe a teacher at ABC. There are lots of role models". The worthiness of role models was based on the characteristics that Lisa valued.

This ABC instructor was perceived to be a positive role model to another student but for a different reason. Anna explained, "When I come to ABC, there is Nancy who is a chemistry teacher. I was with her for quite a few chemistry classes that she taught. And she is a role model because she is a female and there aren't very many". This instructor was valued for her gender representation in an area of science where women appeared to be absent.

Another interesting choice for a role model outside school was offered by Debbie. She explained:

Outside school would be Drew Barrymore because she is my favorite actress and I want to be an actress when I grow up. And when she was little, she was famous and did drugs at the age of eight. And she had to overcome that. I read her autobiography called Little Girl Lost.

This participant stated she wanted to be an actress and this role model's ability to overcome her problems had made her a good example to follow.

For one participant, self-appraisal was involved in the selection of role models and extracurricular activities. Five participants expressed self-appraised comments (mean of 0.6 times per interview). Some participants, who appeared to select role models based on the similar characteristics that they valued, reported using self-appraisal to predict their success or even to select an activity. Only Sam appeared to use self-appraisal and fear of being embarrassed as a deterrent in her choice of selecting new activities.

Famous female scientists exemplified the possibility of being successful in a science career. Not surprising, 58% of the participants named Marie Curie first as a famous woman scientist. Robert Bondar, Julie Payette, Jane Goodall and Helen Sawyer-Hogg were mentioned by three participants as second and third choices. Lisa reported, "Marie Curie. [Then] Roberta Bondar, she is not a scientist but an astronaut. It is strange, you don't hear about many women scientists. You have to look". It was interesting that Lisa was not aware that Dr. Roberta Bondar was a payload specialist responsible for science experiments on her mission. This demonstrated the lack of information available concerning women scientists other than Marie Curie.

In addition, Debbie's mother had made an effort to provide her daughter with this information about women scientists. Debbie asserted, "Marie Curie. My mother is always making me read extra stuff on women scientists and stuff". Similarly, the school assigning projects on famous scientists provided an opportunity for research. Rachel commented, "Marie Curie and there is also Helen Sawyer-Hogg. I did a science project on her. She is an astronomer and the telescope at the Museum of Science and Technology is named after her". Without the assignment at school, participants may not have been exposed to female scientists as role models.

Forty-two per cent of participants did not know any famous female scientists. Mary disclosed, "I don't know any. We haven't done it yet in school". Without school assignment or parental direction, independent inquiry was not mentioned by the participants. In addition, interest appears to be a factor. Sam commented, "I am not quite sure. If I ever did read about it I have forgotten". And in some situations, research projects were assigned at school but in other subjects. Erica explained when asked, "No, not that I can think of. We have only done projects or things like Canada. Stuff like that". Without positive examples to follow or knowing that there

are women scientists, girls have been failed and their dreams stunted from the lack of possibilities.

Role models appeared to play an important influence in the lives of participants'. Some role models affected the girls in a daily manner, while other role models influenced the participants' aspirations for the future. Perhaps, this factor should merit further study to assess the advantages that might be gained through the coordinated use of positive role models.

The Extracurricular Activities (EA) Theme

All participants took part in extracurricular activities due to the fact that all of the girls attended a science class at ABC during the year. In addition, most participants were engaged in other extracurricular activities (see Figure 11). Extracurricular activities gave participants the opportunity to demonstrate motivation and develop a positive self-concept. Most participants indicated that they were positively evaluated by others and viewed their accomplishments satisfactorily.

Through extracurricular activities, the participants discussed how they perceived themselves in relation to their involvement. The issue of self-concept arises as a composite view of oneself that occurs quite extensively in their talk about their extracurricular activities. In fact, self-concept reference appeared 19 times in the interviews. There are many examples of positive self-concept. Mary affirmed, "I think I am really good at probably everything at school because I get good marks on my report cards. And out of school, I am good at playing sports like soccer". Similarly, another participant viewed herself as a good hockey player. Erica asserted:

I am good at a lot of things. I think the thing I am best at is playing hockey. I am a goalie. I used to play on a boy s' team but I like the girls' team better because they are a lot less competitive.

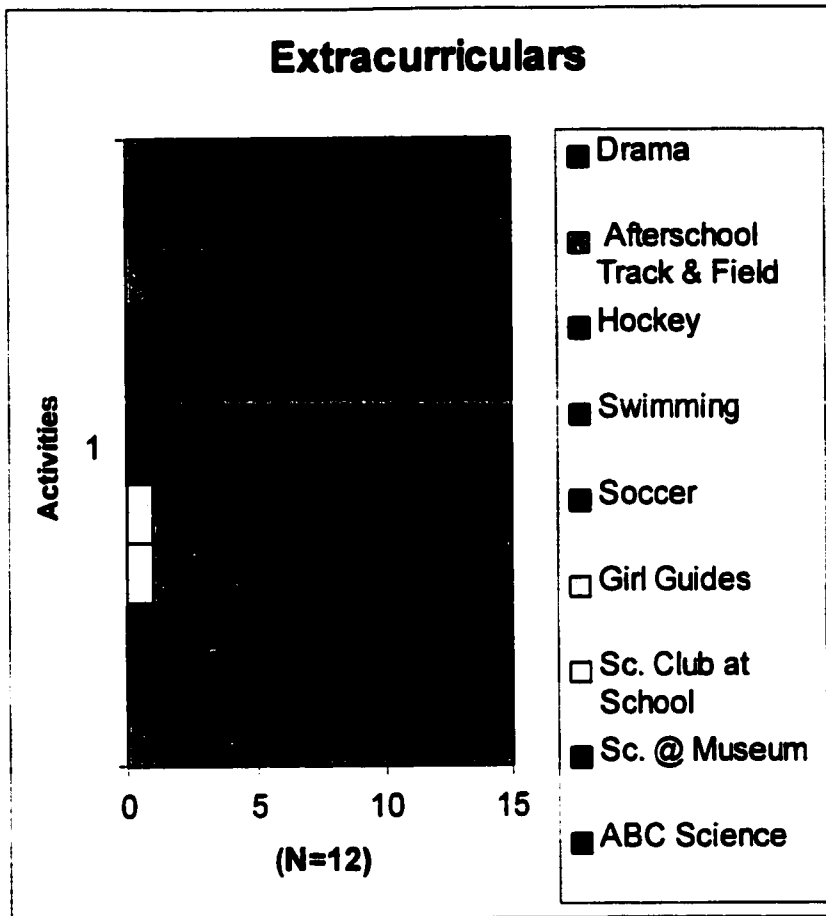


Figure 11. The various types of extracurricular activities of the 12 participants.

Although Erica didn't like the level of competition among the boys, she switched to a girls' team and still viewed herself as a good hockey player.

Negative evaluations from others, especially peers, were determined by self-image. Sam disclosed:

I am practicing high jump. Although, I don't really want to because I think that if I make a mistake people will laugh at me. At my new school, they have gotten mad at me when we were playing because I didn't catch the ball. And they kept teasing me about it.

This participant's direct experiences and the evaluations of her peers appeared to have made her afraid of repeating mistakes and of failure in new situations. Sam continued:

Sometimes I usually want to take sports after school but I don't really want to do it because if I do something wrong they will laugh at me. And it will be very, very embarrassing. And the next day if I am brave enough to go back, then they will still laugh and say "here she comes" and laugh again.

Instead of experiencing increasing confidence and self-concept, this participant perceived the response she received from her peers as ridicule. Thus, she viewed herself as someone who made embarrassing mistakes.

All participants engaged in various extracurricular activities that allowed most the opportunity to demonstrate motivation and develop a positive self-concept. The negative comments of peers caused one participant to have a diminished view of herself. Perceptions of positive and negative evaluations are very personal. What encouraged one participant, may discourage another.

The Equity in School (EQ) Theme

For the purpose of this study, equity in school was defined as the quality of being impartial or fair. The frequency count of this theme was 13 times in the interviews. Participants reported two types of equitable treatment: Calling on students and Fairness in grading.

Calling on students.

Every one of the participants described her teacher as being fair when calling on students. Calling on students was perceived as a means of capturing the students' attention. Erica asserted, "If someone wasn't paying attention she will ask them. She usually picks at random. If someone was looking under their desk and not paying attention, she would ask them the question. But usually they don't know". Another participant thought her teacher encouraged students to guess when they were unsure of themselves. Debbie explained:

She will see who has their hand up and if someone is loud she won't call on them. Once she has called on people who have had their hands up roughly once or twice, she will tell the others to take a guess at it because there are five or six people who answer the questions the most in science. And most of the other people raise their hand occasionally so sometimes she won't pick anybody until almost everybody has raised their hands.

In contrast, leaving the selection process to chance was another way students were called on. Soteira remarked, "He does a really neat thing. He has these cards with our names on them and he flips them to ask questions a lot. He balances it out pretty well". These participants had a favorable opinion regarding fairness in calling on students for answers.

Fairness in grading.

The perception of fairness in grading was only mentioned by one participant. When asked who in school was a positive role model, Lisa stated, "I'm not sure you would want to imitate your teacher because I think she sort of has her favorites like when she is marking a project". It was interesting to note that minimal behaviors on the part of the teacher can be perceived as favoritism. What led the participant to perceive herself as treated unfairly? Lisa explained:

Well, my teacher really like sports. And she really likes kids who are sporty. And Angela really loves sports and is into competitive swimming and gymnastics and the teacher just loves her. And she actually doesn't do great work. She also likes Nina because she is good at art. So the teacher actually says "all the kids say she is really good and she is my favorite at art".

It was difficult for this participant to differentiate between encouragement, positive feedback, and favoritism. Perceptions could have been uncertain for many reasons, particularly the possibility of inconsistent, unequal feedback for the teacher. Perhaps, this could have been avoided by attributional feedback.

In summary, all participants thought their teachers fair when addressing students even though different methods were used. One participant perceived her teacher as marking projects unfairly and having favorite students in the class. The perceptions of the gifted girls' had many similarities and individual differences concerning equity.

The next section concerns the validity of the answers from the interviews and the data from the content analysis. The f results for semantic and computer analysis were compared. This was done in order to validate the results before exploring the first two research questions.

Validation of the Interview Analysis

To analyze the data obtained from the interviews, the researcher coded all answers from each participant and then constantly compared answers to help improve coding of the next interview. Before the interview data was imported into a qualitative software program, the participants' responses were compiled question by question according to the correspondence of the concepts and emerging meaning as perceived by the researcher during semantic analysis. A computer program was then used to check the researcher's coding for accuracy of interpretation (semantic analysis). The comparison of the results of both approaches is presented in Table 2.

Table 2.

The Frequency of Occurrence for Semantic and Computer Analysis.

Themes and factors	Frequency of occurrence semantic analysis	Frequency of occurrence Computer count (Nudist)
How science is taught (HST)	Total HST = 97	<u>Total HST =107</u>
- Self-agency	34	36
- Self-efficacy	30	34
- Boredom	20	20
- Groupwork	13	17
Voicing of opinion and beliefs (VO)	Total VO = 93	<u>Total VO = 100</u>
- Expressing opinion	57	62
- Confidence	3	3
- Assertiveness	3	3
- Self-doubt	30	32
Fun (FT)	Total FT = 86	<u>Total FT =85</u>
- Fun	86	85
Career Interest (CI)	Total CI = 75	<u>Total CL =23+</u>
- Traditional sex role	28	*
- Non traditional sex roles	22	*
- Motivation	17	15
- Self-appraisal	8	8
Peer (PR)	Total PR = 70	<u>Total PR = 66+</u>
- Peer influence	51	63
- Independence	12	*
- Choosing Sc.	7	3
Feedback (FB)	Total FB = 68	<u>Total FB = 69</u>
- Attributional Feedback	8	6
- Self-evaluation	27	30
- Achievement	20	21
- Ability	13	12
Encouragement (ET)	Total ET = 57	<u>Total Et =69</u>
- Support	48	49
- Expectations	9	20
Role Models (RM)	Total RM = 55	*
Extracurricular activities (EA)	Total EA = 19	<u>Total EA =19</u>
- Self-concept	19	19
Equity in school (EQ)	Total EQ = 13	Total EQ = 14

Note. A * means the responses were based on personal characteristics and too individualistic to code for f.

Four factors could not be coded by the computer because participant responses were too individualistic to be categorized under general themes: Traditional sex-role, Non-traditional sex-role, Independence and Role models.

However, as shown in Table 2, when the frequency of occurrence for factors obtained by content analysis was compared to the computer coding, correspondence was close. In some instances, the computer frequencies were slightly higher because a participant repeated the same expression or key word within the same sentence. When this was coded based on the researcher's interpretation, such responses were only coded once. Since all codes had a specific frequency of occurrence, they were used to determine the descending order of occurrence for the ten themes. Thus, seven of the themes comprised multiply coded factors whose sums determined their order as shown in Table 2. The other three themes comprised only one factor.

In summary, it seems plausible to conclude that the two approaches used in analyzing the data obtained from the interviews with the participants were coherent. They lead to the same factors and thus, can be used as valid indicators to attempt an answer to the two first research questions.

Regrouping of Factors

Before attempting to answer the questions regarding the perceived degree of strength of factors that influence gifted girls' choice to enroll in extracurricular science programs, they were regrouped according to: first, Bandura's classification and second, the f of the factors drawn from the interviews with the participants.

Using Bandura's classification.

The reader is reminded that in the review of literature 25 factors were regrouped according to Bandura's Social Cognitive Theory as summarized in Table 3. The Internal Personal

Factors reported were: (1) self-agency; (2) self-efficacy; (3) self-evaluation; (4) self-concept; (5) motivation; (6) ability; and (7) self-appraisal. These are the original factors identified in the literature review. The total frequency of internal personal factors was 148, the lowest score of the three sections. The Behavioral Factors included : (1) voicing opinion; (2) self-doubt; (3) traditional sex-roles; (4) non-traditional sex-roles; (5) achievement; (6) independence; (7) choosing science classes; (8) confidence; and (9) assertiveness. Behavioral factors, appeared 172 times. The third section regrouped Environmental Factors: (1) fun; (2) role models; (3) peers; (4) encouragement; (5) boring; (6) equity; (7) groupwork; (8) expectations; (9) attributional feedback as well as two other factors, 'boredom' and 'groupwork'. The total frequency of occurrence for this section was 303.

Based on a analysis of the interviews, environmental characteristics appeared to be the most prevalent component that affected gifted girls' choice to take extracurricular science classes. As pre-adolescents, it seems that interpersonal and behavioral factors are not fully developed and therefore, not fully utilized. In addition, some factors such as confidence and assertiveness, emerged from the interviews and were difficult to differentiate. These factors belonged to the same category (behavioral characteristics) so their f total was not affected.

Similarly, self-concept, self-efficacy, and self-agency were also difficult to distinguish and they belonged to the Interpersonal Characteristics category. This difficulty in distinguishing these three factors was also noticed in the literature review because some researchers used these terms interchangeably.

Table 3.

Regrouped Factors in Light of Bandura's Social Cognitive Theory and Their Frequency of Occurrence.

Themes and factors	Interpersonal Factors	Behavioural Factors	Environmental Factors
How science is taught (HST) - Self-agency - Self-efficacy - Boredom - Groupwork	34 30		20* 13*
<u>Voicing of opinion and beliefs (VO)</u> - Expressing opinion - Confidence - Assertiveness - Self-doubt		47 3 3 30*	
Fun (FT) - Fun			86
Career Interest (CI) - Traditional sex role - Non-traditional sex roles - Motivation - Self-appraisal	17 8	28 22*	
<u>Peer (PR)</u> - Peer influence - Independence - Choosing Sc.		12 7	51
Feedback (FB) - Attributional Feedback - Self-evaluation - Achievement - Ability	27 13	20	8
Encouragement (ET) - Support - Expectations			48 9
Role Models (RM)			55
Extracurricular activities (EA) - Self-concept	19		

Equity in school (EQ)			13
Totals	148	172	303

Note. A * means that the factor was not pre-identified but emerged during analysis.

In summary, the data collected during the interviews was analyzed using two complementary strategies. When the same 25 factors were regrouped into three categories, based on Bandura's Social Cognitive Theory, their f showed that the 'Environmental Characteristics' category had the largest total. Therefore, it was reasonable to conclude that environmental factors had the greatest affect on gifted girls' choosing extracurricular science classes.

Classifying the data from the structured interviews.

Because of the saliency of the environmental conditions, it was necessary to refine this category. The twenty one questions that were used in the structured interviews permitted the researcher to classify the factors as emerging from the schools, families, or broader environments. The re-grouping of these factors is presented in Table 4.

Table 4.

Typology of Factors That Emerged Categorized as the Family, School, and the Broader Environment.

Themes and factors	Family Environment	School Environment	School & Family Environment	Broader Environment
How science is taught (HST)				
- Self-agency	x	x	X	X *
- Self-efficacy		X		X
- Boredom		X		X
- Groupwork		X		
<u>Voicing of opinion and beliefs (VO)</u>				
- Expressing opinion	x	x	X	X *
- Confidence		X		X
- Assertiveness		X		X
- Self-doubt	x	x	X	X *
Fun (FT)				
- Fun	x	x	X	X *
Career Interest (CI)				
- Traditional sex role	x	x	X	X *
- Non-traditional sex roles	x	x	X	X *
- Motivation	x	x	X	X *
- Self-appraisal		X		X
<u>Peer (PR)</u>				
- Peer influence		X		X
- Independence		X		X
- Choosing Sc.	x	x	X	X *
Feedback (FB)				
- Attributional Feedback	x	x	X	X *
- Self-evaluation		X		X
- Achievement		X		X
- Ability	x	x	X	X *
Encouragement (ET)				
- Support	x	x	X	X *
- Expectations	x	x	X	
Role Models (RM)	x	x	X	X *
Extracurricular activities (EA)				
- Self-concept	x	x	X	X *
Equity in school (EQ)		X		
Total	13 x	25 x X	14 X	22 X

Note. If a factor was present in the combined 'School and Family' category, it was noted with a large "X". In addition, a small "x" was placed in each category ('School Environment' and 'Family Environment') to keep accurate count. Therefore, in the 'Family Environment' category, 13x means that no factors were solely influenced by the family environment but the x(s) were carry-overs from the combination of the 'School and Family' category. The total of the 'School and Family' combination category was 14X. To find the number of factors that were solely affected by the 'School Environment' (25xX), 25 was then subtracted from 14 (in the combination category). This left 13 factors solely influenced by the school environment. A * means the factor was present in all three categories.

Table 4 illustrates how environmental factors are affected by the family, school, or broader environment. Thirteen factors were identified as being present in all four categories and therefore, were thought to have greater weight in influencing the choice of extracurricular science by these gifted girls.

From participants' responses, the themes of How science is taught, Peers, Voicing opinion, Feedback, and Equity appeared to be influenced by the school environment. In addition, all of the themes except for Equity, seemed to be affected by a combination of the school and family environments. Other individual influences and preferences within the broader environment of the participants, were perceived to affect all of the themes except Equity at school. On the other hand, the family in itself did not appear to affect any of the themes. This seems to demonstrate the importance of a strong and positive relationship between home and school for gifted girls regarding academic achievement. How, in fact, do the factors and resulting themes relate to the original research questions?

How the Factors and Themes Relate to the First Two Research Questions

The first research question.

The first research question that guided this study was: What do girls, grades four to six, think are influences within the school environment that affect their choice to take extracurricular science classes. The participants perceived the themes of Peers, How science is taught, Voicing opinion, Feedback, and Equity to be influenced by the school environment (see Table 4). Peers were reported both to disrupt and assist learning, influence the choice to take science classes and exert pressure to conform to stereotyping. The participants thought that various components were involved in relation to equitable treatment in the school environment such as whether teachers called on students, grading, and having favorite students. In addition, how some girls' perceived receiving feedback, affected how they viewed their teacher.

Exposure to activities during science class helped some participants choose future occupational goals that were similar to their personal interests as well as being a component to their liking science. The opportunity for participants to voice their opinion and be heard influenced their enjoyment and their choosing science classes. Moreover, all of the other themes, except Equity, comprised factors influenced by both school and family. Either the school provided the opportunity for the factors in this theme or their influence could not be distinguished from the parental aspect.

The second research question.

The second research question was: From the girls' perspectives, how did parents best support and encourage their daughters, grades 4-6, to take extracurricular science classes. The participants' responses showed that none of the themes were solely influenced by the family.

However, nine themes are comprised of factors that were influenced by both school environment and family. Hence, the parents and the school provided complementary aspects of the themes. Of course, there were other individual influences and preferences that may have acted as catalysts to aid the family and school in supporting the participants.

In summary, environmental factors appeared to be the prime determinants to the selection of extracurricular science activities. This was made evident in the regrouping of the factors based on Bandura's Social Cognitive Theory as seen in Table 3. In addition, there was a larger presence of factors in the 'broader environment' section which, perhaps, makes it possible to intervene to allow gifted girls 'real' choice to participate in extracurricular science classes (see Table 4).

It must be remembered that these participants have parents who are committed and have met all their basic needs and more. If these needs were unfulfilled, they would be of foremost importance. Family and pedagogical implications can be made regarding the influence of environmental factors on gifted girls' choices to take extracurricular science. Table 4 presented a typology of factors that could be used to assess each participants' environment for areas that need improvement. The participants' environments not only involve the home, but the school as well. Perhaps, with school boards' renewed interest in family, community, and school partnerships, a formal and consistent evaluation of gifted girls' environments can take place.

Attitudes Towards Science

Attitudes toward science was an important component in addressing why gifted girls chose extracurricular science classes. How this "attitude" was measured is briefly revisited. The results of the Test of Science Related Attitudes are presented, along with the analysis of individual results. Research question three is answered and its implications discussed.

In the past, there existed confusion as to the possible meaning of attitudes toward science which has been alleviated with the creation of Fraser's (1981) the Test of Science Related Attitudes (TOSRA). The TOSRA, according to its author (Fraser, 1981), had a validity coefficient of 0.33 and a reliability coefficient of 0.82; thus, it seemed appropriate for use. The TOSRA was administered to each participant prior to their interview. Although there was no time limit, the completion time averaged between 20-25 minutes. While participants were told they could ask questions at any time, only one question was asked concerning whether 'science class' referred to school or extracurricular science. Since the TOSRA was intended to be administered to students in schools, the participants were told to consider 'science classes' as part of their school curriculum. .

Measured attitudes towards sciences.

The results of the TOSRA are listed in Table 5, and the mean highlighted for each of the seven categories. This mean was then compared to the mean provided with the students in year 7 of Fraser's (1981) sample as illustrated in Figure 12. Year seven in Australia corresponds approximately to grade 6 or 7 in Canada

In each of the seven categories, the mean were very different from the comparison group. In our study, the total mean of the seven categories was 40 while the total mean of Fraser's (1981) seven categories was 34 for year 7. Each of the categories' total means were higher by a range of 2-10 points. Although Fraser's (1981) sample size comprised approximately 340 students [for year 7] compared to the 12 gifted participants in this study, a definite difference in the participants' attitudes toward science was observed as seen in Figure 12. Similarly, a difference was also noted regarding attitude towards science among the gifted participants in this study but not to such an extent in comparison to Fraser's (1981) mean.

Table 5

TOSRA Group Results.

Name	Social Implications of Science	Normality of Scientists	Attitude Toward Scientific Inquiry	Adoption of Scientific Attitudes	Enjoyment of ScienceLessons	Leisure Interest In Science	CareerInterest In Science	Total	Age
Erica	44	42	46	41	48	39	40	42.86	9
Hanna	38	36	42	46	48	46	41	42.43	9
Lisa	45	44	40	47	41	47	44	44	10
Debbie	48	41	38	35	33	33	35	37.57	10
Christine	36	35	41	40	38	36	35	37.29	10
Corina	39	42	45	37	32	35	35	37.86	10
Mary	37	33	40	45	45	41	41	40.29	10
Kayley	38	39	40	41	42	43	36	39.86	11
Sam	44	36	42	36	43	38	39	39.71	11
Rachel	39	35	41	37	33	30	28	34.71	11
Anna	38	33	46	45	48	35	35	40	12
Soteira	41	43	46	43	39	44	50	43.71	12
Mean	40.30	38.2	42.30	41.00	41.00	39.00	38.1	40.02	10.42
Abbrev.	S	N	I	A	E	L	C		

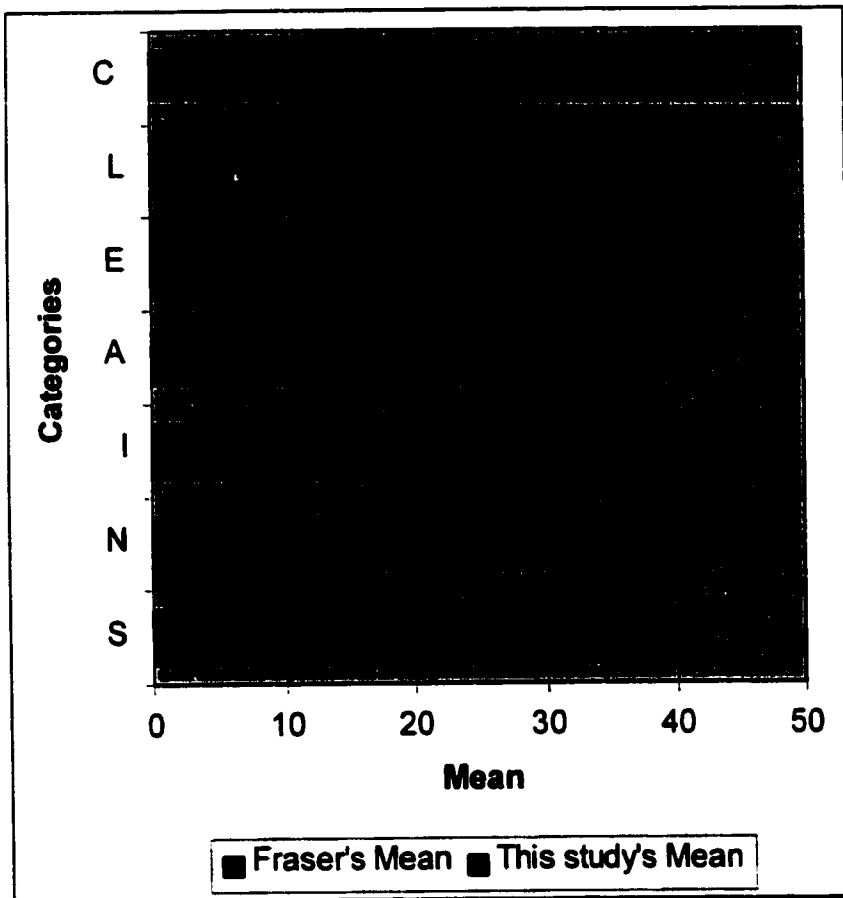


Figure 12. Comparison of TOSRA group means.

Third Research Question in Relation to Attitude Towards Science

The third research question that guided this study examined the participants' attitudes towards science. Four of the five participants who reported wanting a career in science also had a high score in the category of Leisure Interest in Science. The mean for Leisure Interest In Science was 43 out of a possible 50 points. The five participants who stated they wanted a career in science had a mean of 41 out of 50 in the category of Career Interest in Science. Their score was higher compared to the total mean of 38.1 for Career Interest in Science (see Table 6).

On the other hand, five participants who reported being bored and annoyed with peers in science class chose science by default at ABC and stated they did not want a career in science. However, the data supported their story. The TOSRA results on Leisure Interest in Science, Career Interest in Science, and Enjoyment of Science Lessons was 35 (mean) for each subcategory. And when the above results were compared to the five students who reported enjoying science, who chose extracurricular science at ABC, and who reported wanting a career in science, the difference in the scores for each sub-category was obvious (see Table 6). Therefore, those who reported wanting a career in science, had an increased mean of six to eight points compared to the mean of those participants who stated not wanting a career in science. Of course, even those participants who wanted a career in science did not always enjoy what was offered by the school, a fact that was reflected in their Enjoyment of Science Lessons score.

The literature that accompanied the TOSRA (Fraser, 1981) as well as the study done by Farenga and Joyce (1998), presented evidence that the three categories, Enjoyment of Science Lessons, Leisure Interest in Science, and Career Interest in Science, scores to be closely related. Fraser (1981) stated that these three categories presented the highest intercorrelations (values of

.53, .58, .59). He added that although these three categories are conceptually distinct, it is expected that they would moderately correlate among the students since there would be a tendency for a student who enjoys science lessons to be more likely to have a leisure and career interest in science. This expectation proved true for ten of the participants in this study (see Table 5). On the other hand, two participants did not fit this pattern. Although Erica and Hanna did not want a career in science, they had very high scores in the three categories mentioned above. These two participants were the youngest in the study [9 years old], and perhaps had not truly considered all their career options and interests.

The three categories with the highest total scores were Attitude Towards Scientific Inquiry, Adoption of Scientific Attitudes, and Social Implications of Science. Many of the ways in which participants said science was taught addressed these three categories. Conversely, the four categories Normality of Scientists, Enjoyment of Science Lessons, Leisure Interests in Science, and Career Interests in Science, involved individual participants' experiences and preferences. Therefore, the TOSRA seems to accurately reflect what the participants reported in their interviews.

Links Between Identified Themes and Attitudes Toward Science

The Test of Science Related Attitudes [TOSRA] had seven conceptually different categories that supported the themes developed and corroborated by the participants' responses to the interview questions. The TOSRA also measured the participants attitudes towards science and gave a numerical value for each category (see Table 5). The individual participant histograms illustrate the participants' scores and can be seen in Appendix H. In addition to

providing a numerical measure to answer research question three, other connections between the interview data and the TOSRA were investigated.

The Test of Science Related Attitudes (TOSRA) has a subsection called Enjoyment of Science Lessons. The mean score for this category was 41 out of a possible 50 points. When the TOSRA sub category was compared with the results of the interview question, “what do you like best about science?”, there was little correlation.

Some of the participants who scored high liked experiments the best. Conversely, some of the participants who had a lower score reported liking mostly experiments. It was possible that the participants' science lessons did not contain much of what they liked best, thus, lessening their enjoyment. There were, perhaps, other factors involved in enjoyment of science lessons not reported by the participants.

The participant who scored the lowest for Enjoyment of Science was Corina. It wasn't science, however, but the way it was taught and the environment in which it was taught that caused her to dislike it so much. Since participants reported various things as boring and fun, it was difficult for any learning situation to meet all their needs. Perhaps, the learner and her family have to take some responsibility for providing learning experiences that participants found interesting. The parents of these 12 participants have certainly attempted to supplement their daughters' learning experiences.

Another category of the TOSRA that was looked at more closely was Leisure Interest in Science. For the most part, the scores in this category were in keeping with the scores in Enjoyment of Science Lessons. Those participants who scored high in one category tended to score high in the other. There were two unexpected exceptions. Erica had scored 48/50 for Enjoyment of Science Lessons but only scored 39/50 for Leisure Interest in Science.

More interestingly, her first choice at ABC was a chemistry class. Similarly, Anna had scored 48/50 for Enjoyment of Science Lessons and only 35/50 for Leisure Interest in Science. This participant reported liking science and taking many chemistry classes, in addition to helping her mother with the administrative details of running the ABC programs. Of these two exceptions, only Anna said she wanted a career in science. How did reported future career interests correspond with the scores on the TOSRA?

The final category of the TOSRA that was explored was Career Interests in Science. Most of the participants who reported wanting a career in science also obtained a high score on the Career Interest in Science category. In addition, most participants who scored highly on Enjoyment of Science Lessons and Leisure Interests in Science also did well on Career Interests in Science. Surprisingly, there were more exceptions than with the other two categories of the TOSRA that we examined for connections between the TOSRA results and the interview data.

Two participants who stated they did not want a career in science had relatively high scores, 40 and 41 /50, in the Career Interests in Science category. Conversely, two other students who reported wanting a career in science had scores below this category's mean of 38 out of a possible 50 points. The other eight participants' scores in the Career Interests in Science category generally corresponded to their scores in Enjoyment of Science Lessons and Leisure Interests in Science categories.

Therefore, this general correspondence of the three categories agreed with Fraser's theory (1981) of the intercorrelation of these same three categories. This intercorrelation was also supported in a more recent study done by Farenga and Joyce (1998). For the most part, this instrument resembled the findings of two major studies and was considered valid.

Due to incomplete data, a clear connection could not be made between parental interests and careers and their influence on the participants' future career interests. Some participants were not sure what their parents occupations were, did not directly state the occupation, or did not answer the question at all. From the participants' interviews, each individual had personal interests that motivated her. Perhaps parental encouragement was a good predictor of personal fulfillment in the future not necessarily a specific career.

In summary, the mean results of our participants' in every category of the TOSRA, outperformed the Year 7 results provided by Fraser (1981). The participants in this study were a bit younger than Fraser's (1981) sample and were considered gifted. The age of students in Year 7 in Australia was approximately 12-13 years and the participants in this study ranged in age from 9-12 years. As predicted by Farenga and Joyce (1998) and Fraser (1981) the three last categories of the TOSRA's results intercorrelated and perhaps, were the most indicative of true choice to take extracurricular science classes. The TOSRA also verified the participants' answers during their interviews. On the other hand, their responses to interview questions also increased the validity of the TOSRA's measurements. Both the interviews and the TOSRA measured what was intended.

This study was conducted to explore if parental support and the school environment influenced gifted girls' choice to take extracurricular science classes. Moreover, it aimed to determine which personality, behavioral, and environmental factors appeared to have the greatest influence with this group of participants. There appears to be evidence that the participants were influenced by many of the factors described in the literature reviewed. The themes developed from the interview data will be further discussed in relation to the literature review in the following chapter.

CHAPTER 4: DISCUSSION

The findings indicate that the gifted girls in this study encountered factors that influenced their decision to take extracurricular science classes. This was consistent with the literature reviewed. All 21 of the pre-identified factors were found in the interview data. Moreover, four emerging factors were found to influence gifted girls' options in pursuing extracurricular science. However, not all factors appeared to influence this choice with the same frequency. Seventeen of the pre-identified factors were present in over half of the data obtained from the girls, while the four themes that emerged were present more than 50% of the time.

This chapter attempts to link the findings derived from this study to the literature reviewed previously. The pre-identified and emerging factors, organized into ten dominant themes in descending order of frequency, will be discussed in relation to the literature review. Then, findings and implications from the study are summarized including the participants' attitudes towards science. Finally, the limitations of this study will be presented along with suggestions for further research.

Themes In Relation to the Literature Review

1. How Science Was Taught (HST) Theme

The first theme explored whether the way science was taught may produce lasting impressions on girls to affect its selection as an extracurricular activity, a subject for further study, or a future career interest. For this reason, the participants' understandings of methods and activities were examined. Only two reported science as their favorite subject at school. While participants had many perceptions of how they were taught science at school, the methods most often reported were experiments, research projects, building 'stuff', and taking notes from the board. However, hands-on activities were rated as the favorite way to learn science. This was consistent with the study of Burham, Lee, and Smerdon (1997) who suggested that hands on

activities in science class increased adolescent girls' performance and interest. On the other hand, reading from the textbook and science tests topped the list of least-liked activities. The common element of these disliked features was that they provided little opportunity for individual selection or any other components of motivation or fun. This coincided with Bandura's (1997) description of the features of motivation which included selection, activation, and sustained direction of behavior. Furthermore, when the participants did not receive the science activities they expected and seemed to require, they and their parents sought other means of science instruction. This illustrated the notion (Kellegan et al., 1993) that parental participation played an important part in determining the amount of students' interest in learning and the level of their achievement.

Self-efficacy and self-agency in science classes in HST theme.

Generally, the participants showed high self-efficacy in their talk about themselves. In fact, ten girls reported that they always thought they could do the science lesson. Although in this study they were only elementary students, this is similar to the study of Lent et al. (1994) where students with high self-efficacy in science tended to achieve high grades in science courses and to continue with science instruction at higher levels of education.

Participants with high self-efficacy claimed that they always attempted a difficult lesson. Furthermore, the difficulty and challenge made the task interesting, while science lessons with no appropriate challenge were considered boring and failed to motivate students. These findings were supported by the definition of fun as proposed by Middleton et al.(1992).

When all participants were coded for self-agency not only did they believe they could do it, they firmly indicated that they acted on that belief. It appeared, therefore, that self-efficacy and self-agency may be inter-related and that both were needed to attain a goal. Indeed, the

participant with the highest frequency for these two factors was raised by a single mother who ensured that her daughter was aware of sex role stereotyping and exposed her to many educational experiences. This was in keeping with Martinez-Pons (1996) who acknowledged that it was important for parents to model and guide their children's learning opportunities . Moreover, as Lam (1997) concluded, children from single-mother families with a high SES background and authoritative parenting, which included parental monitoring, parental supportiveness, and psychological autonomy, did not show lower academic achievement when compared to intact families of similar SES. So, in a sense, parents with high self-efficacy encouraged high self-efficacy in their children.

Boredom in the HST theme.

Student boredom was a factor that emerged due to its high frequency of occurrence. Participants who reported being bored with science lessons reported being offered a limited selection of learning activities or activities that failed to stimulate high arousal. The provision of intellectual stimulation for such a diverse group was a challenge supported by Clark (1997) and Kerr (1994) who reported gifted students annoyed and bored with slowness and repetition.

Appropriate challenges, on the other hand, stimulated interest that motivated the participants to try science activities. While, science lessons without challenge were thought to be boring by half of the participants, they also reported that boys and girls tended to react differently to boredom. Boys developed behavioral problems and girls became frustrated with science. This corresponded with Kerr's (1994) affirmation that gifted girls may not complain or act out as some boys do when their needs are unmet. On the other hand, boredom, withdrawal, poor class participation, daydreaming, or sadness suggested that gifted girls need more stimulation and opportunity through mentoring, individualized instruction, or acceleration.

Boredom was one of the factors that most clearly affected some participants' attitudes toward science and thus appeared to have far reaching consequences upon the future selection of science classes.

Groupwork in the HST theme.

The participants perceived group work as an ingredient common to science classes. Groupwork was used to help other children who had difficulty, to monitor students with behavior problems, and to share equipment when there wasn't enough for everyone. When some participants were allowed to choose their groups, they often chose their friends. Other participants were placed in groups by mixed ability and mixed work habits so the 'positive' students could influence the others. Most often the girls reported boys in their group were disruptive. Evans (1996) indicated that boys consistently positioned themselves as powerful members during group work and perceived themselves as having the right to tease and belittle girls, an action which simultaneously positioned the girls as powerless members who were expected to accept such treatment. Even when participants resisted by seeking the help of the teacher, the situation seldom changed because excuses were made for the boys' behavior.

Incorporated into some learning activities to increase interest and retention, discussion was thought to be important in science when students' theories are contradicted by scientific thought (Alvernann & Hynd, 1989; Duit, 1995). But another complaint reported by the girls was that boys did not listen to them. Previously, Bernstein and Gilligan (1990) noted that girls think fairness and listening are intimately related concepts necessary for learning. Unless the girls were allowed to choose their groups, group work was not viewed as a positive learning experience. The effect of how science was taught in school was very complex theme. The intent of teaching

exercises was not always achieved with the result that some participants learned to view science negatively.

Thus, attitudes towards science appeared to be influenced by the many subtle occurrences mentioned in this theme. According to the participants, it was important to consider not only how science was taught but also the environment in which it was taught, because the biggest complaint was the disturbance created by the boys in the classroom. While same-sex schooling may not be appropriate for all girls, perhaps gifted girls who may be discouraged by the teaching environment of science classes would benefit from a same-sex environment for science and develop a more positive attitude towards learning in general. This was previously noted by Kerr (1994) who suggested that an all-female educational environment may make a huge difference in the amount of intellectual stimulation a gifted girl receives. Luckily, these external influences can be changed with consistent, individual assessment of each gifted girls' learning environment.

2. Voicing of Opinion and Beliefs (VO) Theme

The voicing of opinion (VO) theme initially included: expressing what the participants thought, as well as confidence, and assertiveness. Although participants expressed what they thought quite frequently and often explained their reasons, three participants with the highest frequency also exhibited the highest levels of confidence and assertiveness. This was in agreement with the findings of Guzzetti and Williams (1996) that girls' explanations for their differential participation was related to issues of self-confidence and social norms.

An unexpected factor, self-doubt, emerged in this theme due to its high frequency of occurrence, often in place of or before the participants' voicing of opinions. More than half of the participants made doubtful statements such as "I don't know" and "I am not sure". Because they

then proceeded to offer complete and interesting comments, these statements may indicate that self-doubt may have many levels of meaning. This was supported by the earlier work of Gilligan et al. (1990) and Kerr (1994) who posited that the frequency with which adolescent girls say “I don’t know” in the course of a conversation, combined with the use of pauses, hesitations, and other qualifiers, denote characteristics of adolescent girls’ communication in a process referred to as self-silencing. It is possible that some of the pre-adolescent gifted girls in this study, were in the initial stages of “self-silencing” because the frequency of doubtful statements appeared to increase as the participants’ ages increased. Furthermore, it was suggested that proper role-modeling and encouragement from parents may help alleviate self-doubt (Gilligan et al., 1990; Hollinger & Fleming, 1992). As suggested by Hollinger and Fleming (1992), activities such as athletics and mastery of other opportunities may serve a similar purpose, whatever the girls’ interests may be.

3. The Fun Theme (FT)

Different activities were considered fun for the participants. When asked why they liked certain activities, many of the answers were similar. Fun has been defined as activities that required a high level of arousal, a high level of perceived control, and tasks tailored to personal interests (Middleton et al., 1992). Activities reported as being fun, but not related to a particular subject or activity included: learning and doing new things, creating new things, and being active. Certain subjects or activities provided more perceived fun as well as tasks tailored to personal interests. This then led the participants to identify the subjects at school that they particularly enjoyed. While the prevailing favorite subject was Math, two girls mentioned Language Arts, and another two participants thought gym was popular. These findings disagreed

with Middleton et al. (1992) who found girls enjoyed art, spelling, and being in the gifted program the most fun.

Although most participants found different activities fun, all activities mentioned supported Middleton's et al. (1992) definition. The perception of fun and prior experiences appeared to influence the selection of activities by the participants. As studies by Farenga and Joyce (1998) and Heller and Ziegler (1996) indicate, prior experiences with mathematical, physical, or technological problems, games, and other learning opportunities influenced gender differences such that girls may be negatively influenced with regards to the development of interest in these areas. The gifted girls' in this study did not appear to be negatively influenced because they or their parents ensured that the necessary prior experiences were provided.

4. Career Interest (CI) Theme

Intrinsic to the career interest theme, sex-roles were examined in relation to the future career interests of the girls in this study and were defined as tasks or functions assigned to males or females. According to Wells (1985), attitudes of teachers and parents to sex roles greatly influenced sex-role development in children. While non-traditional sex role was a factor that was expected to be present, it was interesting that traditional sex role development was a factor that emerged with greater frequency. Almost all of the participants made statements that referred to traditional sex role at both home and school. This coincided with the findings of Raymond and Benbow (1989) who concluded from their study that parents can model sex roles which contribute to the development of stereotypical ideas.

Given these findings, pursuing a career interest in science could be a difficult decision indeed. Despite the higher frequency for traditional sex-roles development, five participants

expressed an interest in a science career as well as the desire to work with children. Some participants, however, had already chosen one possibility over the other. Gifted girls' choosing to work with children or even combining their interest in science with children were, perhaps, career decisions based on traditional sex-roles not ability. This agreed with studies by Bandura (1997) and Kerr (1994) who concluded that the more strongly girls adopt gender-roles that are stereotypically feminine, the more often they underestimate their capabilities.

The fact that a few participants wanted to combine the desire to work with children and an interest in science for the future corresponds to findings by Gilligan et al. (1990) and Kerr (1994) who noticed that there was a critical shift in adolescence from achievement needs to relationship needs. This may explain why younger gifted girls talk so excitedly about careers in paleontology and other areas of science (Kerr, 1994). All participants, however, spoke of traditional sex-roles which may have influenced some of the girls towards traditional career choices. Conversely, traditional sex-roles motivated one participant to want to be an engineer in order to dispel the myth of male domination in certain occupations.

Most pre-adolescents in this study admitted changing their career interest in the past and will do so many more times before deciding on a career. Gifted students showed less stability in their interest patterns due to their ability to select and develop any number of career goals, according to Kerr (1994). In addition, participant reports of parental influence in their career interests appeared minimal. While the same five participants who wanted a career in science also freely chose to take extracurricular science classes, other participants obliged their parents' encouragement but did not change their interests or preferences for the future study of science. Parental effect may be even more limited with "gifted career-focused girls" (Kerr, 1994). Most of the girls had high career aspirations in agreement with other studies that indicated gifted girls are

unlike average girls, in that they dream big dreams (Farenga & Beverly, 1998; Greenberg-Lake, 1991). What cannot be denied, however, was the frequency of traditional sex roles reported by the participants and its subtle influence on choices.

5. Peers (PR) Theme

The theme, concerning the influence of peers, appeared to affect different girls in various ways. Over half of the participants said peers interfered with performance in science class. Moreover, the gender of the peers who disturbed participants was most often male. Indeed, twice as many participants mentioned boys created distractions as compared to girls. This was in keeping with Sadker and Sadker (1985) who found that boys, in grades 4-6, vocally dominated the classroom. Similarly, Bandura (1997) noted that unless teachers are proactive in promoting equal gender opportunities to learn science and math, male students come to dominate these instructional activities, which further promotes differential development.

On the other hand, female friends were considered to be a positive influence on participants' choices to take science classes. Four of the girls who took a paleontology course at the extracurricular Saturday program were in the same gifted class at school and belonged to the same peer group. According to Bandura (1997), children are sensitive to their relative standing among peers whom they associate with in activities that determine prestige and popularity. Unfortunately, this also can have the opposite influence as two participants reported knowing girls who discontinued science classes because one or more of the popular peers in the group changed their interests and thus, the rest followed suit.

Furthermore, two participants reported remembering girls who chose not to take extracurricular science because they were afraid that the boys would think they were too smart and wouldn't like them. Similarly, another participant recounted a female classmate pretending

to be “stupid” for the same reason. These findings are supported by the earlier work of Kerr (1994) and Noble (1989) who thought that many young gifted females are taught at a young age that competence and achievement will lead to loneliness and social rejection.

Not all girls were thought to be so directly affected by peer pressure. Other influences, counteracted negative stereotyping were discussed by one participant. She disclosed the source of stereotypical messages as being magazines and peer pressure from friends. Moreover, she stated she thought she was immune to these stereotypical messages because her mother constantly drew attention to them as well as to explaining how they were harmful. This parental practice was indicated by Howard-Hamilton and Robinson (1991) who advised that societal gender roles should be made known early to young girls in order for them to develop strategies to negotiate the challenges they will encounter as gifted females.

This fifth theme exerted an important function in the lives of gifted girls. Some participants reported being both positively and negatively influenced while one gifted girl explained how she became ‘immune’ to stereotyping. If pre-adolescent peers can affect girls’ selection of extracurricular science classes, how much greater will the pressure be in secondary school?

6. The Feedback (FB) Theme

The lack of perceived attributional feedback was important. These attributions came from five participants with the mean being 0.4 per interview. Participants received positive feedback usually in the form of grades or awards. Thus, achievement was equated with positive feedback and failure with any type of negative feedback. This type of feedback did not inform the girls what was wrong or how to correct it. Gifted girls should receive attributional feedback after success and variable factor feedback after failure (Bandura, 1997; Heller & Ziegler, 1996). In

this way, failure would be considered bad luck or lack of effort and success would be credited to talent and ability. These reinforcement experiences would encourage gifted girls to develop positive methods of evaluating themselves. This was supported by the earlier study of Ryckman and Peckham (1987) who concluded that self-evaluation style influenced future motivation and was dependent on experiences and reinforcement from the educational environment.

It appeared, based on the interview data, that as some participants intellectually matured, they were able to combine self-evaluation with positive feedback from their environment. For one participant, her reported perceptions of positive and negative feedback were inadequate for it left her confused and discouraged. This participant's perception of criticism was painful. Moreover, her teacher's reported statement would have been less upsetting if it had also included an explanation of how to improve her project in addition to what was already correct.

In addition, this same participant's self-evaluation in reported instances appeared overly critical and inaccurate. Heller and Ziegler (1996) concluded that, although their study showed impressive improvements in self-concept and achievement related to math and science, it might be more effective to re-train the self-evaluation styles of gifted girls as a means of prevention rather than remediation. If gifted girls are to accurately assess themselves and be assessed, it is necessary that they know what needs improvement, how to correct it, and what is already correct.

7. Encouragement (ET) Theme

Family support in the ET theme.

Participants perceived many forms of encouragement from their families to take science classes. Most participants said that parents taking them to Saturday extracurricular classes encouraged science. In addition, two of the participants also took another extracurricular science

class as well. A few participants disclosed that books provided by the parents encouraged them to do well in science. Also, two participants thought their parents were encouraging when they contributed help. Rewards as being reinforcing were only mentioned once. Only one participant stated that she perceived going to the science museums as encouraging although, three quarters reported visiting most of the many museums in the Ottawa region with their families. These reported forms of encouragement were consistent with suggestions made by Farenga and Joyce (1998); Heller and Ziegler (1996); Hollinger and Fleming (1992).

The perception that parents stimulated an interest in science by providing help and support was present in one-third of the interviews. These participants went to both parents when they needed assistance. The next largest category disclosed was that of obtaining help from the mother. Three of these participants said they did so because their mother was usually at home when they were doing their homework.

In contrast, those who chose to ask their father for help with homework did so because of his perceived expertise. Two participants reported that their fathers helped them with math and science and said they were the best in those subjects. This stereotypical modeling could have instilled the idea that ability is based on gender as one of those participants disclosed she was not good in math but didn't know why. This supported the earlier work of Raymond and Benbow (1986) who thought that because fathers were typically involved in math and science areas and mothers in verbal areas, this role-modeling may develop the idea of math and science choices being more appropriate for males.

Siblings provided another avenue for perceived help. Three of the participants said they went to their older siblings first before asking their parents for help. In addition, one participant received help from the babysitter as she was expected to complete her homework before her

parents arrived home from school. Sometimes those who provided support also modeled attitudes and influenced major aspects in a child's life due to the amount of contact. This participant claimed her father encouraged her to take ABC science and to 'keep going' in science. She also disclosed being encouraged by her babysitter to be an interior decorator because she was good with colors. At the time of her interview, she thought she wanted to pursue a career in decorating. Her reported future career interest, therefore, appeared to be the complete opposite to her father's encouragement.

As Kerr (1994) suggested, it appears that all role models are important, even babysitters. Hence, finding an older girl or woman who is intellectually oriented, self-confident, and assertive is necessary. Although high parental involvement appeared to be essential, encouragement from others in the family had great influence on some participants as well.

School support in the ET theme.

Over half of the participants perceived school as encouraging them in science. For some participants, school encouragement emerged as a difficult question. Some spoke of direct influences, sources of indirect planning of science, and no perceived encouragement. One school provided encouragement in science through extracurricular activities such as science clubs. The choice of science activities in class was perceived as encouragement by five participants who mentioned that experiments and research projects stimulated science activities. However, not all participants reported learning activities that were encouraging for the most disliked activity was reading from a science textbook. According to Bandura (1997), efficacy in science educators was a concern because of the increasing importance of scientific literacy and competency, as well as the many technological transformations taking place in society today.

The most salient activity that encouraged science in the school was that of inviting a guest scientist, preferably one who allowed hands-on activities. Burham et al. (1997) noted that, for adolescent girls, 'science performance and interest increased when hands on activities were provided. One participant spoke of a guest who made science 'fun, neat, and cool' for her because he brought his area of expertise to the class. This was supported by Gilligan et al. (1990) perhaps, when she concluded that girls use different approaches to understand and master information that is traditionally used in science class. Many girls need to see the social relevance of the scientific concepts taught and 'guest experts' provided the opportunity to obtain detailed answers and modeled questioning as another way to 'talk' science (Guzzetti & Williams, 1996). Small changes in the learning environments, of both home and school, may help some girls see the social significance and meaning in the science lessons they are taught.

8. Role Models (RM) Theme

Most participants had a favorite character on television with which they could identify. However, four participants said they did not have a favorite character or that they were not sure. Although no one chose the same role model, common qualities were: being brave, smart, fun, and physically similar. Although the girls in the study reported watching little television, the characters they chose modeled independence, self-confidence, and self-assertiveness, but not to the exclusion of feminine attributes (Bandura, 1997; Gilligan et al., 1990).

Suggestions for positive role models at school were convergent. More than half of the participants thought teachers were positive role models at school. Reported attributions of these teachers of both genders included being nice, fair, interesting, involved with students, and assertive. In addition, peers were suggested as positive role models for many different reasons. Lisa stated she admired serious learners that she could learn from and classmates who she could

look up to. This is consistent with Clasen and Clasen (1995) who found some students thought their friends were a buffer against peer pressure from 'other kids' and shared the need to get good grades.

Similarly, Hanna affirmed that she admired her friends because they didn't smoke or take drugs. It was interesting to note that Hanna's father is an R.C.M.P. officer who perhaps, encouraged his daughter to admire another type of 'good' example to follow. These findings are supported by Bandura (1997) who concluded that children choose or gravitate toward others who share similar interests and values.

One participant mentioned a role model that was both a cousin and a peer at school, who was good at building pulleys and gears, in addition to being kind to those who had no friends. It was interesting that she considered her cousin a good example to follow for what appeared to be two completely different reasons. Sex-role characteristics such as love of children, gentleness, and understanding, may be reinforced by parents according to Bem (1974), while Howard-Hamilton and Robinson (1991) suggest that the very characteristics that some parents value, model, and teach to their daughters eventually cause them not to do well or avoid 'masculine' subjects such as math and science. If the participants had multiple interests, then multiple role models or role models that had various attributions were reported. It appeared, for these participants, that the selection of role models was based on personal interests.

Comparable findings regarding positive role models outside school were also identified. Two participants thought the Saturday science instructors were positive role models, while one particular instructor was valued for her gender representation in an area of science where women appeared to be absent. In addition, parents were mentioned in half of the interviews as positive role models mostly for the help and support they provided. This contradicted the findings of Kerr

(1994) who concluded that in many families the intellectual and emotional needs of gifted girls go unmet because their family has other priorities, and because gifted girls are so accepting of their families' other priorities.

Frequently, the worthiness of role models was based on the characteristics that participants reported valuing. For one participant, self-appraisal appeared to be involved in selecting role models and extracurricular activities. However, not all participants reported using self-appraisal to predict their success or even to select an activity. For example, Sam appeared to allow self-appraisal and fear of being embarrassed to be a deterrent.

This was not reflected in the findings of Phillips and Zimmerman (1990) who noted that girls' patterns of self-appraisal have their origins partly in parents' gender-linked beliefs about their children's capabilities. Thus, girls generally disparage their capabilities. This participant only mentioned the negative comments of peers as the reason for her not wanting to try new things or repeat embarrassing activities.

Famous female scientists exemplified the possibility of being successful in a science career. Not surprising, over half of the participants named Marie Curie as a famous woman scientist. Robert Bondar, Julie Payette, Jane Goodall and Helen Sawyer-Hogg were mentioned by three participants as second and third choices. Almost half of participants did not know of any famous female scientists. This demonstrated the lack of information available concerning women scientists other than Marie Curie. Quek (1995) indicated that examples of eminent female scientists provide models of personality characteristics necessary for gifted girls to succeed and encourage them to decide whether other people will facilitate or impede their pursuit of ambition and attainment of success.

In addition, one participant's mother had made an effort to provide her daughter with this information about women scientists in addition to sex-role stereotyping. This mother's efforts were in keeping with Kerr (1994) who suggested parents provide role-models for their daughters that demonstrate self-confidence and agency. Similarly, the school assigning projects on famous scientists provided an opportunity for research. Independent research without school assignment or parental direction was not mentioned. Some role models influenced the girls in a daily manner, while other role models influenced the participants' aspirations for the future. Role models appeared to be an important influence in the lives of these participants'.

9. Extracurricular Activities (EA) Theme

All participants took part in extracurricular science at ABC. In addition, most participants reported being engaged in other extracurricular activities. Extracurricular activities gave participants the opportunity to demonstrate motivation and develop a positive self-concept. Most participants indicated that they were positively evaluated by others and viewed their accomplishments satisfactorily. There are many examples of positive self-concepts and some participants reported thinking they were good at everything. This supported the earlier work of Kerr (1994) who determined that by age ten, gifted girls express wishes and need for self-esteem through school and club achievements.

Instead of having increased confidence and self-concept, one participant perceived the response she received from her peers as ridicule. Thus, she viewed herself as someone who made mistakes and was embarrassed. She reported wanting to take sports after school but was afraid she would do something wrong that would cause her peers to laugh or respond negatively. According to Bandura (1997) efficacy beliefs, not self-concept, are highly predictive of behavior. Hence, the strength of a girl's self-efficacy will determine whether a behavior will be started, the

amount of effort devoted to pursuing the goal, and the degree of goal persistence in the face of barriers (Bandura, 1977). Perceptions of positive and negative evaluations are very personal and powerful. What encouraged one participant, may discourage another.

10. The Equity in School (EQ) Theme

Every one of the participants described her teacher as being fair when calling on students. Calling on students randomly was perceived as a means of capturing the students' attention. Another participant thought her teacher encouraged students to guess when they were unsure of themselves by giving time to answer and prompting. In contrast, leaving the selection process to chance by turning over cards with the students' names on them was another way students were called on. These participants had favorable opinions regarding fairness of teachers in challenging students for answers.

The perception of fairness in grading was only mentioned by one participant. This was disclosed when the participant was asked who in school was a positive role model. The participant replied that the teacher shouldn't be imitated because she had favorites when marking projects. It was interesting that the smallest behaviors on the part of the teacher can be perceived as favoritism. It appeared difficult for the participant to differentiate between encouragement, positive feedback, and favoritism. This was supported by the earlier work of Hollinger and Fleming (1992) who concluded that evaluation of classroom environments by teachers is needed to ensure equity. Many things could have clouded perceptions particularly the possibility of inconsistent, unequal feedback. Perhaps, this could have been avoided by using attributional feedback

Two participants mentioned boys yelling out answers and taking the teacher's attention away from the science lesson. According to Klein and Zehms (1996), regardless of race or gender, teachers often give male students more positive and negative attention. Although the boys were punished more often for the aforementioned behavior, the girls reported that it was a regular behavior, indicating the punishment they received did not work. This was in agreement with Guzzetti and Williams (1996) who established that female students attributed gender inequity to the males in the class and not the teacher. Thus, the perceptions of the gifted girls' showed many similarities and individual differences concerning equity.

Summary of Research Questions

As previously presented, the data collected during the interviews were analyzed using two approaches that caused the factors to be organized in the same way and were considered valid. When the factors were regrouped into three categories based on Bandura's Social Cognitive Theory, their frequency showed that the 'Environmental Characteristics' category had the largest total. Therefore, it was reasonable to conclude that environmental factors had the greatest affect on gifted girls' choosing extracurricular science classes. Because of the preponderance of factors that emerged from the environment, it was necessary to refine this category. The twenty one questions that were used in the semi-structured interviews that permitted the researcher to group the factors as emerging from the school, family, or a broader environment.

The different factors within each theme were affected by the family, school, or broader environment. There were 13 factors identified as being present in all four of the new divisions and therefore, were thought to have greater weight in influencing the choice of extracurricular science by these gifted girls as seen in Table 7.

Table 7

Factors Perceived to Have the Greatest Weight in Affecting Choice to Take Extracurricular Science.

<u>Self-agency</u>	Expressing opinion	Self-doubt
Fun	Traditional sex-role	Non traditional sex-role
Motivation	Choosing Science	Attributional Feedback
Ability	Support	Role models
Self-concept		

From participants' responses, the themes of How science is taught, Peers, Voicing opinion, Feedback, and Equity appeared to be influenced by the school environment. In addition, all of the themes except for Equity seemed to be affected by a combination of the school and family environments. Other individual influences and preferences within the broader environment of the participants, was perceived to affect all of the themes except Equity at school. On the other hand, the family by itself did not appear to affect any of the themes. This seems to demonstrate the importance of strong and positive relationships between home and school for gifted girls regarding academic achievement.

The participants' attitudes towards science was measured by the Test of Science Related Attitudes which corroborated what they reported in their interviews. Five participants who reported being bored and annoyed with peers in science class chose science by default at the extracurricular Saturday program and stated they did not want a career in science. However, when the TOSRA data was examined, it supported their story. From the TOSRA results, when Leisure Interest in Science, Career Interest in Science, and Enjoyment of Science Lessons were

examined, the mean of these participants was 35 for each subcategory. And when that was compared to five students who reported enjoying science, freely chose extracurricular science classes, and reported wanting a career in science, the difference in scores was obvious (see Table 6). Therefore, those who reported wanting a career in science, had an increased mean of six to eight points compared to the mean of those participants who stated not wanting a career in science. Of course, even those participants who wanted a career in science did not always enjoy what was offered by the school, a fact that was reflected in their Enjoyment of Science Lessons score.

In summary, environmental factors appeared to be the prime determinants to the selection of extracurricular science activities. This was made evident in the regrouping of the factors based on Bandura's Social Cognitive Theory. In addition, there was a larger presence of factors in the 'broader environment' section. Perhaps, it is possible to intervene with the environmental factors reported by the participants to encourage a positive attitude toward science and allow them 'real' choice to participate in extracurricular science classes.

Implications

Four factors emerged that were not originally in the review of literature or listed as pre-identified factors: Boredom, Groupwork, Self-doubt, and Traditional sex-roles. These four emerging factors had environmental influences found in both the home and school. In addition, all of the 21 pre-identified factors were present in the interview data.

It must be remembered that these participants have involved parents who reportedly have met all their basic needs and more. If these needs were unfulfilled, however, the results might have been different. Nonetheless, pedagogical and family implications can be seen regarding the

influence of environmental factors on gifted girls' choices to take extracurricular science. A typology of factors in Table 4 could be used to assess each participant's environment for areas that need improvement. If mandatory 'individual educational programs' (IEP) were developed for each gifted girl, perhaps, the learning environments could be better addressed to suit each individual's needs. The development of IEPs must include the parents, as well as the schools, since it appeared in this study that their support was essential to their daughter's academic success.

Furthermore, the participants' attitudes toward science appeared to be directly affected by their learning environments which was more than just the school. Almost all of the participants, who reported perceiving their learning environments positively, also had a high score on the TOSRA in addition to wanting a career in science. This not only validated the interview data but further emphasized the importance of assessing both the home and school environments. Ultimately, however, it is up to the parents to ensure that their children's needs are met as the parents of the participants in this study were reported to have done. In conclusion, there were some individual differences but it appeared that all of the factors either directly affected the participants' decisions or their attitude toward science which may have far reaching consequences such as future selection of science classes.

Limitations

This study was successful in examining some within-gender differences of pre-adolescent gifted girls who chose to take extracurricular science classes but there were some limitations to this study. The study has limited applicability because of the small sample size and the homogeneity of the characteristics shared by the participants. All 12 participants appeared to

have come from 'middle class' backgrounds. In addition, ten participants were white, while two other girls were of 'visible minorities'.

The 12 girls interviewed did not represent all gifted girls. These participants all reported high achievement, high parental involvement, and many educational opportunities both in and out of school. It is unclear, based on the results from this study, if gifted girls from different races, cultures, and rural areas have similar factors influencing their choices to take extracurricular science. Although two participants were from 'visible minorities,' ethnicity was not intentionally examined.

Another limitation is that of the selection of gifted participants. Enrollment in the extracurricular science classes did not require any screening procedures. Similarly, most were identified as gifted by their school board, but not all were assessed in the same manner. The fact that they chose to participate in these advanced science classes during their leisure time is a more specific indicator of what this study investigated (Farenga & Joyce, 1998; Moaz, 1990).

Another limitation to consider is that of researcher bias because the researcher was a previous instructor at Saturday program. In addition, two of the participants were previous students of the researcher. In many ways, this enhanced the ability to collect valuable data and gain the trust of the participants in a very short time, but may have decreased the researcher's objectivity. In order to counteract this bias, the interview data was objectively coded by computer analysis.

A fourth possible limitation to this study was that of a priori construct. By using twenty-one pre-identified factors that were identified from the literature review with a mixed methodology for analysis, the research design may not be considered truly qualitative. This might have been a problem if the data were forced to fit in one of the constructs. However, a

qualitative methodology was chosen to allow the rich, descriptive narrative to reflect what the participants' reported opinions. Content analysis allowed the factors to be ordered based on frequency of occurrence, and the measured instrument corroborated the participants' responses.

The rationale for pre-identifying factors was based on the fact that no previous literature involved pre-adolescent gifted girls and extracurricular science classes. By pre-identifying influencing factors from other studies concerning gifted females, by mixing the research design, and documenting the occurrence and non-occurrence of factors in this study's interview data, knowledge was added to the field of gifted education.

Suggestions

Because of the extensiveness of factors that emerged from the environment, it is necessary that recommendations be made. First and foremost, the teaching of science in the classroom needs to be addressed by teachers, parents, principals, superintendents of schools, and Ministries of Education. It is not enough that the Ontario Curriculum mandates science instruction, but compulsory science inservice for teachers, along with adequate science equipment and supplies must be made available. Furthermore, introducing subject-specific teachers for grades 3-6 may increase teacher efficacy in relation to science. The teacher's love or fear of science is contagious and inservice may not be enough.

Ultimately, the selection of science activities is left up to the teacher. Educators should be aware of the different approaches some girls prefer when learning science such as: seeing the social relevance in science, small group discussions with other girls, posing ideas as questions, and being heard in the classroom. Teachers should model behaviors such as restating, elaborating, and questioning as another way to 'talk' science. Examples of activities that include

these approaches are: inviting guest scientists, exploratory hands-on experiments, independent research projects based on interests, and the accomplishments of eminent female scientists woven into everyday lessons. The behavior of male students in the classroom and their reported impact on the learning environment should be pointed out to educators and parents as a starting point, since lack of awareness usually translates into lack of action.

Educators and parents need to be aware of the signs when gifted girls' needs are not being met such as boredom, withdrawal, poor class participation, daydreaming, and sadness. This may indicate the need for more stimulation, individualized instruction, mentoring, or same sex-schooling based on the needs of the individual. In addition, the environment and the attitude with which science is taught should include fun as it appears to be one of the main factors that motivates individuals to become lifelong learners. Parents and educators need to be aware of the changes in the perceptions of fun based on gender, interests, and age of individual students.

A consideration for both parents and educators is how gifted girls are evaluated. Attributional feedback is necessary for gifted girls to know what is already correct, what needs improvement and how. This may decrease the confusion of some and promote accurate self-evaluation among pre-adolescent gifted girls.

Lastly, the importance of role-models should be examined by both home and school. By providing female role-models who are assertive, confident, and successful in science, gifted girls are made aware of the possibilities and not their gender's absence. The participants in this study mentioned parents, educators, child care providers, and peers as being an immediate source of role models. An environment that surrounds a gifted girl with positive role models can encourage them to make accurate, meaningful choices and promote academic success.

This study showed the great variability among gifted girls who participated in extracurricular science classes. Female students, even supposedly as homogeneous as gifted girls, are very different and need to be seen as individuals. Further research should entail a larger group of participants that are more representative of the pre-adolescent gifted girl population. Participants should be drawn from various extracurricular science clubs and organizations. In addition, a wide range of participation across geographic, cultural, and ethnic strata is recommended.

In conclusion, continued research is necessary to ensure that both parental support and the school environment provide the necessary ingredients for gifted girls to attain their 'large dreams'. An interactive partnership between both home and school cannot be stressed enough. It is both of these environments that prepare gifted girls to become successful members of society and hopefully, with their contribution and equal participation, make it a better place.

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Appendix A**Test on Science Related Attitudes****By Fraser, B. (1981)**

Test of Science Related Attitudes

by Fraser, B. (1981).

Description: This 70-item, 5-point, agree/disagree scale was designed to measure seven distinct science-related attitudes of secondary school students. These scales measure **social implications of science, normality of scientists, attitudes toward scientific inquiry, adoption of scientific attitudes, enjoyment of science lessons, leisure interest in science, career interest in science.** The scale was prepared for use by teachers, curriculum evaluators, or researchers to monitor student progress toward meeting educational goals in Australian schools in years 7-10. These years approximate the high school years in the U.S. , (Middle or junior high in Canada).

Administration: May be group or individually administered in one class period. For older students, less time is used. The test itself is untimed. It may be group administered anonymously to encourage students not to answer with a positive bias.

Scoring and Interpretation: The scale is said to be most useful for measuring group performance although it can be used with individual students. Yields a separate score for each subtest or attitudinal component making it possible to plot a profile of attitude scores for groups of students. Point values are assigned to responses and summed. Scale scores are calculated. There is no total score.

Technical Information: The norm sample consisted of 1 337 students in metropolitan Sydney, Australia in years 7-10 of the Australian school system. Internal consistency via Cronbach's alpha ranged from .64 to .93 across subscales and grades in Australian schools and from .68 to .91 for a sample of grade 9 girls in two urban Catholic schools in Philadelphia. Test-retest reliability ranged from .69 to .84 after two weeks. Discriminant validity for TOSRA is discussed based on the uniqueness of each subscale since scale intercorrelations were low at a range of .10 to .59. Norms are reported as means and standard deviations for students in years 7-10 in Australian schools. Additional information on statistical properties of the instrument can be found in the manual on the fiche. Information on the use of the instrument with the U.S. student group can be found in the reference cited below.

Materials: Test, Score Key, Handbook, Answer Sheet.

References: Fraser, B.J. and Butts, W.L. (1982). Relationship between levels of perceived classroom individualization and science-related attitudes. Journal of Research in Science Teaching, 19, (2), 143-54.

Name:	Age:	strongly SA	agree A	not sure N	disagree D	strongly SD
Questions		SA	A	N	D	SD
1. Money spent on science is well worth spending.		SA	A	N	D	SD
2. Scientists usually like to go to their laboratories when they have a day off.		SA	A	N	D	SD
3. I would prefer to find out why something happens by doing an experiment than by being told.		SA	A	N	D	SD
4. I enjoy reading about things which disagree with my previous ideas.		SA	A	N	D	SD
5. Science lessons are fun.		SA	A	N	D	SD
6. I would like to belong to a science club.		SA	A	N	D	SD
7. I would dislike being a scientist after finishing school.		SA	A	N	D	SD
8. Science is the world's worst enemy.		SA	A	N	D	SD
9. Scientists are about as fit and healthy as other people.		SA	A	N	D	SD
10. Doing experiments is not as good as finding out information from teachers.		SA	A	N	D	SD
11. I dislike repeating experiments to check that I get the same results.		SA	A	N	D	SD
12. I dislike science lessons.		SA	A	N	D	SD
13. I get bored when watching science programs on TV at home.		SA	A	N	D	SD
14. When I finish school, I would like to work with people who make discoveries in science.		SA	A	N	D	SD
15. Governments have spent public money on science wisely in the last few years.		SA	A	N	D	SD
16. Scientists do not have enough time to spend with their families.		SA	A	N	D	SD
17. I would prefer to do experiments than to read about them.		SA	A	N	D	SD
18. I am curious about the world in which we live.		SA	A	N	D	SD
19. School should have more science lessons each week.		SA	A	N	D	SD
20. I would like to be given a science book or a piece of scientific equipment as a present.		SA	A	N	D	SD
21. I would dislike a job in a science laboratory after I finish school.		SA	A	N	D	SD
22. Scientific discoveries are doing more harm than good.		SA	A	N	D	SD
23. Scientists like sports as much as other people.		SA	A	N	D	SD

	strongly SA	agree A	not sure N	disagree D	strongly SD
Questions					
24. I would rather agree with other people than do an experiment to find out for myself.	SA	A	N	D	SD
25. Finding out about new things is unimportant.	SA	A	N	D	SD
26. Science lessons bore me.	SA	A	N	D	SD
27. I dislike reading books about science during my holidays.	SA	A	N	D	SD
28. Working in a science laboratory would be an interesting way to earn a living.	SA	A	N	D	SD
29. The government should spend more money on scientific research.	SA	A	N	D	SD
30. Scientists are less friendly than other people.	SA	A	N	D	SD
31. I would prefer to do my own experiments than to find out information from a teacher.	SA	A	N	D	SD
32. I like to listen to people whose opinions are different from mine.	SA	A	N	D	SD
33. Science is one of the most interesting school subjects.	SA	A	N	D	SD
34. I would like to do science experiments at home.	SA	A	N	D	SD
35. A career in science would be dull and boring.	SA	A	N	D	SD
36. Too many laboratories are being built at the expense of the rest of education.	SA	A	N	D	SD
37. Scientists can have a normal family life.	SA	A	N	D	SD
38. I would rather find out about things by asking an expert than by doing an experiment.	SA	A	N	D	SD
39. I find it boring to hear about new ideas.	SA	A	N	D	SD
40. Science lessons are a waste of time.	SA	A	N	D	SD
41. Talking to friends about science after school would be boring.	SA	A	N	D	SD
42. I would like to teach science when I leave school.	SA	A	N	D	SD
43. Science helps to make life better.	SA	A	N	D	SD
44. Scientists do not care about their working conditions.	SA	A	N	D	SD
45. I would rather solve a problem by doing an experiment than be told the answer.	SA	A	N	D	SD
46. In science experiments, I like to use new methods which I have not used before.	SA	A	N	D	SD
47. I really enjoy going to science lessons.	SA	A	N	D	SD
48. I would enjoy having a job in a science laboratory during my school holidays.	SA	A	N	D	SD
49. A job as a scientist would be boring.	SA	A	N	D	SD
50. Canada is spending too much on science.	SA	A	N	D	SD

	strongly SA	agree A	not sure N	disagree D	strongly SD
Questions	SA	A	N	D	SD
51. Scientists are just as interested in art and music as other people are.	SA	A	N	D	SD
52. It is better to ask the teacher the answer than to find it out by doing experiments.	SA	A	N	D	SD
53. I am unwilling to change my ideas when evidence shows that the ideas are poor.	SA	A	N	D	SD
54. The material covered in science lessons is uninteresting.	SA	A	N	D	SD
55. Listening to talk about science on the radio would be boring.	SA	A	N	D	SD
56. A job as a scientist would be interesting.	SA	A	N	D	SD
57. Science can help to make the world a better place in the future.	SA	A	N	D	SD
58. Few scientists are happily married.	SA	A	N	D	SD
59. I would prefer to do an experiment on a topic than to read about it in science magazines.	SA	A	N	D	SD
60. In science experiments, I report unexpected results as well as expected ones.	SA	A	N	D	SD
61. I look forward to science lessons.	SA	A	N	D	SD
62. I would enjoy visiting a science museum on the weekend	SA	A	N	D	SD
63. I would dislike becoming a scientist because it needs too much education.	SA	A	N	D	SD
64. Money used on science is wasted.	SA	A	N	D	SD
65. If you met a scientist, he or she would probably look like anyone else you might meet.	SA	A	N	D	SD
66. It is better to be told scientific facts than to find them out from experiments.	SA	A	N	D	SD
67. I dislike listening to other people's opinions.	SA	A	N	D	SD
68. I would enjoy school more if there were no science lessons.	SA	A	N	D	SD
69. I dislike reading newspaper or magazine articles about science.	SA	A	N	D	SD
70. I would like to be a scientist when I finish school.	SA	A	N	D	SD

Appendix B

Research Questions

- 1) What do girls, grades 4-6, think are factors within the school environment that influence their choices to take extracurricular science classes?
- 2) From the girls' perspectives, how can parents best support and encourage their daughters, grades 4-6, to take extracurricular science classes?
- 3) What are the girls', grades 4-6, attitudes toward science?

Original Interview Questions

- a) What school subject do you enjoy the most and why?
- b) How useful is science to you and society?
- c) In what ways have you been encouraged to do well in science 1. By your parents?
2. By your school?
- d) What careers should women choose or what jobs do you think women can do?
- e) Who is your favorite female character on television and why?
- f) What do you like best and least about science class?
- g) Have you ever felt you couldn't do a science lesson?
- h) What do you do when you have trouble solving a problem?
- i) What are the best ways to learn science?
- j) Does anything stop you from doing your best or learning in science class?
- k) How does your teacher call on everyone fairly for answers in science class?
- l) Why do you think some girls stop taking science classes?
- m) Who do you think is a positive role model 1. At school? 2. Out of School?
- n) Who helps you do your homework?
- o) What do you think you are really good at?
- p) What have you done in the past that has made you feel very proud?
- q) What career would you like to choose when you get older? Why?
- r) Tell me the name of a famous woman scientist?
- s) Where do you usually go on family vacations and weekly outings? Where is your favorite?
- t) What do your parents do while you are in your Saturday science class?

Correspondence of Interview Questions to Research Questions:

Research Question 1: c2, e, g, i, j, k, m1, p

Research Question 2: c1, m2, n, s, t,

Research Question 3: a, b, d, f, l, r, h, o, q,

Appendix C

Letter to Recruit Subjects

My name is Shaunda Wood. I am an M.A. student in the Faculty of Education at the University of Ottawa. I am currently doing my M.A. thesis. I am studying how school environment and parental support affect gifted girls' choices to take science classes. I have selected you to be part of the sample because of your participation in The Saturday Take-Off Program of the Association for Bright Children. My interest in factors that influence girls to choose science classes stems from research that has mostly concentrated on differences between males and females. I will be concentrating on within-gender differences. I am interested in what factors influence some girls to take science classes and why others do not.

Many parents of gifted girls enroll their children in the Saturday Take-Off Program to enhance their learning. It has been noted in these extracurricular science classes, grades 4-6, that attendance of girls' past grade five is minimal. Previous research has called for questions to be raised about how and when the cycle of lower female achievement and fewer accomplishments begins since females attain higher grades than males throughout elementary, high school, and college. Perhaps if researchers study girls who choose extracurricular science classes, they can discover what factors influence them in order to nurture these characteristics in future generations.

If you decide to take part in this study, you will be required to complete the Test For Science Related Attitudes and an interview. This will take place at Algonquin College and the time required will be approximately one hour in total. I thank you for having taken the time to read this. If you are interested, please return your signed consent form next week to your instructor or myself and I will contact you to arrange a time for the interview. If you have any questions, please contact me at 243-0984.

Thank you for your time,

Shaunda L. Wood
M.A. Candidate

If you are interested, could you fill out the following:

Your name:

Parent(s) name:

Phone number to arrange time for TOSRA and interview:

Address (optional):

Informed Consent Protocol

This is to be read by the interviewer before the beginning of the interview. One copy of this form should be left with the interviewee, and one copy should be signed by the interviewee and kept by the interviewer.

My name is Shaunda Wood. I am an M.A. student in the Faculty of Education at the University of Ottawa. I would like to thank you for participating in this study. Before beginning the administration of the Test of Science Related Attitudes (TOSRA) and the interview, I would like to explain the study and discuss your rights as a participant in this study.

I am studying how school environment and parental support affect gifted girls' choices to take science classes. I have selected you to be part of the sample because of your participation in The Saturday Take-Off Program of the Association for Bright Children. My interest in factors that influence girls to choose science classes stems from research that has mostly concentrated on differences between males and females. I will be concentrating on within-gender differences. I am interested in what factors influence some girls to take science classes and why others do not.

Many parents of gifted girls enroll their children in the Saturday Take-Off Program to enhance their learning. It has been noted in these extracurricular science classes, grades 4-6, that attendance of girls' past grade five is minimal. Previous research has called for questions to be raised about how and when the cycle of lower female achievement and fewer accomplishments begins since females attain higher grades than males throughout elementary, high school, and college. Perhaps if researchers study girls who choose extracurricular science classes they can discover what factors influence them in order to nurture these characteristics in future generations.

These are the questions and motivations behind the study. I hope you will take part. You will be asked to complete the TOSRA and the interview. Interviews will be tape recorded and transcribed. All data will be presented anonymously. If you have any questions, at any time concerning this study you can contact me at 243-0984. You may also contact my Faculty Advisor, Dr. Pierre Michaud, at 562-5800 ext. 4523, University of Ottawa.

Before beginning the study, I would like to inform you of your rights as a participant in this study. Your participation in answering the TOSRA and the interview is voluntary. As such you can refuse to answer any question at any point in time. As well, you are free to withdraw your participation at any point. In addition, you also have the right to ask me any questions at any time.

The interview and the TOSRA results will be kept strictly confidential and will be accessible only to me. The TOSRA results and the interview will have your name (in the event that I require further classification). Only my advisor, Dr. Pierre Michaud; a member of my thesis committee, Dr. Janice Leroux, and myself will discuss them. The purpose of my discussions with these two people is to improve my interpretation and data analysis of the answers.

Answers from the TOSRA may be made part of the final research report but neither your full name nor any identifying characteristics will be included in the report. Furthermore, if excerpts from the interview are used, neither your full name nor any identifying characteristics will be included. Anonymity will be maintained. Once the final report is completed and defended, all questionnaires and interviews will be destroyed to further ensure confidentiality.

The University of Ottawa Human Research Ethic Committee requires that all research participants be informed of the purpose and nature of their participation in any study conducted at the university. This is a requirement so that all research participants' rights are upheld. Therefore, before any research can proceed using human subjects, a written mandatory consent form must be signed. Please sign this form to show that I have informed you as to the nature of this study, to indicate that you understand your rights as a participant, and that you choose to take part in this research.

Participant's signature:

Printed:

Date:

Parent's signature:

Printed:

Date:

Definitions of Pre-Identified Codes

Interpersonal Factors

Self-concept	"is a composite view of oneself that is presumed to be formed through direct experience and evaluations adopted from significant others".	(Bandura, 1998, p.10)
Self-efficacy	"refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments".	(Bandura, 1998, p.3)
Self-agency	"is personal production of action for and intended outcome done intentionally".	(Bandura, 1998, .3)
Motivation	" is a general construct that encompasses a system of self-regulatory mechanisms. The three main features of motivation include selection, activation, and sustained direction of behavior toward certain goals".	(Bandura, 1998, p.228)
Ability	"possession of the necessary skill or power to do something".	Collins Dictionary, 1996
Self-appraisal	the assessment of the quality of oneself based on similarity to the models' personal characteristics that are thought to predict the capability of performance.	Bandura, 1998
Self-evaluation	the individuals' emotional reactions to the quality of the performance or action.	Bandura, 1998

Behavioral Factors

Choosing Science Classes	"to select from a number of alternatives " a science class.	Collins Dictionary, 1996
Non-Traditional Sex-Roles	not following the unwritten body of beliefs, customs handed down from generation to generation based on tasks or functions assigned to males or females.	Collins Dictionary, 1996
Achievement	"something that has been successfully completed or accomplished by hardwork, ability, or heroism".	Collins Dictionary, 1996
Voicing Opinion	expressing a belief not "founded on certainty or proof but on what seems probable".	Collins Dictionary, 1996

Behavioral Factors cont.

Independence	"free from the influence or control of others; capable of acting for oneself or on one's own".	Collins Dictionary, 1996
Confidence	"sure of oneself".	Collins Dictionary, 1996
Assertiveness	"confident and direct in dealing with others".	Collins Dictionary, 1996

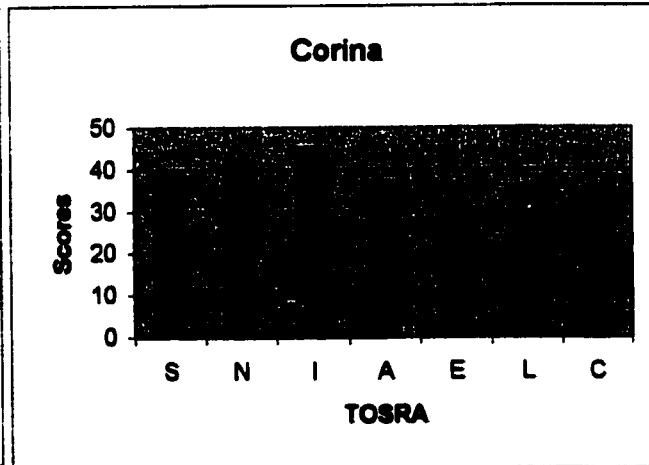
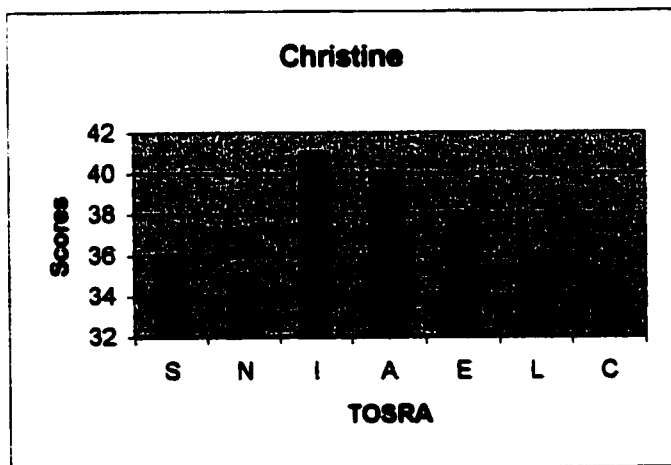
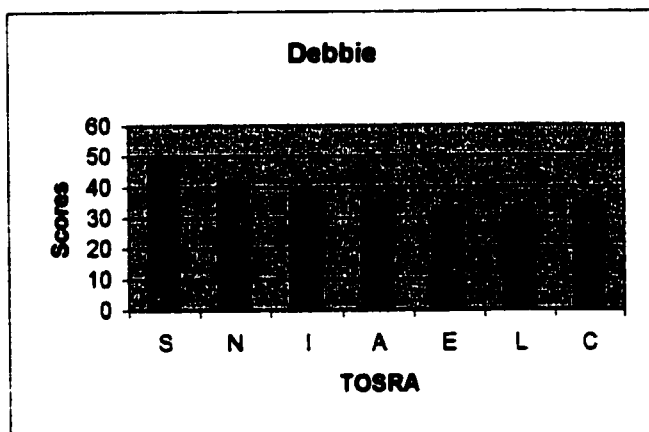
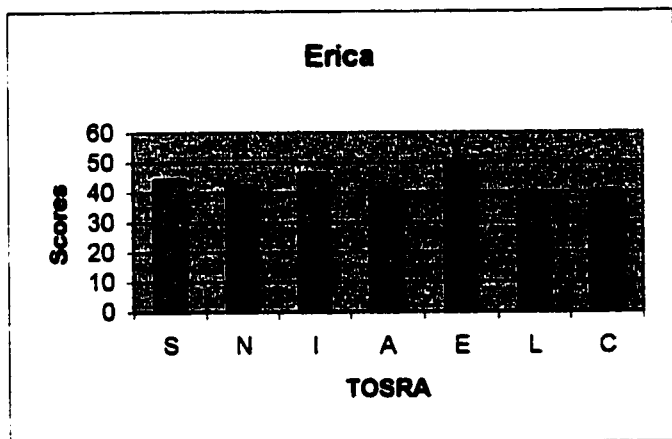
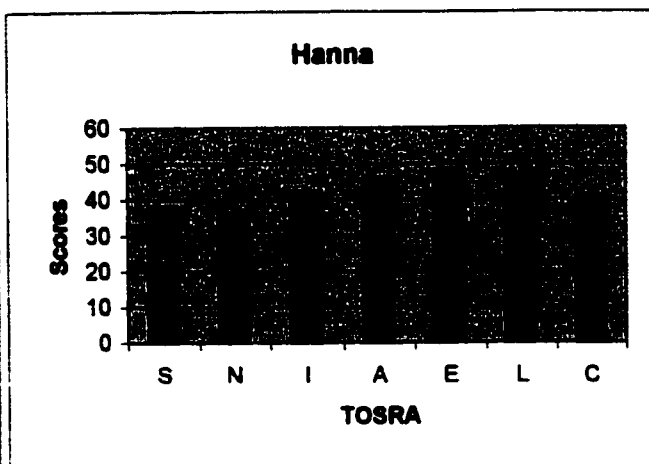
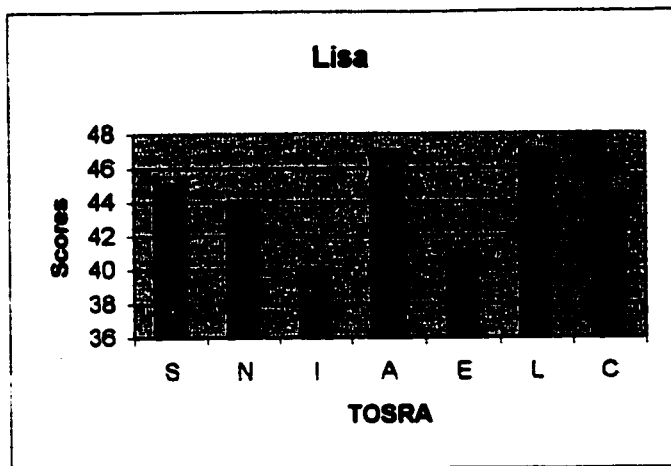
Environmental Factors

Equity	the quality of being impartial or fair	Collins Dictionary, 1996
Role Models	a person regarded by others as a good example to follow.	Collins Dictionary, 1996
Expectations	"that particular actions will produce specified outcomes".	Bandura, 1998, p.125.
Attributional Feedback	"information in response to an inquiry about what needs improvement and how, as well as what is correct".	Bandura, 1998, p.374.
Peers	a person of equal social standing, rank, age, etc.	Collins Dictionary, 1996
Encouragement	to stimulate something or someone by approval or help.	Collins Dictionary, 1996
Fun	activities that require a high level of arousal, a high level of perceived control, and tasks tailored to personal interests.	Middleton et al., 1992

Additional Codes Added Due to Frequency

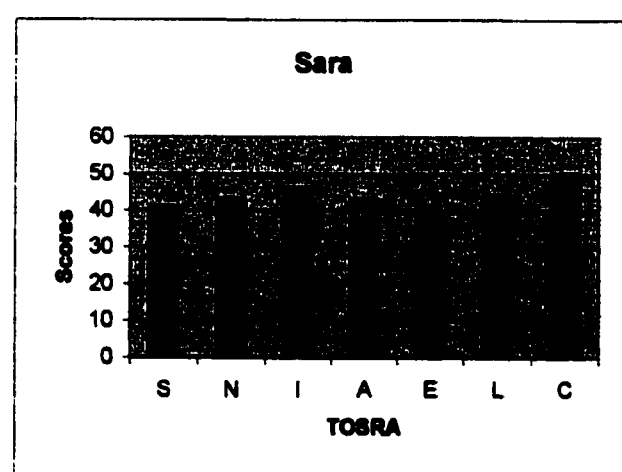
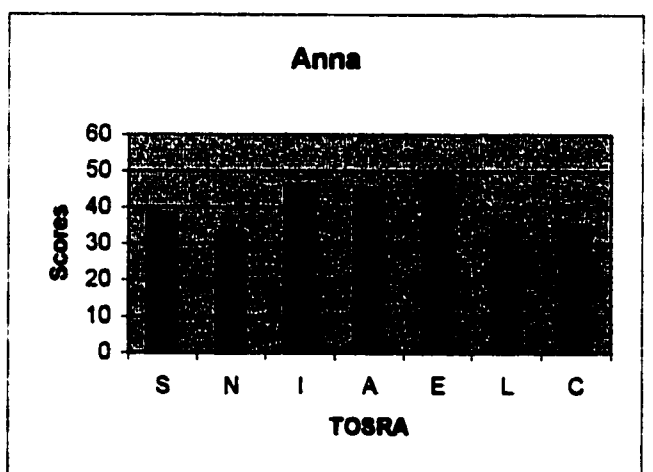
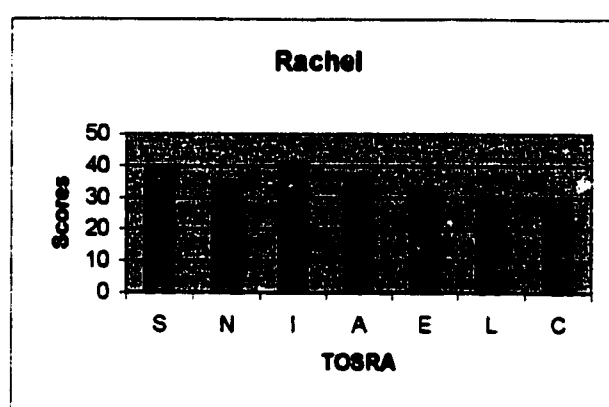
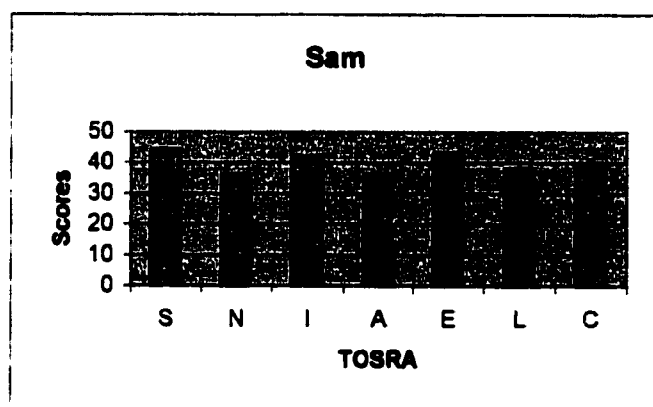
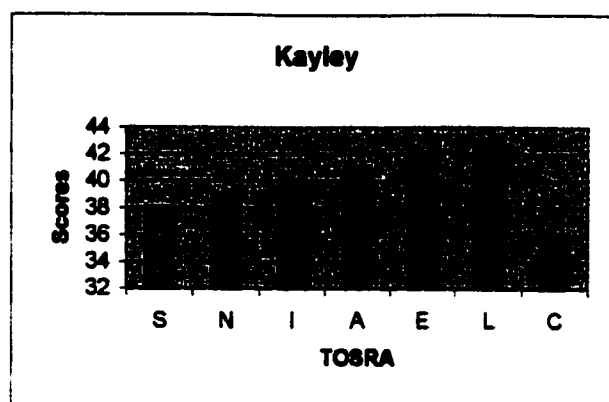
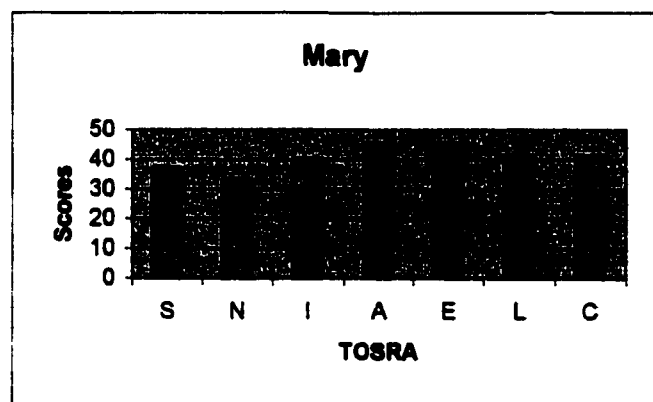
Boring	to tire or make weary by being dull, repetitious, or uninteresting.	Collins Dictionary, 1996
Traditional Sex-roles	following the unwritten body of beliefs, customs handed down from generation to generation based on tasks or functions assigned to males or females.	Collins Dictionary, 1996
Group Work	class work done with more than one person	
Doubt	"uncertainty about the truth, facts, or existence of something".	Collins Dictionary, 1996

Appendix F
Individual Participant Histograms of TOSRA Scores.



Note:
TOSRA scores are out of 50 possible points

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Histogram of Individual TOSRA Scores.



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TOSRA scores are out of 50 possible points.