A Threefold Model of Intellectual Styles

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The field of styles presents three major controversial issues: styles as value-laden versus value-free, styles as traits versus states, and styles as different constructs versus similar constructs with different labels. We address these issues by proposing an integrative model of styles—the Threefold Model of Intellectual Styles—which divides all styles into three basic kinds. The foundation of this model is Sternberg and Zhang's body of empirical investigations into the thinking styles proposed in the theory of mental self-government. The model also draws upon others' previous empirical findings in the literature. The model argues that most styles are value-laden rather than value-free; that they have both trait-like and state-like aspects, but for the most part are modifiable and hence more state-like; and that they overlap highly across theories.

Jack loves to come up with his own ways of doing things. He prefers unstructured assignments and to come up with his own essay and project topics rather than being told what to do. Jill prefers to be given fairly explicit directions regarding how to do things. She prefers more structure in assignments and to be given an essay or project topic, or at least a choice of topics. Jack and Jill have different *intellectual styles*.

Intellectual Styles

In this article, intellectual style is used as a general term that encompasses the meanings of all major "style" constructs postulated in the past

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few decades, such as cognitive style, conceptual tempo, decision making and problem-solving style, learning style, mind style, perceptual style, and thinking style. An intellectual style refers to one's preferred way of processing information and dealing with tasks. To varying degrees, an intellectual style is cognitive, affective, physiological, psychological, and sociological. It is cognitive because whatever styles one uses to process information, one must be engaged in some kind of cognitive process. It is affective because one's way of processing information and of dealing with a task (i.e., employing an intellectual style) is partially determined by how one feels about the task. If one is genuinely interested in the task at hand (assuming that the task does require one to be creative and to have a deep understanding), one may, for example, use the legislative thinking style or the deep learning approach. On the contrary, if one feels indifferent about the task at hand, one may simply use the executive style or the surface approach to learning. It is partially physiological because the use of a style is partially influenced by the way our senses (e.g., vision, hearing, and touch) take in the information provided to us. It is psychological because the use of a particular style is partially contingent upon how one's personality interacts with one's environment. Finally, it is sociological because the use of a style is affected by the preferences of the society in which one lives for various ways of thinking.

Concepts Underlying Intellectual Styles

A careful examination of the nature of the various intellectual styles indicates that any style may have one or more of the following concepts as part of its underpinnings. These are one's preference for high degrees of structure versus low degrees of structure, for cognitive simplicity versus cognitive complexity, for conformity versus nonconformity, for authority versus autonomy, and for group versus individual work. Although these dimensions of preference are placed in bipolar terms, the pair of descriptors for each dimension can be viewed as two ends of a continuum.

Problems and Problem-Solving

Intellectual styles, as an individual-difference variable in human performance, have been investigated over many years (see review in Sternberg, 1997). Until recently, the field of styles was characterized by the conundrum that different styles are supposed to be not better or worse, but simply different. However, for many styles, this is not true. For example, field

independence—a propensity for being able to orient oneself in space without regard to one's particular surroundings—is generally more adaptive than field dependence—the propensity to orient oneself in accord with the surroundings in which one finds oneself. A pilot who is field independent, for example, is at a big advantage over one who is field dependent in case of poor visibility. Similarly, a diver under water who is field independent is less likely to drown than one who is field dependent. Reflectivity, a tendency to ponder what to do before doing it, is generally more adaptive than blind impulsiveness. In general, some styles are more adaptive than are others. At the same time, other styles seem truly to be neither better nor worse. For example, being internal or external—more introverted or extraverted in one's work orientation—can be seen as equally advantageous, depending on the situation. The internal person may be at an advantage when working alone, the external person, when working in a group. In a similar vein, the field of styles has also left unresolved two other controversial issues: styles as relatively permanent traits versus relatively labile states, and styles in different theories as entirely different constructs versus similar constructs with different style labels.

The goal of this article is to address these paradoxical issues through the construction of an integrative model of intellectual styles—the Threefold Model of Intellectual Styles. The model is based on empirical findings from our own studies as well as those from other investigators documented in the literature. The article consists of four parts. The first part recapitulates the history of the field of styles; in particular, it describes four major existing integrative models of styles, followed by an introduction of three major controversial issues in the field. The second part illustrates Sternberg's (1997) theory of mental self-government and the research supporting it. The third part presents a new integrative model of styles: the Threefold Model of Intellectual Styles. The final part of this article discusses the contributions of the new model, proposes a possible research agenda for testing the model, and describes the implications of the model for educational practice.

A BRIEF HISTORY OF THEORY AND RESEARCH ON STYLES

For more than half a century, scholars and educators have investigated the roles of styles of thinking and learning in human performance. However, until recently, the field of styles was characterized more by disorder than by order. To begin with, scholars do not all agree on the origin of the concept of style in cognitive psychology. Scholars have attributed the origin of this concept in cognitive psychology differently—some to classical

Greek literature (see Vernon, 1973), others to James's (1890) conception of individual differences, others to Allport's (1937) idea of "life styles," and still others to Jung's (1923) theory of personality types (see Sternberg and Grigorenko, 1997). Similarly, works on styles have roots in diverse research traditions, most notably, differential psychology, psychoanalytic ego psychology, and the experimental psychology of cognition (see Messick, 1994).

Within the first few decades of research on styles, especially during the "golden age" of the styles movement from the late 1950s to the early 1970s, a diverse and even massive collection of theories and models of styles resulted in various labels with the root word "style" (see Messick, 1984; Riding and Cheema, 1991), including cognitive style, defensive style, expressive style, responsive style, and learning style, among others. As a result, styles are perceived as multidimensional. Different theorists emphasize different dimensions of styles in their conceptualizations and place emphasis on different criterion features in their assessments of styles. In the history of the styles literature, this diversity in theorization and research contributed to the sometimes seemingly chaotic state of the work on styles. This lack of convergence and, ultimately, aimlessness eventually led to a reduction in the quantity (and, arguably, quality) of styles research between the early 1970s and the mid 1980s (e.g., Jones, 1997a; Riding and Cheema, 1991). As Riding and Cheema (1991) explained, "... many researchers working within the learning/cognitive style research fail[ed] to mention the existence of other types of style" (p. 193).

The last couple of decades, however, have witnessed a resurgence of interest in the study of styles in both academic and nonacademic settings. This interest is manifested through two types of work. The first type is conceptual integration of previous work on styles as well as proposals of new styles. The second type is empirical research aimed at investigating the relationships among the different style labels.

Among the efforts in conceptual integration, four major integrative models of styles particularly stand out. Consider each in turn.

Curry's Model

The first model is Curry's (1983) three-layer "onion" model. Curry proposed that nine of the major learning-style measures can be organized into three layers resembling those of an onion. The innermost layer of the style onion is composed of measures of personality dimensions. The middle layer comprises style measures that assess information processing. The outermost layer consists of measures assessing individuals' instructional preferences. In her 1983 article, Curry pointed out that the validity of this model is supported by data indicating the following two results. First, the

three measures in any one layer of this model assess the same thing, or at least the three measures are more closely related to one another than they are to measures from the other two layers. Second, the innermost layer (cognitive personality) is shown psychometrically to be essential to the other two layers. Moreover, in her proposed design for research, Curry (1983) pointed out that all research participants should respond to all nine instruments.

Curry's (1983) model has explicitly addressed the issue of malleability of styles. She hypothesized that styles in the outermost layer of the onion (i.e., instructional preferences) are the most modifiable and that styles in the innermost layer (i.e., personality styles) are the most stable. That is to say, the degree of malleability determines where styles go in the successive layers. Some empirical evidence confirms this hypothesis. For example, Ingham (1989) validated the concept of nested levels in prediction patterns between learning styles in the middle layer and instructional formats in the outermost layer. The correlations among the styles within each layer were higher than were those among the styles across the two layers. Also, for instance, using Curry's model, Melear (1989) explained the relationships between a then-new learning style inventory (The Learning Style Profile, Keefe and Monk, 1989) and the Myers-Briggs Type Indicator (MBTI, Myers and McCaulley, 1988). The MBTI is a personality type inventory assessing four dimensions of preferences: extroversion-introversion (how one approaches the outer world), sensing-intuitive (how one perceives and takes in information), thinking-feeling (how one makes decisions), and judging-perceiving (how one deals with the outer world). Table I provides a brief description of each individual personality type.

Unfortunately, so far, barely any effort has been made to obtain the two results that, according to Curry, should provide empirical evidence for the validity of the model. The only attempt made to administer all of the nine inventories included in the 'onion' model to all participants in the same research was Curry's (1991) study of "patterns of learning style" among professionals across a few selected medical specialties. However, the central goal of this study was merely to observe the style differences among professionals of different medical fields.

Miller's Model

The second model is Miller's (1987) model of cognitive processes and styles. Miller views cognitive styles as comprising individual differences in the various subcomponents of an information-processing model of three main types of cognitive processes: perception, memory, and thought.

Table I. Individual Styles in Nine Style Models

Style construct	Individual style	Key characteristics
Learning approach	Surface	Reproduce what is taught to meet the minimum requirement
	Deep	Gain a real understanding of what is learned
Career personality type	Achieving	Maximize one's academic grades
	Realistic	Work with things
	Investigative	Engage in scientific kinds of work
	Artistic	Deal with tasks that provide opportunities to use imagination
	Social	Work in situations that provide opportunities to interact with others
	Enterprising	Work in environments in which leadership opportunities are available
	Conventional	Work with data under well-structured situations
Mode of thinking	Holistic	Process information in an intuitive, Gestalt-type, and synthesized manner
	Analytic	Process information in a piecemeal, analytical, and sequential manner
	Integrative	Process information in an interactive and dynamic way
Personality type	Extroversion	Enjoy action-oriented activities and group interactions
	Introversion	Enjoy reflection and individual efforts
	Sensing	Rely primarily on concrete information provided by the five senses
	Intuitive	Like to find general patterns and new ways of doing things
	Thinking	Rely primarily on impersonal and analytic reasoning in making decisions
	Feeling	Rely primarily on personal and social values in making decisions
	Judging	Prefer more structured learning environments
	Perceiving	Prefer learning situations that are more free, open, and flexible
Mind style	Abstract random	Approach learning holistically and prefer to learn in an unstructured way
	Concrete-sequential	Extract information through hands-on experiences and prefer well-structured work environments
	Abstract-sequential	Adopt a logical approach to learning and strong in decoding written, verbal, and image symbols
	Concrete random	Take trial-and-error, intuitive, and independent approaches to learning
Decision-making style	Innovative	Work in non-traditional ways and not concerned with the social consequences of producing less acceptable solutions
	Adaptive	Work within existing frameworks and minimize risks and conflicts

Table I. Continued

Style construct	Individual style	Key characteristics
Conceptual tempo	Reflective	Tend to consider and reflect on alternative solution possibilities
	Impulsive	Tend to respond impulsively without sufficient forethought
Structure of intellect	Divergent	Deal with problems in a flexible way and tend to generate multiple solutions to a single problem
	Convergent	Deal with problems in a mechanical way and tend to see a problem and a solution as having a one-to-one relationship
Perceptual style	Field independent	Tend to see objects or details as discrete from their backgrounds
	Field dependent	Tend to be affected by the prevailing field or context

He suggested that all cognitive styles are subordinate to a broad stylistic dimension: analytic-holistic. According to Miller, at the analytic pole of this organization, there are such styles as field independence, sharpening, converging, and serial information processing; at the holistic pole, there are such styles as field dependence, leveling, diverging, and holistic information processing. Miller (1987) argued that the analytic-holistic dimension is composed of cognitive styles, each contributing to a consistent individual difference in cognitive processing. However, as Messick (1994) has rightfully pointed out, this proposed organization of styles is merely a heuristic device, rather than a synthesis of empirical findings. Furthermore, we argue that this bi-polar organization of styles has one major limitation: It allows only for the integration of style models that address bipolar styles.

Following the development of his model of information processing and styles, Miller made several attempts at incorporating a personality typology of cognitive, affective, and conative dimensions into his 1987 model (e.g., Miller, 1988, 1991a,b). In these works, Miller provided preliminary empirical evidence for his more recent model. However, Miller's contemporary model requires more extensive investigation.

Riding and Cheema's Model

The third model is Riding and Cheema's (1991) integrative model of cognitive styles. Based on the descriptions, correlations, methods of assessment, and effects on behavior of more than 30 style labels, Riding and Cheema concluded that they could be grouped into two

principal cognitive-style dimensions: wholistic-analytic and verbal-imagery. The former adimension concerns whether an individual tends to process information in wholes or does so in parts; the latter pertains to whether an individual has a tendency to represent information by thinking verbally or in terms of mental pictures.

The Cognitive Styles Analysis (CSA, Riding, 1991) was designed to measure the two style dimensions. The CSA is a computer-based measure comprising three subtests, one assessing the verbal-imagery dimension, and the other two assessing the wholistic-analytic dimension. The instrument works on the basis of responses to a series of 48 statements (to be judged true or false) and computes a ratio for both dimensions. No reliability data were reported by Riding (1991). The construct validity of the inventory was supported by the findings that the two style dimensions are independent of each other and that they are independent of intelligence (Riding and Pearson, 1994). Jones (1997a) concluded that, except for the reflectivity-impulsivity style, other styles included in the wholistic-analytic family support Riding and Cheema's integration of styles. Recently, Peterson *et al.* (2003) found that the wholistic-analytic dimension as measured by Riding and Cheema reaches a satisfactory level of reliability only if the CSA is doubled in length.

There is good supporting empirical evidence for the two style dimensions. Many of the studies conducted by Riding and his colleagues are documented in Riding (1997) and Riding and Rayner (1998). The research indicates that the two cognitive style dimensions are associated with such elements of learning as learning performance, learning preferences, and subject preferences; with conduct behavior and occupational behavior; and with physical well-being. Furthermore, the two style dimensions have been tested in many empirical studies conducted by other scholars (e.g., Adams, 2001; McKay, 2000; Russell, 1997). As Jones (1997a) has put it, Riding and Cheema's (1991) work has been serving as a catalyst for cognitive-styles research.

Grigorenko and Sternberg's Model

The final and most recent endeavor in integrating works on styles is Grigorenko and Sternberg's (1995; Sternberg, 1997) model. According to this model, work on styles takes one of three approaches (or, put another way, falls into one of three traditions): cognition-centered, personality-centered, and activity-centered. Styles in the cognition-centered tradition most closely resemble abilities. Moreover, like abilities, styles in this tradition are measured by tests of maximal performance with "right" and

"wrong" answers. Within this tradition, two models of styles have aroused the most interest: Witkin's (1962) field-dependence/independence model and Kagan's (1976) reflectivity-impulsivity model. The personality-centered tradition considers styles as most closely resembling personality traits. Furthermore, like personality traits, styles in this tradition are measured by tests of typical, rather than maximal performance.

Myers and McCaulley (1988) have done important work in this tradition, basing their ideas on Jung's (1923) theory of personality types. Holland's (1973, 1994) theory of vocational types and Gregorc's (1979) model of types of styles also fall into this tradition. The activity-centered tradition emphasizes that styles are mediators of activities that arise from both cognition and personality. One major group of works in this tradition is represented by similar theories of deep- and surface-learning approaches proposed by, Marton (1976), Biggs (1978), Entwistle (1981), and Schmeck (1983). Moreover, Renzulli and Smith (1978) proposed different learning styles, with each corresponding to a method of teaching, such as discussion, drill and recitation, and lecturing.

The validity of Grigorenko and Sternberg's integrative model of three kinds of styles has not been tested. However, testable predictions for this model can be easily derived from their definition of each of the three approaches to the study of styles. We predict that any style construct is more closely related to other style constructs within the same approach than it is to styles from a different approach. We further predict the following relationships: (1) cognition-centered styles are more closely related to abilities than are styles of the other two approaches; (2) personality-centered styles are more closely related to personality traits than are styles from the other two approaches; and (3) activity-centered styles are more closely related to learning strategies than are styles from the other two approaches.

Meanwhile, scholars are increasingly interested in examining the relationships among different style constructs. Earlier studies with the aim of clarifying the relationships among different style constructs were based on only a few classical models of styles, such as Witkin's model of field-dependence/independence, Kagan's model of reflectivity-impulsivity, and Jung's (as well as Myers and McCaulley's) personality types. After a thorough search on the PsycInfo database, Zhang (2000a) organized the then existing studies of style relationships according to Grigorenko and Sternberg's three traditions in the study of styles. She concluded that more recent studies were increasingly based on theoretical models with more cogent implications for the teaching-learning process. However, studies are lacking that examine the relationships among the style constructs from the three traditions based on more general theories of styles.

Comparing and Contrasting the Four Integrative Models

Obviously, all four integrative models have achieved the goal of bringing the existing style constructs under one umbrella. However, the four models are created by two different approaches: a systems approach and an information-processing approach. Curry's and Grigorenko and Sternberg's models take the former approach; Miller's and Riding and Cheema's models take the latter.

Both Curry's and Grigorenko and Sternberg's models classify existing style constructs into three systems: personality dimensions, mental processes, and behavior-oriented dimensions. However, there are also two differences between the two models. First, whereas personality dimensions are the core of Curry's model, the three systems are viewed as three parallel systems in Grigorenko and Sternberg's model. Second, whereas Curry believes that the degree of style malleability varies among the three systems, with the innermost system the most stable and the outermost system the most modifiable, Grigorenko and Sternberg do not make such a distinction. Sternberg (1997) believes that styles are malleable, depending on the stylistic demands of a given task.

Similarly, both Miller's and Riding and Cheema's models put emphasis on mental processes. Yet, the two models stress mental processes from rather different perspectives. In Miller's model, under one stylistic dimension (analytic-holistic), three specific kinds of cognitive processes (perception, memory, and thought) are at the core of investigation. Riding and Cheema's model, however, stresses two stylistic dimensions. The wholistic-analytic dimension concerns how one processes information, and the verbal-imagery dimension addresses how one represents information.

Conclusion

Despite the new efforts in theory and research on styles, at least three major controversial issues remain in the field. The first is the debate over whether styles represent traits (and thus are stable and unchangeable) or states (and thus are flexible and modifiable). The second is the debate over whether styles are value-laden or value-free. The third is the debate over whether different style labels represent different style constructs or are similar constructs but with different root words describing those styles.

THE THEORY OF MENTAL SELF-GOVERNMENT

This part of the article presents the theory of mental self-government and the research evidence supporting it. Furthermore, we present our view

of the three controversial issues regarding intellectual styles. We place strong emphasis on the theory of mental self-government in this article because the research based on this theory is the starting point for the establishment of our new integrative model of intellectual styles, to be illustrated in the next part.

In an effort to resurrect previous works in the field of styles, Grigorenko and Sternberg (1995) integrated the earlier works on styles into three traditions. Sternberg also has taken things a step further by constructing a theory of styles—the theory of mental self-government (Sternberg, 1988, 1997). Using the word "government" metaphorically, Sternberg contended that just as there are many ways of governing a society, there are many ways of governing or managing our activities. These different ways of managing our activities can be construed as our thinking styles. Thinking styles are defined as our preferred ways of using the abilities that we have. In managing our activities, we choose styles with which we feel comfortable. Moreover, we are at least somewhat flexible in our use of styles and try with varying degrees of success to adapt ourselves to the stylistic demands of a given situation. For example, an individual using the legislative style when writing a novel may prefer to use the executive style when setting up a VCR/DVD player according to written instructions. Moreover, styles may change with time and with life demands. One of the important features of thinking styles, according to Sternberg, is that they are at least partially socialized, suggesting that thinking styles can be cultivated and modified.

The theory of mental self-government describes thirteen thinking styles that fall along five dimensions. There are three functions (legislative, executive, and judicial styles), four forms (hierarchical, oligarchic, monarchic, and anarchic styles), two levels (global and local styles), two scopes (internal and external styles), and two leanings (liberal and conservative styles) of mental self-government. Table II presents a brief description of each of the thinking styles.

The theory of mental self-government can be viewed as a general model of styles not only because the theory can be applied to various settings—academic and nonacademic—but also because it embraces all three traditions in the study of styles. The styles in this theory are cognitive in their way of looking at things (e.g., judicial style, global style, and so forth) and correspond to preferences in the use of abilities. But the styles are typical-performance, rather than maximal-performance. Therefore, they resemble the personality-centered tradition. Finally, the styles resemble the activity-centered tradition in that they can be measured in the context of ongoing activities.

Apart from being general, the theory of mental self-government also possesses two differentiating characteristics when compared with most

Table II. Thinking Styles in the Theory of Mental Self-government

Dimension	Thinking style	Key characteristics
Function	Legislative	Work on tasks that require creative strategies; Choose one's own activities.
	Executive	Work on tasks with clear instructions and structures; Implement tasks with established guidelines.
	Judicial	Work on tasks that allow for one's evaluation; Evaluate and judge the performance of other people.
Form	Hierarchical	Distribute attention to several tasks that are prioritized according to one's valuing of the tasks.
	Monarchic	Work on tasks that allow complete focus on one thing at a time.
	Oligarchic	Work on multiple tasks in the service of multiple objectives, without setting priorities.
	Anarchic	Work on tasks that would allow flexibility as to what, where, when, and how one works.
Level	Global	Pay more attention to the overall picture of an issue and to abstract ideas.
	Local	Work on tasks that require working with concrete details.
Scope	Internal	Work on tasks that allow one to work as an independent unit.
	External	Work on tasks that allow for collaborative ventures with other people.
Leaning	Liberal	Work on tasks that involve novelty and ambiguity.
	Conservative	Work on tasks that allow one to adhere to the existing rules and procedures in performing tasks.

previous models of styles. First, the styles it specifies fall along five dimensions, rather than along one. Second, the theory yields a profile of styles for each individual, rather than merely the identification of a single style.

The theory of mental self-government has been operationalized through several instruments, including the Thinking Styles Inventory (TSI, Sternberg and Wagner, 1992; see also Sternberg, 1997). The TSI is a 65-item self-report measure in which respondents rate themselves on a 7-point scale ranging from 1 (*low*) to 7 (*high*) on a number of preferences. Examples of items from the inventory are: (1) "I like tasks that allow me to do things my own way" (legislative), (2) "I like situations in which it is clear what role I must play or in what way I should participate" (executive), and (3) "I like to evaluate and compare different points of view on issues that interest me" (judicial). The TSI went through a translation and back-translation procedure between Chinese and English in 1996. More recently, it has gone through a revision, resulting in both Chinese and English versions (Sternberg *et al.*, 2003). For the revised inventory, with the exception of that for the anarchic scale, Cronbach's alpha coefficients for the scales range from the low .70s to the high .80s. Cronbach's alpha coefficient for the anarchic scale is in the mid .50s. Internal validity of the inventory was

assessed through factor analysis. Results of factor analysis support the theory. External validity of the inventory was assessed by examining the nature of thinking styles not only against a number of constructs that belong to the family of work on styles but also against a few constructs that are predicted to be related to thinking styles (see the remainder of this part for details).

In its original form, the Thinking Styles Inventory along with other inventories were tested in the United States by Sternberg and Grigorenko (1995; see also Grigorenko and Sternberg, 1997). Since 1996, Zhang, Sternberg, and their colleagues have conducted three main lines of research based on the theory of mental self-government in cross-cultural settings. The first and also the most basic line of research explores the relationships of thinking styles with various student and teacher characteristics, both personological (e.g., age, gender, birth-order, socioeconomic status, etc.) and situational (e.g., extracurricular activities and perceived learning or teaching environment). The second line of research investigates the role of thinking styles in various aspects of student learning and development, including academic achievement, self-esteem, cognitive development, personality, and psychosocial development. The third line of research identifies the nature of the relationships of thinking styles with style constructs proposed by other theorists, including Biggs's (1978, 1992) learning approaches (from the activity-centered tradition), Holland's (1973, 1994) career personality types (from the personality-centered tradition), and Torrance's (1988) modes of thinking (from the cognition-centered tradition). In the rest of this section, we present the major findings of the research centering on the theory of mental self-government (MSG) as they relate to the three controversial issues in the field of styles.

Trait Versus State

The first line of research has explored the relationships of thinking styles with various student and teacher characteristics. It was aimed at addressing the issue of whether styles represent traits or states. Although none of the studies was longitudinal and thus had a focus on examining the stability (versus flexibility) of thinking styles of individuals over time, several cross-sectional studies have indicated that students' thinking styles vary as a function of age, gender, birth order, academic discipline, socioeconomic status, work experience, traveling experience, and extracurricular experience (e.g., Sternberg and Grigorenko, 1995; Zhang, 1999a, 2001a; Zhang and Postiglione, 2001).

The studies also revealed that teachers' thinking styles differ, depending on age, gender, the subject matter and grade that they teach, professional experience outside school settings, the stylistic pattern of one's

school, and perceived work environment (see Sternberg and Grigorenko, 1995; Zhang and Sachs, 1997; Zhang and Sternberg, 2002). These empirical findings, although not obtained through longitudinal investigations, speak to the question of whether thinking styles represent stable traits or changeable states. For example, in both Hong Kong and the United States (Sternberg and Grigorenko, 1995; Zhang and Sachs, 1997), teachers with more teaching experience scored lower on the legislative style than did teachers with less teaching experience. This could be explained by the reality that new teachers need to keep trying different teaching strategies and adopting various teaching materials until they become comfortable with their teaching. On the contrary, experienced teachers already know what works best for them and thus may stop being creative in their work. Therefore, with increasing teaching experience, teachers' thinking styles in teaching may change from being more creative to being more conservative.

As another example, Zhang and Sachs (1997) found that both students and teachers in natural science and technological disciplines scored higher on the global thinking style than did those in social science and humanities. This finding can be explained by the typical manner in which knowledge is acquired and applied in the two different academic fields. In acquiring and applying knowledge in natural science and technology, one can use the "universal truth" to solve problems in many subject matters. For example, mathematical knowledge is needed not only in such academic areas as economics, finance, accounting, statistics, and so on, but also in any scientific studies that are social, political, and cultural in nature. Thus, successful learning in the arena of natural science and technology may require one to think globally. On the contrary, knowledge in social science and humanities tends to be domain-specific even though there are numerous situations that require the integration of multiple disciplines.

A case in point is the differences between the grammatical rules in French and those in English. Each language has its own unique system of grammatical rules. Thus, successful learning in each language requires one to master the details (local style) in each language system. Therefore, because people from different fields of studies are exposed to different learning environments, their predominant thinking styles become different as time goes by. That is, the nature of an academic discipline modifies people's thinking styles. These differences in thinking styles of teachers and students based on both personological and situational characteristics lend support to the argument made by Sternberg—that thinking styles are at least partially socialized. Similarly, studies based on the theory of mental self-government conducted by other researchers (e.g., Kaufman, 2001; Tucker, 1999) also indicate that people's thinking styles vary as a function of their personal characteristics. For example, Kaufman (2001) found that journalists were

more executive in their thinking than were creative writers, whereas creative writers scored higher on the legislative style than did journalists.

People's thinking styles change as people interact within different environments (e.g., Zhang and Sachs, 1997; Zhang and Sternberg, 2002). People's thinking styles can be modified as a result of their life experiences. Consequently, we argue that thinking styles largely represent states, not traits. People may have proclivities, however, to enter into these states. That is, some people may prefer, say, a legislative way of seeing things, others, an executive way. But this is not to say that they could not change states and approach tasks differently if they desired to do so.

Value-Laden Versus Value-Free

This issue has been addressed by the second and third lines of research. The second line of research investigates the role of thinking styles in various aspects of student learning and development. The third line identifies the nature of the relationships of thinking styles with style constructs proposed by other theorists. Results from the second line of research reveal several findings.

Thinking styles that are more creative and that require higher levels of cognitive complexity (e.g., legislative, judicial, global, hierarchical, and liberal styles—labeled as "Type I thinking styles") were related to higher levels of self-esteem (Zhang, 2001a; Zhang and Postiglione, 2001), higher cognitive-developmental levels (Zhang, 2002a), the personality trait of openness to experience (Zhang, 2002b,c; Zhang and Huang, 2001), and a stronger sense of purposefulness concerning vocational purpose, avocational-recreational purpose, and style of life (Zhang, 2002d). Moreover, thinking styles that suggest favoring of norms and that denote lower levels of cognitive complexity (e.g., the executive, local, monarchic, and conservative styles—labeled as "Type II thinking styles") were related to lower self-esteem, lower cognitive-developmental levels, the personality trait of neuroticism, and a lack of sense of purposefulness.

Because creativity and cognitive complexity (characteristics of Type I styles) are both commonly viewed as positive human attributes, as are the variables with which these Type I styles are correlated (i.e., higher self-esteem, higher cognitive-developmental levels, openness to experience, and strong sense of purposefulness), Type I thinking styles carry positive adaptive value for many people. In contrast, blind favoring of existing norms (and thus, lacking in creativity in one's style) and cognitive simplicity (characteristics of Type II styles) are both typically viewed as relatively negative human attributes, as are the variables that these Type II styles are correlated with (i.e., lower self-esteem, lower cognitive-developmental levels,

neuroticism, and lack of sense of purposefulness). Thus, Type II thinking styles are of negative values for many people. Overall, this line of research indicates that thinking styles are value-laden, rather than value-free.

It is worth remembering that what is considered "positive" and what is considered "negative" varies over place and time. In a dictatorship, a Type I style may land one in prison, a Type II style, in a cushy government job. Moreover, some degree of conformity to norms is essential for successful adaptation in anyone's life.

The value-laden nature of thinking styles also emerges from a third line of research: identifying the relationships of thinking styles to style constructs from the three traditions of style studies. Results from this line of research indicate that Type I thinking styles are related to the deep approach to learning (Zhang, 2000a; Zhang and Sternberg, 2000), the artistic career personality type (Zhang, 2000b, 2001b), and the holistic mode of thinking (Zhang, 2002e,f); Type II thinking styles are related to the surface approach to learning, the conventional career personality type, and the analytic mode of thinking. Again, the style constructs related to Type I thinking styles (i.e., a deep approach to learning, an artistic career personality type, and a holistic mode of thinking) are usually perceived as superior to the style constructs related to Type II thinking styles (i.e., a surface approach to learning, a conventional career personality type, and an analytic model of thinking). The former set of style constructs along with Type I thinking styles thus carry positive adaptive values, whereas the latter set of style constructs along with Type II thinking styles carry negative adaptive values, at least in some contexts.

It should be noted that there is no clear pattern of relationships between four of the thinking styles (i.e., oligarchic, anarchic, internal, and external styles) from Sternberg's theory and any of the variables examined so far. Indeed, conceptually, these four styles are not easily categorized as either Type I or Type II thinking styles. These four styles may manifest the characteristics of both Type I and Type II styles, depending on the stylistic demands of the specific task. For example, whether one prefers to work alone (internal style) or prefers to work with others (external style), one can work on tasks that require either Type I or Type II thinking styles. Also, for instance, one could use the anarchic style in a sophisticated way, such as in dealing with different tasks as they arise, but without losing the whole picture of what one wants to achieve. Creative people are often, to some extent, anarchic, defying conventional ways of organizing knowledge and even themselves. Under this circumstance, the anarchic style manifests the characteristics of Type I thinking styles. On the contrary, one also could use the anarchic style in a simple-minded way, such as in dealing with tasks as they come along without knowing how each task contributes to one's ultimate

goal. Under this circumstance, the anarchic style manifests the characteristics of Type II thinking styles. These four thinking styles (i.e., anarchic, oligarchic, internal, and external) were not explicitly "labeled" in previous studies. Zhang recently referred to these styles as "Type III thinking styles" (see Zhang, 2003).

Different Style Constructs Versus Similar Constructs
With Different Style Labels

This issue is addressed by the third line of research. This research examines if style constructs from different theoretical models overlap. As mentioned earlier, studies along this line of research involve investigating the relationships of thinking styles with three style constructs, one from each of the three traditions in the study of styles: learning approach (activity-centered), career personality type (personality-centered), and mode of thinking (cognition-centered). Results from factor analysis indicate that scales in the measures of the two respective style constructs together (i.e., the measure of thinking styles with that of learning approaches, career personality types, and modes of thinking) overlap to a large degree. Regarding Biggs's learning approach, one such study (Zhang, 2000a) indicated that scales in the two measures (Thinking Styles Inventory and Study Process Questionnaire) overlapped overall by 69% in a first sample and by 75% in a second sample, whereas a second study (Zhang and Sternberg, 2000) identified an overlap of 19% in one sample and an overlap of 38% in the other. The great differences in percentages between the two studies suggest the need for a study that replicates this research. Still, it is clear that the two constructs overlap. In terms of Holland's career personality typology, although one study resulted in a 44% overlap between the measure of thinking styles and that of career personality types (Zhang, 2000b), a second study (Zhang, 2001b) obtained a 61% overlap between the two measures. Finally, in relation to Torrance's mode of thinking, one study (Zhang, 2002e) found an overlap of 76% between the measure of thinking styles and that of modes of thinking; a second study (Zhang, 2002f) identified a 55% overlap between the two measures. Table III presents more details regarding the samples involved in these studies.

Tucker (1999) claimed that the dominant thinking styles identified among accounting students indicated a profile of an individual resembling that described by researchers who used the Myers-Briggs Type Indicator (MBTI) in studying accounting professionals and accounting students. That is, the profile of an accounting professional/student as identified by the Thinking Styles Inventory is similar to that of an accounting professional/student described by other researchers using the MBTI.

Table III. Overlap: Scales of TSI With Those of SPQ, SVSDS, and of SOLAT

| | | | Culture | N | | % Overlap | Citation |
				Male	Female		
Learning approaches	Study 1	Sample 1	United States	19	48	69	Zhang, 2000a
		Sample 2	United States	14	51	75	
	Study 2	Sample 1	Hong Kong	362	492	19	Zhang and Sternberg, 2000
		Sample 2	Mainland China	114	101	38	
Career personality types	Study 1		Hong Kong	268	332	44	Zhang, 2000b
	Study 2		Mainland China	342	447	61	Zhang, 2001b
Modes of thinking	Study 1		Hong Kong	154	217	76	Zhang, 2002e
	Study 2		United States	85	126	55	Zhang, 2002f

   Thus, the style constructs involved in these external validity studies overlap substantially. These results, obtained through investigations in three different cultures (Hong Kong, mainland China, and the U.S.), lend support to many other studies that aim to identify relationships among different style constructs (see discussions under the heading "Style Constructs, Measurements, and Empirical Evidence" in the next part). Thus, there clearly are similarities among these style constructs. However, by no means do these substantial overlaps and similarities give us reason to assert that any two of these constructs are identical. Each construct makes a unique contribution to variance in the empirical data. Therefore, we believe that each of the theories of styles is valuable in its own way, at least to some extent.

FROM MENTAL-SELF-GOVERNMENT RESEARCH TO THE THREEFOLD MODEL OF INTELLECTUAL STYLES

   Apart from addressing three of the major controversial issues in the field of styles, results of this research on thinking styles indicate that much of the existing work on styles can be organized into a new integrative model—the Threefold Model of Intellectual Styles. This model is built upon the three types of thinking styles identified in the process of investigating the theory of mental self-government as well as upon previous findings in the styles literature. In the rest of this section, the Threefold Model of Intellectual Styles is delineated. This description includes (1) criteria for inclusion in the Threefold Model of Intellectual Styles and the style constructs included, (2) style constructs, their measurements, and empirical evidence, (3) the nature of intellectual styles, and (4) the three controversial issues within the context of the Threefold Model of Intellectual Styles.

Criteria for Inclusion in the Threefold Model of Intellectual Styles

   In selecting from the existing style models to be organized into the Threefold Model of Intellectual Styles, three criteria were applied. First, the models selected are among those commonly considered to be influential in the styles literature. Second, the style constructs defined in the models are operationalized and thus are empirically based. Finally, the style construct defined in a model has been tested against at least one other style construct. A survey of the existing models in the literature resulted in 10 style models/constructs that satisfy all three criteria. These are (1) Sternberg's thinking styles, (2) Biggs's (1978) learning approaches, (3) Holland's (1973) career personality types, (4) Torrance's (1988) modes

of thinking, (5) Myers and McCaulley's (1988) personality types based on Jung's (1923) work, (6) Gregorc's (1979) mind styles, (7) Kirton's (1961, 1976) adaption-innovation decision making and problem solving styles, 8) Kagan and his colleagues' (1964) reflective-impulsive styles, (9) Guilford's (1950) divergent-convergent thinking, and (10) Witkin's (1962) field-dependence/independence.

Style Constructs, Measurements, and Empirical Evidence

It is important, in reading our review, to keep in mind that whereas many theorists view people as "types," we do not. We view styles as flexible and modifiable as a function of the interaction of person, task, and situation. Hence, when we represent people as "types," we do so to preserve the meanings of the researchers, not because we believe that people are susceptible to simplistic pigeon-holing.

In this section, we describe each of the style constructs, one measurement for each construct (except for divergent-convergent thinking), and major empirical findings for each construct. It is worth noting that some of the research findings presented are, in fact, relevant to the discussion of the three major controversial issues in the styles field, although few studies are intended to serve such a function. Furthermore, because Sternberg's thinking-style construct and the research supporting it were elaborated in an earlier section, we begin the following discussion by describing Biggs's learning approach construct, its measurement, and the empirical findings.

Learning Approach and the Study Process Questionnaire

According to Biggs (1978), there are three common approaches to learning: surface, deep, and achieving. (See Table I for the description of each approach). The most widely used measure of the three learning approaches is the Study Process Questionnaire (SPQ, Biggs, 1987, 1992). The SPQ is a self-report test composed of 42 items falling into 6 subscales. For each item, the respondents rate themselves on a 5-point scale ranging from 1 (*low*) to 5 (*high*). The 6 subscales are: surface-motive, surface-strategy, deep-motive, deep-strategy, achieving-motive, and achieving-strategy.

Results from many studies show internal consistencies ranging from the mid .50s to the mid .70s for the six subscales. Both internal and external validity data for the SPQ are well documented in the literature. The internal validity is assessed by examining the internal structure of the instrument. Whereas some studies support Biggs's original argument that the SPQ assesses three approaches to learning (surface, deep, and achieving,

e.g., Bolen *et al.*, 1994; O'Neil and Child, 1984), other studies support a two-factor (surface and deep) model (e.g., Niles, 1995; Watkins and Dahlin, 1997). The two-factor model is consistent with the model proposed by Marton (1976), who used a phenomenographic method in studying students' learning approaches. In taking a phenomenographic approach, the researchers describe students' learning experiences from the perspective of students, rather than looking at students' learning as outsiders.

External validity of the measure is assessed by examining the SPQ against other instruments assumed to be based on constructs similar to those measured by the SPQ. The SPQ assesses similar constructs to Entwistle's (1981) Approaches to Studying Inventory (Wilson *et al.*, 1996) and Cantwell and Moore's (1996) Strategic Flexibility Questionnaire (Cantwell and Moore, 1998). The Study Process Questionnaire was also assessed for its heuristic value in educational settings in different parts of the world. Considerable work was done to investigate the impact of student characteristics and learning context upon the learning approaches that students take (e.g., Biggs, 1988; Sadler-Smith and Tsang, 1998). Meanwhile, a great deal of work also focuses on the relationships between students' learning approaches and their academic achievement (e.g., Albaili, 1997; Biggs, 1988; Zhang, 2000a). Moreover, putting Biggs's notion of learning approaches within the context of the styles literature, Zhang and Sternberg (2000; also Zhang, 2000a) examined the associations between learning approaches and thinking styles in Sternberg's (1988, 1997) theory of mental self-government. In both studies, students who reported a deep approach to learning scored higher on Type I thinking styles; students who reported a surface approach to learning scored higher on Type II thinking styles.

Career Personality Type and the Self-Directed Search

According to Holland (1973), people are characterized by six personality types corresponding to six occupational environments: realistic, investigative, artistic, social, enterprising, and conventional (see also Table I). The Self-Directed Search (SDS, Holland, 1985, 1994) is the most popular inventory used to assess the six career personality types. The SDS is a self-administered and self-scored inventory in which the respondents indicate their likes and dislikes of the activities and occupations in the six types of environments and rate their competencies in each of the six areas.

The SDS has been widely used in studies carried out in both Western and non-Western cultures (e.g., Bickham *et al.*, 1998; Brand *et al.*, 1994; Glidden and Greenwood, 1997). Apart from being used as a career-counseling tool, the SDS has also been examined against people's individual differences in other traits, such as competencies, values, and intellectual

styles. For example, Alvi and his colleagues conducted a series of three studies (Alvi *et al.*, 1988; Khan *et al.*, 1985; Khan and Alvi, 1986) on the relationships between Holland's career personality types as assessed by the SDS and Witkin *et al.*'s field-dependence/independence construct as assessed by the Group Embedded Figures Test (GEFT, Witkin *et al.*, 1971) among Canadian and Pakistani secondary and university students. The authors found, among both the Canadian and Pakistani samples, that students with two- or three-letter codes consisting of R (realistic), I (investigative), and A (artistic) in any order, obtained higher GEFT scores than did those with two- or three-letter codes composed of S (social), E (enterprising), and C (conventional).

In examining the relationships of thinking styles with career personality types, Zhang designed the Short-version Self-directed Search (SVSDS, Zhang, 1999b), which aims at overcoming the gender bias for which the SDS is often criticized and at maintaining the research participants' attention when responding to the questionnaire. The SVSDS is a self-report questionnaire containing 24 items, with each set of 4 items contributing to the assessment of one of the six career personality types.

Reliability and validity data of the SVSDS are recorded in two of Zhang's studies (Zhang, 2000b, 2001b). Cronbach's alpha coefficients for the six scales ranged from the mid .50 to the mid .80s, with the majority in the high .70s. Internal validity of the inventory was assessed by factor analysis. Both sets of data yielded a two-factor solution, with each factor containing high loadings from precisely the same scales. One factor is dominated by high loadings from the realistic, investigative, and conventional scales; the other is dominated by high loadings from the artistic, social, and enterprising scales. Each of the two factors consists of three career personality scales that are adjacent to one another, which is supportive of Holland's notion of "consistency" of the SDS scales. External validity of the inventory was assessed by testing its scales against the thinking styles in the Thinking Styles Inventory (Sternberg and Wagner, 1992) among Hong Kong Chinese and mainland-Chinese university students. Similar correlations were obtained in the two studies. The artistic career personality type was negatively correlated with Type II thinking styles, whereas the conventional career personality type was positively correlated with Type II thinking styles. Furthermore, the social and enterprising types were positively associated with the external thinking style, but negatively with the internal thinking style.

Mode of Thinking and the Style of Learning and Thinking

Mode of thinking has been traditionally known as brain dominance or hemispheric specificity. Research from the past 20 years suggests that the

two hemispheres are more dynamic than static and that they are more interactive than they were once believed to be. Thus, the terms "brain dominance" and "hemispheric specificity" have been gradually replaced by the terms "hemispheric style" and "hemispheric thinking style" (e.g., Albaili, 1993, 1996; Hassan and Abed, 1999). More recently, Zhang (2002e,f) cast the term "brain dominance" in yet another different light—that of mode of thinking. The three modes of thinking are the analytic (originally left-brain dominance), holistic (originally right-brained dominance), and the integrative (originally whole-brained) modes of thinking (see also Table I).

The Style of Learning and Thinking (SOLAT, Torrance *et al.*, 1988) is designed to measure alleged brain dominance. It is a self-report inventory, comprising 28 items (each containing two statements), with each item allowing the respondents to choose one of the two statements or both. One of the statements is supposedly characterized by left-brained dominance, the other by right-brained dominance. Choosing both statements results in scoring on the whole-brained dominance scale.

Reliability and validity statistics for the SOLAT (Youth Form) are reported in the SOLAT Administrator's Manual (Torrance, 1988). Cronbach's alpha is .77 for the analytic scale and .74 for the holistic scale. No reliability data are reported for the integrative scale. In her study of Hong Kong university students, Zhang (2002e) reported a Cronbach's alpha of .75 for the analytic scale, of .70 for the holistic scale, and of .85 for the integrative scale. Similarly, her study of U.S. university students (Zhang, 2002f) resulted in the following reliability data: .75 for the analytic scale, .73 for the holistic scale, and .83 for the integrative scale.

Not much can be found in the literature regarding the SOLAT's validity (Youth Form). However, as Torrance (1988) pointed out, evidence for its validity rests primarily upon evidence accumulated for a few older versions of the SOLAT (for details, see Torrance, 1988). In general, although creative problem-solving and creative thinking require both analytic and holistic modes of thinking, the essence of creative behavior calls for a holistic mode of thinking. Among the existing studies of brain dominance, several major findings emerge. First, male research participants are more right-brain dominant than are their female counterparts (e.g., Albaili, 1993; Helfeldt, 1983; Tan-Willman, 1981). Second, traditional schooling favors so-called left-brain dominant students while often ignoring or even penalizing so-called right-brain dominant students (e.g., Bracken *et al.*, 1979; Torrance *et al.*, 1976; Yellin, 1983). Third, creativity is highly associated with the use of the holistic mode of thinking (e.g., Harnad, 1972; Kim and Michael, 1995; Krueger, 1976; Okabayashi and Torrance, 1984; Tan-Willman, 1981; Torrance and Reynolds, 1978). Finally, brain dominance or mode of thinking can be developed (e.g., Bever and Chiarello, 1974; Gazzaniga, 1971;

Reynolds and Torrance, 1978) and each is socialized (e.g., Gadzella and Kneipp, 1990; Kinsbourne, 1982; Petty and Haltman, 1991).

Placing the mode of thinking (brain dominance) within the context of intellectual styles, Zhang (2002e,f) investigated the correlations between the modes of thinking as assessed by Torrance *et al.*'s (1988) Style of Learning and Thinking and the thinking styles as measured by the Thinking Styles Inventory (Sternberg and Wagner, 1992). In both studies, the holistic mode of thinking was related to Type I thinking styles, and the analytic mode of thinking was associated with Type II thinking styles.

Personality Type and the Myers-Briggs Type Indicator

Jung (1923) proposed that people attend selectively to elements in a learning environment, seeking out learning environments compatible with their alleged type, and avoiding or leaving incompatible environments. They also prefer to use certain learning tools and to avoid others. Furthermore, according to Jung, these preferences lie along three dimensions: extroversion-introversion, sensing-intuitive, and thinking-feeling. Myers and McCaulley (1988) extended Jung's work by adding a further dimension—judging-perceiving. (see Table I for a brief description of each individual personality type).

The Myers-Briggs Type Indicator (Myers and McCaulley, 1988) is a forced-choice personality type inventory assessing the four aforementioned dimensions of preferences. Split-half reliability estimates for the four scales (each representing a dimension of personality types) range from .80 to .87 (Myers, 1962; Myers and McCaulley, 1988; Stricker and Ross, 1963). Test-retest reliability estimates range from .48 (which is marginal) to .73 (Levy *et al.*, 1972; Myers and McCaulley, 1988; Stricker and Ross, 1962). The scales distinguish among groups of people and correlate with other inventories as expected by type theory (e.g., Carlson, 1985; McCaulley, 1981). Furthermore, the MBTI scales do not correlate with measures of unrelated constructs (see McCaulley, 1990).

The MBTI has been widely used in both academic and nonacademic settings. Significant correlations can be found between styles derived from the MBTI and mastery of a second language (Ehrman, 1994), creative performance on the job (Jacobson, 1993), and many other activities (cf. Hahn-Rollins and Mongeon, 1988). Furthermore, Jacobson (1993) found that adaptors on the Kirton Adaption Innovation Inventory (KAII, Kirton, 1976), a measure of decision-making styles, were sensing and judging types and that innovators were intuitive and perceiving types (see also Carne and Kirton, 1982). There also is a significant relationship between the MBTI and the Gregorc Style Delineator (GSD, Gregorc, 1982). In general, people

who are high on the Concrete Sequential scale in the GSD tend to be of the sensing and judging types in the MBTI, whereas people who score high on the Concrete Random scale in the GSD tend to be of the intuitive and perceiving types (e.g., Bokoros *et al.*, 1992; Drummond and Stoddard, 1992; Harasym *et al.*, 1996; Stuber, 1997). Finally, field-independent people are likely to be the intuitive and perceiving types; field-dependent people are likely to be the sensing and judging types (e.g., Carey *et al.*, 1989; Holsworth, 1985).

Research does not provide clear indication of how the thinking-feeling and introversion-extraversion dimensions relate to scales in the other style inventories. For instance, the relationship between Kirton's adaptation-innovation and the extraversion-introversion and thinking-feeling dimensions is unclear (Jacobson, 1993; also see Myers, 1962). Similarly, there are inconsistent findings regarding the relationships of field-dependence/independence with the extraversion-introversion and thinking-feeling dimensions (Thomas, 1983; also see Evans, 1967; Feather, 1967).

Mind Style and the Gregorc Style Delineator

Gregorc (1979, 1984, 1985) suggested that individuals' tendency to use mediation channels or mind styles (often referred to as "learning styles") could be understood in terms of two basic dimensions: use of space and use of time. Space refers to perceptual categories for acquiring and expressing information. It is divided into concrete (or physical) and abstract (or metaphorical) space. Time is divided into two different ways of ordering facts and events: sequential (i.e., in a step-by-step or branchlike manner) and random ordering (i.e., in a weblike or spiral manner). These two poles of the two dimensions form four styles that are referred to by Gregorc as mind styles: abstract random, concrete sequential, abstract sequential, and concrete random (see also Table I).

The Gregorc Style Delineator (GSD, Gregorc, 1982) is a self-report inventory composed of 40 words organized into 10 columns, each consisting of 4 words. The respondents are required to rank the 4 words relative to their preference for receiving and processing information. The technical manual for the inventory (Gregorc, 1984) reported alpha coefficients ranging from .89 to .93, whereas Joniak and Isaken's study (1988) resulted in scale alpha coefficients ranging from .23 to .66. Also in his 1984 work, Gregorc reported good construct validity as assessed through factor analysis. Submitting the items of the GSD to a factor analysis, Joniak and Isaken (1988) obtained several orthogonal factors. Employing confirmatory factor analysis, O'Brien (1990) examined the construct validity of the GSD, but found only minimal validity.

Consider additional evidence regarding Gregorc's theory. First, Gregorc's styles are related to students' academic achievement scores. In general, students with a concrete-sequential style outperform students with other styles (e.g., Drysdale *et al.*, 2001; Elsberry, 1995; O'Brien, 1991, 1994). However, students' academic achievement does not vary as a function of their learning styles (e.g., Harasym *et al.*, 1996; O'Brien and Wilkinson, 1992). Similarly, although some studies suggest that students' learning styles make a difference in their instructional preferences (e.g., Ross, 2000; Seidel and England, 1999), others do not reveal a relationship between students' learning styles and their instructional preferences (e.g., Elsberry, 1995; Perchaluk-Kemppainen, 1997). Still other studies show that Gregorc's styles are related to teaching behaviors (e.g., Stuber, 1997) and to job satisfaction (e.g., Willis, 1995).

As noted earlier, individuals who prefer the concrete sequential learning style tend to be sensing and judging types of people, whereas individuals who prefer the concrete random learning style tend to be intuitive and perceiving types of people (Bokoros *et al.*, 1992; Drummond and Stoddard, 1992; Harasym *et al.*, 1996; Stuber, 1997). Further, Joniak and Isaken (1988) concluded that Gregorc's sequential types tend to be adaptors and that the random types tend to be innovators.

Decision-Making and Problem-Solving Style and the Kirton Adaption-Innovation Inventory

Kirton (1976) designed the Kirton Adaption-Innovation Inventory (KAII), a measure of "style of decision making, problem-solving, and by implication, creativity" (Kirton, 1988, p. 65). Consisting of three scales (Originality, Efficiency, and Group Rule Conformity), the KAII is a 32-item self-report test in which respondents indicate the difficulty (or ease) involved in maintaining a certain image consistently for a relatively long time (e.g., as manifested in an individual's tendency for continuing to pursue a creative idea). Scores indicate whether the respondents tend to be innovators or adaptors (see also Table I). Cronbach's alpha coefficients range from the high .70s to the low .90s. Test-retest reliability coefficients normally fall in the mid .80s. The internal structure of the inventory was assessed through factor analysis. External validity of the inventory was examined by testing the KAII against measures of creativity. Results suggest the independence of Kirton's decision-making style from creativity (e.g., Clapp, 1993; Joniak and Isaken, 1988; Kirton, 1994; Taylor, 1994).

Several research trends emerge from the investigations of the KAII. A first is cross-national validation of the inventory. Although a few studies

suggest that national culture makes a difference in problem-solving styles (e.g., Danis and Dollinger, 1998; Skinner *et al.*, 2003), the majority of the studies indicate that problem-solving styles are largely independent of culture (e.g., Bagozzi and Foxall, 1995; Kubes, 1998; Prato-Previde, 1991; Shiomi and Loo, 1999). In fact, after examining the already published and the then-new cross-cultural data, Tullett (1997) found that there was substantial similarity in the Kirton Adaption-Innovation Inventory's psychometric properties as obtained for versions in five different languages (English, French, Dutch, Italian, and Slovak). Meanwhile, the author examined another six studies conducted in four countries and found that managers' decision-making styles differed as a function of the foci of their operation. Managers who were engaged in operations that were oriented outside their own organizations (e.g., marketing and sales) were more likely to be innovators, and those who were engaged in operations that were within their own organizations (e,g., accounts, maintenance, and production) were more likely to be adaptors. Similarly, in the same review, after comparing data collected from five occupational groups, Tullett found that people with a more adaptive style were attracted to occupations that require close attention to detailed and more structured types of work, whereas people with a more innovative style were attracted to occupations where systems and operational procedures are less structured and where bigger pictures are given more emphasis than are details. The author concluded that the adaption-innovation style varied more by occupation and work function than by national culture.

A second group of studies focus on the relationships between problem-solving styles and personality traits. For example, Kwang and Rodrigues's (2002) study of teachers in Singapore revealed that adaptors scored higher on the conscientiousness scale of the Big 5 and that innovators scored higher on the extraversion and openness scales. Also, for instance, Alter's (2001) investigation among eighth-grade students indicated that adaptors expressed higher needs for cognitive structure and order, whereas innovators expressed higher needs for autonomy.

A third group of studies place emphasis on the relationships of problem-solving styles with students' academic performance and with teachers' teaching behaviors. In examining the relationships between college students' adaption-innovation style and their achievement on a multiple-choice test, Skinner and Drake (2003) found that adaptors scored higher than did the innovators. In investigating the relationships between teachers' scores on the KAII and their preference for educational procedures, Kirton *et al.* (1991) found that innovators preferred educational procedures that are loose in structure, with aims not easily articulated, and without simple methods of assessment. Meanwhile, the authors found that

the adaptors preferred procedures that are tighter in structure, with more definable aims, and with more precise assessment methods.

A fourth group of studies address the malleability of styles. This research was conducted among several different populations, ranging from school children (e.g., Taylor, 1994) to college students, (see also Taylor, 1994) and to adults (e.g., Clapp and de-Ciantis, 1989). Problem-solving styles were found to be largely stable and not modifiable (see also Clapp, 1993; Murdock *et al.*, 1993). However, the procedures used to modify the styles may have been inadequate. The studies cannot prove nonmodifiability.

Finally, as a measure of style construct, the KAII has been tested against other style inventories, such as the Myers-Briggs Type Indicator, the Gregorc Style Delineator, and the Group Embedded Figures Test. Kirton's adaptive-innovative decision-making style was related to both personality type and mind style. Fleenor and Taylor (1994) examined the relationships between the MBTI Creativity Index (Gough, 1987) and the KAII among 12,115 managers participating in a leadership program. They found that 57% of the variance in the KAII scores was accounted for by the MBTI Creativity Index scores. Carne and Kirton (1982), Jacobson (1993), and Gryskiewicz and Tullar (1995) independently found that Kirton's adaptors tended to belong to the MBTI sensing and judging personality types. Kirton's innovators were more likely to belong to the MBTI intuitive and perceiving personality types. However, the relationships of the Kirton adaptive-innovative distinction with the MBTI thinking-feeling and introversion-extraversion dimensions are not entirely clear. Moreover, as has been discussed in the previous section, Kirton's innovators tend to be Gregorc's random types, whereas adaptors are more likely to be sequential types. In studying the relationship between adaption-innovation and field-dependence/independence, Robertson *et al.* (1987) found that innovators were less field dependent than were adaptors and "average" individuals.

Reflectivity-Impulsivity and the Matching Familiar Figures Test

The reflectivity-impulsivity style construct, also referred to as conceptual tempo, was originally introduced by Kagan and his colleagues (Kagan *et al.*, 1964). Reflectivity is the tendency to consider and reflect on alternative solution possibilities. Impulsivity is the tendency to respond impulsively without sufficient forethought (Block *et al.*, 1974; Kagan and Messer, 1975). This construct is often measured by the Matching Familiar Figures Test (MFFT, Kagan *et al.*, 1964), in which an individual is instructed to select from several alternatives the one that exactly matches a standard picture. The examiner measures the number of errors and the time to complete the

test. The median point of each measure is viewed as a proper score for categorizing individuals. People with faster times and relatively more errors are called impulsive, whereas those with longer times and fewer errors are called reflective. Different forms of the MFFT are available for preschoolers, school children, and adults.

Reliability and validity studies for the MFFT demonstrate only fair reliability for the test. For example, Messer (1976) obtained internal consistency coefficient of .76 for response time and .50 for errors. Messer also found test-retest coefficients of .56 and .78, respectively, for errors and time to respond. Subsequent research (e.g., Becker *et al.*, 1978; Cairns, 1977) also suggests that the MFFT's reliability, especially for the error score, is less than satisfactory. Consequently, efforts were made to revise the MFFT. Among these efforts, Cairns and Cammock's (1978) and Zelniker and Jeffrey's (1976) stand out. Research indicates that the reliability of the MFFT has been improved (e.g., Buela-Casal *et al.*, 2003; Kirchner-Nebot and Amador-Campos, 1998). For example, Cairns and Cammock (1978) reported split-half correlations of .91 for latency and .89 for errors; Kirchner-Nebot and Amador-Campos (1998) reported internal consistency of .94 for latencies and .77 for errors.

Messer (1976) and Jonassen and Grabowski (1993) showed that reflectives consistently outperform impulsives on a variety of conceptual, perceptual, and perceptuomotor problem-solving tasks that involve response uncertainty (Kagan, 1966; Messer, 1976). Reflectives also do better in reading, writing, and memory tasks, as well as on a wide range of achievement tests (e.g., Becker *et al.*, 1978; Gullo, 1988; Joffe, 1987; Logan, 1983). Regarding personality traits and social behaviors, Messer (1976) reviewed studies dealing with the relationships of the reflectivity-impulsivity style with such variables as anxiety over error, attentiveness, aggressiveness, locus of control, moral behavior, and delay of gratification. For example, Thomas (1971) found that impulsive boys display more aggressive behaviors than do reflective ones. Schleifer and Douglas (1973) found that reflective children are at a more advanced stage of moral judgment than are impulsive ones.

Many studies investigated the relationship between the reflectivity-impulsivity construct and the construct of field-dependence/independence (e.g., Ausburn, 1979; Banta, 1970; Campbell and Douglas, 1972; Keogh and Donlon, 1972; Logan, 1983; Massari, 1975; Neimark, 1975; Schleifer and Douglas, 1973). The studies confirmed a significant relationship between the two constructs. In general, people who are high on the reflective style are more field independent than are those high on the impulsive style. The overlap between the two constructs may be due to the common process involved in the measures assessing reflectivity-impulsivity and field-dependence/independence (Messer, 1976).

Reflectivity can be developed (e.g., Brown and Lawson, 1975; Epstein *et al.*, 1975; Huey-You, 1985; see also reviewed studies in Jonassen and Grabowski, 1993 and in Messer, 1976). For example, forced delay of response resulted in a marked improvement in the performance of impulsive children (e.g., Albert, 1969; Brown and Lawson, 1975). Another example is that of modeling. Students became more reflective after observing reflective adult models and after being taught by more reflective teachers (e.g., Denney, 1972; Yando and Kagan, 1968).

A related issue to the malleability/modifiability of conceptual tempo is that of whether it is value-laden or value-free. All training programs have been aimed at cultivating research participants' reflectivity, rather than impulsivity (see studies on malleability). The reason is that reflectivity is superior to impulsivity in almost all adaptive situations. These include, but are not limited to, situations requiring problem-solving skills, cognitive complexity, particular personality traits, social behaviors, and moral development. Thus, it is only fair to conclude that reflectivity-impulsivity is value-laden, with reflectivity a more desirable style than impulsivity.

Divergent-Convergent Thinking and Its Measurement

The concept of divergent-convergent thinking (see also Table I) was introduced by Guilford (1950, 1967) when he proposed his model of the "structure of intellect." No single universally accepted test is associated with the assessment of the divergent-convergent dimension. Instead, the tendency toward divergent-convergent thinking usually is inferred from one's performance on various tests. Furthermore, the construct is also assessed by tests (typically open-ended questions) that require the respondents to generate multiple answers (Riding and Cheema, 1991).

Divergent thinkers tend to have better academic achievement than do convergent ones (e.g., Bennett, 1973; Eastwood, 1965; Feldhusen *et al.*, 1971; Olive, 1972b). However, the relationship between divergent thinking and general intelligence is relatively weak (e.g., Mehdi, 1974; Olive, 1972b). With regard to personal characteristics and personality traits, Alpaugh and Birren (1977) found that older research participants were as intelligent as younger ones. However, the former performed less well on Guilford's tests of divergent thinking. Olive (1972a) found that female adolescents were superior to their male counterparts on 5 of the 7 divergent-thinking subtests they administered. Taft (1971) found that undergraduate students who scored high on divergent-thinking tests of originality were more competent, stable, and resourceful.

Like many other style constructs, the divergent-convergent construct was also tested against constructs from the styles literature. For example,

Gelade (1995) tested the relationship between Guilford and Guilford's Consequences and Alternate Uses tests and the Kirton Adaption-Innovation Inventory. Although the adaptors and the innovators produced roughly the same number of common responses, the innovators produced a larger number of uncommon responses. Using two styles (the convergent and divergent learning styles) from Kolb's (1976) Learning Style Inventory (LSI), Donoghue (1995) examined the relationships of the divergent-convergent construct with scales from the Myers-Briggs Type Indicator. The author discovered a significant relationship between the LSI divergent/convergent styles and the combinations of intuition-perceiving and sensing-judging types. Jonassen (1980) found that field independence was the best predictor of students' performance on divergent tasks in an introductory instructional media course (see also Bloomberg, 1971; Noppe and Gallagher, 1977).

Finally, the issue of whether or not the divergent-convergent construct carries any value orientation has also been implicitly addressed in the literature. For example, Dirkes (1977) discussed the importance of cultivating divergent thinking among students. One could argue that there are courses on such topics as logic, mathematics, and physics that teach convergent thinking. However, these are rare cases. The majority of learning activities aim at promoting students' divergent thinking. For decades, many educational systems from all over the world set developing students' divergent thinking as a major institutional goal. Thus, the divergent-thinking style is considered superior to the convergent-thinking style.

Field-Dependence/Independence and the Group Embedded Figures Test

Field-dependence/independence is also referred to as psychological differentiation (Witkin *et al.*, 1962). It is the extent to which people are dependent versus independent of the organization of the surrounding perceptual field (see also Table I).

Several instruments have been developed to assess the field-dependence/independence (FDI) construct, including the widely used Group Embedded Figures Test (GEFT, Witkin *et al.*, 1971). The GEFT is a group-administered and timed paper-and-pencil performance test adapted from the individually-administered Embedded Figures Test. The test takers are presented with 8 simple figures and 25 complex figures. One of the 8 simple figures is embedded within each of the 25 complex figures. The test takers' task is to locate and trace, within the context of the complex figures, as many of the simple figures as possible within three timed sections (of 2, 5, and 5 min of duration). The score on the GEFT is the number of items

correctly traced. The higher one's score is, the more field independent one is; the lower one's score is, the more field dependent one is.

Good reliability data on the GEFT have been obtained in various forms, including test-retest, parallel forms, split-half, and scale internal consistencies (e.g., Lewin, 1983; Melancon and Thompson, 1989; Murphy *et al.*, 1997; Panek *et al.*, 1980; Snyder, 1998). However, although supported by most of the studies (e.g., Lewin, 1983; Melancon and Thompson, 1989; Murphy *et al.*, 1997), the validity of the inventory occasionally has been challenged (e.g., Cakan, 2003; Panek *et al.*, 1980).

The field-dependence/independence (FDI) construct is probably the most extensively researched style construct, although it is often criticized for not being a style construct, but rather, a perceptual ability (e.g., Dubois and Cohen, 1970; Hyde *et al.*, 1975; Jones, 1997b; MacLeod *et al.*, 1986; Richardson and Turner, 2000; Satterly, 1976; Spotts and Mackler, 1967; Stuart, 1967; Weisz *et al.*, 1975). The FDI construct has been examined in various contexts. We only review three main areas of research: the relationships between FDI and academic achievement, the relationships of the FDI construct with other style constructs, and training of field independence.

The FDI construct was investigated in relation to various kinds of academic achievement (e.g., problem solving, laboratory tasks, language learning, tasks involving disembedding skill, organizing information, etc). In general, field-independent people are higher in their academic achievement than are field-dependent people (e.g., Bagley and Mallick, 1998; Mansfield, 1998; see also Jonassen and Grabowski, 1993 for a comprehensive review). Since the late 1970s and early 1980s, the FDI construct has become more and more widely examined in the context of learners' achievement under computer-assisted instructional conditions. In general, field-independent learners achieve more in computer-based learning environments. For example, compared with field-dependent learners, field-independent learners do better on problem-solving performance (e.g., Williams, 2001) and programming performance (e.g., Clements, 1986; Johnson and Kane, 1992; Wilson *et al.*, 1990). Field-independent and field-dependent learners use different learning strategies in a computer-assisted learning environment (e.g., Ford and Chen, 2000; Liu and Reed, 1994). For example, field-dependent learners made less use of Back/Forward buttons, whereas field-independent learners made greater use of Back/Forward buttons. Field-dependent learners spent less time exploring the "detailed techniques" section of the tutorial, whereas field-independent learners made fuller use of the "detailed techniques" section.

As discussed earlier, field independence is related to styles that are creativity-generating and that denote higher levels of cognitive complexity, such as the artistic career personality type, the intuitive and perceiving

personality types, and reflectivity. On the contrary, field dependence is associated with styles for norm-favoring and that suggest lower levels of cognitive complexity, including the conventional career personality type, the sensing and judging personality types, and impulsivity.

Since the late 1960s and early 1970s, various training programs aimed at enhancing people's field independence have been designed and carried out. These training programs, including training in depth perception (e.g., Mshelia and Lapidus, 1990), meditation (e.g., Linden, 1973), and hunting ecology (e.g., MacArthur, 1973), indicate that field independence can be developed (see also Collins, 1994; Pysh, 1970). For example, in their study of 167 Nigerian 4th graders, Mshelia and Lapidus (1990) conducted a training program as part of their experimental study. The aim of the program was to raise children's performance level on depth-perception tasks (tasks that require the field-independent style). Having had their initial levels of field-dependence/independence determined by their scores on the Group Embedded Figures Test, the children were ranked and assigned to four groups. Two groups received Depth Picture Perception training with Mshelia's Sets A and B items. During the Depth Picture Perception training, each child individually observed for 6 min a six-grade student model (either male or female) previously trained on the Mshelia pictures. Immediately after that, each child spent 6 min with an experimenter for a posttest. A third group received training with the GEFT odd items. Children in this group observed the same trainers completing the GEFT odd items. The fourth group was a control group that received no training. Post-test results indicated that children who received training on depth picture perception tasks performed better on an alternative form of a parallel task and on the GEFT. Furthermore, children who received training on the GEFT scored higher on field independence than did children in the control group.

Finally, again, a related issue to the training and modifiability of people's field-dependence/independence (with the aim of promoting field independence) is the issue of value—that is, whether field-dependence/independence is value-free or value-laden. Many scholars argue that styles (including the FDI construct) are value-free, in that the same style can serve an individual differently, depending on the specific situation. However, after analyzing available empirical findings, Messick (1994) argued for the value directionality of the FDI construct, with field independence superior to field dependence (see also Kogan, 1989; Messick, 1996).

To summarize, this review of the nine individual models (along with the theory of mental self-government introduced earlier) and of the empirical findings supporting these models suggests the following with regard to the three controversial issues over styles. First, styles are not value-free. Second, except for research findings based on Kirton's (1976)

decision-making styles, all findings based on other style models indicate that styles are malleable and that they can be developed. Third, any one of the style constructs reviewed is significantly related to at least one of the other nine style constructs. Furthermore, there are three characteristics of the manner in which these styles are related to one another. First, those styles carrying "positive values" (see earlier discussion, e.g., field independent, reflective, legislative, artistic, perceiving, deep, and so forth) are positively correlated with one another and are related to human attributes that are commonly perceived as positive. Second, styles that carry "negative values" (also see earlier discussion, e.g., field dependent, impulsive, executive, conventional, judging, surface, and so forth) are positively related to one another and are associated with human attributes that are usually perceived as negative. Finally, in the style models that address more than just bipolar intellectual styles, some styles (e.g., internal, introverted, thinking, feeling, achieving, and so forth) do not indicate consistent relationship patterns with style constructs that have only bipolar styles. Table IV lists major studies revealing significant relationships among intellectual styles.

The Nature of Intellectual Styles

People's intellectual styles can be classified into three types. These types are based on individual differences in people's preferences for each of the underlying concepts (i.e., structured versus free of structure, cognitive simplicity versus cognitive complexity, conformity versus nonconformity, authority versus autonomy, and group versus individual). They correspond to the three types of thinking styles discussed earlier that were discovered through research on Sternberg's theory of mental self-government. In other words, the three types of thinking styles are the groundwork for the three types of intellectual styles discussed in this article. Therefore, consistent with the three types of thinking styles, there are three types of intellectual styles. (Obviously, thinking styles are now put within the framework of intellectual styles, as are the other style constructs.)

Type I intellectual styles normally fall on the right end of each of the first four continua of preference: low degrees of structure, cognitive complexity, nonconformity, and autonomy. That is, Type I intellectual styles denote preferences for tasks that have low degrees of structure, that require the individuals to process information in a more complex way, and that allow originality and high levels of freedom to do things in one's own way. Based on both the descriptions of specific styles in the 10 models illustrated earlier and the existing research findings generated by these models, the following styles are classified as Type I intellectual styles: the deep-learning

Table IV. Selected Studies Supporting Significant Relationships Among Intellectual Styles

Style construct	a	b	c	d	e	f	g	h	i	j
[a] Learning approach										Zhang, 2000a;
[b] Career personality type									Alvi et al., 1988; Khan and Alvi, 1986	Zhang, 2000b
[c] Mode of thinking										Zhang, 2002e
[d] Personality type					Bokoros et al., 1992 Drummond and Stoddard, 1992;	Carne and Kirton, 1982; Jacobson, 1993			Carey et al., 1989; Holsworth, 1985	Sternberg, 1994; Tucker, 1999
[e] Mind style				Harasym et al., 1996; Stuber, 1997 Fleenor and Taylor, 1994;		Joniak and Isaken, 1988			Robertson et al., 1987	Sternberg, 1994
[f] Decision-making style										
[g] Conceptual tempo							Massari, 1975; Neimark, 1975; Schleifer and Douglas, 1973	Noppe and Gallagher, 1977	Banta, 1970; Campbell and Douglas, 1972; Keogh and Donlon, 1972; Bloomberg, 1971; Jonassen, 1980;	
[h] Structure of intellect						Donoghue, 1995				
[i] Perceptual style		Khan et al., 1985								
[j] Thinking style	Zhang and Sternberg, 2000	Zhang, 2001b	Zhang, 2002f							

Note. ^a Biggs's theory of student learning, ^b Holland's theory of career personality types, ^c Torrance's construct of brain dominance, ^d Jung's theory of personality types, ^e Gregorc's model of mind styles, ^f Kirton's model of decision-making styles, ^g Kagan's model of reflectivity-impulsivity conceptual tempo, ^h Guilford's model of structure of intellect, ^i Witkin's construct of field-dependence/independence, ^j Sternberg's theory of mental self-government.

approach, the artistic career personality type, the holistic mode of thinking, the intuitive and perceiving personality types, the concrete- random mind style, the innovative decision-making style, the reflective conceptual tempo, divergent thinking, and the field-independent perceptual style, as well as the Type I thinking styles of legislative, judicial, global, hierarchical, and liberal.

Type II intellectual styles normally fall on the left end of each of the first four continua of preference: structure, cognitive simplicity, conformity, and authority. That is, Type II intellectual styles suggest preferences for tasks that are structured, that allow individuals to process information in a more simplistic way, and that require conformity to traditional ways of doing things and high levels of respect for authority. Similarly, based on the descriptions of the individual styles in the 10 models reviewed and on the existing research findings, the following styles are categorized as Type II intellectual styles: the surface-learning approach, the conventional career personality type, the analytic mode of thinking, the sensing and judging personality types, the concrete-sequential mind style, the adaption decision-making style, the impulsive conceptual tempo, convergent thinking, the field-dependent perceptual style, as well as the Type II thinking styles of executive, local, monarchic, and conservative.

Finally, Type III intellectual styles fall neither into the Type I group nor into the Type II group of styles. Instead, they manifest the characteristics of both Type I and Type II intellectual styles, depending on the stylistic demands of a specific task and on an individual's level of interest in the task. Again, based on the nature of the particular styles in the 10 models and on existing research findings relevant to these style constructs, the following styles are categorized as Type III intellectual styles: the achieving learning approach, the realistic, investigative, social, and enterprising career personality types, the integrative mode of thinking, the thinking, feeling, introversion, and extraversion personality types, the abstract random and abstract sequential mind styles, as well as the Type III thinking styles of oligarchic, anarchic, internal, and external.

Although it is included as one of the five pairs of concepts underlying intellectual styles, the preference dimension of group versus individual was not mentioned in the discussion of either Type I or Type II intellectual styles. It is in the context of Type III intellectual styles that people's group versus individual preference plays a major role. Type III intellectual styles are dominated by styles that suggest sociological preferences, including the social and enterprising career personality types, the introverted and extraverted personality types, as well as the internal and external thinking styles. The styles that denote sociological preferences and the remaining Type III styles share a common characteristic: They may be employed as either Type I or Type II styles, depending, as mentioned earlier, on the

stylistic demands of a specific task and on the individual's feelings about the task. For example, an individual with the social career personality type may perform a task in a creative way and invest a great deal of complex thinking in an attempt to do a good job if the task requires the individual to do so and if the individual is interested in the specific task at hand. In this case, the social career personality type manifests the characteristics of Type I intellectual styles. The same person may also perform the task in an established way, however, without putting too much thought into what he/she is doing if the task does not require much creativity or deep thinking and if the individual does not have high level of interest in the task at hand. Under such a circumstance, the social career personality type shows the features of Type II intellectual styles.

Table V presents details on each of the three types of styles. It includes the original name for each of the intellectual style constructs and the labels for each of the individual styles within each theoretical model. The footnote specifies the theoretical foundation for each style construct.

The Three Controversial Issues and the Threefold Model of Intellectual Styles

The Threefold Model of Intellectual Styles implies a stand on each of the three main controversial issues mentioned earlier regarding styles: trait versus state, value-laden versus value-free, and different style constructs versus similar constructs with different style labels. These three issues were discussed earlier in the context of the three lines of research on thinking styles and in the review of the other nine style models and empirical findings supporting these models. We now discuss these issues within the context of the Threefold Model of Intellectual Styles.

Regarding the issue of styles as traits or states, investigations focusing on thinking styles indicate, as noted earlier, that thinking styles represent states because they can be socialized and modified. By the same token, other intellectual styles from other style models also can be socialized and modified, as discussed earlier. This argument is supported by the fact that many training programs are aimed at modifying people's intellectual styles. This effort in modifying people's intellectual styles has made some of the once strong believers in the notion of styles as traits change their theoretical positions over time. For example, in the early stage of studying Witkin's concept of field-dependence/independence, the Witkin group advanced the idea that field-dependence/independence represents a highly stable and pervasive construct with deep roots in personality and possibly even in biology. However, in his 1977 Heinz Werner Lectures delivered at Clark University, Witkin discussed an ongoing training program aimed at

Table V. Intellectual Styles

	Style type	Type I	Type II	Type III
Style construct	[a]Learning approach	Deep	Surface	Achieving
	[b]Career personality type	Artistic	Conventional	Realistic, Investigative, Social, Enterprising
	[c]Mode of thinking	Holistic	Analytic	Integrative
	[d]Personality type	Intuitive, Perceiving	Sensing, Judging	Thinking, Feeling, Introversion, Extraversion
	[e]Mind style	Concrete random	Concrete sequential	Abstract random, Abstract sequential
	[f]Decision-making style	Innovation	Adaptation	
	[g]Conceptual tempo	Reflectivity	Impulsivity	
	[h]Structure of intellect	Divergent thinking	Convergent thinking	
	[i]Perceptual style	Field independent	Field dependent	
	[j]Thinking style	Legislative, Judicial, Global, Hierarchical, Judicial	Executive, Local, Conservative Monarchic,	Oligarchic, Anarchic, Internal, External

Note. Theoretical foundations: [a]Biggs's theory of student learning, [b]Holland's theory of career personality types, [c]Torrance's construct of brain dominance, [d]Jung's theory of personality types, [e]Gregorc's model of mind styles, [f]Kirton's model of decision-making styles, [g]Kagan's model of reflectivity-impulsivity conceptual tempo, [h]Guilford's model of structure of intellect, [i]Witkin's construct of field-dependence/independence, [j]Sternberg's theory of mental self-government.

enhancing restructuring skills. States can be changed, while traits are much more stable. Some scholars suggest that traits are in-built characteristics that are hard to change. Because our research (e.g., Zhang, 1999a, 2001a; Zhang and Sachs, 1997; Zhang and Sternberg, 2002) and other scholars' research (e.g., Collins, 1994; Huey-You, 1985; Linden, 1973; Mshelia and Lapidus, 1990) indicate that the majority of styles are trainable (and/or socialized), we argue that the styles in the Threefold Model of Intellectual Styles represent states.

However, status as states does not mean that intellectual styles constantly change. They can normally be rather stable, except when there is a demand for change of styles by specific situations. Therefore, to be more precise, we posit that intellectual styles largely represent relatively stable states. Furthermore, Type I and Type II styles are relatively more stable than are Type III styles, because Type III styles are more contingent upon the nature of a task and upon one's feelings about the task.

Regarding the value issue of styles, research on thinking styles has led to our position that thinking styles, especially Type I and Type II thinking styles, are value-laden, rather than value-free. In a like vein, it can be easily argued that all the other intellectual styles (especially Type I and Type II) discussed are also value-laden (see earlier review of each of the individual style models). For example, Kogan (1989) used convincing examples to support the argument that styles have never been value-free. He pointed out, with regard to Witkin's notion of field-dependence/independence, that training studies have tried to make individuals more field independent rather than field dependent. He further noted that similar considerations hold even more strongly in the case of reflectivity-impulsivity as a style construct. All training efforts have been directed at the enhancement of the reflective style. Positive characteristics associated with an impulsive style have yet to be demonstrated. Indeed, much research concludes that, in general, reflectivity is associated with better academic and cognitive performances of various kinds (see Messer, 1976 for a comprehensive review; also Stahl *et al.*, 1986; Zelniker and Oppenheimer, 1973).

Yet, it should be noted that some scholars also proposed the concept of value differentiation based on the contention that styles are typically bipolar and that each pole of a style dimension has different adaptive implications. That is, in the context of styles, an individual can be both good and poor at tasks, depending on the nature of the task (e.g., Messick, 1994; Riding, 1997). For example, whereas field dependence can be viewed as a deficiency due to the absence of those skills associated with field independence, it can, at the same time, be perceived as a valuable asset because field dependence is also associated with a set of well-developed interpersonal

and social skills (e.g., Miller, 1987). However, we argue that such an example cannot be taken completely at face value. Whereas it is true that one can find something positive to say about any intellectual style, the majority of intellectual styles, especially Type I and Type II styles, are heavily value directional. In the Threefold Model of Intellectual Styles, Type I intellectual styles are predominantly positive, whereas Type II intellectual styles are predominantly negative. The word "predominantly" is used to qualify our position on the value domain to allow for any style's occasional manifestation of the characteristics of the styles that are of the opposite type, assuming that Type I and Type II styles are the opposites of each other. That is, Type I styles may occasionally exhibit the characteristics of Type II styles; and vice versa, Type II styles may occasionally display the characteristics of Type I styles. Thus, the concept of value differentiation may occasionally apply to Type I and Type II intellectual styles. Meanwhile, this concept of value differentiation applies to Type III intellectual styles to a much greater extent. That is, Type III intellectual styles are more value differentiated. As discussed earlier, Type III styles can be carried out either with the characteristics of Type I intellectual styles or with those of Type II styles. In other words, Type III styles have both "positive" and "negative" adaptive values, which satisfies the condition of their being value differentiated. Therefore, the Threefold Model of Intellectual Styles implies that Type I and Type II intellectual styles are predominantly value-laden, whereas Type III styles are value differentiated. However, intellectual styles cannot be value-free.

As for the third major controversial issue, that of style constructs being distinct constructs versus being similar constructs with different style labels, research on thinking styles, as discussed earlier, demonstrates that style constructs overlap to varying degrees. By the same token, numerous empirical studies based on other style models also indicate that different degrees of overlaps exist among different style constructs. The style construct underlying any one of the 10 style models included in this newly proposed model of intellectual styles has been empirically shown to be correlated with at least one of the other style constructs. Therefore, on the issue of styles being distinct constructs versus styles being similar constructs with different style labels, the Threefold Model of Intellectual Styles does not take either position. Instead, based on empirical research findings, we contend that those constructs with different style labels overlap to varying degrees. These overlaps indicate that style constructs are neither completely different constructs nor similar constructs with different style labels. Instead, these style constructs share certain degrees of similarities, while each possessing its own uniqueness.

CONTRIBUTIONS, VALIDATION, AND IMPLICATIONS

In this article, a new integrative style model has been proposed: the Threefold Model of Intellectual Styles. Inevitably, three major questions arise relevant to this model. First, "What contributions has this model made?" Second, "What should a research agenda look like in order for the model to be validated?" Third, "What implications does this model have for educational practice?" The remainder of this article addresses these three questions.

Contributions

Two major contributions of this model are worth mentioning. First, this model is the first integrative style model that explicitly takes a stand on each of the three major controversial issues regarding styles. Second, other models tend to mention one kind of styles, but not other kinds. Specifically, whereas both Miller (1987) and Riding and Cheema (1991) referred to their integrative models as models of "cognitive styles," Curry (1983) referred to her model as one of "learning styles." In this article, we choose to use "intellectual styles" as the umbrella term for all existing style labels, including cognitive and learning styles.

Research Agenda

The Threefold Model of Intellectual Styles is not only a heuristic device, but also a summary of empirical relationships. What is perhaps lacking in the previous integrative models (except for Riding and Cheema's model) is adequate empirical evidence. We discuss a possible research agenda and make testable predictions from the model.

To test the validity of this model, a number of research procedures need to be implemented so that the following three questions can be answered, each relating to one of the three controversial issues addressed in the Threefold Model of Intellectual Styles. First, assuming that different style constructs are related (this assumption is made based on the research evidence presented in this article), how are they related? Second, are styles more dynamic or more static? Third, are styles relatively more value-laden or more value-differentiated?

One of the research procedures that can be used to answer the first question is a quantitative study in which all participants respond to all inventories discussed above that are relevant to the 10 individual style models. Analysis of this set of data can be focused on the manner in which the style scales from the 10 inventories are related to one another. This can be

identified by a simple exploratory factor analysis or a canonical correlation procedure. We predict that the style scales from all 10 inventories will load on three factors, with each factor dominated by styles of the same type (i.e., Type I, Type II, and Type III), respectively. Furthermore, we predict the following correlations: (1) individual styles within each type will be positively related to one another; (2) styles from the Type I group will be negatively correlated with those from the Type II group; and (3) Type III styles will be moderately positively related to Type I styles and to Type II styles.

To answer the question about the malleability of intellectual styles, one can design and conduct programs that aim at developing particular intellectual styles. We predict that all styles will be modifiable, but to varying degrees, depending on the nature of each style construct. We predict that the success of changing Type I styles into Type II styles (suppose some training programs attempt to develop Type II styles), or vice versa, will take more efforts and a relatively longer period of time to achieve; whereas the cultivation of Type III styles will be relatively easier. In other words, as we argued earlier, Type I and Type II styles are relatively more stable than are Type III styles.

The question on the value issue of styles can be answered from two different angles. The first is to collect information about the nature of the existing training programs. We predict that almost all training programs will attempt to develop Type I intellectual styles. The second is to investigate the relationship between any of the intellectual style constructs and variables that are cognitive, affective, physiological, psychological, or sociological in nature. We have three predictions, the first two of which are relevant to variables that are cognitive, affective, physiological, and psychological in nature, and the third related to variables that are sociological in nature. First, Type I intellectual styles will be positively related to any variable that denotes a positive value (e.g., higher levels of cognitive development, higher self-esteem, and openness to experience). Second, Type II styles will be positively related to any variable that denotes a negative value (e.g., lower levels of cognitive development, lower self-esteem, and neuroticism). Third, Type III styles and sociological variables will be related. However, the ways in which they are associated with each other are more adaptive. In other words, as previously discussed, Type I and Type II intellectual styles are predominantly value-laden and more stable, whereas Type III styles are value differentiated and more dynamic.

Implications for Educational Practice

For educational practice, the present model has three major implications. First, the model suggests that educators can make use of the

interrelationships among the intellectual styles to limit testing time. For example, when time is limited, an educational practitioner could use one or two inventories to identify students' intellectual styles, rather than administering a whole range of inventories. Then, given the inter-relationships among the intellectual styles, one could predict with reasonable confidence scores on particular styles that are not tested.

Second, the Threefold Model of Intellectual Styles can help address one of the major concerns often expressed by teachers to whom the notion of styles is new. Scholars who do research on styles and who promote style awareness among teachers are often asked: "So, you are telling us that there are many different styles and that our teaching should take styles into account. Then the problem is: how could our teaching accommodate so many different styles?" The present model would answer this question by stating that, in general, teachers need only to address the three broad types of intellectual styles by attending to the five basic dimensions of preferences underlying intellectual styles: high degrees of structure versus low degrees of structure, cognitive simplicity versus cognitive complexity, conformity versus nonconformity, authority versus autonomy, and group versus individual. Furthermore, we believe that good teaching treats the two polar terms of each dimension as the two ends of a continuum and provides a balanced amount of challenge and support along each dimension.

Finally, the Threefold Model of Intellectual Styles provides a practical framework to educational practitioners in their endeavors in fostering students' development in multiple dimensions: cognitive, affective, physiological, psychological, and sociological. Educational programs can be designed more systematically so that not only students' intellectual styles are taken into account but also their characteristics in other aspects such as the five dimensions of preferences.

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