The gifted female: The endangered species

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Abstract
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The Gifted Female:
The Endangered Species

A Graduate Review
Submitted to the
Division of Education for the Gifted
Department of Curriculum and Instruction
in Partial Fulfillment
of the Requirements for the Degree
Master of Arts in Education
UNIVERSITY OF NORTHERN IOWA

by
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June, 1995
This Graduate Review by: Sue Griswold
Titled: The Gifted Female:
The Endangered Species

has been approved as meeting the research paper requirement for the Degree of Master of Arts in Education.

July 19, 1995
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Abstract

This paper presents the findings of a literature review that focused on gifted females and their inability to achieve in mathematics-based careers on a level equal to gifted males. The gifted female precedes the gifted male in intellectual development at an early age. However, she appears to fall behind as the years progress. The reasons why these women do not achieve levels of career attainment commensurate with their early abilities, specifically internal barriers and societal factors are discussed. The writer concludes with implications for future education.
Research has shown that female children demonstrate a more rapid intellectual development than males in the early years of their lives. Silverman (1986) has found that such "giftedness" is evident in girls at an earlier age than boys because gifted girls are more likely to show developmental advancement. Stitt's (1988) research indicates that girls precede boys in speaking, reading, and counting. However, the frequency of giftedness in females appears to decrease as they advance in school. Preschool programs for the gifted have no trouble finding gifted girls. However, in the elementary grades, the point at which a majority of school districts begin their gifted programs, many of those "early bloomers" who were identified as gifted in the earlier years have lost their lead and demonstrate no particular advancement over their peers (Silverman, 1986).

Silverman's (1991) research also indicates that by junior high school, there are many more "identified" gifted boys than gifted girls; and in high school the number of gifted girls continues to dwindle. During the junior high/senior high school years, the highly capable girls are at risk for denying their talents if they are in an environment where it is not popular to be smart. College records, she points out, reveal even fewer identified gifted females, and the number in graduate school diminishes the number even further. "The gifted female," she says, "is an endangered species" (p. 44).

Even though young gifted girls have high aspirations and vivid career fantasies (Kerr, 1985), adolescence brings changes in gifted girls' aspirations, expectations, attitudes, and achievement. The changes that occur for gifted girls today may be more subtle than those that occurred fifty, twenty, or even ten years ago, Kerr reports. Nevertheless, the direction of change is still the
same overall, and it is one of declining involvement with former achievement goals.

These changes are most evident in academic achievement, test scores, courses taken, and other academically-related behaviors (Kerr, 1985). Lowering aspiration levels, declining achievement, and failure to realize one's potential are well-documented issues of significant concern with respect to gifted and talented females (Kerr, 1985; Rodenstein & Glickhauf-Hughes, 1979).

Eccles (1985), in examining gender differences, concludes that the achievement of gifted females is not as high as that of gifted males. Also, they are less likely to seek out advanced educational training; and, when they do, they do not enter the same fields as their male peers. She points out that they are also overrepresented in fields of education and literature and are underrepresented in science, mathematics, and engineering. In addition, they are underrepresented in almost all advanced educational programs and in the vast majority of high status occupations. Finally, Eccles' report shows that gifted women are less likely to have a professional career than their male peers. Those who choose a profession tend to select occupations that have a lower status, require less education, and are more compatible with family-time schedules and make fewer demands on one's off-the-job time and one's family.

Statement of Problem and Purpose

It is apparent from the cited research literature that, although very young females demonstrate rapid intellectual growth, they are subject to societal and psychological factors which impact on their self-esteem, their talent development, and their chosen careers, particularly in the field of mathematics. A discernment of such factors would appear to be vital to
classroom teachers and teachers of the gifted in subsequent provision of learning environments and support for identified gifted females from entry to exit from the school system. Indeed, the literature reveals that some of these factors begin their impacting very early in a child's life and may even begin prior to the baby's birth (Fox & Tobin, 1988).

Therefore, it was the purpose of this literature review to ascertain the major societal and psychological factors that may have an impact on the decisions made by gifted females, decisions which help to determine the future level of their career aspirations and career attainments, particularly in the field of mathematics.

Within this literature review, the writer specifically sought answers to the following questions:

1. Does society (family, school, community, peers, work force) send messages to females that may have an impact on the developing female self-image and which may affect their levels of career aspirations or career attainments in the field of mathematics?

2. Do gifted females in high school and/or college take fewer advanced courses in mathematics than do gifted males, thus imposing a ceiling on their level of career attainment?

3. What are the internal barriers to the success of the gifted female in the mathematics discipline?

Methodology

To answer these questions and to determine how the self image of gifted females is influenced by societal factors, including customs and beliefs, an ERIC search of the literature was implemented, using gifted females and career aspirations as key words. These sources of information yielded numerous articles and reports of studies. In addition, the libraries of the
University of Northern Iowa and the University of Nebraska at Omaha were used extensively.

Impact of Societal Messages

If various aspects of society send to gifted females messages which may influence their levels of career aspirations or attainments, what are these messages? What are the sources of these messages? How early do these messages begin? What can be done to counteract the messages which appear to impact negatively on the levels of achievement of these gifted females? The home and parents will be examined first because they are vital to the early development of the child.

Parents and the Home

Gilligan (1982) suggests that girls are guided through a different socialization process at a very early age. According to Goldberg and Lewis (1969), girls are treated differently from birth. Infant girls are held and fondled while infant boys are tossed in the air. Boys are given sports equipment and mechanical toys which promote activity while girls are given dolls and dishes. Thus, girls often have not had the opportunity to develop the ability to comprehend figural-spatial systems (Meeker, 1991).

As Lindley and Keithley (1991) point out, even before the baby is born, parents shape dreams for their child. Often the goals and dreams of mothers and fathers differ according to the sex of the newborn. Expectations about gender are communicated very early to the young child and the messages continue throughout life.

Prior to age three, the awareness in boys and girls is fairly consistent. However, according to Erikson (1950), boys begin to break their maternal dependence by age four, moving toward an autonomous independent stance. Girls continue to be nurtured toward the relational values of intimacy and
empathy. However, by early adolescence, girls begin confronting a value conflict with a society which values the independence that is typically nurtured in males.

By eleven to fourteen years of age, many girls discover that their intimacy, sensitivity, and empathy are valued only in some areas, and that few of them are achievement or career oriented. Gilligan (1982) suggests "that for girls to remain responsive to themselves, they must resist the conventions of feminine goodness; to remain responsive to others, they must resist the values placed on self-sufficiency and independence" (p. 70). She suggests that women have "a different voice" and adds that, at this point of awareness, girls may silence their distinctive voice, responding in a manner incongruent with their sense of self. She warns that consequences are critical for any person who buries her internal sense of self.

The literature seems to indicate that girls are more likely to be given inadequate parental encouragement, particularly with respect to their early independence training (Stone and Church, 1973). The differences that then emerge are continuously used by society to differentiate roles which males and females must assume, and this structures their opportunities for development. According to Stone and Church (1973), from the earliest acculturation by the family, girls derive a set of expectations about themselves and their appropriate role in society that becomes a crucial part of their self-image.

**Educational System**

Does the educational system have a discernible impact upon the developing self-image of gifted females in our society? The American Association of University Women conducted a survey in 1990 and reported their findings in 1991 in a report titled _Shortchanging Girls_. Shortchanging
America. They concluded that the loss of self-esteem by gifted girls impacted greatly their career aspirations. Lowered aspirations caused these gifted girls to aim lower and to achieve less in school, in the work place, and throughout life.

According to the report (1991), lower self-esteem among girls is a sign of less confidence in their own talents. It found that approximately one-half as many girls as boys refer to their talents as what they like most about themselves. Another conclusion was that girls are nearly twice as likely as boys to mention a physical characteristic, such as appearance, hair, or clothing, as the thing they like most about themselves. The report concluded that this reflects society's message that these are the things for which women are valued.

But what causes this decline in self-esteem? Cramer (1989), reporting on a qualitative study which studied attitudes of gifted boys and girls toward mathematics, suggested that children's responses demonstrated indications that the attitudes of male peers may well be a factor in girls' participation and performance in mathematics and may help to explain the antecedents for the underachievement appearing later in females' school and adult careers. According to Meece, Parsons, Kaczala, Goff, and Futterman (1982), the female adolescent may choose to avoid achievement in mathematics so as to protect her feminine self-image.

The previously cited study of the American Association of University Women (1991) indicated that gender bias in schools amounts to tracking girls out of courses of study that lead to high-skilled, high-paying, high-technology careers and into less-respected and less-rewarding jobs. For example, Stitt (1988) reported that girls identified as gifted in mathematics are far less likely to be identified than are gifted boys. Furthermore, he wrote that identified
girls are far less likely to participate in accelerated mathematics classes to
develop this special talent.

A study by Loeb and Jay (1987) on the self-concept of gifted youth,
grades four to six, demonstrated that gifted females find their giftedness an
advantage and reported that they possess a more positive self-concept and
more internal locus of control than non-gifted females. They found that for
girls of their age, being successful in school work results from following the
traditional role of exhibiting obedience and doing what is expected. However,
Callahan (1980) points out that the behavior which helped females do well in
school may be a detriment to them later in the competitive professional
world.

**Sex-role Expectations**

According to some researchers, cultural expectations suggest that
females should be selfless, nurturing, giving, passive, dependent, and
"feminine." They are encouraged to manage a household and subjugate
careers to those of their spouses (Rodenstein, Pfleger, & Colangelo, 1977).
Kerr (1983) has stated that gifted females are caught between the expectations
of developing talents because they are gifted with the cultural expectations for
their development as women. Gifted students are expected to be active,
exploring, and assertive; yet, women are expected to be passive and
dependent. The gifted female, seeing a conflict between family and career,
may decide against occupations requiring great personal commitment. These
are the occupations which would lead to high status and salary (Kerr, 1983).

Kerr (1988) also found that young gifted women are deeply concerned
about role expectations and are often confused and unclear about their goals.
They may feel the need to hide this confusion by claiming impressive-
sounding goals when, in fact, they have little interest in that goal or
knowledge of how to pursue it. They may feel pressure to be highly achieving and work-oriented, but they have not learned the deeper lesson of the women’s movement: They are in charge of their own lives.

As a result of a study conducted with 2000 third through twelfth grade students about their perceptions of sex roles, Baumgartner Papageorgiou (1982) concluded that students see traditional sex roles as their only choice. She summarized these themes which highlight the damaging effects of sex-role socialization:

1. Females learn that it is best not to work outside the home; but if one does, one should choose from a limited number of career options.
2. Females are taught to select careers which are less rewarding than those which males are taught to select.
3. Females are taught that their most valued asset is their appearance.
4. Males are taught to be independent, competitive, aggressive, and to use violence.
5. Females are taught to be dependent, compliant, and fearful.
6. Males are taught to expect freedom; females are taught to expect restrictions.
7. Males and females are taught that home and child-care responsibilities are not to be shared equally.
8. Males and females are taught only those skills which are consistent with traditional sex roles.
9. Males and females exclude themselves from courses or extra-curricular activities in school that develop interests and talents which are valuable to both sexes.
10. Females receive better treatment from teachers, but males get more encouragement to achieve.
11. Both males and females are taught that being male is inherently better than being female (pp. 2-11).

Siegel (1977), using an open-ended questionnaire with sixty-one second grade students in a middle class suburb in Boston, determined that distinct sex differences in occupational choices appear to be operative by second grade. The girls in the study chose a smaller range and different types of occupations than boys. Similar patterns were reported by other investigations on other age groups.

Contemporary critics hold that the psychological literature is founded on distorted research because it is centered primarily on studies of men (Kline & Short, 1991). They also state that, as a result, women are often at risk emotionally, socially, and perhaps medically in a world where men not only make the rules, but often focus standard-setting developmental, psychological, and medical research upon themselves. Fifty-one percent of the population is female, yet only 15% of sociologists are female. More importantly, Frazier and Sadker (1973) presented evidence that, for the most part, research is carried out from a masculine point of view.

Kerr (1983) determined that the abilities and talents of gifted youth point toward potential high-fulfillment in career aspirations, yet attaining achievement in a vocation appears to be influenced by the gender of the gifted youth. Career aspiration tests given before and after a one-day career guidance workshop reflected a change in career goals of eleventh grade girls to more prestigious occupations. However, gifted boys did not show a change. They already had high career aspirations and did not need additional input; however, the gifted girls did.

Rodenstein and Glickauf-Hughes (1979) claim that throughout adolescence, gifted girls receive conflicting messages. The first messages
encourage them to achieve; and thus, substantiating Terman’s (1916) conclusions (as cited in Kerr, 1985), they surpass boys in intelligence at all age levels up to age fourteen. Then, according to Rodenstein and Glickhauf-Hughes (1979), they are encouraged to be "feminine" which implies passivity and dependence. Rodenstein and Glickhauf-Hughes also conclude that gifted girls are asked to adjust to the "disability" of being female by de-emphasizing achievement in the face of evident societal barriers. High achieving girls (Sadker & Sadker, 1985) receive the least attention in the classroom. The sex-role socialization message is: Boys should be academically assertive and grab teacher attention, whereas girls should act like ladies and keep quiet.

Some researchers believe that a major societal factor impeding the full development of girls is the unspoken decree in our society against female independence. For example, Walker and Mehr (1992) feel that a key ingredient of leadership is the willingness to take risks. Clark (1983) says that fearful for their daughters' safety, parents may discourage them from risk-taking, while overlooking, allowing, or encouraging the same behavior in boys. Such messages, they are convinced, breed feminine insecurity and self-doubt. Eccles (1985) states that self-confidence may be a better predictor of adult achievement than high grades or high aspirations. Finally, Fox and Tobin (1988) point out that females comprise about one-half of our nation's gifted and talented children; yet they are conspicuously absent from the ranks of leadership in the adult world.

Gifted Female Enrollment in Advanced Mathematics Courses

Do gifted females choose fewer advanced mathematics courses than do gifted males? Have these advanced courses become the filter through which many of our gifted female students are being removed? The literature seems
to indicate that mathematics traditionally has been classified as a masculine activity in our society. It has been perceived as a domain in which men can and should excel and one in which women need not participate beyond a basic level. There also is considerable evidence that both sexes, but males in particular, regard mathematics in such sex-stereotyped terms (Fennema & Sherman, 1977).

Stitt (1988) found that one of the factors which influences the level of career aspiration/attainment for women is the background they have in mathematics and science. In her study she concluded that girls' academic performances are equal to those of boys in mathematics and science in the early grades. However, as girls progress through school, their achievement-test scores show significant decline, while the scores of boys continue to rise and eventually reach and surpass those of their female counterparts, particularly in mathematics and science. Rekdal (1984) reports that women have been, and will continue to be, restricted educationally and that their career options will be radically circumscribed by inadequate backgrounds. Mathematics is seen as a major key necessary in unlocking a majority of important career opportunities available for our most intelligent and mathematically-able students.

Eccles (1985) indicates that few gifted girls are aware of the absolute importance of mathematics to their future goals. They often drop out of mathematics courses for superficial reasons, not realizing that most college majors leading to high level careers and professions require four years of high school preparation in mathematics.

As for those girls who continue with advanced mathematics and science courses in high school, are they likely to achieve in college? Hall and Sandler (1982), in their Project on the Status and Education of Women of the
Association of American Colleges, conclude that the college experience of women has been described as not encouraging career and educational aspirations. Gilligan (1982) says that females receive different messages from their teachers. Her studies show that, while individuality is prized in males, females are taught by parents, teachers, and friends to be conformists.

Even more discouraging is the finding that although women achieve better grades than men in high school, they are less likely to believe that they can do college work (Stitt, 1988). Of the brightest high school graduates who do not go on to college, 70% - 90% are women. According to Kerr (1991), the vast majority of mathematically-gifted girls, those who qualify for the talent search criteria, have the intellectual capacity for any mathematics-related positions existing today, if, to their intellectual ability, they add the training, confidence, expectations, attitudes, and personality characteristics needed to explore the concept of numbers (p. 406).

Results of studies differ when comparing numbers of males and females in advanced level mathematics classes. A study by Garrison (1993) found that gifted females in the sample enrolled in advanced level classes more often than gifted males. However, of high school seniors who had taken both calculus and physics, only 18.6% of females planned to pursue engineering or science majors in college. This is far below the 64% of males stating an interest in these fields. Butler and Sperry (1991), in a discussion of the 1979 findings of Berkovitz, concluded that boys take more mathematics courses than girls at the point when curricula choice is possible in middle grade years. According to them, this choice is not because of native ability, but because adults tend to steer girls away from mathematics and sciences. Stitt (1988) has found that boys do not like mathematics better than girls, but that
the greater participation by males in mathematics is related, instead, to their understanding that math may be a necessary prerequisite for their subsequent careers.

If girls take the rigorous mathematics classes in high school, why is there such a discrepancy in the numbers of students planning to use these rigorous courses as they select college majors? According to Reis (1991), many gifted females are encouraged by their families to get good grades but not to channel these efforts into careers or further education. Reis reports there is a definite decline in how girls view their intelligence between high school and their sophomore year in college. However, Hay and Bakken (1991) are convinced that, if girls limit their academic or career options in high school, they will find it more difficult to broaden the base in later years.

Dickens and Cornell (1993) investigated maternal and paternal influences on the mathematics self-concepts of high-achieving adolescent girls. They discovered that the magnitude of the relationship between parent expectations and a daughter's mathematics self-concept among these high-ability girls was surprisingly strong. For example, they stated that parents with positive concepts of their own mathematics ability tended to have high expectations for their daughters, and these expectations, in turn, had a positive effect on their daughters' self-concepts.

Internal Barriers to the Success of Gifted Females in Mathematics

According to the literature, the level of attainment in the mathematics sequence by gifted females is an essential ingredient in discussions pertaining to gifted females and their self-esteem or to gifted females and sex-role socialization. Sex-role socialization may have placed some of the external barriers in the gifted female's life, and it also may have created some internal
barriers to success for gifted women. Included in these internal barriers are Hunter's "Fear of Success Syndrome" (Horner, 1972), Clance and Imes' (1978) "Impostor Phenomenon", and Dowling's (1981) "Cinderella Complex".

**Hunter's "Fear of Success Syndrome"**

Hunter's "Fear of Success Syndrome" is described as a tendency of women to underachieve in competition with men and to perceive success negatively. High school girls with great mathematics ability may work to hide that ability from boys they wish to interact with socially. Horner (1970, 1972) found that women's career changes correlated significantly with their degree of "motive to avoid success." This suggests that most highly competent young women are faced with a conflict between their feminine image and the expression of their competencies and abilities. He postulated that the greater their fear, the less well they did in competitive activities, particularly those situations involving competitions with men. These college women adjusted their behavior to their internalized sex-role stereotype and considered intellectual achievement unfeminine; they anticipated a negative effect on their eligibility for marriage. Fear of success increased as these women progressed in college. It is not surprising, therefore, that by the senior year, the majority of women had switched to traditionally feminine career goals.

**"Impostor Phenomenon"**

"Impostor Phenomenon" is a term developed by Clance and Imes (1978) to account for a tendency of gifted women in psychotherapy who express fear of being "found out" - of someone discovering that she is not really bright or competent. They speculate that bright women learn to doubt their own abilities in the absence of clear, direct reinforcement for accomplishment.
"Cinderella Complex"

Dowling (1981) proposed the "Cinderella Complex" as the affliction which prevents bright women from attaining success. He stated that the self-defeating tendency to want to be taken care of or rescued from the responsibility of taking care of oneself can cause gifted women to lower their aspirations. College women may make educational and occupational plans on a contingency basis. They may be choosing jobs that provide occupational flexibility.

Self-Imposed Career Limitations

Epstein (1970) found that many of the career limitations on women were self-imposed. For example, they often chose positions which gave them immediate but short term social and economic advantages and failed to explore their true motivational and natural capacities. Rauta and Hunt (cited in Sutherland, 1981) stated that in the choice of a job, financial considerations ranked relatively low in girls' estimations.

However, in her work with gifted women, Kerr (1985) has concluded that they are happiest when they are challenging the limits of their intellectual potential. Women need to realize, she continues, that they are in charge of their lives. According to Kerr, it may not be the phobias that prevent gifted women from achieving success. It may be because they are well-adjusted, cheerful, compliant, and friendly. It may be because their congeniality allows them to accept sexism and adapt to discriminatory situations. In addition, the literature shows women will put their plans on hold in an effort to assume responsibilities for others (Kerr, 1985).

If sex-role socialization causes girls to internalize barriers and to consider only traditional careers, would single-sex schooling eliminate this situation? Walker and Mehr (1992) interviewed graduates of the Hunter
College School for gifted girls. Although these girls were educated during their formative years where the idea of deferring to men or playing dumb was entirely unknown, most of these women had no one at Hunter whose specific job was to prepare them for obstacles and barriers in the outside world, to encourage them to pursue non-traditional roles, and to inspire them to leadership. Without specific direction from counselors trained to encourage their abilities, they chose and pursued their careers dependent solely upon friends and family for advice. Interestingly, many of them chose traditional careers.

The reviewed literature provided information concerning career awareness programs specifically designed to deal with the barriers/self-imposed career limitations already discussed. Project CHOICE, a 14-week career development program was conducted during the 1977-78 school year in the Greater Cleveland area and was funded under the auspices of the Women's Educational Equity Act (1977 to 1978). CHOICE (Creating Her Options in Career Exploration) was designed specifically for gifted and talented female adolescents and sought to identify and address personal (internal) and societal (external) barriers that prevent many young women from achieving educational and career goals commensurate with abilities and talents. Concerns that developed included the possibility that gender role socialization may have distorted some of a gifted girl's perceptions so that she may underestimate her talents and abilities. She may perceive mathematics and science as having little task value or relevance (Hollinger & Fleming, 1993).

Other researchers have investigated the special needs of the gifted female from the viewpoint of internal barriers to academic success. For example, Kerr (1985) believes gifted girls must be given specific information
about their superior abilities very early; they should be helped to understand their intellectual strengths and to see how their abilities can help them in classwork. She states that they need to perceive giftedness not as a mysterious force out of their control, but rather as a set of potentials that, when combined with effort, can lead to extraordinary accomplishments.

In order to enable gifted females to use these potentials, educational interventions should be initiated to aid gifted women in the development of their sense of identity (Phelps, 1991). Phelps suggests that if gifted females have denied their inner voice and have failed to develop a secure sense of self, they will be unable to develop appropriate career aspirations or unable to base career decisions on deeply held values.

In Bloom's 1985 study of talent development and eminent women he used, as case studies, a concert pianist, Olympic athlete, and a sculptor. He ascertained that a critical step in the attainment of eminence was the development of a personal identity. Likewise, Silverman (1991) has addressed the essential ingredients that facilitate the development of girls' potential. According to her, adults should foster girls' interests in mathematics and science, should enable students to progress academically at their own rate and learn with other gifted peers, and should encourage girls to take as many mathematics courses as possible. She feels that gifted girls should be accelerated in mathematics and science. These actions may help to discourage them from limiting their career options by dropping out of mathematics. Stitt (1988) points out that the majority of girls enter college without completing four years of high school mathematics. This lack of preparation in mathematics serves as a "critical filter" inhibiting or preventing girls from entering many science, mathematics, or technology-related careers.
Conclusions and Recommendations

This review of the literature seems to indicate that, while females begin their education feeling confident about their mathematics abilities, their confidence appears to decline as the years progress. The loss of self-esteem, the views of society toward mathematics and females, and the internal barriers gifted females adopt all seem to work together to cause a decline in the number of women who select mathematics-related careers.

The entire sex-role socialization, which the reviewed literature indicates probably begins before the birth of the child, has conditioned the child to think in terms of traditional careers. When girls plan for a non-traditional career, often the pressure to conform or the lack of female role models on which to pattern themselves may convince the females to change their plans. Authors such as Sadker and Sadker (1994) have written of gender bias issues. These acts of bias may have been carried out unintentionally, but the impact of the messages is still felt by the female students.

The literature demonstrates that gifted girls are hampered in their career development by both external and especially internal barriers. Girls are held back by their failure to continue in advanced-level mathematics courses or by their failure to use these advanced-level courses as stepping-stones to a high-level career. Further, girls are conditioned through societal expectations to perform in a prescribed way. Not all research shows gifted females leaving the mathematics arena through the filtering system, but the literature does indicate that gifted females are not succeeding at the expected level of career attainment.

What implications for our schools does the documented research have on our future? First, the importance of meeting the needs of gifted students cannot be overemphasized. Meeting the needs of only the gifted males will
not advance our nation to the forefront. We also need to utilize, to the fullest, the abilities of our gifted females. As Sadker and Sadker (1984) have revealed, tomorrow's women cannot afford to be cheated out of their academic achievement and self-esteem.

To analyze the findings of this literature review on the local level, the writer conducted a mini-study involving Challenge Center students in the Council Bluffs Schools. Students may be identified and placed in the Challenge Center Program as early as first grade. The Challenge Centers serve the top 2% to 3% academically-identified students as a replacement program. These students are removed from their regular classrooms for mathematics and language arts, and in some cases, science. The earliest group of Challenge Center students graduated from high school in 1994. The second group is ready to graduate in 1995. When the transcript card of each of these identified students from the class of 1994 was examined, all of the males and ten of the eleven females had completed four years of high school mathematics, including trigonometry and calculus.

The class of 1995 transcripts indicated that all males and females who had studied in the Challenge Centers had completed three years of high school mathematics, and their senior year schedules included calculus for each of them. These statements would indicate that there does not appear to be any significant differences between the mathematical preparation of gifted males and gifted females in the Council Bluffs school system. Perhaps larger school systems, such as Council Bluffs, tend to provide more female role models which may encourage females to continue in mathematics. Or, perhaps, the Challenge Center Programs provide more positive reinforcement for mathematics acceleration.
The Challenge Centers have not been in existence long enough for research to include the students' college years. Much of the literature seems to indicate that a decline in career aspiration levels begins at the sophomore year in college. Therefore, a longitudinal study following these students through their high school and college years and into the work force should be initiated. Only then could it be determined if these girls used their high school mathematics preparation to pursue careers which require mathematics to be a part of their college curricula.

As the result of information gained from this study, it would seem to be imperative that schools, from preschool through graduate school, avoid any sex-stereotyping of courses, activities, and careers, and any gender bias must be eliminated. At the high school and college level, it is important that gifted females receive good counseling. The AAUW (1991) report concluded that if a male fails in mathematics, he tends to blame it on his lack of effort. However, when a female fails, she tends to believe she lacks the ability to do better. Counseling is needed to prevent these gifted females from dropping out when they have failed in one course.

Another conclusion which might be reached from this review is the importance of the availability of adult role models for gifted females. It is perhaps too difficult to visualize themselves as successful engineers if they have never encountered a successful female engineer. It is more secure to follow what is familiar than to explore a non-traditional field. On the basis of such evidence, it would appear that a strong mentoring program in each junior and senior high school would be essential. These programs could be arranged through universities.

America's future will be strongly dependent upon decisions girls make about their lives, their education, and their careers. These decisions will
depend largely upon the girls' self-esteem—their faith in themselves, their belief in their abilities, and their confidence in their potentialities to live their dreams and determine their own futures. Gifted females need to understand early in their development that they are in charge of their lives. It is apparent that, in order for the United States to make great technological advances, women must be actively involved. We cannot allow our gifted females to aim for less than their best. According to Sadker and Sadker (1994) "for every girl who succeeds, too many fail or live down to expectations or settle for second best" (p. xi). As educators, one of our goals must be to provide the environment and the encouragement that will be necessary to assure these gifted females an equal opportunity to develop their abilities.


Siegel, C. L. F. (1977). In Associated University Presses (Eds), Sex bias in the schools. Cranbury, NJ.


