The Journal of Psychology, 2000, *134*(5), 469–489

Are Learning Approaches and Thinking Styles Related? A Study in Two Chinese Populations

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ABSTRACT. This article presents the results of an investigation of the construct validity of J. B. Biggs's (1987) theory of learning approaches and of R. J. Sternberg's (1988) theory of thinking styles in two Chinese populations. The study is also an examination of the nature of the relations between the two theories. University students from Hong Kong (n = 854) and from Nanjing, mainland China (n = 215), completed the Study Process Questionnaire (J. B. Biggs, 1992) and the Thinking Styles Inventory (R. J. Sternberg & R. K. Wagner, 1992). Results indicated that both inventories were reliable and valid for assessing the constructs underlying their respective theories among both Hong Kong and Nanjing university students. Results also showed that the learning approaches and thinking styles are related in the hypothesized ways: The surface approach was hypothesized to be positively and significantly correlated with styles associated with less complexity, and negatively and significantly correlated with the legislative, judicial, liberal, and hierarchical styles. The deep approach was hypothesized to be positively and significantly correlated with styles associated with more complexity, and negatively and significantly correlated with the executive, conservative, local, and monarchic styles. Implications of these relations are discussed.

THINKING AND LEARNING STYLES are sources of individual differences in academic performance that are related not to abilities but to how people prefer to use their abilities. There are alternative theories of thinking and learning styles, all of which share a common goal—that is, to explain individual differences in performance that are not explained by abilities (Sternberg, 1994, 1997).

Given the differences among theories of thinking and learning styles, a question that arises is whether such theories relate to different constructs, using a common root word "style," or rather if they are theories of the same construct but have different names for overlapping styles. Psychologists and educators need to

understand whether the various theories—and the measures associated with them—provide insights into different constructs or the same constructs under different labels. Following this view, the primary goal of the present study was to verify the nature of the relations between Biggs's (1987, 1992) theory of approaches to learning and Sternberg's (1988, 1990, 1994, 1997) theory of mental self-government, a theory of thinking styles.

What, exactly, is a style? How does a style differ from an ability? A style is a preferred way of thinking or of doing things. A style is not an ability, but rather a preference in the use of the abilities people have. It is an interface between ability and personality (Sternberg, 1994, 1997).

Since the beginning of the cognitive-styles movement in the 1950s and early 1960s, different theories of thinking styles have been constructed. Because there are many more than we could address here (for more extensive reviews, see Grigorenko & Sternberg, 1995; Kogan, 1983; Sternberg, 1997), we review only selected theories.

Myers (1980; Myers & McCaulley, 1988) proposed a series of psychological types based on Jung's (1923) theory of types. According to Myers, there are 16 types, resulting from all possible combinations of (a) two ways of perceiving (sensing vs. intuiting), (b) two ways of judging (thinking vs. feeling), (c) two ways of dealing with self and others (being introverted vs. being extraverted), and (d) two ways of dealing with the outer world (judging vs. perceiving). Gregorc (1985) proposed four main types of styles, based on all possible combinations of two dimensions (concrete vs. abstract and sequential vs. random). Renzulli and Smith (1978) suggested various learning styles, with each corresponding to a method of teaching (e.g., projects, drill and recitation, and discussion), and Holland (1973) proposed six styles (realistic, investigative, artistic, social, enterprising, and conventional) that have been used as a basis for understanding career interests. Some other theories of styles are not general theories; rather, they are theories of specific aspects of cognitive-stylistic functioning (Grigorenko & Sternberg, 1995). For example, Kagan (1976) studied individual differences between impulsive and reflective persons, and Witkin (1978) examined the differences between field-independent and field-dependent individuals.

Recently, two theories have been proposed that are fairly general. One is

Research for this project was supported in part by the Committee on Research and Conference Grants as administered by The University of Hong Kong.

Preparation of this article was supported in part under the Javits Act Program (Grant No. R206R50001) as administered by the Office of Educational Research and Improvement, U.S. Department of Education. Grantees undertaking such projects are encouraged to express freely their professional judgment. This article, therefore, does not necessarily represent the position or policies of the Office of Educational Research and Improvement or the U.S. Department of Education, and no official endorsement should be inferred.

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Biggs's (1987, 1992) theory of students' approaches to learning, also known as the 3P model; the other is Sternberg's (1988, 1990, 1997) theory of mental self-government.

Biggs's Theory of Approaches to Learning

Adapted from Dunkin and Biddle's (1974) presage–process–product model, Biggs's model addresses those three components in the classroom. *Presage* concerns components before learning takes place; *process* pertains to components while learning is taking place; *product* pertains to outcomes after learning has taken place. In the present study we focus on the process of learning. According to the 3P model, there are three common approaches to learning: *surface,* which involves a reproduction of what is taught to meet the minimum requirements; *deep,* which involves a real understanding of what is learned; and *achieving,* which involves using a strategy that will maximize one's grades. Each approach is composed of two elements: motive and strategy (see Biggs, 1987, 1992, for a description of the Study Process Questionnaire [SPQ]). *Motive* describes why students choose to learn, whereas *strategy* describes how students go about their learning.

An alternative theory is that of Marton (e.g., Marton & Booth, 1997), who proposed surface and deep but not achieving strategies. A question in need of resolution, therefore, is whether the achieving style truly is distinguishable from the other two as a third style, or is a variant of one or both of them. Related work has been done by Entwistle and his colleagues (e.g., Entwistle, 1988, 1990; Entwistle, Koseki, & Politt, 1987; Entwistle & Marton, 1994), who have considered both the two-style and three-style models.

One of the instruments used to assess learning approaches among university students is the SPQ (Biggs, 1987, 1992), which was originally designed to assess the learning approaches of Canadian and Australian students. Many studies have been undertaken with the SPQ. Focusing on students' motives and strategies for learning, Biggs (1992) summarized major endeavors regarding the 3P model using the SPQ before 1992. These motives and strategies for learning have been examined in the following contexts: cross-cultural comparisons, the language medium of instruction, teaching/learning environments, student characteristics, professional and staff development, and factor structure and dimensionality of subscales.

More recent work examining learning approaches as defined by the 3P model have as their foci the investigation of the relationships between learning approaches and academic achievement (e.g., Albaili, 1995; Rose, Hall, Bolen, & Webster, 1996) and the construction of other versions of the SPQ (e.g., Albaili; Watkins & Murphy, 1994). Investigation of the factorial structure of the SPQ continues to be one of the major approaches to examining the instrument and its underlying 3P model (e.g., Bolen, Wurm, & Hall, 1994; Niles, 1995; O'Neil &

Child, 1984). In addition, individual differences based on age and gender (e.g., Sadler-Smith & Tsang, 1998; Watkins & Hattie, 1981; Wilson, Smart, & Watson, 1996) also have been of major interest to scholars using the SPQ in their investigations of student learning.

In their study of the relationship between SPQ scores and overall grade point average (GPA) among 202 U.S. undergraduate students, Rose et al. (1996) found that only scores on the achieving approach contributed to prediction (negative correlation) of GPA. Albaili (1995), in his study of 246 United Arab Emirates undergraduate students, found that GPAs were negatively correlated with the surface approach and positively correlated with the deep and achieving approaches.

As mentioned earlier, the SPQ was originally constructed to measure Australian and Canadian university students' learning approaches. Other versions of the SPQ, however, also have been constructed. For example, in 1992, a Hong Kong version was established (Biggs, 1992). In 1994, when they studied Brunei university students, Watkins and Murphy came up with a simplified English as a Second Language (ESL) version and a Malay version. In 1995, Albaili established an Arabic version of the SPQ in his study of university students in the United Arab Emirates. All of the versions of the SPQ proved to be reliable and valid measures for assessing students' learning approaches.

The study of the validity of the SPQ has taken two forms. One is the examination of its internal structure. The other is the examination of the SPQ compared with other instruments. Many studies have had a focus on the examination of the internal structure of the SPQ. Although some studies supported Biggs's original argument that there are three factors in the SPQ, other studies have shown that there are only two factors. For example, in their study of a sample of U.S. university students' approaches to learning, Bolen et al. (1994) identified three factors—Surface Approach, Deep Approach, and Achieving Approach. Similarly, O'Neil and Child (1984), studying British university students, also identified three factors in the SPQ. However, in a study in Australia by Niles (1995) of overseas and Australian university students, and in Watkins and Dahlin's (1997) study of university students in Sweden, a two-factor model was identified (see also Entwistle, 1981; Marton & Booth, 1997). The two factors were Deep Approach and Surface Approach to learning, and the two Achieving subscales were split between the two factors.

Few researchers have investigated the relations between the SPQ and other instruments. We identified three such studies in the literature. A first study was conducted by Kember and Gow (1990), who administered both the SPQ and the Approaches to Studying Inventory (ASI; Entwistle, 1981) to Hong Kong university students. Although all three factors (Surface, Deep, and Achieving) appeared in the SPQ, only two factors (Deep and Achieving) appeared in the ASI. Surface learning was replaced by a factor labeled "narrow orientation" (Harper & Kember, 1989), which has been variously called "operation learning" by Watkins (1982, p. 80) and "disorganized study" by Ramsden and Entwistle (1981, p. 372).

A second study was carried out by Murray-Harvey (1994), who conducted a factor analysis on the Productivity Environmental Preference survey and the SPQ data collected from 400 Australian university students. Results indicated that the two inventories measure two quite different conceptualizations of student learning. It was concluded that learning approach is relatively stable over time and that learning style is not quite as stable.

A third study was conducted by Wilson et al. (1996), who also studied the relationship between the SPQ and the ASI. Analyzing the data collected from 283 Australian university students, the authors found significant correlations between the scales in the two inventories. They concluded that the two inventories measure similar constructs.

Age and gender are two of the variables that scholars have investigated in relation to the SPQ. Findings are, again, varied. For example, Sadler-Smith and Tsang (1998), studying British and Hong Kong university students, did not find any age or gender difference in the British sample; they did, however, observe an interaction of age and gender in their effects on deep and strategic (see Entwistle, 1981) approaches. That is, mature male students reported higher scores on the deep approach than did the non-mature male students; however, for female students, this pattern was reversed. Sadler-Smith and Tsang specified 23 years as the cutoff age between non-mature and mature participants.

By the same token, Watkins and Hattie (1981) also observed age and gender differences. They found that male students scored significantly higher on the scales measuring surface learning than did female students, whereas female students scored significantly higher on the scales measuring deep learning than did their male counterparts. They also found that older students scored significantly higher on the scales measuring deep learning than did their younger counterparts. On the contrary, Wilson et al. (1996) found no gender differences.

In summary, there is strong evidence that the SPQ is a reliable and valid instrument for assessing the learning approaches of university students, including Chinese university students.

Sternberg's Theory of Mental Self-Government

Sternberg's (1988, 1990, 1997) theory of mental self-government addresses people's thinking styles, which may be used in many settings, including university, home, and community. At the heart of this theory is the notion that people need somehow to govern or manage their everyday activities. There are many ways of doing so; whenever possible, people choose styles of managing themselves with which they are comfortable. Still, people are at least somewhat flexible in their use of styles and try with varying degrees of success to adapt themselves to the stylistic demands of a given situation. Thus, an individual with one preference in one situation may have a different preference in another situation. Moreover, styles may change with time and with life demands. Thinking styles

are at least partly socialized (Sternberg, 1994, 1997), a fact that suggests that, to some extent, they can be modified by the environment in which people reside. As applied to individuals, the theory of mental self-government posits 13 thinking styles that fall along five dimensions of mental self-government: (a) functions, (b) forms, (c) levels, (d) scope, and (e) leanings.

Functions

As in government, there are three functions in human beings' mental self-government: legislative, executive, and judicial. An individual with a *legislative* style enjoys being engaged in tasks that require creative strategies. These individuals prefer to choose their own activities, or at least to do the activities chosen for them in their own way. An individual with an *executive* style is more concerned with implementation of tasks with set guidelines. Such an individual prefers more direction or guidance in structuring tasks. An individual with a *judicial* style focuses attention on evaluating the products of others' activities.

Forms

Also as in government, a human being's mental self-government takes four different forms: monarchic, hierarchic, oligarchic, and anarchic. An individual with a *monarchic* style enjoys being engaged in tasks that allow complete focus on one thing at a time. In contrast, an individual with a *hierarchic* style prefers to distribute attention to several tasks that are given priority according to their value to the individual in achieving his or her goals. An individual with an *oligarchic* style also likes to work on multiple activities in the service of multiple objectives, but may not enjoy setting priorities. Finally, an individual with an *anarchic* style enjoys working on tasks that allow flexibility as to what, where, when, and how one works, but he or she eschews systems of almost any kind.

Levels

As with governments, human beings' mental self-government functions at two different levels: local and global. An individual with a *local* style enjoys being engaged in tasks that require working with concrete details. In contrast, an individual with a *global* style prefers to pay more attention to the overall picture of an issue and to abstract ideas.

Scope

Mental self-government can deal with internal and external matters. An individual with an *internal* style enjoys being engaged in tasks that allow that individual to work independently. In contrast, an individual with an *external*

style likes being engaged in tasks that allow for collaborative ventures with other people.

Leanings

Finally, in mental self-government, there are two leanings: liberal and conservative. An individual with a *liberal* style enjoys engaging in tasks that involve novelty and ambiguity, whereas an individual with a *conservative* style prefers adhering to the existing rules and procedures in performing tasks.

The theory of mental self-government has been operationalized through inventories, including the Thinking Styles Inventory (TSI; Sternberg & Wagner, 1992), which have been shown to be reliable and valid for U.S. and Hong Kong samples. Furthermore, results from such research have shown some value of the theory and have generated a number of implications for teaching and learning in educational settings. In the United States, Sternberg and Grigorenko conducted a series of studies. In one such study, Sternberg and Grigorenko (1995) reported significant relationships between teaching styles and grade taught, length of teaching experience, and subject area taught. Specifically, teachers teaching at lower grade levels were more legislative than teachers teaching at higher grade levels; complementarily, teachers teaching at lower grade levels were less executive than teachers at higher grade levels. It was shown that teachers with more teaching experience were more executive, local, and conservative than were those teachers with less teaching experience. Furthermore, it was found that humanities teachers were more liberal than were science teachers.

A second set of findings indicated significant relationships between students' learning styles and such demographic data as students' socioeconomic status (SES) and birth order (Sternberg & Grigorenko, 1995). Specifically, participants of higher SES status tended to score higher on the legislative style. Likewise, participants who were later-borns in their family scored higher on the legislative style than did participants who were earlier-borns. A third data set indicated that teachers inadvertently favored those students who had thinking styles similar to their own (Sternberg & Grigorenko). In a more recent study, Grigorenko and Sternberg (1997) found that certain thinking styles contribute significantly to prediction of academic performance over and above prediction of scores on ability tests. Their study also indicated that students with particular thinking styles fared better on some forms of evaluation than on others.

Three studies concerning the theory of mental self-government have been carried out in Hong Kong (Zhang, 1999; Zhang & Sachs, 1997; Zhang & Sternberg, 1998). These studies indicate that the thinking styles defined by Sternberg's theory also can be identified among university students in Hong Kong. The internal consistency reliabilities and validity data are generally satisfactory (see description in the Method section, under Inventories). Furthermore, results from these studies have suggested that students' thinking styles are statistically differ-

ent based on such variables as age, sex, college class, teaching experience, college major, school subject taught, and travel experience. For example, male participants scored higher on the global style than did their female counterparts. Participants who had had more teaching experience (as measured by the length of teaching) and those who had had more travel experience scored higher on the creativity-promoting thinking styles, such as legislative and liberal. In our recent study (Zhang & Sternberg, 1998) of 622 Hong Kong university students, we found that thinking styles (as defined by the theory of mental self-government) could serve as reasonable predictors of academic achievement over and above self-rated abilities. For example, higher achievement was positively correlated with the use of conservative, hierarchic, and internal styles of thinking; yet, higher achievement was negatively correlated with the use of the legislative, liberal, and external styles of thinking.

Although both the SPQ and the TSI and their underlying theories have been well researched, the present study is the first to investigate the relationships among the scales in the two inventories and the connections between the two theories. In the present study, we examined the relations between the two theories and corresponding measures of styles in two Chinese populations—university students from Nanjing, mainland China, and university students from Hong Kong. The means to achieve this goal was to determine the reliability and validity of the SPQ and of the TSI, to examine the relations between the scales in the two inventories, and to determine whether the hypothesized relationships between the SPQ and the TSI exist among more than one sample. These two inventories were studied together because they are based on similar theoretical constructs. By nature, both Biggs's theory of learning approaches and Sternberg's theory of mental self-government concern two types of mental functioning and thus, two ways of processing information: more simple and more complex.

We proposed two sets of hypotheses, drawn in part on past work in the field by Beishuizen, Stoutjesdijk, and Van-Putten (1994), who studied the relation between cognitive levels of task accomplishment and deep versus surface processing of material. Beishuizen et al. expected deep-processing students to benefit from metacognitive support and surface-processing students to benefit from cognitive support. They found that students who processed at a surface level tended to benefit from cognitive support. Students who combined self-regulation with deep processing and students who combined external regulation with surface processing outperformed students who showed the opposite pairings of type of regulation with type of processing.

We expected students who take a surface approach to learning and those who use executive, monarchic, local, and conservative styles to be individuals who want to get things done with given structures, who do not want to make mistakes, and who want to "play it safe." We expected students who take a deep approach to learning and those who tend toward legislative, judicial, hierarchic, anarchic, global, and liberal styles to want to make up their own minds and use their own

judgments in learning. We expected these students to want to work more in situations in which their creativity and imagination would be allowed free rein. Furthermore, we expected them to be less afraid of making mistakes.

Thus, we proposed the following: First, the surface approach should be positively and significantly correlated with styles associated with less complexity—executive, monarchic, local, and conservative styles. Complementarily, this approach should be negatively and significantly correlated with the legislative, judicial, liberal, and hierarchic styles. Second, the deep approach should be positively and significantly correlated with styles associated with more complexity—legislative, judicial, hierarchic, anarchic, global, and liberal styles. Complementarily, this approach should be negatively and significantly correlated with the executive, conservative, local, and monarchic styles.

No specific predictions were made regarding the relations between the achieving approach subscales of the SPQ and the subscales of the TSI, because previous research (e.g., Niles, 1995; Watkins & Dahlin, 1997; Wong, Lin, & Watkins, 1996) has yielded conflicting results. In particular, the achieving motive and strategy subscales of the SPQ (which assess the achieving approach) may be either clustered with one of the two scales (Deep and Surface) or split between the two. In other words, like Marton and Booth's (1997) theory, Biggs's theory conceptually addresses two approaches to learning: deep and surface.

Method

Participants

Hong Kong sample. A total of 854 (362 male and 492 female) students were selected randomly from about 4,000 entering students at the University of Hong Kong during the orientation week of the fall semester of 1997. These 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. Of these students, 501 were in social sciences/humanities, 349 were in natural sciences, and 4 were not identifiable. Of all the participants, 702 were undergraduate freshmen, 66 were beginning to pursue their post-graduate certificates, and 86 were starting their education for a master's degree. The average age of the participants was 21 years; 66% were 19 years old or younger, 20% were between the ages of 20 and 25, and 14% were between 26 and 57 years of age. At the time the study was conducted, 535 of the participants were not holding any job, 110 were working full-time, and 198 were working part-time. Eleven did not indicate their employment status.

Nanjing sample. A total of 215 (114 male, 101 female) entering freshmen from two big universities in Nanjing, mainland China, participated in the study at the beginning of the fall semester of 1997. Ten teachers were trained in the adminis-

tration of the questionnaires. Each of the 10 teachers informed his or her class about the nature of the study. Those students who were not willing to participate in the study were not required to participate. Those who volunteered (98% of the students) to participate were from several areas of study, including chemistry, computer science, education, finance, history, law, management, mathematics, medicine, and political science. Classified into the two broad fields of study, 126 were from social sciences/humanities and 89 were from natural sciences. The average age of the participants was 19 years, with a range from 15 to 23. In all, 75% of the participants were 19 years old or younger.

Inventories

Two inventories and a demographic questionnaire were used in the study. The first inventory was Biggs's SPQ (1992; Chinese version normed on Hong Kong university students). The second was Sternberg and Wagner's (1992) TSI. Both of the inventories were developed originally in English and were later translated and back-translated between Chinese and English.

The SPQ is a self-report questionnaire consisting of 42 items. This questionnaire has 6 subscales, with 7 items on each subscale. For each item, the respondents are asked to rate themselves on a 5-point scale anchored by 1 (*never or only rarely true of you*) and 5 (*always or almost always true of you*). The 6 subscales are Surface Motive, Surface Strategy, Deep Motive, Deep Strategy, Achieving Motive, and Achieving Strategy. Therefore, the 3 scales based on the three approaches to learning are Surface (Motive and Strategy), Deep (Motive and Strategy), and Achieving (Motive and Strategy). As described earlier, motive describes why students choose to learn, whereas strategy describes how students go about their learning.

As mentioned earlier, numerous studies involving the use of the SPQ have been conducted all over the world (e.g., Albaili, 1995; Bolen et al., 1994; Kember & Gow, 1990; Murray-Harvey, 1994; Watkins & Akande, 1992; Watkins & Regmi, 1990). Most of those studies have resulted in internal consistencies ranging from the mid .50s to the low or mid .70s for the 6 subscales and from the low .70s to the low .80s for the three scales (see Albaili, 1995, for details).

The TSI (Sternberg & Wagner, 1992) is a self-report questionnaire consisting of 65 items. The inventory has 13 subscales, with 5 items on each subscale. For each item, respondents are asked to rate themselves on a 7-point scale anchored by 1 (*does not characterize you at all*) and 7 (*characterizes you extremely well*). These 13 subscales correspond to the 13 thinking styles described in Sternberg's theory of mental self-government.

Sternberg and Wagner (1992) collected norms for various age groups on the long version of the TSI (which contains 104 items, 8 for each of the 13 subscales). For Sternberg and Wagner's college sample, subscale reliabilities ranged from .42 (monarchic) to .88 (external), with a median reliability of .78. In anoth-

er study using the TSI, Sternberg (1994) found a five-factor model corresponding to the five dimensions of mental self-government described in his theory of thinking styles. These five factors accounted for 77% of the variance in the data.

The TSI also has been validated against instruments based on other theories of styles (e.g., Myers-Briggs Type Indicator, Gregorc's measure of mind styles), as well as a standard IQ test, the Scholastic Assessment Test (SAT), and GPA. Results from these construct-validity studies indicated that, among U.S. students, the TSI is a reliable and valid instrument for studying thinking styles as defined by the theory of mental self-government.

The TSI also has proved to be reliable and valid for identifying thinking styles of university students in Hong Kong. The statistics from three studies (Zhang, 1999; Zhang & Sachs, 1997; Zhang & Sternberg, 1998) conducted in Hong Kong are similar in magnitude to those obtained by Sternberg (1988, 1990, 1994, 1997). For example, the alpha coefficients in Sternberg's (1994) study ranged from .44 to .88; those in Zhang and Sachs's (1997) study ranged from .53 to .87 (from .46 to .89 in Zhang, 1999, and from .43 to .78 in Zhang & Sternberg, 1998). Although Zhang and Sachs's (1997) study extracted only three factors corresponding to the constructs in the theory of mental self-government, both Sternberg's (1994) and Zhang's (1999) studies extracted five factors (the former accounted for 77% of the variance and the latter, 78%). In these studies, each factor roughly corresponded to one of the five dimensions delineated in the theory. In our recent study (Zhang & Sternberg, 1998), the validity of the TSI was tested through an interscale correlation matrix. It was shown that the scales were, in general, correlated in the predicted directions. For example, the correlation between the executive and conservative styles was .63 ($p < .001$); that between the legislative and liberal styles was .41 ($p < .001$); and that between the internal and external styles was $-.30$ ($p < .001$).

Data Analysis

The following analyses were conducted both separately for men and women and for the sexes combined. The reliability of each of the 6 subscales in the SPQ and the 13 subscales in the TSI was estimated by Cronbach's alpha. The validity of each of the two inventories was examined through the relations shown among the subscales by its respective intercorrelation matrix. The relations between the two theories were examined via a correlation matrix, with the subscales of the SPQ providing one set of variables and those of the TSI providing another.

Results

In both the Hong Kong and Nanjing samples, t tests on the 6 subscales of the SPQ and the 13 subscales of the TSI resulted in a few pairs of statistically significant ($p < .05$) means for men and women. On a 5-point Likert-type scale (of

the SPQ), the statistically significant mean differences were (a) .19 on Achieving Motive, (b) .11 on Deep Strategy, and (c) .11 on Surface Motive for the Hong Kong sample; and (a) .24 on Deep Motive and (b) .31 on Deep Strategy for the Nanjing sample. On a 7-point Likert-type scale, the statistically significant mean differences were (a) .12 on the legislative style, (b) .20 on the judicial style, (c) .15 on the global style, (d) .38 on the liberal style, and (e) .23 on the internal style for the Hong Kong sample; and (a) .39 on the legislative style, (b) .74 on the liberal style, and (c) .35 on the internal style for the Nanjing sample. In all cases, men scored higher than women. These differences, although statistically significant, were small in magnitude. Furthermore, none of the remaining statistical analyses conducted for men and women separately indicated significant gender differences. These analyses included (a) a correlational analysis on the 13 subscales of the TSI, (b) a factor analysis on the SPQ, and (c) a correlational analysis between the subscales of the two inventories. Because of the lack of gender differences in the previous three statistical procedures, the results are reported with combined gender analyses.

Subscale Reliabilities for the SPQ

The alpha estimates of internal consistency for the Deep and Achieving Motive and Strategy subscales for both the Hong Kong and Nanjing samples are in line with those obtained by Biggs (1987) for his Australian norming sample (see Table 1). The findings also are in line with estimates obtained by other authors, such as Watkins and Dahlin (1997), in their study of Swedish university students. However, the alpha coefficients of the Surface Motive and Surface Strategy subscales are higher for the samples in this study (in the mid .60s and low .70s) than for the aforementioned Australian and Swedish samples (low .40s for Surface Motive and mid .50s for Surface Strategy). The alpha coefficients for

TABLE 1
Study Process Questionnaire Subscales: Means, Standard Deviations, and Alpha Coefficients

Subscale	Items	*M*		*SD*		α	
		HK	NJ	HK	NJ	HK	NJ
Achieving Motive	3, 9, 15, 21, 27, 33, 39	3.04	3.51	.74	.73	.78	.72
Achieving Strategy	6, 12, 18, 24, 30, 36, 42	3.16	3.49	.69	.66	.80	.73
Deep Motive	2, 8, 14, 20, 26, 32, 38	3.26	3.42	.58	.64	.65	.64
Deep Strategy	5, 11, 17, 23, 29, 35, 41	3.33	3.60	.58	.62	.75	.74
Surface Motive	1, 7, 13, 19, 25, 31, 37	2.96	2.80	.66	.73	.68	.67
Surface Strategy	4, 10, 16, 22, 28, 34, 40	2.74	2.47	.60	.58	.70	.64

Note. HK = Hong Kong. NJ = Nanjing. Hong Kong $n = 854$. Nanjing $n = 215$

the 6 subscales ranged from .65 to .80, with a median of .73, for the Hong Kong students, and from .64 to .74, with a median of .70, for the Nanjing students. The alpha coefficients for the Surface, Deep, and Achieving scales were .80, .82, and .83, respectively, for the Hong Kong sample, and .78, .78, and .76, respectively, for the Nanjing sample. These alpha coefficients were considered sufficiently high to allow further statistical analyses.

Subscale Reliabilities for the TSI

The magnitudes of the estimates of internal consistency for the TSI for the Hong Kong sample and the Nanjing sample were similar (see Table 2). Furthermore, these results are comparable to those obtained by Sternberg (1994) in his study of U.S. participants, by Zhang and Sachs (1997), and by Zhang (1999). Notice that 3 subscales were less internally consistent in those respective studies. These subscales were local, monarchic, and anarchic. Even so, the estimates of internal consistency obtained in the present study were considered to be adequate to allow further statistical analyses.

Subscale Intercorrelations for the SPQ

In accordance with Biggs's theory, we predicted that the Deep Motive and Deep Strategy subscales would be significantly negatively correlated with the

TABLE 2
Thinking Styles Inventory Subscales: Means, Standard Deviations, and Alpha Coefficients

Subscale	Items	*M*		*SD*		α	
		HK	NJ	HK	NJ	HK	NJ
Legislative	5, 10, 14, 32, 49	4.91	5.45	.81	.86	.71	.65
Executive	8, 11, 12, 31, 39	4.91	4.68	.79	.97	.66	.61
Judicial	20, 23, 42, 51, 57	4.67	4.87	.85	.92	.72	.62
Global	7, 18, 38, 48, 61	4.28	4.59	.76	.95	.58	.60
Local	1, 6, 24, 44, 62	4.35	4.35	.72	.90	.48	.49
Liberal	45, 53, 58, 64, 65	4.20	4.74	.94	1.0	.80	.81
Conservative	13, 22, 26, 28, 36	4.50	3.96	.86	1.12	.72	.74
Hierarchical	4, 19, 25, 33, 56	4.87	5.01	.88	1.06	.76	.78
Monarchic	2, 43, 50, 54, 60	4.59	4.98	.76	.86	.48	.43
Oligarchic	27, 29, 30, 52, 59	4.57	4.62	.80	.95	.64	.66
Anarchic	16, 21, 35, 40, 47	4.45	4.48	.73	.76	.44	.13
Internal	9, 15, 37, 55, 63	4.35	4.71	.99	.97	.77	.67
External	3, 17, 34, 41, 46	4.83	5.12	.89	1.06	.74	.72

Note. HK = Hong Kong. NJ = Nanjing. Hong Kong n = 854. Nanjing n = 215.

Surface Motive and Surface Strategy subscales. Furthermore, as mentioned earlier, no prediction was made on the Achieving Motive and Achieving Strategy subscales because these subscales may be positively and significantly correlated with either the Deep subscales or the Surface subscales, or split between the two (Watkins & Dahlin, 1997; Wong et al., 1996). The predictions were fully supported by the results from the Nanjing sample. Results from the Hong Kong sample, however, did not support these predictions, in that three of the correlations were in the direction opposite from what was expected from the theory. These correlation coefficients were (a) Surface Motive with Deep Motive ($r = .17$, $p < .01$), (b) Surface Motive with Deep Strategy ($r = .16$, $p < .01$), and (c) Surface Strategy with Deep Strategy ($r = .10$, $p < .01$). These three correlations indicate that students who took a surface approach to learning also tended to take a deep approach, a pattern not consistent with Biggs's theory, according to which surface subscales presumably should be negatively correlated with the deep subscales.

Because of the presence of the three unexpected correlations, we conducted a principal-axis factor analysis with a varimax rotation, to examine further the validity of the SPQ for the Hong Kong sample. A scree test (Cattell, 1966) indicated that a two-factor solution would be appropriate. Furthermore, there were two factors with eigenvalues greater than 1. Thus, a two-factor model was retained (see Table 3 for details). The analysis yielded a clear factor for a deep approach (factor loadings: .86 for Deep Motive; .89 for Deep Strategy; .76 for Achieving Strategy) and one for a surface approach (factor loadings: .88 for Surface Motivation; .87 for Surface Strategy; .71 for Achieving Motive). The Achieving Motive and Achieving Strategy subscales thus were split between the Deep and Surface subscales, as expected (Niles, 1995; Watkins & Dahlin, 1997; Wong et al., 1996).

TABLE 3
Oblimin-Rotated Two-Factor Model for the Study Process Questionnaire

	Hong Kong		Nanjing	
Subscale/Item	Factor 1	Factor 2	Factor 1	Factor 2
Surface Motive	−.04	.89	−.12	.86
Surface Strategy	−.10	.89	−.10	.86
Deep Motive	.88	−.07	.81	−.04
Deep Strategy	.90	−.07	.82	−.16
Achieving Motive	.32	.67	.50	.60
Achieving Strategy	.74	.15	.77	.04
% of variance	48.2	24.7	36.5	31.0
Cumulative %	48.2	72.9	36.5	67.5
Eigenvalue	2.89	1.48	2.19	1.86

Note. Hong Kong $n = 854$. Nanjing $n = 215$.

A principal-axis factor analysis with a varimax rotation also was conducted with the Nanjing participants' data to confirm the validity of the SPQ for the Nanjing sample. Results from this analysis revealed the same two factors as those for the Hong Kong data (see Table 3). The first factor corresponded to the deep approach (factor loadings: .81 for Deep Motive; .81 for Deep Strategy; .77 for Achieving Strategy). The second factor corresponded to the surface approach (factor loadings: .86 for Surface Motive; .86 for Surface Strategy; .61 for Achieving Motive).

Consequently, the SPQ, when conceptualized as a two- rather than three-factor instrument, appeared to be valid for assessing the learning approaches of the two Chinese samples. These results from factor analyses supported not only previous studies using the SPQ (e.g., Niles, 1995; Watkins & Dahlin, 1997; Wong et al., 1996) but also Marton and Booth's (1997) findings regarding learning approaches.

Subscale Intercorrelations for the TSI

In general, for both the Hong Kong and Nanjing samples, the correlations among the 13 subscales were in the direction predicted by the theory of mental self-government (see Table 4 for details). Some of the examples are (a) Executive with Conservative (r = .65 for Hong Kong; r = .66 for Nanjing), (b) Legislative with Liberal (r = .42 for Hong Kong; r = .50 for Nanjing), (c) Conservative with Liberal (r = −.10 for Hong Kong; r = −.42 for Nanjing), (d) Global with

TABLE 4
Interscale Pearson Correlation Matrix for 13 Subscales of the Thinking Styles Inventory

Subscale	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Legislative		−.09	.34	.24	.06	.50	−.14	.22	.10	.02	.22	.54	−.10
2. Executive	.33		.05	.04	.34	−.20	.66	.23	.31	.31	.22	−.01	.29
3. Judicial	.44	.20		.18	.13	.51	−.11	.37	.27	.11	.29	.20	.22
4. Global	.36	.25	.34		−.35	.20	.06	.18	.24	.11	.13	.24	.03
5. Local	.22	.34	.32	.08		.09	.30	.15	.17	.22	.24	.04	.17
6. Liberal	.42	.03	.52	.37	.26		−.42	.33	.19	.05	.33	.37	.07
7. Conservative	.23	.65	.05	.16	.33	−.10		−.05	.21	.29	.12	−.08	.15
8. Hierarchical	.30	.32	.45	.18	.41	.28	.20		.23	.22	.33	.26	.14
9. Monarchic	.40	.42	.28	.34	.35	.25	.41	.30		.31	.31	.20	.13
10. Oligarchic	.21	.41	.18	.26	.33	.14	.44	.18	.35		.30	−.06	.37
11. Anarchic	.35	.25	.33	.24	.39	.34	.25	.34	.31	.33		.27	.23
12. Internal	.64	.21	.34	.28	.27	.40	.16	.23	.34	.05	.23		−.28
13. External	.07	.21	.35	.20	.28	.21	.07	.36	.15	.31	.35	−.23	

Note. Numbers above the diagonal are for the Nanjing sample. Numbers below the diagonal are for the Hong Kong sample. Hong Kong n = 854. Nanjing n = 215.

Local (r = .08 for Hong Kong; r = −.35 for Nanjing), and (e) Internal versus External (r = −.23 for Hong Kong; r = −.28 for Nanjing). Except for the correlation between Global and Local for Nanjing, these correlations were significant at the .01 level. Furthermore, the magnitudes of these correlations were generally stronger for the Nanjing sample than for the Hong Kong sample.

Correlations Among Subscales in the Two Inventories

In general, the hypotheses were supported by the data from both samples (see Table 5). The majority of the correlations were in the expected directions. Some of the examples are (a) Surface Motive with executive style (r = .24 for Hong Kong; r = .23 for Nanjing), (b) Surface Strategy with liberal style (r = −.03 for Hong Kong; r = −.31 for Nanjing), (c) Deep Motive with judicial style (r = .40 for Hong Kong; r = .31 for Nanjing), and (d) Surface Strategy with judicial style (r = −.13 for Hong Kong; r = −.11 for Nanjing). These correlations varied from being statistically insignificant to being significant at the .01 level. Achieving subscales were inconsistently correlated positively with either the Deep or the Surface subscales. These correlations indicated that students who took a surface approach to learning tended to use an executive thinking style, but

TABLE 5
Pearson Correlation Matrix for the Subscales in the Study Process Questionnaire and Thinking Styles Inventory

	SM		DM		AM		SS		DS		AS	
Subscale	HK	NJ	HK	NJ	HK	NJ	HK	NJ	HK	NJ	HK	NJ
Legislative	.05	−.09	.28*	.24*	.21*	.20	−.02	−.12	.26*	.33*	.10*	.02
Executive	.24*	.23*	.17*	.08	.20*	.20	.26*	.34*	.18*	−.04	.20*	.20
Judicial	−.00	−.02	.40*	.31*	.17*	.15	−.13*	−.11	.38*	.49*	.26*	.18
Global	.17*	.05	.24*	.04	.18*	.13	.13*	.02	.25*	.13	.13*	.00
Local	.17*	.18	.24*	.15	.21*	.14	.17*	.23*	.26*	.10	.30*	.23*
Liberal	.07	−.15	.37*	.31*	.20*	.08	−.03	−.31*	.37*	.53*	.19*	.18
Conservative	.25*	.36*	.07	.00	.19*	.19	.36*	.47*	.07	−.16	.19*	.07
Hierarchical	−.01	−.13	.32*	.35*	.13*	.23*	−.04	−.14	.36*	.39*	.39*	.49*
Monarchic	.22*	.20	.28*	.23*	.26*	.30*	.22*	.18	.24*	.21	.29*	.31*
Oligarchic	.18*	.23*	.13*	.23*	.10	.24*	.19*	.23	.13*	.14	.12*	.25*
Anarchic	.04	.14	.25*	.26*	.10	.28*	.08	.08	.24*	.27*	.18*	.30*
Internal	.07	−.02	.24*	.13	.24*	.36*	.05	−.02	.20*	.30*	.07	.10
External	.02	−.02	.22*	.07	.02	−.06	−.02	.02	.24*	.09	.20*	.22*

Note. HK = Hong Kong. NJ = Nanjing. Hong Kong n = 854. Nanjing n = 215. SM = Surface Motivation. DM = Deep Motivation. AM = Achieving Motivation. SS = Surface Strategy. DS = Deep Strategy. AS = Achieving Strategy.
*p < .01.

not judicial or liberal thinking styles. In addition, students who took a deep approach to learning tended to use the judicial thinking style.

There were a few correlations that clearly did not support the predictions. First, for the Hong Kong sample, the correlation between Deep Strategy and executive style was significantly positive ($r = .18$, $p < .001$), meaning that the Hong Kong students in this sample who used a deep strategy to learn also preferred using an executive thinking style. Second, our prediction about the relations between learning approach subscales and the global and local styles were only partially supported (see Table 5). Results of this study suggested that regardless of their level of mental functioning (global or local), students could take either a deep or surface approach to learning. Finally, all learning approach subscales were positively and significantly correlated with the monarchic style, which probably means that students with a monarchic thinking style may take either a deep or a surface approach to learning. These unexpected correlations were mostly from the Hong Kong sample, however. These results perhaps can be explained by Pask's (1976) concept of the "versatile learner." For example, the deep learners in Hong Kong may be creative (using the legislative and liberal styles) in their learning; meanwhile, they may also follow closely their teachers' instructions (using the executive and conservative styles).

Discussion

The major goal of this study was to establish the relations between the constructs in Biggs's theory of learning approaches and Sternberg's theory of thinking styles in two Chinese populations. Results indicated that the two inventories were reliable and valid (there are two factors in the SPQ—Deep Approach and Surface Approach) for assessing the underlying theoretical constructs for these two populations and that the subscales in the two inventories were related in largely predicted ways. Our study suggests that the SPQ and the TSI measure similar constructs. Students who reported taking a surface approach to learning preferred using executive, local, and conservative thinking styles (which are more traditional, norm favoring, and task oriented), whereas students who reported taking a deep approach to learning preferred using legislative, judicial, and liberal thinking styles (which are more creative, norm questioning, and meaning seeking). Although most of the correlations between the scales of the two inventories were low, they were statistically significant. In addition, these results both supported our own hypotheses (based on the study of Beishuizen et al., 1994) about the relationships between the two inventories and confirmed previous research findings of similar studies (e.g., Wilson et al., 1996). Therefore, we believe that these correlations, although weak, revealed true relationships between the two inventories.

The contributions of this study may be considered from two perspectives: research and practice.

From a research viewpoint, the results of this study have enhanced our knowledge about theories of styles. The question raised earlier was whether theories of styles are different theories of different things, using a common root word ("style") or theories of the same thing but with different names for overlapping styles. Sternberg (1997) suggested that alternative theories of styles cover roughly similar attributes, but with different labels. The relations indicated by the subscales in the two inventories used in this study suggest that Biggs's (1987, 1992) theory of students' approaches to learning and Sternberg's (1988, 1990, 1994, 1997) theory of mental self-government cover similar but not identical ground, with different names for overlapping styles. This finding is also consistent with previous construct-validity studies of measures derived from the theory of mental self-government (e.g., compared with the Myers-Briggs Type Indicator and with Gregorc's measures of mind styles; Sternberg, 1994). Of further theoretical importance is the finding that the two-learning-style approach of Marton and Booth (deep and surface; 1997) appears to capture better the structure of the data than does the three learning-style approach of Biggs (deep, surface, achieving).

From a practical viewpoint, we believe that there are three implications. First, both teachers and students should be aware that people approach learning differently and use their abilities in a variety of ways.

Second, but equally important, teachers and students should understand the relations between learning approaches and thinking styles. An understanding of the existence of different learning approaches and different thinking styles can assist teachers in using several measures to facilitate effective learning. Teachers should try to teach via a variety of styles so that all students, regardless of their preferred ways of dealing with learning tasks, can benefit from teachers' instructions. Alternatively, because learning styles can be modified (Saracho, 1993; Sternberg, 1988, 1990, 1997), awareness of the different learning styles can make students more in tune with how they usually approach their learning tasks and help them identify their preferred, as well as their nonpreferred, learning styles. As a result, students may learn not only how to capitalize on their strengths and compensate for their weaknesses but also how to adapt to those learning environments with which their own styles may not be compatible.

Third, a teacher can use different assessment techniques to allow for different learning and thinking styles (Sternberg, 1988, 1990, 1994, 1997). Recognizing this fact, Biggs (1995) coined the term "backwash effect." In particular, he argued that assessment drives the ways in which students learn and think, the content of the curriculum, and how teachers teach. Therefore, among other things, assessment links Biggs's and Sternberg's theories—it has a common impact on both learning approaches and thinking styles. Learning approaches and thinking styles as implemented at a given time may vary as a function of the assessment measures used. For example, if student performance is measured by a multiple-choice test, students may tend to take a surface approach to learning

and use executive, conservative, internal, and local thinking styles. In contrast, if student performance is assessed by a group project, it is more likely that students will take a deep approach to learning and use such thinking styles as judicial, legislative, liberal, and external.

An awareness of the interrelations between the two theories also can be helpful in teachers' efforts toward the enhancement of effective learning. Each of the learning approaches discussed by Biggs (1987, 1992), as mentioned earlier, contains two concepts, motivation and strategy. Students' learning motivations, learning strategies, and thinking styles are intertwined. Given this intertwining, teachers can facilitate the students' efforts to be flexible in their implementations of styles. For example, teachers may wish to motivate students to take a deep approach to learning more important material, but a surface approach to learning less important material. The significant positive correlations manifested in this study indicate that when students are deeply motivated to learn, they will think critically and creatively, and certainly, also will use a deep strategy in performing their learning tasks. Alternatively, teachers may allow for different thinking styles by using the aforementioned strategies, such as teaching about styles, instructing in different ways, and using varied assessment tools.

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Received July 6, 1999