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PERSONALITY, LEARNING STYLE AND COGNITVE STYLE PROFILES OF MATHEMATICALLY TALENTED STUDENTS

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Clear personality differences were found for a sample of academically talented students when compared to a general population of same age students. On the Myers-Briggs dimensions, the academically talented students differed significantly from the comparison group on all four dimensions. Specifically, the academically talented group expressed greater preferences for introversion, intuition, and thinking. Although there were more judging types in this group than in the comparison group, overall more academically talented students expressed a preference for a perceptive style. They also tended to be higher on achievement motivation and lower on interpersonal and social concerns. In particular, a cognitive style that empasizes a thinking over a feeling mode appears to mediate gender differences in mathematics ability and achievement.

For over 30 years now, researchers have explored the personality or affective characteristics of "gifted" individuals, particularly those characteristics that may differentiate the "gifted" from other learners, or high achieving persons with talent from those who never fulfil their promise. For example, Terman and Oden (1959) concluded that more successful gifted people differed from those who were less successful on a number of personality and motivational characteristics. Similar work was conducted in the area of creativity by Roe (1952) and MacKinnon (1965).

In 1966, Maccoby suggested that personality characteristics, particularly those that are identified with sex roles, may act as "mediating" variables in cognitive development and functioning, as well as achievement. Mills confirmed and extended this work with her study published in 1981 which showed that the pattern of personality variables related to achievement differed for males and females, as well as for talented students in comparison to a normative group of adolescents.

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More recently, Wong and Csikszentmihalyi (1991) reported that, controlling for ability, affective/personality variables such as "work orientation" and intrinsic motivation were related to academic achievement. Similar findings are reported by Bloom (1985), Renzulli (1986), Feldhusen (1986), and Haensly, Reynolds, and Nash (1986).

In addition to explorations of personality "traits" and motivational variables, researchers have looked at how cognitive styles may be related to high ability and achievement. A review of this line of research is reported in a paper by Rogers (1986). For her review, cognitive style was defined as "consistencies in the unique manner in which a learner acquires or processes information." An extension of this work utilizing the Myers-Briggs Type Indicator (MBTI) has been done by Olszewski-Kubelius and Kulieke (1989), as well as Gallagher, Brown, and Kimble (1990) with academically talented students.

Although a few investigations have focused on within group differences in academically talented populations, most have examined predictors of achievement or gender differences. Only a few studies have looked at within group differences for type of ability or talent (Albert & Runco, 1986; Brody & Benbow, 1986; Gallagher, Brown, & Kimble, 1990; Olszewski-Kubelius & Kulieke, 1989; Viernstein, McGinn, & Hogan, 1977). Several methodological problems, however, have emerged from these studies. Small sample sizes, samples limited to boys only, and overlapping populations (some students fell into both the high verbal and high math groups) limit the generalizability of the results from these studies. The use of widely different instruments with little theoretical rationale for their selection also limits the usefulness of some studies.

The present study examined personality trait differences and cognitive/learning style differences within a group of academically talented students. Although the entire sample was compared to a normative group of adolescents, the focus of the investigation was on within group differences in type of ability, particularly for mathematically talented students. The instruments chosen were selected because of either empirical or theoretical links to academic talent, achievement and gender differences.

Method

Subjects: The subject pool in this study consisted of 610 academically talented students between the ages of 12 and 16 who participated in the Johns Hopkins University Center for Talented Youth's summer programs. The sample contained 257 females and 353 males. To qualify for programs, students had to score at least 430 on the verbal section of the SAT (for humanities courses) *or* at least 500 on the quantitative section of the test *and* attain a combined score of at least 930 (for mathematics and science courses). The average SAT-V score for the sample was 499.61; the mean SAT-M score was 564.85.

In addition, a comparison sample of 224 adolescents matched to the talented group for age, sex, and SES was chosen from three middle schools in Pennsylvania. This group contained individuals with a wide range of verbal and mathematical ability.

Instruments: The *Myers-Briggs Type Indicator* (Myers, 1962) is a forced-choice, paper-and-pencil measure of preferences on four bipolar dimensions: extraversion-introversion, sensing-intuition, thinking-feeling, and judging-perceiving. Combinations of the four dimensions form 16 "types." In addition, it is possible to examine continuous scores on each of the dimensions to determine the strength of the preference.

Extraversion-introversion refers to preferred modes of relating to the external world. **Extraverts** are individuals who relate more easily to the outer world of people and things than to the inner world of ideas; **introverts** express a preference for relating to the inner world of ideas. The **sensing-intuition** dimension refers to how individuals prefer to take in and process information; i.e., perception processes. **Sensing** refers to a preference for working with known facts rather than with possibilities and relationships, while **intuition** refers to a preference for abstract, symbolic, and theoretical relationships and possibilities. An individual's preferred way of thinking about and evaluating experiences, information, perceptions is measured by the **thinking-feeling** dimension. **Thinking** types tend to prefer a logical, impersonal, analytical process, while **feeling** types tend to use a subjective, interpersonal process considering values, aesthetics, and personal implications. Finally, the **judging-perceptive** dimension refers to preferences for either a decisive, planned, orderly approach to life or a more flexible, adaptable, and spontaneous style.

Scores on the MBTI have been shown to be related to academic ability and achievement (Myers, 1962; Mills, 1983b, 1984). In addition, the MBTI has been used with academically talented adolescents (Gallagher, Brown, & Kimble, 1990; Olszewski-Kubelius & Kulieke, 1989) showing consistent differences in type preference for the talented versus norm groups. The MBTI has been linked both empirically and theoretically to preferences in "learning style" and "cognitive style" defined as:

(a) preferred or habitual patterns of mental functioning;

(b) patterns of attitudes and interests that influence what a person will attend to in a potential learning situation;

(c) a disposition to seek out learning environments compatible with one's cognitive style, attitudes and interests, and to avoid environments that are not congenial;

(d) a disposition to use certain learning tools and avoid others (Lawrence, 1984).

Recent validity studies of the MBTI support the constructs underlying the instrument (Kreitler & Kreitler, 1990), as well as the bipolar construction of the test (Tzeng, Ware & Bharadwaj, 1991). More importantly, Hoffman and Betkouski (1981) review the research applications of the MBTI in education, while Mills (1983b) discusses both the educational and counseling implications of personality/cognitive style preferences for gifted populations. There is also some recent evidence that the MBTI may be useful in understanding gender differences in mathematical reasoning ability, as well as within gender differences in achievement levels for females (Mills, 1992).

The *Adjective Checklist* (Gough & Heilbrun, 1965) is a list of 300 self-descriptive adjectives that group together to form 37 scales (some of which are experimental scales). Seven of these scales were used in the present study because of their theoretical and empirical relationship with academic achievement. Five of the seven scales are related to dispositions identified as important in Murray's (1938) need-press theory of personality. They are: **Achievement** ("to strive to be outstanding in pursuits of socially recognized significance"), **dominance** ("to seek and maintain a role as a leader in groups, or to be influential and controlling in individual relationships"), **endurance** ("to persist in any task undertaken"), **order** ("to place special emphasis on neatness, organization, and planning in one's activities"), and **affiliation** ("to seek and maintain numerous personal friendships"). The sixth scale from the ACL is **autonomy** ("to act independently of others or of social values and expectations") and the last scale is **self-confidence** ("to be confident, determined, ambitious, enterprising, and assertive").

For females, in particular, a large body of research has shown these variables to be either positively or negatively related to academic achievement and especially high achievement in mathematics.

RESULTS

Personality differences between the academically talented and normative samples of adolescents

Myers-Briggs Type Indicator (MBTI) – Table 1 shows the breakdown of percentages for the academically talented students compared to the normative sample on the four MBTI dimensions. Using a Chi Square analysis, the two groups were found to differ on all four dimensions. The "index" shown in the far right hand corner of the table is the ratio of the frequency in one sample compared to the frequency in the other. The index or ratio is greater than 1.00 when there are more subjects in the academically talented group.

As can be seen from the table, the academically talented population had twice as many students describing themselves as having an introverted style as in the

normative group of adolescents. The 72 percent of extraverts in the normative sample is typical of the general population in the United States. It was not surprising to find that the academically talented sample contained more introverts, since introversion has been shown to be correlated with ability and academic interests, as well as educational attainment.

Table 1. *Percentages of MBTI types for academically talented students and a normative sample*

MBTI Types	Academically Talented Adolescents (N = 610)	Normative Adolescents (N = 224)	Index
E	42.9	72.3	.59*
I	57.1	27.7	2.06*
S	27.0	59.4	.46*
N	73.0	40.6	1.80*
T	64.0	56.2	1.14*
F	36.0	43.8	.82*
J	40.5	33.0	1.23*
P	59.5	67.0	.89*

(* = Chi Square significant at $p < .05$)

For the sensing-intuition dimension, the academically talented group contained 1.8 times the number of individuals preferring intuition. Seventy-three percent of the group expressed this preference. This is a preference for dealing with the abstract, the theoretical, and relationships between ideas and concepts.

Although still significant, the smallest difference between the normative sample and the academically talented students was found on the thinking-feeling dimension. Sixty-four percent of academically talented students preferred a thinking style (e.g., an analytical, objective, impersonal approach to decisions and evaluation). This particular dimension is the only one where a gender difference is evident in the general population, with females preferring a feeling mode and males preferring a thinking mode. Although a gender difference was found in the academically talented population on this dimension, many more of the academically talented girls are thinking types (over half) than girls in general (typically 25%).

On the judging-perceptive dimension, again the academically talented group differed from the normative group of adolescents. A greater percentage (1.23 times) of the academically talented group expressed a preference for a judging style (e.g., organized, planned, decisive). However, **within** the academically talented group, there was still a greater percentage of perceptive types (e.g., flexible, spontaneous).

In summary, the academically talented group contained more individuals expressing a preference for introversion, intuition, thinking, and a perceptive attitude. Except for the J-P dimension, the normative group had just the opposite pattern.

Combinations of the four dimensions are also useful to examine. Striking differences were found between the normative and academically talented groups for the IN (introverted, intuition) and NT (intuition, thinking) combinations. In particular, over three times as many IN's (40%) were found in the academically talented group as in the normative group. This is quite significant since only 9 percent of the students in a typical classroom express this particular combination of preferences. Conversely, about 51 percent of the typical school population will have ES (extraverted, sensing) preferences, while only 10 percent of the academically talented expressed this combination of preferences.

Adjective Checklist (ACL) – Table 2 shows the mean score for the scales on the ACL for the two groups of adolescents. Using an effect size greater than 1/3 of a standard deviation as a cut-off, the academically talented group differed from the comparison group on three scales. They were higher on "achievement" and "endurance," and lower on "affiliation." In other words, the students in the academically talented group described themselves, on the whole, as more goal directed, persistent, ambitious, and determined to achieve than the normative group of adolescents. On the other hand, they also described themselves as less comfortable in social situations, liking group situations less, and tending to be more introverted. These differences are consistent with the findings on the MBTI.

Table 2. *Means on ACL scales for academically talented youth and a normative group*

ACL Scales	Academically Talented Adolescents (N = 610)	Normative Adolescents (N = 224)	*d*
Self-confidence	47.84	46.25	.16
Achievement	48.48	43.50	.53*
Dominance	49.29	47.65	.16
Endurance	46.49	43.11	.35*
Order	42.94	43.72	.07
Affiliation	42.50	47.75	.40*
Autonomy	53.36	52.03	.13

(*d* = effect size in standard deviation units)

Personality differences within the group of academically talented

Students: Students were divided into three distinct, nonoverlapping groups according to their SAT scores: *high math* (above 500 on SAT-M and below 430 on SAT-V); *high verbal* (above 430 on SAT-V and below 500 on SAT-M), and *high both* (above 500 SAT-M and above 430 SAT-V). The largest group consisted of students with high scores on both sections of the SAT. The *high math, low verbal* group contained the lowest number of students.

As can be seen in Table 3, the students in the High Both group were not only "doubly talented," but their mean scores for **both** verbal and math SAT scores were higher than either of the other two groups.

Table 3. *Mean SAT scores for academically talented subgroups*

SAT Scores	High Math (N = 82)	High Verbal (N = 118)	High Both (N = 410)
SAT-Verbal	396.10	488.30	523.56
	(24.53)	(51.78)	(70.27)
Sat-Math	590.46	411.86	603.76
	(60.80)	(58.45)	(74.70)

MBTI – Table 4 shows the frequencies for the MBTI dimensions, as well as continuous scores, for the three groups. Continuous scores not only reflect the proportions for each pole of a dimension, but they also include the degree of preference or intensity. Using the continuous scores, it was possible to compare the three groups on each of the dimensions using one-way ANOVA's.

Table 4. *Percents and continuous scores for ability types on MBTI dimensions*

MBTI Dimensions	Ability groups			*F* ratio
	High Math (N = 82)	High Verbal (N = 118)	High Both (N = 410)	
E	54.90	49.20	38.80	
I	45.10	50.80	61.20	
Continuous score	98.27^{a}	100.05^{b}	107.29^{ab}	6.08*
	(27.81)	(27.25)	(26.37)	
S	43.90	27.10	23.40	
N	56.10	72.90	76.60	
Continuous score	104.90^{cd}	114.78^{c}	117.99^{d}	10.17*
	(21.17)	(23.07)	(24.91)	
T	64.60	56.80	65.90	
F	35.40	43.20	34.10	
Continuous score	92.51	92.64	86.41	3.73
	(23.50)	(27.06)	(26.47)	
J	50.00	39.80	38.80	
P	50.00	60.20	61.20	
Continous score	103.66	109.91	109.69	2.37
	(25.57)	(28.88)	(30.75)	

(Means with the same superscript differ at $p < .05$; * = significant at the $p < .05$ level)

As can be seen in the table, the groups differed on two dimensions – extroversion-introversion and sensing-intuition. The *high both* group was distinct from the other two groups, having a greater percentage of introverts and, thus, a

higher continuous score. The largest difference between the groups can be seen on the S-N dimension where the *high math* group distinquished itself from the other two groups by a stronger preference for sensing. Almost twice as many of the *high math* students, as compared to the High Verbal or High Both students, expressed this preference.

ACL – Mean scaled scores for the ACL can be seen on Table 5. The groups differed on two dimensions. The **high math** group was significantly lower on the *self-confidence* and *autonomy scales* than either of the other two groups. In other words, they described themselves as less outgoing, assertive, and socially confident. They also described themselves as more conventional and less risk-taking.

Table 5. *Mean scaled scores an ACL scales for ability types*

ACL Dimensions	Ability groups			*F* ratio
	High Math (N = 82)	High Verbal (N = 118)	High Both (N = 410)	
Self-confidence	44.52^{ab} (9.81)	49.63^{a} (9.36)	47.98^{b} (10.31)	6.36*
Achievement	46.73 (8.99)	49.53 (9.07)	48.53 (9.53)	2.18
Dominance	47.26 (9.60)	50.63 (8.98)	49.31 (10.45)	2.71
Endurance	46.01 (8.83)	46.09 (9.73)	46.70 (9.96)	.29
Order	43.40 (9.40)	41.46 (9.75)	43.27 (10.39)	1.56
Affiliation	43.88 (13.16)	42.24 (13.32)	42.30 (13.16)	.51
Autonomy	49.14^{cd} (7.45)	54.91^{c} (9.95)	53.75^{d} (10.58)	8.85*

(Means with the same superscript differ at $p < .05$; * = significant at the $p < .05$ level)

Personality traits and cognitive styles of mathematically talented students

The remaining analyses were focused on the mathematically talented students. Separate analyses were conducted for males and females to examine any gender differences.

Table 6 (on next page) shows the pattern of scores for males and females on the MBTI. A significant difference was found for only one dimension, *thinking-feeling.* Significantly more of the mathematically talented males expressed a preference for a "thinking" style. The mathematically talented girls were more evenly split between a thinking and a feeling cognitive style. The fact that 47% of the mathematically

talented girls expressed a preference for a thinking orientation, however, is significant since only about half this number of girls in the general population express this preference.

Table 6. *Gender differences on MBTI for mathematically talented students*

MBTI Dimensions	Males (N = 308)	High Verbal (N = 184)	χ^2	*F* ratio
E	40.30	43.50		
I	59.70	56.50	.37	
Continuous score	106.70	104.27		.56
	(26.09)	(27.96)		
S	26.60	25.50		
N	72.40	74.50	.15	
Continuous score	115.64	116.11		.30
	(25.27)	(24.04)		
T	76.90	46.70		
F	23.10	53.30	45.28*	
Continuous score	80.39[a]	99.22[a]		99.86*
	(25.02)	(23.47)		
J	40.30	41.30		
P	59.70	58.70	.02	
Continuous score	108.49	109.03		.07
	(30.77)	(28.76)		

(Means with the same superscript differ at $p < .05$; * = significant at the $p < .05$ level)

Table 7. *Mean scores on ACL scales for mathematically talented male and female students*

ACL Scales	Males (N = 307)	Females	*F* ratio
Self-confidence	47.17	47.80	.43
	(10.54)	(9.90)	
Achievement	48.97[a]	46.98[a]	5.19*
	(9.42)	(9.41)	
Dominance	49.00	48.91	.01
	(10.66)	(9.79)	
Endurance	47.05	45.81	1.87
	(9.73)	(9.83)	
Order	43.48	42.98	.28
	(10.26)	(10.18)	
Affiliation	42.69	42.36	.07
	(12.44)	(14.31)	
Autonomy	52.43	53.91	2.40
	(10.29)	(10.18)	

(Means with the same superscript differ at $p < .05$; * = significant at the $p < .05$ level)

Table 7 shows the mean scaled scores for males and females on the ACL. Differences within the mathematically talented group were observed for only one scale of the ACL, **achievement**, with boys scoring higher.

Because the largest gender difference within this group was found on the T-F dimenson of the MBTI, the mathematically talented group was further divided into four subgroups: thinking males, thinking females, feeling males, and feeling females. Comparisons were then made between the subgroups for the remaining MBTI dimensions and the ACL scales.

On the ACL, three significant differences were found between the subgroups. Thinking girls and thinking boys were significantly higher on the Achievement, Endurance, and Order scales than their "feeling" counterparts. Thus, the thinking boys and the thinking girls described themselves as highly goal directed, high achievers with intellectual stamina, and clearly focused energies. What is significant is that in all three instances, the thinking girls were more like the thinking boys than feeling girls. The same is true for the boys. In general, this is true for most of the ACL scales. Both thinking girls **and** thinking boys scored higher on Self-Confidence, Achievement, Dominance, Endurance, Order, and Autonomy. They scored lower than their feeling counterparts on Affiliation. These differences can be seen in Table 8.

Table 8. *Mean ACL scaled scores for mathematically talented males and females (thinking–feeling comparisons)*

	Thinking–Feeling Preferences			
	Thinking Males (n = 230)	**Feeling Males (n = 70)**	**Thinking Females (n = 81)**	**Feeling Females (n = 93)**
Self-confidence	47.79 (10.42)	45.30 (10.90)	48.15 (10.38)	47.99 (9.26)
Achievement	49.89^{ab} (9.46)	45.91^{a} (8.83)	49.26^{c} (9.17)	45.53^{bc} (8.98)
Dominance	49.84 (10.86)	46.35 (9.93)	50.05 (9.51)	48.48 (9.79)
Endurance	47.89^{de} (9.88)	44.49^{d} (9.04)	47.95 (9.97)	44.17^{e} (9.17)
Order	44.55^{fg} (10.10)	40.00^{fh} (10.06)	46.02^{hi} (9.85)	40.64^{gi} (9.83)
Affiliation	41.63 (12.18)	46.51 (12.86)	41.49 (13.25)	44.02 (14.76)
Autonomy	52.63 (10.80)	51.33 (8.58)	56.12 (10.00)	51.59 (9.96)

(Means with the same superscript differ at $p < .05$)

Table 9 (see next page) shows the preferences on the remaining three MBTI dimensions for thinking boys, thinking girls, feeling boys, and feeling girls.

Significant differences in the proportions of expressed preferences were found on all three dimensions. Although all four subgroups mirrored the pattern of preferences expressed by the overall group of academically talented students (more introverts than extraverts; more preferences for intuition over sensing; more perceiving than judging types), the "thinking" males and females again distinquished themselves from their "feeling" counterparts on all three dimensions. The thinking males and females had more introverts, more sensing, and more judging types than either the feeling boys or feeling girls.

Table 9. *MBTI preferences for mathematically talented males and females (thinking–feeling comparisons)*

MBTI Dimensions	MBTI Preferences			
	Thinking Males (n = 230) %	Feeling Males (n = 70) %	Thinking Females (n = 81) %	Feeling Females (n = 93) %
Extraversion	38.3	48.6	32.1	55.9
Introversion	61.7	51.4	67.9	44.1
χ^2 value	13.19; $p < .01$			
Sensing	31.3	15.7	30.9	21.5
Intuition	68.7	84.3	69.1	78.5
χ^2 value	8.72; $p < .05$			
Judging	44.8	28.6	53.1	31.2
Perceiving	55.2	71.4	46.9	68.8
χ^2 value	14.41; $p < .01$			

The thinking types (both male and female) more often than the feeling types described preferences for an intellectual in contrast to a people orientation. More of them also expressed a preference for a practical, factual approach to learning, and a more organized, orderly, and decisive approach to life. In all instances, the within gender differences were greater than the between gender comparisons. In other words, *thinking girls* expressed preferences very similar to those expressed by *thinking boys.* Thus, the thinking-feeling orientation on the MBTI appears to be a mediating variable that reduces between-gender differences and accentuates within gender differences.

Most significantly, the gender difference in mathematical ability typically found in this population which usually reaches an effect size of about .5 was not found when SAT-M scores for girls with a strong thinking preference were compared to those for boys with a strong thinking preference. These scores can be seen in Table 10 (see next page). Again, the *within* gender differences for the SAT-M were much greater than the *between* gender differences when the genders were divided according to their "thinking-feeling" preferences on the MBTI.

Table 10. *SAT-Math scores for mathematically talented males and females with strong thinking–feeling preferences*

	MBTI Types	
	Thinking	**Feeling**
Males (N = 152, 24)	614.72[a] (71.62)	605.00 (72.65)
Females (N = 30, 34)	613.66[b] (70.64)	567.06[ab] (45.96)

(Means with the same superscript differ at $p < .05$)

Discussion

Many of the academically talented students expressed personality and learning style/cognitive style preferences that are very different from the majority of their classmates and teachers. In addition, their learning preferences are not entirely compatible with typical instructional practice. Many of them have a strong need for autonomy and choice; with a desire for variety, novelty, and change. Therefore, in addition to feeling "different" because of exceptional academic ability, the academically talented student may also feel isolated and misunderstood by other students and their teachers because of a different set of personality and learning preferences. It is possible that this experience may result in underachievement, a poor self-concept, or a decreasing interest in academics.

Although there are clear differences between the academically talented adolescents and a normative group of students, it is important to remember that there are also strong within-group differences. For example, the group of students with high scores on both the SAT-V and SAT-M, the *mathematically talented with high verbal scores,* was the most introverted of the three groups and the one with the strongest preference for intuition. Myers (1962) describes introverts with an intuitive preference as individuals who use their minds in a way that is different from extraverted sensing types and advantageous for dealing with the intricacies of thought and language. They are, however, also the group that is the least sociable, the least tuned into interpersonal relations and social concerns.

Of particular interest was the *high math group with low verbal scores.* This group had the largest number of sensing types and almost **70 percent** of them were thinking types. Sensing-thinking (ST) types tend to prefer impersonal, logical analysis with an emphasis on facts; they tend to be practical and matter-of-fact. These preferences are not surprising, given their exceptional aptitude for mathematics. What is surprising, however, is the fact that over half the *high math group* expressed preferences for intuition and 30 percent for a feeling style (a number of whom are females). These preferences appear to be less congruent with their high ability in

mathematics. We may find that these style differences/preference differences are related to **how** an individual uses and develops his or her ability.

The *high math group* was also the lowest of the three groups on the ACL scales of Self-Confidence and Autonomy. In other words, these people are less likely to take risks, to act independently of others and may be more shy and withdrawn. Clearly, they constitute a group distinct from the verbally talented students, but also distinct from individuals who are high on **both** math and verbal ability.

Studies examining personality variables in populations of talented students seldom examine within group differences. Generalizations made from a mixed group of academically talented students can be, therefore, quite misleading. For both programming and counseling purposes, these within group distinctions are important to understand. For example, the way in which the other personality variables clustered together for the students with a preference on the MBTI for a "thinking" style suggests an intriguing personality profile. As a group, the thinking girls and boys with high mathematical ability described themselves as introverted, relatively self-confident, high achieving, persistent, organized, goal-directed, autonomous, independent, and unconcerned with pleasing others or conforming.

Do these traits predict the students who will ultimately be the most persistent and successful in following a demanding educational and career path in mathematics or the sciences? Are their particular cognitive style and learning habits more consistent with the way in which mathematicians and scientists work and think? On the other hand, what about the students (both male and female) with strong mathematical ability who express a "feeling" preference? Will they be less persistent and goal directed as indicated by their personality profile? Is their interest and liking for mathematics less than the "thinking" types, or will they end up being the more passionate and dedicated mathematicians and scientists because of their very personal dedication and orientation to their chosen field? Will the thinking-feeling differentiation simply direct the students into different career paths and applications of their talent? Perhaps the feeling types will seek to use their quantitative ability to benefit society or solve aesthetically interesting problems. The thinking types, on the other hand, may use their mathematical ability to pursue more abstract and "basic" problems without regard to beauty or personal consequences?

It is also important to remember that within any group of academically talented students, individual differences in personality will be found. Although differentially distributed, all types will be represented and need to be understood, because it is quite likely that personality and affective variables act as **mediating** variables to either enhance or inhibit successful interactions and performance in the classroom.

Finally, gender differences within groups of mathematically talented students present an additional challenge to understanding the relationship between ability and personality. The fact that mathematically talented males are more likely to be thinking types, more goal-directed, with highly developed instrumental traits and less concern about the needs of others than females, may help to explain some of the ability and

achievement differences between males and females, particularly in the mathematics and science areas.

The personality dimension of *thinking-feeling* from the MBTI, in particular, was found to differentiate between mathematically talented adolescent males and females for both ability (SAT-M scores) and personality variables. Most significantly, the profile for thinking girls looked very similar to that for thinking boys on SAT-M scores, as well as most all of the other personality variables. Conversely, both the thinking boys and thinking girls looked very different from their feeling counterparts who had very similar profiles. Clearly, the T-F dimension on the MBTI is a mediating variable **decreasing** the between-gender differences in ability and cognitive style while **increasing** the within-gender differences.

It is tempting to speculate about the relationship between the *thinking-feeling* dimension and how mathematically talented young women, in particular, use their ability, make choices about educational and career goals, and persist in pursuing academic goals. Together with the constellation of other personality variables that seem to be related to the thinking-feeling dimension, a way of thinking and dealing with experiences that helps talented young women to resist society's stereotypes and environmental distractions may be involved. In another recent study by Mills (1992), this relationship among gender, ability, and the T-F personality dimension was found to be related to differential coursetaking and achievement in flexibly paced mathematics classes. It seems likely, therefore, that the gender differences in mathematics achievement over time typically found in academically talented groups may ultimately be better understood by studying the mediating effects of personality and cognitive style variables.

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