



Title	Are Thinking Styles and Personality Types Related?
Author(s)	Zhang, LF
Citation	Educational Psychology, 2000, v. 20 n. 3, p. 271-283
Issued Date	2000
URL	http://hdl.handle.net/10722/42669
Rights	Creative Commons: Attribution 3.0 Hong Kong License



Are Thinking Styles and Personality Types Related?

LI-FANG ZHANG, *Department of Education, The University of Hong Kong*

ABSTRACT *The relationship between thinking styles and personality types is investigated within the contexts of Sternberg's theory of mental self-government and Holland's theory of personality types. A total of 600 university students from Hong Kong responded to the Thinking Styles Inventory (TSI) and the Short-version Self-directed Search (SVSDS) that was specially designed for the present study. A major finding of this study is that thinking styles and personality types overlap to a degree. A secondary finding is that the SVSDS is sufficiently reliable and valid for assessing Holland's personality types. Implications of both findings are discussed.*

Styles, as an individual-difference variable in human performance, have long been investigated. Between the late 1950s and 1970s, many theories and models of styles were constructed. However, this mass production of theories and models of styles went into a state of subsidence partially due to the overwhelming output from the field and partially due to its lack of internal dialogue (Jones, 1997). By 1991, when Riding and Cheema reviewed the area, 30 style labels showed up in the literature. As a result, we are left with a research field that embraces a confusing variety of seemingly different, yet similar, constructs.

In the past decade or so, there has been renewed interest in the study of styles. This interest has been manifested through two types of work. The first type is conceptual integration of previous work on styles. The second type is empirical research aimed at investigating the relationships among the different labels for the style construct.

In relation to conceptual integration, three works have attracted the most attention. The first is Curry's (1983) three-layer 'onion' model of style measures. The second is Riding and Cheema's (1991) model of two style dimensions and one family of learning strategies. The third, also the most recent, is Sternberg's conceptualisation of three approaches (or traditions) to the study of styles. All three works have been described in detail in Zhang's (in press) recent study. The present paper is contextualised in

Sternberg's conceptualisation of the styles literature. Therefore, Sternberg's work is recapitulated here.

Sternberg (1997) argued that existing models and theories with the style labels can be classified into three approaches to the study of styles—cognition-centred, personality-centred and activity-centred. Styles in the cognition-centred tradition most closely correspond to abilities. Moreover, like abilities, these styles have normally been assessed by tests of maximal performance with 'right' and 'wrong' answers. Two models of styles in this tradition have aroused the most interest: the field-dependence–independence model of Witkin (1964) and the reflection–impulsivity model of Kagan (1976). The personality-centred tradition views styles as most closely resembling personality traits. In addition, styles in this tradition are assessed via typical, rather than maximum, performance tests. Examples of work adopting this approach are Holland's (1973) theory of vocational types (also known as personality types) and Gregorc's (1979) model of types of styles that are based on all possible combinations of two dimensions—concrete versus abstract and sequential versus random. The activity-centred tradition emphasises the notion of styles as mediators of various forms of activities that tend to arise from aspects of cognition and personality. Three similar theories of learning approaches best represent work in this tradition. Marton (1976) proposed a deep- and surface-learning model using the phenomenographic method. Using the quantitative approach, Biggs (1979) added the achieving approach and Entwistle (1981) added the strategic approach. Another prominent piece of work in this approach is that of Renzulli and Smith (1978) who proposed different learning styles, with each corresponding to a method of instruction such as discussion, drill and recitation, and lecturing.

In relation to empirical research, which aimed at clarifying relationships among the style construct labels, we identified studies conducted in two periods. The first period is between the late 1960s and the 1970s, and the second is between the late 1980s and the late 1990s. As has been pointed out by Zhang (in press), studies in the former period mainly involved theories of styles from the cognition-centred tradition (see also Riding & Cheema, 1991), particularly Kagan's (1976) reflective–impulsivity and Witkin's field-dependence–independence models (e.g. Banta, 1970; Campbell & Douglas, 1972; Keogh & Donlon, 1972; Massari, 1975; Neimark, 1975; Schleifer & Douglas, 1973). All these studies found a significant relationship between the two theoretical models. In general, people who are high on the reflective style are significantly more field-independent than are those who are high on the impulsive style.

A few studies were found in the literature that employed theories across two approaches to the study of styles—the cognition-centred and the personality-centred approaches. With no exception, the cognition-centred theory used is Witkin's field-dependence–independence theory. As for the personality-centred theory, all except one study used the Strong Vocational Interest Blank (Campbell, 1972; Strong, 1955). The exception is Osipow's (1969) study in which Holland's Vocational Preference Inventory was employed. In general, these studies indicated that field-independent people tended to prefer occupational activities that require competence in analytical-articulated cognitive structure, whereas field-dependent people expressed interest in occupational activities that emphasise interpersonal relations.

Studies between the late 1980s and the late 1990s also tended to employ theories from the same tradition to the study of styles (e.g. Cantwell & Moore, 1998; Kember & Gow, 1990; Wilson *et al.*, 1996). Five major studies (Alvi *et al.*, 1988; Ford, 1995; Riding & Wigley, 1997; Sadler-Smith, 1997, 1999) have been identified that are based

on theories belonging to different traditions. Of the five studies, three (Ford, 1995; Sadler-Smith, 1997, 1999) are based on a theory of cognition-centred (e.g. field-dependence–independence) and that of activity-centred (approaches to learning). The fourth study is by Riding and Wigley (1997) who examined the relationship between personality attributes and cognitive styles. The authors found that physiologically based personality sources have no significant relationships to cognitive styles, but are moderated by styles in their effects on behaviours. The fifth study (Alvi *et al.*, 1988) was based on the model of field-dependence–independence as assessed by the Group Embedded Figures Test (GEFT, Oltman *et al.*, 1971) and Holland's personality types as measured by the Self-directed Search. The authors found that students with two- or three-letter codes consisting of R (Realistic), I (Investigative) and A (Artistic) in any order, scored higher on the GEFT than did those with two- or three-letter codes composed of S (Social), E (Enterprising) and C (Conventional).

This review of empirical work shows that the majority of studies (with the exception of Riding & Wigley's study) are based on at least one old theory of styles, especially Witkin's theory of field-dependence–independence that addresses only one dimension of cognitive styles. Theories and models from the personality-centred and the activity-centred approaches need to be tested against a more recent and more general theory of styles. Sternberg's (1988, 1990, 1994, 1997) theory of mental self-government is such a theory.

The theory of mental self-government addresses people's thinking styles. Thinking styles are defined as preferred ways of using the abilities that we have. The theory applies to both academic and non-academic settings. The essential notion of this theory is that people need, somehow, to manage or govern their everyday activities. In managing their activities, people choose styles with which they are comfortable. Moreover, people vary their use of thinking styles depending on the stylistic demands of a given situation. Furthermore, thinking styles are in part socialised (Sternberg, 1997), suggesting that thinking styles can be modified by the environments in which they live. The theory discusses 13 thinking styles that fall along five dimensions of mental self-government. The first dimension is the function of the mental self-government, including the legislative, executive and judicial thinking styles. The second dimension is the form of mental self-government, including the hierarchical, oligarchic, monarchic and anarchic thinking styles. The third dimension is the level of mental self-government, including the global and local thinking styles. The fourth dimension is the scope of mental self-government, including the internal and external thinking styles. The fifth dimension is the leaning of mental self-government, including the liberal and conservative thinking styles. A brief description of each of the 13 thinking styles is provided in Appendix A.

The theory of mental self-government is a general theory of styles not only because this theory is designed to be used with different populations, but also because it embraces all three approaches to the study of styles. The styles in this theory are cognitive in their way of looking at things (e.g. judicial style, global style, etc.) and correspond to preferences in the use of abilities. But the styles are typical-performance, not maximum-performance. Therefore, they resemble the personality-centred approach. Finally, the styles resemble the activity-centred approach in that they can be measured in the context of activities.

The theory of mental self-government has been operationalised through several inventories, including the Thinking Styles Inventory (Sternberg & Wagner, 1992) and the Thinking Styles in Teaching Inventory (Grigorenko & Sternberg, 1993). Research

has been conducted in Hong Kong, mainland China as well as in the USA. The research participants involved were secondary school students and teachers in Hong Kong and the USA, and university students in all three aforementioned cultures. This research has resulted in sufficient reliability and validity data for both inventories. The usefulness of the two inventories has been assessed in educational settings in the three cultures. Results of this research are summarised briefly. Firstly, students vary in their thinking styles depending on their personal characteristics and their learning environments. Secondly, teachers' thinking styles as manifested in teaching vary as a function of their personal characteristics, their teaching experience, as well as of their school environments. Thirdly, students tend to achieve better academic results if their thinking styles match the thinking styles of their teachers. Fourthly, students' thinking styles contribute to their academic achievement beyond what can be explained by their abilities that have been assessed through both self-rating and performance test.

In order to examine the nature of thinking styles postulated in the theory of mental self-government, we have investigated the thinking style construct against the construct "learning approaches", a construct from a theory of styles in the activity-centred centred approach. In the first study, Zhang and Sternberg (2000) investigated the relationship between thinking styles and learning approaches among 215 mainland Chinese university students and 854 Hong Kong university students, using the Thinking Styles Inventory and the Study Process Questionnaire (Biggs, 1992). Results indicated that the scales across the two inventories are, in general, related in predictable ways. Students who reported taking a surface approach to learning preferred using the more simplistic and norm-favouring thinking styles, such as the executive, local and conservative thinking styles. On the other hand, students who reported taking a deep approach to learning preferred using the more complex and creativity-generating thinking styles such as the legislative, judicial and liberal thinking styles.

In a second study, Zhang (in press) investigated the relationship between thinking styles and learning approaches among two US university student samples ($N_1 = 67$, $N_2 = 65$). To examine further this relationship, the author also studied the relationship of each of the two inventories to a range of student characteristics relevant to student involvement outside their classroom (e.g. work and travel experience and leadership experience). Results from this study supported the relationships between thinking styles and learning approaches found in Zhang and Sternberg (2000). Furthermore, this study indicated that more student involvement outside the classroom is related to the deep approach to learning and to thinking styles that are more complex and more creativity-generating (e.g. legislative and liberal thinking styles).

It should be noted that the Thinking Styles Inventory has also been tested against theories and models from the personality-centred approach. Sternberg (1994) reported the correlates of the TSI with the Myers-Briggs Type Indicator and with the Gregorc Style Delineator (Gregorc, 1982). With the Myers-Briggs's, 30 of 128 correlation coefficients were statistically significant. With Gregorc's inventory, 22 of 52 were statistically significant. These correlations went well beyond the levels that would be expected by chance. However, the precise correlations have never been recorded in the literature. Therefore, it is necessary that the thinking styles construct proposed by Sternberg be tested against a style construct that belongs to the personality-centred tradition.

The present study aims to examine the relationship between Sternberg's theory of thinking styles and Holland's (1973; Holland *et al.*, 1994) theory of personality types (also known as theory of vocational interests). It aims at empirically testing if indeed the

theory of mental self-government encompasses styles from Holland's theory, a theory from the personality-centred tradition. Holland's theory was chosen for two major reasons. Firstly, like Sternberg's theory, Holland's theory applies to a variety of populations, from both academic and non-academic settings. Secondly, the instrument—the Self-directed Search, based on Holland's theory—is easy to be administered and scored. The present study employed a simplified version of the Self-directed Search.

Holland's (1973) theory of vocational interests is also known as a theory of personality because an individual's vocational interests reflect personality (Holland, 1985). According to Holland (1973), people can be characterised by six personality types corresponding to six occupational environments: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E) and Conventional (C). A brief description of each of the six types is also provided in Appendix A.

The Self-directed Search (SDS) is a self-administered and self-scored inventory that assesses these six personality types. The SDS has been widely used with studies carried out in both Western and non-Western cultures (e.g. Bickham *et al.*, 1998; Brand *et al.*, 1994; Glidden & Greenwood, 1997). Apart from being used as a career counseling tool, the SDS also has been examined against people's individual differences in other aspects such as competencies, values and cognitive styles. However, as pointed out by Holland *et al.* (1994), the evidence for the relation of personality types to cognitive styles has until recently been inconsistent and incomplete. Furthermore, all studies found in the literature (e.g. Alvi *et al.*, 1988; Khan & Alvi, 1986; Khan *et al.*, 1985) have tested Holland's theory against Witkin's theory of field-dependence-independence which has been proved to be basically the same as perceptual ability. What needs to be done is to test Holland's theory against a more general theory of styles such as Sternberg's (1988, 1997) theory of mental self-government.

The present study employed a short version (specially designed for this study) of the SDS. There are two reasons for not using the full version of the SDS. Firstly, the SDS has been criticised for being gender-biased. The gender-bias mainly arises from the different ways in which male and female respondents respond to specific occupational activities and competencies. Therefore, the inventory used in the present study does not include items that explicitly refer to specific occupations. The second reason is that the present study involves the use of two inventories that would take a long time for the respondents to complete. In order to maintain the research participants' attention, a shorter version of the SDS is considered more appropriate for the purpose of this study.

There are two goals of this study. The first was to validate the newly designed short version of the SDS (SVSDS). A second, and more important, goal was to examine the relationship between thinking styles as defined by Sternberg's theory of mental self-government and personality types as defined by Holland's theory of personality types. Based on the characteristics of the personality types and the thinking styles defined respectively in the two theories, three predictions were made: (1) the Social and/or Enterprising types are positively related to the use of the external thinking style, whereas they are negatively related to the use of the internal thinking style; (2) the Artistic type is positively associated with the use of the legislative and liberal thinking styles, whereas it is negatively related to the executive, local and conservative thinking styles; and (3) the Conventional type is positively related to the executive, local and conservative thinking styles, whereas it is negatively related to the legislative and liberal thinking styles. Notice that not all personality types and thinking styles are included in these predictions. In fact, the four forms of thinking styles were not even assessed as no

relationship was anticipated of these forms of thinking styles to any of the six personality types.

Method

Participants

During the University of Hong Kong's orientation week in Autumn 1999, 600 (268 male and 332 female) entering university students volunteered to participate in the present study. The participants were from all of the nine faculties (Architecture, Arts, Dentistry, Education, Engineering, Law, Medicine, Science and Social Sciences) and the School of Business at the university. Among these participants, 500 students were beginning to pursue their Bachelor's degrees and 100 students were beginning to pursue their postgraduate degrees. The average age of the participants was about 22, ranging from 17 to 56 years. A total of 74% of the participants were at or below the age of 20.

Measures

The Thinking Styles Inventory (TSI, Sternberg & Wagner, 1992) and the Short-version Self-directed Search (SVSDS) were administered to the participants. The Thinking Styles Inventory is based on Sternberg's theory of mental self-government. The TSI is a self-report test in which respondents rate themselves on a seven-point scale, with 1 indicating that the statement does not describe them at all and 7 indicating that the statement characterises them extremely well. There are 65 items, each five falling into one of the 13 different style scales. In the present study, research participants responded to 45 items from nine scales. Because no relationship was anticipated of the four forms of thinking styles to any of Holland's personality types, the four forms of thinking styles (hierarchical, oligarchic, anarchic and monarchic) were omitted.

The TSI was translated and back-translated between English and Chinese in 1996. Since then, a series of studies have been carried out using the Chinese version in both Hong Kong and mainland China. Results indicated that the TSI is an inventory that is both reliable and valid for assessing the thinking styles of students in the two Chinese cultures (e.g. Zhang, 1999; Zhang & Sternberg, 2000).

The Short-version Self-directed Search (SVSDS) was specially designed for this study, based both on Holland's theory of types and on part of his SDS. The SVSDS is a 24-item self-report questionnaire. It is composed of two parts, each of 12 items. The first part consists of 12 statements, each two assessing one of the six personality types. Examples of items from this questionnaire are: (1) "I have athletic or mechanical ability, prefer to work with objects, machines, tools, plants, or animals, or to be outdoors" (Realistic); (2) "I like to observe, learn, investigate, analyse, evaluate, or solve problems" (Investigative); and (3) "I have artistic, innovating abilities, and like to work in unstructured situations, using my imagination or creativity" (Artistic). Participants rated themselves on a seven-point scale, with 1 indicating that the statement does not fit them at all and 7 indicating that the statement fits them extremely well. The second part also consists of 12 items, which is directly taken from the part of Holland's SDS on 'self-estimates'. Participants were instructed to rate themselves on different traits (including a variety of skills and abilities) on a seven-point scale, with 1 being at the low end and 7 at the high end of the scale. Among the 12 items, each two contribute

TABLE I. Short-version Self-directed Search Scales: means, standard deviations and reliabilities ($N = 600$)

Scales	M	SD	α
Realistic	4.26	0.96	0.68
Investigative	4.29	0.99	0.66
Artistic	3.72	1.24	0.82
Social	4.65	0.88	0.62
Enterprising	4.05	1.07	0.75
Conventional	4.20	0.85	0.48

to the assessment of one of the six personality types. Therefore, in the SVSDS, each personality type scale is composed of four items.

Data Analysis

As the SVSDS is newly designed, an initial concern of this study was to assess the reliability and validity of response to this inventory. The internal consistency of each of the six scales was estimated with Cronbach's alpha coefficient. The validity of the SVSDS was assessed by a principal-axis factor analysis with an oblique rotation. Following this, possible gender differences were tested for scales from both inventories. As statistically significant differences were identified in six of the nine TSI scales and three of the six SVSDS scales, the statistical analysis that aimed at examining the relationship between the TSI and the SVSDS (which is the major interest of the present study) was performed both for males and females separately and for the entire sample. The relationship between the TSI and the SVSDS also was assessed by a principal-axis factor analysis with an oblique rotation, with all scales from the two inventories being submitted to the factor analysis. However, results of the three separate factor analyses (for males, females, and for combined genders) were strikingly similar. Therefore, only results from the gender-combined procedure are reported.

Results

Reliability the SVSDS

The alpha coefficients, ranging from 0.48 to 0.82, with a mean and a median of 0.67, are reported in Table I. These estimates, although not as high as those reported in the SDS technical manual (which reports a range of 0.90 to 0.94 for the six summary scales, using KR-20, Holland *et al.*, 1994), are considered adequate for the purpose of the present study given the shortness of the scale.

Validity of the SVSDS

A two-factor model resulted from the factor analysis procedure. The first factor is dominated by loadings of the Realistic, Investigative and Conventional scales. The second factor is dominated by loadings of the Artistic, Social and Enterprising scales. These two factors accounted for 66% of the variance in the data. The two factors make substantive sense in that the six scales loaded in a way that would be expected by the statistical structure of the hexagonal model. Each of the two factors is composed of

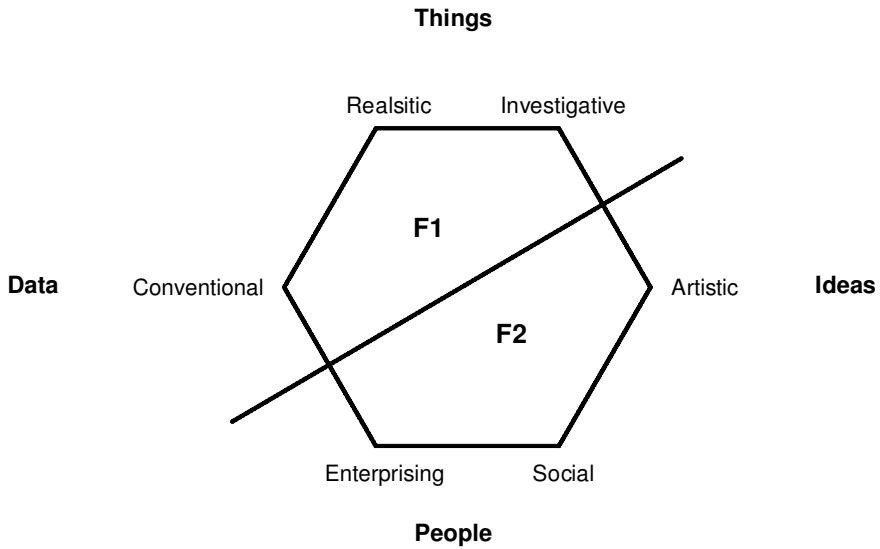


FIG. 1.

three personality scales that are adjacent to one another, which is supportive of what Holland called ‘consistency’ of the SDS scales (see Fig. 1). The first factor is characterised by people who are interested in working with things and with data. The second factor is characterised by people who are interested in working with people and with ideas.

Relationship Between Thinking Styles and Personality Types

The factor analysis performed on all scales from the two inventories resulted in a four-factor solution based on visual inspection of eigenvalues with the scree test (Cattell, 1966). Scales from both inventories loaded on each of the first two factors, indicating relations between the two inventories. The first factor (accounting for 31% of the variance in the data) loaded positively on the social and enterprising scales of the SVSDS and positively on the judicial and external styles, but negatively on the internal thinking style of the TSI. The second factor (accounting for 13% of the variance in the data) loaded negatively on the artistic scale of the SVSDS, but positively on the executive, local and conservative thinking styles. The third and fourth factors were loaded by thinking style scales and personality type scales, respectively. In all, the four factors accounted 64% of the variance in the data. Detailed data are reported in Table II.

Discussion

The present study aimed to achieve two objectives. A preliminary objective was to assess the reliability and validity of a short version of the Self-directed Search that was particularly designed for this study. A major objective was to investigate the relationship between thinking styles and personality types. Both objectives have been obtained satisfactorily.

TABLE II. Factor loadings: jointly for the Thinking Styles Inventory (TSI) and the Short-version Self-directed Search (SVSDS) ($N = 600$)

Scales	Factor I	Factor II	Factor III	Factor IV
TSI				
Legislative			-0.76	
Executive		0.89		
Judicial	0.51		-0.45	
Global			-0.71	
Local		0.43		
Liberal			-0.68	
Conservative		0.87		
Internal	-0.41		-0.82	
External	0.85			
SVSDS				
Realistic				0.74
Investigative				0.74
Artistic		-0.31		
Social	0.73			
Enterprising	0.53			0.35
Conventional				0.82
% Variance	30.75	13.35	11.16	8.63
C. Variance	30.75	44.10	55.26	63.89
Eigen values	4.61	2.00	1.67	1.29

Note: factor loadings below $|0.30|$ have been omitted.
C. Variance = Cumulative Variance.

Firstly, results indicated that for the purpose of the present study, Holland's personality types can be assessed by a much simpler questionnaire that is both reliable and valid. The present study using the SVSDS also identified gender differences in the Investigative scale, as well as in the Realistic scale. This suggests that the full-versions SDS may not be gender-biased, but, rather, identifies true differences between males and females. Of course, the SVSDS is only a newly designed brief questionnaire that requires further investigation.

Secondly, the predictions made regarding the relationship between the thinking styles and the personality types were partially supported by the results from the factor analysis performed upon all scales of the two inventories. In the first factor, as predicted, the social and enterprising scales are positively related to the external style, whereas they are negatively correlated with the internal thinking style. In addition, the social and enterprising scales are also positively related to the judicial thinking style. This finding might suggest either that people of the social and enterprising types tend to be involved in occupations that require them to use the judicial thinking style, or that people who prefer the judicial thinking style tend to be attracted to the social and enterprising environments. Overall, this first factor is loaded with scales, both personality types and thinking styles ones, which indicate that people approach the outer world by interacting with other people and evaluating different ideas and situations, but not by working alone.

The relationships manifested in the second factor provide partial support for the second prediction. The second prediction not only anticipated a negative relationship between the artistic type and the executive, local and conservative thinking styles, as have been identified in the present study, but also anticipated a positive relationship

between the artistic type and the legislative and liberal thinking styles. This second factor is loaded with scales that suggest people's tendency for carrying out detailed and routine tasks with given instructions, and a dislike for working under unstructured situations. However, no relationship was identified between the artistic type and the legislative and liberal thinking styles.

The third prediction was about the relationships between the conventional type and the legislative, liberal, executive, local and conservative thinking styles. Results from the factor analysis did not reveal these relationships. Moreover, the third and fourth factors also did not suggest any relationship between the two inventories.

Sternberg (1994), as mentioned earlier, has reported some statistically significant relationships of thinking styles to two other inventories based on models of personality types, these being the MBTI and Gregorc's styles. The present study, anchored in Sternberg's theory of mental self-government and Holland's theory of personality types, serves to lend partial support to the evidence of the relationships of thinking styles to personality types.

Implications

The present study has made two major contributions. Firstly, the study suggests that Holland's personality types can be assessed by a simple questionnaire that is both reliable and valid. Therefore, those researchers, counsellors or teachers who need to use information about their clientele's personality types as defined by Holland, but cannot afford the time administering the full-version of the SDS, may consider using a simple questionnaire such as the one used in the present study.

The second and more important contribution of the present study is that it has, for the first time, examined the relationship of thinking styles as defined by the theory of mental self-government to personality types as defined by Holland's theory of vocational/personality types. It was found that the two constructs from the two theories, although not strongly related, overlap to some extent. This finding indicates that the genesis of thinking styles may partially be explained by the nature of the relationship between thinking styles and personality types.

The second major finding is significant not only because it has clarified the relationship between two theories of styles from two different approaches, but also because it has practical implications for teachers and career counsellors. Teachers may use the two inventories to cross-validate students' thinking styles so that teachers could either teach and assess students according to students' thinking styles, or teach and assess in a way that they develop students' flexibility in their employment of thinking styles. Career counsellors may wish to help their clients to explore their career interests more comprehensively by using the Thinking Styles Inventory in addition to administering the SDS or the SVSDS.

Acknowledgements

I am very grateful to the Committee on Research and Conference Grants of The University of Hong Kong for supporting this work. I sincerely thank Professor David Watkins for his constructive comments on a preliminary draft of this article.

Correspondence: Dr. Li-fang Zhang, Department of Education, The University of Hong Kong, Pokfulam Road, Hong Kong. Tel/Fax: (852) 2859-2522. Email: lfzhang@hkucc.hku.hk

REFERENCES

- ALVI, S.A., KHAN, S.B., HUSSAIN, M.A. & BAIG, T. (1988) Relationship between Holland's typology and cognitive styles, *International Journal of Psychology*, 23, pp. 449-459.
- BANTA, T.J. (1970) Tests for the evaluation of early childhood education: the Cincinnati Autonomy Test Battery (CATB), in: J. HELLMUTH (Ed.) *Cognitive Studies*, Vol. 1, pp. 424-490 (New York, NY, Brunner-Mazel).
- BICKHAM, P.J., MILLER, M.J., O'NEAL, H. & CLANTON, R. (1998) Comparison of error rates on the 1990 and 1994 revised self-directed search, *Perceptual and Motor Skills*, 86, pp. 1168-1170.
- BIGGS, J.B. (1979) Individual differences in study processes and the quality of learning outcomes, *Higher Education*, 8, pp. 381-394.
- BIGGS, J.B. (1992) *Why and How Do Hong Kong Students Learn? Using the Learning and Study Process Questionnaires*, Education Paper No. 14 (Faculty of Education, The University of Hong Kong).
- BRAND, H.J., VAN-NOORWYK, J.S. & HANEKOM, J.D. (1994) Administering the self-directed search on a group of black adolescents, *South African Journal of Psychology*, 24, pp. 47-52.
- CAMPBELL, D.P. (1972) *Handbook for the Strong Vocational Interest Blank* (Stanford, CA, Stanford University).
- CAMPBELL, S.B. & DOUGLAS, V.I. (1972) Cognitive styles and responses to the threat of frustration, *Canadian Journal of Behavioral Science*, 4, pp. 30-42.
- CANTWELL, R.H. & MOORE, P.J. (1998) Relationships among control beliefs, approaches to learning, and the academic performance of final-year nurses, *The Alberta Journal of Educational Research*, 44, pp. 98-102.
- CATTELL, R.B. (1966) The Scree test for the number of factors, *Multivariate Behavioral Research*, 1, pp. 245-276.
- CURRY, L. (1983) *An Organization of Learning Styles Theory and Constructs*, p. 185 (ERIC Document 235).
- ENTWISTLE, N. (1981) *Styles of Teaching and Learning: an integrated outline of educational psychology for students, teachers, and lecturers* (New York, NY, John Wiley & Sons).
- FORD, N. (1995) Levels and types of mediation in instructional systems: an individual differences approach, *International Journal of Human-Computer Studies*, 43, pp. 241-259.
- GLIDDEN, R.C. & GREENWOOD, A.K. (1997) A validation study of the Spanish Self-Directed Search using back-translation procedures, *Journal of Career Assessment*, 5, pp. 105-113.
- GREGORC, A.F. (1979) Learning/teaching styles: potent forces behind them, *Educational Leadership*, 36, pp. 234-236.
- GREGORC, A.F. (1982) *Gregorc Style Delineator* (Maynard, MA, Gabriel Systems).
- GRIGORENKO, E.L. & STERNBERG, R.J. (1993) Thinking Styles in Teaching Inventory, *Unpublished test*, Yale University.
- HOLLAND, J.L. (1973) *Making Vocational Choices: a theory of careers* (Englewood Cliffs, NJ, Prentice-Hall).
- HOLLAND, J.L. (1985) *Making Vocational Choices: a theory of vocational personalities and work environments*, 2nd Edn (Englewood Cliffs, NJ, Prentice-Hall).
- HOLLAND, J.L., FRITZSCHE, B.A. & POWELL, A.B. (1994) *Self-directed Search—Technical Manual* (Odessa, Florida, Psychological Assessment Resources).
- JONES, A.E. (1997) Reflection-impulsivity and wholist-analytic: two fledglings? or is R-I a cuckoo?, *Educational Psychology*, 17, pp. 65-77.
- KAGAN, J. (1976) Commentary on reflective and impulsive children: strategies of information processing underlying differences in problem solving, *Monographs of the Society for Research in Child Development*, 41 (5, Serial No. 168).
- KEMBER, D. & GOW, D. (1990) Cultural specificity of approaches to study, *British Journal of Educational Psychology*, 60, pp. 356-363.
- KEOGH, B.K. & DONLON, G. (1972) Field dependence, impulsivity and learning disabilities. *Journal of Learning Disabilities*, 5, 331-336.

- KHAN, S.B. & ALVI, S.A. (1986) *A Study of Validation and Structure of Holland's Theory of Careers* (Toronto, Canada, Ontario Institute for Studies in Education).
- KHAN, S.B., ALVI, S.A. & KWONG, S.L. (1985) *Field-dependence and Field-independence Cognitive Styles of Intermediate and High School Students in Relation to Differences in Age/Grade, Gender, and Academic and Vocational Orientations* (Toronto, Canada, The Ontario Institute for Studies in Education).
- MARTON, F. (1976) What does it take to learn? Some implications on an alternative view of learning, in: N.J. ENTWISTLE (Ed.) *Strategies for Research and Development in Higher Education*, pp. 200–222 (Amsterdam, Swets and Zeitlenger).
- MASSARI, D.J. (1975) The relation of reflection–impulsivity to field-dependence–independence and internal–external control in children, *Journal of Genetic Psychology*, 126, pp. 61–67.
- NEIMARK, E.D. (1975) Individual differences and the role of cognitive style in cognitive development, *Genetic Psychology Monographs*, 91, pp. 171–225.
- OLTMAN, P.K., RASKIN, E. & WITKIN, H.A. (1971) *Group Embedded Figures Test* (Palo Alto, CA, Consulting Psychologists Press).
- OSIPOW, S.H. (1969) Cognitive styles and educational–vocational preferences and selections, *Journal of Counseling Psychology*, 16, pp. 534–546.
- RENZULLI, J.S. & SMITH, L.H. (1978) *Learning Styles Inventory* (Mansfield Center, CT, Creative Learning Press).
- RIDING, R. & CHEEMA, I. (1991) Cognitive styles—an overview and integration, *Educational Psychology*, 11, pp. 193–215.
- RIDING, R.J. & WIGLEY, S. (1997) The relationship between cognitive style and personality in further education students, *Personality and Individual Differences*, 23, pp. 379–389.
- SADLER-SMITH, E. (1997) 'Learning style': frameworks and instruments, *Educational Psychology*, 17, pp. 51–63.
- SADLER-SMITH, E. (1999) Intuition-analysis style and approaches to studying, *Educational Studies*, 25, pp. 159–173.
- SCHLEIFER, M. & DOUGLAS, V.I. (1973) Moral judgments, behavior and cognitive style in young children, *Canadian Journal of Behavioral Science*, 5, pp. 133–144.
- STERNBERG, R.J. (1988) Mental self-government: a theory of intellectual styles and their development, *Human Development*, 31, pp. 197–224.
- STERNBERG, R.J. (1990) *Metaphors of Mind: conceptions of the nature of intelligence* (New York, Cambridge University Press).
- STERNBERG, R.J. (1994) Thinking styles: theory and assessment at the interface between intelligence and personality, in: R.J. STERNBERG & P. RUZGIS (Eds) *Intelligence and Personality*, pp. 169–187 (New York, Cambridge University Press).
- STERNBERG, R.J. (1997) *Thinking Styles* (New York, Cambridge University Press).
- STERNBERG, R.J. & WAGNER, R.K. (1992) Thinking Styles Inventory, *Unpublished test*, Yale University.
- STRONG, E.K., JR (1955) *Vocational Interests 18 Years After College* (Minneapolis, MN, University of Minnesota).
- WILSON, K.L., SMART, R.M. & WATSON, R.J. (1996) Gender differences in approaches to learning in first year psychology students, *British Journal of Educational Psychology*, 66, pp. 59–71.
- WITKIN, H.A. (1964) Origins of cognitive style, in: C. SHEERER (Ed.) *Cognition, Theory, Research, Promise* (New York, NY, Harper and Row).
- ZHANG, L.F. (1999) Further cross-cultural validation of the theory of mental self-government, *The Journal of Psychology*, 133, pp. 165–181.
- ZHANG, L.F. (in press) Relationship between Thinking Styles Inventory and Study Process Questionnaire, *Personality and Individual Differences*.
- ZHANG, L.F. & STERNBERG, R.J. (2000) Are learning approaches and thinking styles related? A study in two Chinese populations, *The Journal of Psychology*, 134.

Appendix A

Key Characteristics of Sternberg's 13 Thinking Styles and of Holland's six Personality Types dealing with tasks in which one can analyse and evaluate ideas and/or problems; Prefer being engaged in tasks that allow one to make a judgement.

Scale	Key characteristics
Thinking Styles Inventory	
Legislative	Prefer doing things in one's own way; Prefer being engaged in tasks that require creative strategies.
Executive	Prefer implementing tasks according to clear guidelines; Prefer being told what to do and how to do what needs to be done.
Judicial	Prefer dealing with tasks in which one can analyse and evaluate ideas and/or problems; Prefer being engaged in tasks that allow one to make a judgement.
Hierarchical	Prefer working towards several goals within a given period of time and being engaged in tasks that allow one to prioritise one's tasks.
Oligarchic	Prefer working towards several goals within a given period of time, but being engaged in tasks that do not require one to prioritise one's tasks.
Monarchic	Prefer working towards a single goal at a time; Prefer being engaged in tasks that allow one to focus on one thing at a time.
Anarchic	Prefer working towards a variety of goals within a given period of time; Prefer working in situations in which one is allowed great flexibility.
Global	Prefer dealing with larger issues; Prefer being engaged in tasks that allow one to focus one's attention on abstract ideas.
Local	Prefer dealing with issues that are more focused; Prefer being engaged in tasks that allow one to focus one's attention on specific details.
Liberal	Tend to go beyond existing rules and procedures; Prefer being engaged in tasks that involve unfamiliarity and ambiguity.
Conservative	Tend to abide by rules and procedures; Prefer dealing with tasks that are familiar and unambiguous.
Internal	Prefer dealing with things (rather than with people); Prefer being engaged in tasks that allow one to work independently.
External	Prefer dealing with people (rather than with things); Prefer being engaged in tasks that allow one to work with other people.
Short-version Self-directed Search	
Realistic	Have athletic or mechanical ability; Interested in working with objects, machines, tools, plants, or animals, or to be outdoors.
Investigative	Like to observe, learn, investigate, analyse, evaluate, or solve problems.
Artistic	Have artistic, innovating abilities; Like to work in unstructured situations, using one's imagination or creativity.
Social	Like to work with people—to inform, help, train, or develop people; Being skilled with words.
Enterprising	Like to work with people—to influence other people; Prefer to take leadership.
Conventional	Like to work with data; Have clerical or numerical ability; Like to carry things out in detail and to follow others' instructions.

Copyright of Educational Psychology is the property of Carfax Publishing Company and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.