

A Validation Study of the Thinking Styles Inventory: Implications for Gifted Education

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This study examined internal and external validity of the Thinking Styles Inventory (TSI) developed by Sternberg and Wagner (1991) within the framework of Sternberg's (1988) theory of mental self-government. Participants were 96 adolescent students who were in a summer residential program at the time of testing. The results provide evidence of the external discriminant validity, but only lend partial support to the internal validity of the instrument, suggesting the need to theoretically clarify the relationships between and among posited thinking styles as well as empirically test the validity of these thinking styles measures. Implications of thinking styles for gifted education are discussed.

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Intellectual abilities of gifted children are usually the focus of identification and programming. Relatively little attention is given to the characteristic ways gifted children apply their intelligence in everyday and academic life. However, as Sternberg (1988) pointed out, one cannot fully understand intellectual abilities unless one also knows how individuals apply them in adapting to the demands of the environment. Sternberg (1988, 1997) argued that adaptation, selection, and shaping of environments are largely the result of a person's repertoire of thinking styles or characteristic ways of approaching the world intellectually. Gifted children can be most successful if they pursue tasks that match their abilities and styles (Sternberg & Grigorenko, 1993).

Sternberg (1988, 1997) also proposed a theory of mental self-government that defines intellectual styles as an interface between intelligence and personality. The basic assumption is that the way individuals use their mind is analogous to various dimensions of government in the external world. Like the political concept of government, mental self-government has five dimensions: function, form, level, scope, and leaning (see Table 1).

Analogous to the three branches of the U.S. government, there are three primary *functions* of mental self-government. The *legislative function* is concerned with formulating ideas and creating rules. The *executive function* is concerned with carrying out plans and implementing rules initiated by others. The *judicial function* mainly involves comparing and evaluating ideas, rules, and procedures. Although no one can be

viewed as exclusively legislative, executive, or judicial, individuals tend to have distinct dominant style preferences. In contrast to the three functions, *forms* of mental self-government concern various styles of goal-setting and self-management behaviors, such as prioritizing (*Hierarchical*), pursuing goals single-mindedly (*Monarchic*), having multiple goal pursuits (*Oligarchic*), and taking a random approach to goals and problems (*Anarchic*). Furthermore, *levels* of mental self-government distinguish between a preference for problems at a

Thirteen Thinking Styles and Sample Items in the Thinking Styles Inventory

Label	Characteristics	Sample Item
Legislative	likes to create their own rules and do things in their own ways	"When working on a task, I like to start with my own ideas."
Executive	prefers to follow and implement existing rules	"I like to follow definite rules or directions when solving a problem or doing a work."
Judicial	likes to evaluate rules and judge things	"I like to check and rate opposite points of view or conflicting ideas."
Monarchic	likes to focus on one thing at a time and pursue a goal single-mindedly	"When trying to make a decision, I tend to see only one major factor."
Oligarchic	Likes to juggle several things at one time	"I usually know what things need to be done, but I sometimes have trouble deciding in what order to do them"
Hierarchical	likes to pursue and prioritize multiple goals	"When starting something, I like to make a list of things to do and to order the things by importance."
Anarchic	likes to take a random approach to problems	I like to tackle all kinds of problems, even seemingly trivial ones."
Local	likes tasks that require attention to details and precision in execution	"In discussing or writing on a topic, I think the details and factors are more important than the overall picture."
Global	likes problems that are more general and that requires abstract thinking	"I like situations where I can focus on general issues, rather than specifics."
Internal	likes to work alone, independent of others	"I like to work alone on a task or a problem."
External	likes to work with others and likes social interaction	"When working on a project, I like to share ideas and get input from other people."
Liberal	likes to go beyond existing rules	"I like to participate in activities where I can interact with others as part of the team."
Conservative	like familiarity and prefers to follow tradition	"When faced with a problem, I like to solve it in a traditional way."

Table 1

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relatively high level of abstraction (*Global*) and a preference for problems that demand attention to details (*Local*). *Scope* of self-government refers to a preference for tasks that allow one to work alone, independent of others (*Internal*), versus a preference for tasks that allow social interaction and collaboration (*External*). Finally, *leanings* of mental self-government refer to individual preferences for tasks, projects, or situations which involve unfamiliarity and ambiguity and which require going beyond existing rules and procedures (*Liberal*), or preferences for familiarity or situations and tasks that require adherence to existing rules (*Conservative*). According to Sternberg (1988, 1997), the five dimensions and 13 thinking styles, though not exhaustive, represent important stylistic aspects of intellectual functioning.

Sternberg (1988, 1997; Sternberg & Grigorenko, 1997) proposed that these style constructs are not typological but nomothetic and continuous in nature; that is, stylistic differences are not a matter of whether one possesses or does not possess a specific style but a matter of the degree of that particular thinking preference. Furthermore, certain tasks (e.g., creative writing) or instructional methods (e.g., discovery learning) are more congenial to some styles (e.g., legislative style) than others (e.g., executive style), and thus more likely to nurture and encourage the expression of those particular styles. In this sense, styles are not completely innate but developed and socialized and reflect task or situational demands as well as individual dispositions (Sternberg & Grigorenko, 1997). Sternberg and Grigorenko (1993) discussed the implications of thinking styles for gifted education, encompassing issues from acceleration versus enrichment to individualistic versus cooperative learning structures. Initial evidence bears out some of the theoretical and practical significance of thinking styles (e.g., Grigorenko & Sternberg, 1997; Sternberg & Grigorenko, 1995). For example, teachers have been found to give more favorable evaluations to students whose thinking styles match their own, and secondary teachers are more likely to have an executive style than elementary teachers (Sternberg & Grigorenko, 1995, 1997). However, research that applies this model of thinking style to gifted students is still rare.

This study examined the internal, discriminant, and convergent validities and practical utility of the *Thinking Styles Inventory* (Sternberg & Wagner, 1991) in assessing gifted children's thinking styles within the framework of Sternberg's theory of mental self-government. One issue related to internal validity is the bipolar nature of these thinking styles. For example, to some extent the legislative and executive styles parallel the innovative versus adaptive style proposed by Kirton (1976), and the liberal and conservative styles resemble divergent versus convergent styles described by Kolb (1978). However, earlier posited pairs of cognitive and thinking styles were conceptualized as mutually exclusive or antithetical. One is *either* a divergent *or* a convergent learner. The relationships between these apparent opposite styles measured by the *Thinking Styles Inventory* have not been not elucidated. A legitimate research question then is how consistent and compatible these styles are with each other. Are the internal and external styles or global and local styles relatively independent dimensions of style or two ends of an internal-external or global-local continuum? Initial data from a sample of college students (Sternberg, 1994) indicated that legislative and executive, liberal and conservative, global and local, and internal and external styles were negatively correlated with each other, suggesting that opposite styles tend to be mutually exclusive.

A second issue of internal validity concerns relationships among different dimensions of thinking styles. A factor analysis of the 13 subscales conducted with the above mentioned college student sample (Sternberg, 1994) yielded five factors, partly supportive of the dimensions postulated by the theory, although there was an overlapping of the legislative-executive and liberal-conservative dimensions. In the present study, correlational and factor analyses were run to determine the internal validity of the *Thinking Style Inventory* with a sample of gifted adolescent students. More specifically, we examined relationships among thinking styles and the underlying structures of the thinking style measures.

With regard to discriminant and convergent validities, initial validation studies by Sternberg and Grigorenko (1997) and Sternberg and Wagner (1991) found that the number of correlations between the *Thinking Style Inventory* and *Myers-Briggs Type Indicator* (MBTI) or Gregorc's (1982) measure of mind styles was beyond what would be expected by chance. These findings suggest that the *Thinking Styles Inventory* taps into a similar intelligence-personality interface but from a different perspective. In contrast, no consistent relationships were found between the measures of thinking styles and IQ (Sternberg & Wagner, 1991), suggesting that thinking styles as measured by the *Thinking Styles Inventory* are independent of individual differences in intelligence or standardized intellectual performance.

Extant style constructs in the literature can be roughly categorized into three groups: cognition-based, personality-based, and activity-based (Sternberg & Grigorenko, 1997). Since the theory of mental self-government concerns personality functioning rather than mere cognitive preferences, the present study tested the convergent and discriminant validity of the *Thinking Styles Inventory* by examining its relations to traditional measures of personality traits, extroversion-introversion and neuroticism. Previous research showed that extroverts tend to be faster but less accurate and reflective than introverts when attacking intellectual tasks (Eysenck, 1994). It is not known, however, whether extroverts are less *judicial* than introverts, and whether they are also more *anarchic* than *hierarchical* or *monarchic* in planning and goal-management. Since extroverts also tend to be more outgoing and sociable than introverts (Eysenck & Eysenck, 1985), they should also display a disposition to work with people (*external style*) rather than work alone (*internal style*).

The following research questions were addressed:

Are conceptually opposite thinking styles negatively correlated with each other? Is the underlying structure of a factor analysis consistent with the five dimensions postulated by the theory of mental self-government? Patterns of significant negative correlations of opposite styles would confirm the self-consistency assumption of thinking styles. Factor structures could be examined with regard to the dimensions of thinking styles postulated. These two questions address the internal validity of the *Thinking Styles Inventory*.

A further question was: Are thinking styles correlated with the dimensions of extroversion-introversion, and neuroticism-emotional stability as assessed by the *Junior Eysenck Personality Inventory*? It was predicted that the measure of extroversion would be correlated negatively with the *internal style* (working alone) and positively with the *external style* (working with others). It was also predicted that it would be correlated with measures of forms of mental self-government; that is, introverts are more likely to be *hierarchical* and *monarchic* and less likely to be *anarchic*. No prediction was

made for other measures of thinking styles. Relations between thinking styles and standardized academic test performance were also explored.

Methods

Participants

Participants were 96 students (58 boys and 38 girls), aged 12-17, who attended a summer residential program for the gifted at a large midwestern university. Admission criteria included a GPA of A-/B+, a standard achievement test score (verbal or quantitative, depending on what courses they planned to enroll in) above the 95th percentile, and an essay stating students' purposes for attending the summer programs. For those who took the SAT as a way of "out of level" testing, a cut-off of 500 (verbal or math, depending on courses to be taken) was used as one of the admission criteria. Based on the available test score information about the participants, SAT-I-Math scores ranged from 390 to 770, with a mean of 585. SAT-I-Verbal scores ranged from 330 to 670, with a mean of 501. The average age of these students when they took the tests was 13.5 years. Although the test performance varied greatly, their average performance on the math subtests placed them roughly at the 80th percentile of college-bound seniors. Their average performance on the verbal subtests placed them at the 50 percentile of college-bound seniors.

Measures

The *Thinking Styles Inventory* (Sternberg & Wagner, 1991) contains 13 subscales, each of which has 8 items. It was designed to assess five dimensions of mental self-government: actions, forms, levels, scope, and leanings. Since there were some apparent errors in the measure of *oligarchic* style in the operationalization process, only 12 subscales were used in the present study. Table 1 presents sample items of the 12 subscales. Respondents were asked how well each item describes them. A 7-point scale was used, eliciting responses ranging from "Not At All Well" (1) to "Extremely Well" (7).

The *Junior Eysenck Personality Inventory* (Eysenck, 1965) was used to assess the convergent and discriminant validity of the intellectual styles instrument. It contains three

subscales and 60 questions. The three subscales are *extroversion-introversion* (sample item: "Can you get a party going?"), *neuroticism-emotional stability* (sample item: "Are you usually happy or cheerful?"), and *lie* (sample item: "Have you ever told a lie?") which was meant to detect a social desirability bias. Respondents answered "yes" or "no" to the questions. The three scale scores were obtained by adding all points for respective measures.

Results

Alpha reliability coefficients were computed for the 12 subscales for this sample (See Table 2). Except for the measure of *monarchic* style, reliabilities of these subscales were reasonably high, ranging from .64 to .89. The 12 subscales had an average alpha reliability coefficient of .75, higher than those for the norming groups ($\alpha = .64$) reported in the manual (Sternberg & Wagner, 1991), and comparable to what was obtained from a sample of college students (Sternberg, 1994).

To answer the first research question, whether conceptually opposite styles tend to be negatively correlated, relevant pairs of correlations were compared. Consistent with previous research (Sternberg, 1994), *liberal* and *conservative* styles were negatively correlated ($r = -.32, p < .01$), as were *internal* and *external* styles ($r = -.29, p < .01$). The negative correlation between *legislative* and *conservative* styles was significant ($r = -.28, p < .01$). The correlation between *legislative* and *executive* styles, though in the predicted direction, was not statistically significant ($r = -.14, p > .05$). In contrast to previous findings (Sternberg, 1994), *global* and *local* styles were not correlated ($r = -.03, ns$).

Confirming the previous finding that there was a substantial overlap between the *legislative-executive* and *liberal-conservative* dimensions (Sternberg, 1994), *legislative* style was highly correlated with *liberal* style ($r = .76, p < .001$), as was the correlation between *executive* and *conservative* styles ($r = .76, p < .001$). Other correlations greater than .50 in absolute value were between *legislative* and *anarchic* ($r = .62$), *legislative* and *internal* ($r = .55$), *judicial* and *anarchic* ($r = .56$), *judicial* and *liberal* ($r = .50$), and *anarchic* and *liberal* ($r = .52$). Taken together, the correlational analyses indicate

Intercorrelations of the 15 Subscales of the Thinking Styles Inventory and the Junior Eysenck Personality Inventory (N = 96)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Legislative	.81													
2 Executive	-.14	.77												
3 Judicial	.44**	.23*	.78											
4 Global	.22*	.12	.24*	.67										
5 Local	.44**	.23*	.42**	-.03	.68									
6 Liberal	.76**	-.21*	.50**	.21*	.20*	.86								
7 Conservative	-.28**	.76**	.04	.11	.14	-.32**	.84							
8 Hierarchic	.37**	.44**	.43**	.19	.39**	.29**	.28**	.84						
9 Monarchic	.12	.39**	.15	.22*	.25*	.06	.45**	.48**	.38					
10 Anarchic	.62**	-.03	.56**	.31**	.45**	.52**	-.11	.20	.12	.64				
11 External	.01	.24*	.32**	.37**	-.07	.21*	.17	.19	.22*	.28**	.86			
12 Internal	.55**	.02	.26*	.09	.42**	.32**	-.07	.12	.04	.37**	-.29**	.82		
13 Extroverts	.10	.00	.08	.00	-.06	.24*	-.03	.05	.07	.15	.49**	-.15		
Neurotic	-.14	.02	.10	.08	.04	-.06	.06	-.11	.09	-.03	.03	.04	-.09	
Lie	.08	.24	.09	-.15	.22*	-.03	.05	.36**	.13	.04	-.22*	.22*	-.30**	-.18

Note. Alpha reliability coefficients are on the diagonal line. All decimal points are omitted.
** $p < .01$ * $p < .05$

Table 2

that the 12 subscales of thinking styles are interrelated. Some conceptually opposite stylistic dimensions are independent of each other (e.g., global and local), and others seemed mutually exclusive (e.g., liberal versus conservative), although the sizes of the inverse correlations tended to be smaller than previous findings (Sternberg, 1994). The prevalence of intercorrelations suggests that the 12 subscales of the *Thinking Styles Inventory* can be organized into higher-order dimensions.

An exploratory factor analysis with varimax rotation was conducted to determine the pattern of relationships of the 12 subscales and higher-order factors (constructs). The results are presented in Table 3.

Factor Loadings of the 12 Subscales of the Thinking Styles Inventory (Varimax Rotation)

	Factor 1	Factor 2	Factor 3
Legislative	.91		
Liberal	.80		
Anarchic	.79		
Judicial	.67		
Internal	.61		-.59
Local	.56	(.42)	
Executive		.89	
Conservative		.84	
Monarchic		.71	
Hierarchic	(.41)	.66	
External			.86
Global	(.30)		.58

Note. Factor loadings exceeding .30 are presented. All decimal points are omitted.

Table 3

The factor analysis yielded three factors (components) with eigenvalues greater than one, accounting for 68 percent of the total variance. The first factor subsumes *legislative, liberal, anarchic, judicial, internal, and local* styles; the second factor subsumes *executive, conservative, monarchic, hierarchic* styles; and the third factor subsumes *external, global, and internal* styles. Although there were several cross-loadings, the three factors or dimensions seemed relatively independent of one another. The first factor, the *legislative-liberal-judicial-internal-local complex*, seems to tap into a higher-order dimension of *intellectual independence*, with a personal leaning toward innovative and critical thinking. The second factor seems to be best characterized by the term *executive-methodical functioning*, which indicates the extent to which the individual prefers to follow rules and pursue goals in a systematic fashion. The third factor *external-global-internal style* is less intuitively understandable. Although the three-factor structure shares some features with previous findings, it differs in important ways. For example, for this sample of gifted students, the *local* style was correlated with the *legislative* ($r = .44, p < .001$) and *judicial* ($r = .42, p < .001$) styles, but not with the *global* style.

With respect to the second research question, no consistent pattern of relationships was found between intellectual style and personality trait measures. As predicted, *extroversion-introversion* was correlated with *external* styles ($r = .49, p < .001$). However, its correlation with *internal* style was not statistically significant ($r = -.15, p > .05$). Also, correlations between *extroversion-introversion* and *hierarchic, monarchic, and anarchic* styles were not statistically significant. Overall, the results support the discriminant validity of the measures of thinking styles as assessing something different from that tapped by traditional personality trait measures.

However, the analyses only lend partial support to the hypothesized relationships between extroversion-introversion and the external-internal dimension of thinking style.

To explore the relationships between thinking style measures and standardized test performance, the correlations between the 12 measures of thinking styles and SAT-I-Verbal and SAT-I-Math scores were examined. The correlation of *global* style and SAT-I-Verbal score was statistically significant ($r = .42, p < .01$), suggesting that students who are more verbally able prefer to operate at higher levels of abstraction than students who are less verbally able students. No other correlations were statistically significant. Previous findings suggest a relationship between *judicial* style and academic performance (Grigorenko & Sternberg, 1997), but no such relationship was found in the present study.

To probe differences in thinking styles between gifted students and the general student population, the mean responses of the 12 subscales in this sample were compared with those of the norming group of comparable ages and grades (grades 7-12). Table 4 presents means and standard deviations of all measures for boys and girls. The mean score of *legislative* ($M = .5.35$) and *judicial* ($M = 4.47$) styles would place this group of gifted students at about the 75 percentile of the norming group (Sternberg & Wagner, 1991). The mean score of *executive* style ($M = 4.11$) would place them right at the 50th percentile of the norming group. The mean score of *liberal* style for this sample was 5.30, which is somewhere between the 75th and 90th percentiles. Together, these initial comparisons suggest that gifted students as a group may be more legislative, liberal, and judicial than average students.

Since single mean comparisons provide only a profile of an average gifted student, a cluster analysis using the two second-order factor scores (*intellectual independence* and *executive-methodical functioning*) was conducted; it yielded three

Means and Standard Deviations (SD) of the 15 Scales of the Thinking Styles Inventory and Junior Eysenck Personality Inventory

Constructs	Means and SD	Constructs	Means and SD
Legislative	5.35 (.95)	Monarchic	4.19 (.73)
male ($n = 58$)	5.36 (.98)	male	4.20 (.75)
female ($n = 38$)	5.35 (.90)	female	4.16 (.72)
Executive	4.11 (1.02)	Anarchic	4.79 (.97)
male	4.05 (1.06)	male	4.74 (1.02)
female	4.21 (.98)	female	4.86 (.88)
Judicial	4.47 (.98)	External	4.36 (1.26)
male	4.29 (.93)	male	4.26 (1.42)
female	4.74 (1.00)	female	4.53 (.97)
Global	4.29 (.90)	Internal	4.70 (1.16)
male	4.32 (.97)	male	4.67 (1.20)
female	4.24 (.78)	female	4.76 (1.11)
Local	4.16 (.92)	Extroversion	16.38 (5.26)
male	4.15 (.87)	male	16.05 (5.87)
female	4.19 (1.01)	female	16.89 (4.16)
Liberal	5.30 (1.07)	Neuroticism	12.33 (5.59)
male	5.21 (1.13)	male	12.43 (5.55)
female	5.43 (1.00)	female	12.16 (5.72)
Conservative	3.73 (1.12)	Lie	2.82 (2.15)
male	3.76 (1.22)	male	2.81 (2.04)
female	3.68 (.96)	female	2.83 (2.34)
Hierarchic	4.49 (1.19)		
male	4.29 (1.07)		
female	4.80 (1.31)		

Table 4

relatively homogeneous groups. Univariate analyses of variance (ANOVA) were conducted to test the significance of mean differences among the three groups on the two higher-order measures. The mean difference for *intellectual independence* was statistically significant, $F(2, 93) = 53.41, p < .001$, as was the mean difference on *executive-methodical functioning*, $F(2, 93) = 92.57, p < .001$. The first group, the High/High group ($n = 32$, 18 boys and 14 girls), can be described as a *complex group*, since it was high in both innovative and critical thinking ($M = 5.17$) and conventional and methodical thinking ($M = 4.81$). The second group, the Median/Median group ($n = 36$, 23 boys and 13 girls), can be described as an *undifferentiated group*, for its profile shows no elevation in either *intellectual independence* ($M = 4.08$) or *executive-methodical functioning* ($M = 3.94$). The third group, the High/Low group ($n = 28$, 17 boys and 11 girls), can be described as a *self-consistent group* because it was high in innovative and critical thinking ($M = 5.03$) and low in conventional and methodical thinking ($M = 3.18$).

The results of the cluster analysis suggest that, at a more integrated level, more *legislative-liberal* (Sternberg, 1988) styles are not necessarily incompatible with *executive-conservative* (Sternberg, 1988) styles as demonstrated by the complex group. It should be noted that even though the factor analysis of the 12 subscales indicated some higher-order factors, lumping several measures of thinking styles together amounts to widening the conceptual boundary of dimensions of thinking style at the expense of precision.

Discussion

This study addressed two validity issues of the *Thinking Styles Inventory* in a study of gifted adolescent students. First, the measures of opposite thinking styles in this study were found to be less antithetical than previous research has suggested. For instance, the measures of local and global styles seem to measure two discrete dimensions in this sample, whereas earlier evidence suggested that they measure a single bipolar dimension because of the high negative correlation between the measures of *local* and *global* styles ($r = -.61$, Sternberg, 1994). The cluster analysis conducted in this study further indicates that some students endorsed both *legislative-liberal* and *executive-conservative* items, which apparently contradict each other.

The bipolar (i.e., unidimensional) versus discrete nature of conceptually opposite thinking styles is an important theoretical issue, because the conception of intellectual functioning as stylistic implies a certain degree of self-consistency. Yet complexity of the self-system often defies the either-or logic (Csikszentmihalyi, 1993). It is possible that some individuals can be both legislative and executive, local and global, anarchic and hierarchic, depending on the context of a specific task situation. It is also possible that some task situations invite both global and local, and legislative and executive styles. In scientific inquiry, for instance, hypothesis-generating involves the legislative function as well as high levels of abstraction in thinking, while hypothesis-testing demands attention to established rules and procedures, and attention to details. Thus, a student with a complex style profile may be more suited to the task demands than a student with a self-consistent profile for such an intellectual endeavor.

An earlier validation study has provided evidence that the underlying factor structure of the *Thinking Styles Inventory* is

generally consistent with the postulates of the theory of mental self-government (Sternberg, 1994). The present study, however, yielded mixed results. The *legislative, liberal, anarchic, judicial, internal, and local* styles loaded on the same factor for this sample of gifted students. The *legislative, liberal* and *anarchic* styles are conceptually more congenial to one another than they are with *judicial* and *local* styles. Yet it appears that, for gifted students, a disposition for innovative (*legislative* and *liberal*) thinking is highly associated with critical and analytical thinking which seems to underlie *judicial* and *local* styles. We have labeled this emergent dimension *intellectual independence*, though its nature is still not well understood. The relationship found between an *internal* style and *legislative* and *liberal* styles was not predicted. However, it is consistent with the creativity literature which has found that a preference for less-structured learning conditions (i.e., more *legislative* and *liberal*) tends to go along with a preference for solitary play and activity in gifted students (Torrance, 1986). Taken together, the underlying factor structure of the *Thinking Styles Inventory* in this study suggests fewer dimensions than postulated by the theory of mental self-government.

Since the study reported by Sternberg (1994) used a sample of college students while the present study investigated a sample of gifted secondary students, the differential internal validity of the measures may be a function of age and sample. In other words, *Thinking Styles Inventory* may be less discriminative of different dimensions of stylistic difference among high-ability adolescent students. Nevertheless, the results of the present study suggest that gifted adolescent students are quite diverse in thinking styles despite the fact that they have a relatively homogeneous profile of academic abilities and achievement.

With respect to external convergent and discriminant validities of the *Thinking Styles Inventory*, this study yielded evidence that the thinking styles measures are different from traditional measures of personality traits. The *Thinking Styles Inventory* mainly assesses intellectual styles (e.g. *legislative, executive, and judicial* styles, *local* and *global*) and self-management styles or dispositions (e.g., *hierarchic, monarchic* styles), which have less to do with interpersonal matters and more to do with contexts of learning and skilled performance. The only exception is the scope of mental self-government, the *internal* and *external* styles, which concerns individuals' interpersonal styles (solitary versus collaborative). Thus, its connection with *extroversion* is expected.

Further research is needed to clarify the nature of thinking styles as assessed by the *Thinking Styles Inventory*. Conceptually, the style dimensions postulated by the theory of mental self-government bear some resemblance to extant style constructs. For instance, *legislative-liberal* and *executive-conservative* styles parallel the innovative-adaptive dimension postulated by Kirton (1976), and even the investigative and conventional dimensions in Holland's (1992) theory of vocational personality. One would also speculate that the measures of *liberal* style should be correlated with *openness to experience* in the Big Five theoretical framework of Costa & McCrae (1992), for this dimension also taps into intellectual rather than interpersonal styles. However, since the measures of the *Thinking Styles Inventory* were developed within the framework of the theory of mental self-government, they have presumably carved up different style dimensions within the same style space (Sternberg & Grigorenko, 1997). Future research on the *Thinking Styles Inventory* or other measures of the same sort should determine the shared and unique features of these

newly proposed constructs of thinking styles. Furthermore, the loci of the proposed thinking styles also need to be determined. One may hypothesize that legislative and executive styles, internal and external styles are more personality-based; that is, they reflect general personal inclinations, whether innate or nurtured or both. In contrast, local and global styles may be more cognition-based, similar to conceptual tempo or field dependence, which reflects differential cognitive modes of functioning and over which one has less volitional control. In addition, research using different methods of assessing thinking styles other than self-report is necessary to assess the convergent validity of the constructs in question.

Implications for Gifted Education

Sternberg and Grigorenko (1993) suggested that a thinking style perspective can shed light on a wide range of issues and controversies in gifted education (identification, programming, and evaluation). This study suggests that gifted students do indeed differ in their stylistic approaches to academic tasks. The question is whether we should expose them to different learning and performance conditions to make them well-rounded so that they can deal effectively with a variety of task demands and performance conditions, or should we provide optimal person-environment matches to maximize learning and performance? The answer is probably both. On the one hand, students function best when tasks and situations match their abilities and styles. Thus *legislative* or *liberal* students will hopefully become future leaders or inventors by virtue of the educational provisions that are tailored to their individual styles and preferences. On the other hand, certain thinking styles or dispositions and working habits may be crucial for gifted students' future success. For example, it is possible to help the "undifferentiated" group identified in this study develop a more distinct *legislative* or *judicial* style, since their current and future creative endeavors may require these personal dispositions. Although there are no good or bad thinking styles in an absolute sense, thinking styles formulated as such are not value-free. The *legislative*, *liberal* or *judicial* style is preferred to the *executive* or *conservative* style precisely because we want these gifted students to become more creative and critical thinkers.

Renzulli (1986) distinguished two types of gifted performance. Schoolhouse giftedness is characterized by the ease of knowledge acquisition and test-taking proficiency as demonstrated with high grades and high test scores. In contrast, creative-productive giftedness involves generating new ideas and products designed to have an impact on a targeted audience or field. Likewise, Simonton (1996) described those who have mastered and perfectly followed the rules and skills of a domain but have never gone beyond, as demonstrating "received expertise." He advocated "creative expertise" which is evident when people not only can master and follow rules but can also break existing rules or create new rules. From a thinking style perspective, the conventional approach (*executive* and *conservative* styles) to tasks helps develop the first type of gifted behavior or expertise, and the innovative approach (*legislative* and *liberal* styles) nurtures the second type. Typically, classroom instruction and learning, especially at the secondary level, tend to favor the conventional approach (Sternberg, 1997; Sternberg & Grigorenko, 1995). Yet even "schoolhouse gifted" students tend to be more *legislative* than average students as shown in this study. Bridging the gap between the knowledge-receiving mode and knowledge-producing mode, between schoolhouse excellence and real-life

creative-productive accomplishments, demands that educators of the gifted nurture dispositions for creative and critical thinking through effective programming and appropriate evaluation.

Teachers of gifted students will be in a better position to nurture those desirable personal qualities or dispositions in students if they are aware of individual differences in thinking styles. A conservative student may feel insecure when encountering uncertain task conditions, just as a liberal student may feel bored by repetitious and routine activity. Sensitivity to these subtle individual differences will enable teachers to work more effectively with students with different thinking style profiles.

Gifted students can also benefit from awareness of their own thinking styles. It was assumed by using these self-reported measures in the present study that students are more or less aware of their own thinking habits, styles, and preferences. However, deliberate exercise of metacognition and self-regulation to capitalize on one's strengths and compensate for one's weaknesses is another matter. Although the findings of the present study are somewhat inconclusive as to the nature and relationships of thinking styles among gifted students, the construct of thinking styles can certainly be used as a heuristic tool by educators and parents to raise self-awareness among gifted students concerning their own intellectual dispositions and habits of mind. These intellectual dispositions and habits may be as important as their intellectual abilities in the talent development process and future productive-creative achievement.

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