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ABSTRACT

This paper addresses the personological aspects relative to male and female success in two subject areas (math and science) and addresses specific concerns in the area of mentoring. Personality factors operative for success in math and science are reviewed, and teachers are advised to encourage, support, and facilitate those personality traits which appear to augur for success. One particular technique for encouraging females to pursue their interests is mentoring. The need of the mentor to nurture, encourage, and develop certain salient personality traits is emphasized. Reasons why bright individuals (both females and males) do not succeed are listed, such as lack of product orientation and capitalizing on the wrong abilities. Guidelines are presented for mentoring creatively gifted youth. Mentors are urged to guide their female protegees to be sensitive to the elements that enable females to succeed in a male-oriented society and in sometimes male-dominated fields. Mentors to gifted females should also acknowledge the pros and cons of pursuing careers in male-dominated fields. (Includes 20 references) (JDD)

Gifted Females Can be Supported in Math and Science : A Proposal for Mentoring in Secondary Schools

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This paper addresses the role of personality in math and science achievement at the secondary level for female gifted students. Concerns for instruction are suggested and suggestions regarding mentoring are proposed.

Meeting the special educational, emotional and developmental needs of females, in particular gifted females, has recently received much attention. Recent research has addressed the personality differences between gifted males and females in the areas of math and science. In fact, an entire issue of Roeper Review, A Journal on Gifted Education was recently devoted to " Gender Equity : Meeting the Special Needs of Gifted Females " (1991). These needs were seen to be in the areas of emotional needs, counseling, career development, and the influence of parents and schools.

This paper addresses the personological aspects relative to male and female success in two subject areas- math and science, and addresses specific concerns in the area of mentoring. Although personality and mentoring may at first glance appear to be disparate realms, there is much overlap and issues which transcend each area.

What are the personality factors which contribute to success? Surely motivation, committment, interest, persistance and perseveration are necessary in all fields. However, in specific subject areas, certain specific traits appear to be salient.

Odom and Shaughnessy (1989) have investigated the personality factors operative for success in math. They tested a number of junior high school students using the Personality Factor Test (16 PF) These students were all in advanced placement classes and were high achieving math

students. Interesting differences were found between the males and females. Girls showed higher than average scores on Factors E , H, L, and O. These factors reflect certain personality traits that may be imperative for success in the field of math, perhaps particularly so for girls. Factor E indicates that these girls were more dominant and assertive than normal or average. In order to procure placement in these math classes, these girls may have had to be more aggressive or confrontative.

Factor H (adventurous, sociable, participating, spontaneous and emotional) also reflects some traits perhaps not often seen in females. These adjectives describe a somewhat atypical female, particularly at the junior high and high school level.

Factor L (suspecting, self-opinionated, and interested in internal mental life) also describes a somewhat confident, introspective, critical thinking female. These traits are not commonly found in high school females. Interestingly enough, in spite of being in these advanced placement classes, these girls still scored high on Factor O- indicating a degree of anxiety and insecurity. The findings of this study support previous research by Haier and Denham (1976). Helson (1980) has perhaps done the most research on the creative female mathematician. Her research also seemed to indicate that certain personality variables were operative in mathematical success in creative women

mathematicians. She found them to be flexible, introverted, individualistic, and somewhat lacking in social confidence.

In our encouragement of students, in specific, talented females, we very rarely take into consideration the personality traits necessary for mathematical and scientific success, and teachers very rarely either prompt the necessary personality aspects necessary for mathematical interest and success, nor are they perhaps even aware of these personality traits and variables. Assertiveness may need to be encouraged by teachers. Inquisitiveness may also need to be modeled and prompted.

Recently, Ham and Shaughnessy (1992, in press) have investigated the personality structure of promising scientifically precocious children. They tested 32 junior high students who were participating in a NASA sponsored "space camp" . These children were selected from a larger group of 150 students who applied.

These students were given the High School Personality Questionnaire (Cattell, Cattell, and Johns, 1984) a downward extension of the 16PF. It was found that these students were significantly more bold and venturesome, more self assured and confident and more self-disciplined and controlled. They were also more conforming, determined and persevering. Lastly, they were more dominant and more sensitive and intuitive. Interestingly, the girls were found to be more mature emotionally and more excitable as well as the aforementioned factors. These results compare

favorably with the research done by Cattell and Drevdahl (1955) in their work with the personality factors of eminent scientists.

The results again indicate that there seems to be certain personality factors operative in children and preadolescents who possess scientific promise. The results support and substantiate previous reseach by Scobee and Nash (1983), Werner and Bachtold (1969) and Davis and Connell (1985) . Teachers should be aware of, as well as encourage, support and facilitate those personality traits which appear to augur for the highest success. All too often, teachers are so preoccupied with covering the basic subject matter that they have little time to nurture independent thinking, inquisitiveness and persistence.

Although there has been other research into the personality factors operative in other fields (Shaughnessy and Manz, 1991) specific research into certain male dominated fields such as engineering and technology is still lacking. Although we are concerned about giftedness and it's identification (Shaughnessy, Jausovec and Lehtonen, 1992) we do not appear to be as sensitive as we should in terms of the specific encouragement of certain personality aspects which may lend themselves to academic achievement and success. One particular technique which has recently received more attention as a way of encouraging females to pursue their interests, is mentoring.

MENTORING TO AID FEMALES IN DIVERSE FIELDS

Although the concept of mentoring has been with us for centuries, it has only recently been used to enhance success and assist in the growth and development of creative, talented and gifted students. Shaughnessy (1989) has reviewed the field relative to the current knowledge, systems and research in the field.

Cordova, Shaughnessy, and Neely (1990) have written on mentoring women and minorities, specifically in higher education. E. Paul Torrance has perhaps done the most to encourage adults to mentor to those students with potential (1984) and he recently has released a textbook entitled "Mentor's Guide and Protege's Handbook " (Goff and Torrance, 1991) to assist both the mentor and the protege.

However, there has been little written on the process of mentoring students with much potential in terms of encouraging the growth and development of certain personality traits which may be beneficial to them in their careers. Shaughnessy and Neely (1991 in press) have indicated that personality differences between males and females ; mentor and protege may result in difficulties. Also, they have not addressed the need of the mentor to nurture, encourage, and develop certain salient personality traits. While some may say that the personality traits were operative in helping some students achieve success, others would posit that by encouraging personality aspects in children with interest, enthusiasm and potential, that we will be, in effect, assisting in the growth process. How

can we in effect, ensure that students with some potential do maximize their potentialities ?

Mentoring for Personality Factors and Personological Aspects

Many theorists believe that in addition to one's basic intelligence that there are other elements which contribute to the success of both males and females. Sternberg (1986) has posited the following factors are reasons why bright individuals (both females and males) do not do well :

1) Lack of motivation
2) Lack of impulse control
3) Lack of persistence/perseveration or perseverance
4) Capitalizing on the wrong abilities
5) Inability (or difficulty) in translating thought into action
6) Lack of product orientation
7) Task completion problems and lack of follow through.
8) Failure to initiate
9) Fear of failure
10) Procrastination
11) Misattribution of blame.
12) Excessive self pity-feeling sorry for oneself.
13) Excessive dependency or over reliance on others.
14) Wallowing in personal difficulties
15) Distractibility and lack of attention.
16) Spreading oneself too thick or too thin.
17) Inability to delay gratification

18) Inability or unwillingness to see the forest from the trees.

19) Lack of balance between critical analytic thinking and creative synthetic thinking.

20) Too little or too much self confidence. (pp.339-345)

The above generalities can certainly be addressed and worked on in a counseling relationship or mentor relationship to help both males and females. Priorities can be set and time management skills worked on. E. Paul Torrance (1984) has suggested the following seven guidelines for mentors to help creatively gifted youth :

" Help them to :

1) Be unafraid of " falling in love with something" and pursue it with intensity and in depth. A person is motivated most to do the things they love and can do best.

2) Know, understand, take pride in, practice, use, exploit and enjoy their greatest strengths.

3) Learn to free themselves from the expectations of others and to walk away from the games that others try to impose upon them.

4) Free themselves to play their own game in such a way as to make the best use of their strengths and follow their dreams.

5) Find some great teachers and attach themselves to these teachers.

6) Avoid wasting a lot of expensive, unproductive energy in trying to be well rounded.

7) Learn the skills of interdependence and give freely of the infinity of their greatest strenghts (pp.56-57) ."

In terms of personality factors, females particularly must be sensitive to the elements that enable females to succeed in a male oriented society and in sometimes male dominated fields (such as math, science, engineering and technology) . These elements may include competitiveness, assertive behavior and a tolerance for these qualities not being reinforced by males who prefer women to act " more feminine " In addition, women may have to tolerate sexual harassment, sexist remarks, jokes, and innuendoes.

Obviously, girls must be encouraged to pursue their interests and to even investigate other fields that may not be of interest to them at that time. Often, students may develop interests gradually over time. One girl who was mentored by the second author was initially interested in nursing but went on to work in a totally different field- forestry. The first author was originally going to be an artist or a veterinarian- and is now an assistant professor of special education !

Girls must be encourged to take advantage of opportunities which are available to them. They may be counseled as to the possible or probable consequences of their involvement and perhaps innoculated psychologically to the ramifications and repercussions of their interests. In other words, females need to be told in a supportive, sensitive, caring manner that they may not always be

supported or encouraged and in rare instances, ostracized or mocked.

Girls must also be aware that by enrolling in chemistry or advanced geometry that they may have less in common with their female contemporaries and have more in common with their male counterparts. Girls involved in math and sciences may have to work harder to succeed in these highly competetive male dominated classes amd may resent less time for a social life as compared to their more traditional peers.

Girls must also be sensitized to the fact that some teachers may respond negatively to certain personality characteristics that may ultimately be the important traits to have . Inquisitiveness for example is manifested by questioning. Some teachers may regard questions from students as disrespectful-and questions from girls may be responded to with a certain tone, demeanor or body posture that will communicate to a girl with subtle nuances that she is welcomed in a physics or calculus class.

Girls need to be prepared of the fact that they may be excluded from activities that they attend in the community. Eye glances, grimaces and other non verbal gestures will convey to them the impression that they are weird or different. Females in particular need to be aware of the problems that their gifts and talents may present- they may have to try to juggle a family and a career- or that they may have to defer a certain amount of gratification until

later in life. Females need to be aware that their sometimes stereotyped intimacy and self discloure may seem odd or strange in a male oriented field of endeavor. They may be asked to " think rather than feel " .

When mentoring a gifted female, teachers should acknowledge the pros and cons of pursuing a career in male dominated fields. Courses in math and science are highly demanding, very competetive, and require discipline and hard work. Girls will often not receive encouragement from friends, siblings, parents, and relatives who like previous generations, view a woman's role as a childbearer on whom education is " wasted " . Why spend all that time, energy, and college tuition on a career when a woman will " give up " on her career once she marries and has children. Girls are still expected to obtain domestic skills in cooking and cleaning. Even in " modern marriages " with both partners working, the female will be responsible for doing most of the domestic chores. Once a woman decides to have children, she is also expected to do the majority of the parenting. Currently, the male dominated math and sciences have little tolerance for " outside interests " and view anything that takes one time from the field means the person is not dedicated or ambitious. Math and science lead to highly technical careers where it is easy to become out of date if a woman takes some time off for a family. If she leaves a field for more than a year or two, it is unlikely that she will be able to return without more schooling.

But the scenario is not all dismal and negative. There are aspects of math and science education and technology which draw individuals to these sub fields or sub specialties. Such areas are of such interest that it will be possible for a mentor to encourage female students to pursue these fields despite the obstances. Male dominated fields do pay better than traditional female careers. Also, women can be considered pioneers in math and science and may explore technologies which affect woman's issues from a female's point of view. Working in the math and sciences can be highly rewarding since it is usually interesting work and involves dealing with knowledgeable people. These careers also hold prestige in society and a woman will gain the same respect as her male counterparts. Sometimes, she will be respected and admired even more so, since she is a woman.

Females need to be aware that they are making a long term investment in themselves. They pay off may not be immediate- the reward will be in the future. Sadly, much in our society encourages immediate gratification.

Mentoring can not only support gifted girls who may pursue a math or science career, but also provide them with strategies to help cope with the problems of pursuing a male dominated career. The more women who enter these fields, the more accomodating these careers will become. Employee childcare is now becoming an issue that all industries are facing and improvements are being made, albeit slowly.

Society's attitudes are also shifting and many people are supportive of girls who want a technical career. There are several organizations for women which provide grants and support for females entering male dominated fields. So, as opportunities improve for women, we must encourage our female students while they are in our schools. Quality mentoring should not be a dream, it should be a reality which could change the lives of women- and change the society in which we live for gifted students and others with talent and potential in other fields.

Females need to be aware of the following quote from Dr. Rollo May (1981) "It is the genuiuses, the persons of abundant talents who have the greatest difficulty in seeking and living our their destiny because their gifts continually present them with so many possibilities. " (p. 130)

In closing, females should also be encouraged to puruse multiple options and interests and teachers should encourage those traits and personality elements that may engender success not only in certain specific areas such as math or science, but other fields such as robotics, engineering, technology, and other technical domains and fields of endeavor.

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