A cross-cultural study of learning behaviors in the classroom from a thinking style perspective

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A CROSS-CULTURAL STUDY OF LEARNING BEHAVIORS IN THE CLASSROOM FROM A THINKING STYLE PERSPECTIVE

by

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ABSTRACT

This study was designed to search for explanations of different learning behaviors in the classroom presented by American and Chinese students. The researcher speculated that thinking style might have an influence on learning behaviors and at least partially explain the different behavioral traits presented by the two groups of students in the classroom. An existing thinking style measure and a self-developed learning behavior measure were administered to three samples: American students (n = 129), Chinese students in China (n = 134), and Chinese students in the U.S. (n = 121). ANOVA, multiple regression and tests of mediation effects were used to compare learning behavior and thinking style among the sample groups, and to examine the relationships among three variables: cultural group, thinking style, and learning behavior. It was found that American students self-reported more “active” behavioral traits in the classroom and tend to be analytic in thinking style, while Chinese students, both in China and in the U.S., self-reported more “passive” behavioral traits, and were inclined to be holistic in thinking style. It was also found that thinking style variables mediate the relationship between cultural group and learning behavior in the classroom, which suggests that thinking style might partially explain the distinct behavioral traits in the classroom presented by American and Chinese students.
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CHAPTER 1
INTRODUCTION

Western teachers have often characterized Chinese students as quiet and receptive, lacking a challenging attitude toward authority. In contrast to western students who have been viewed as active, self-directed, independent, and intrinsically motivated in their learning approach, Chinese students are often viewed as passive learners exhibiting compliance, obedience and a tendency to absorb knowledge rather than understand it (Olaussen, 1999). These differences between American and Chinese students in perceived learning behaviors and attitudes are considered to have a root in West-East cultural distinctions (Ho & Crookall, 1995). Chinese students’ passive behaviors in class are believed by some scholars to be influenced by Confucian heritage (Cortazzi & Jin, 1996; Littlewood, 1996). Murphy (1987), for instance, claimed that the reason Chinese students “display an almost unquestioning acceptance of the knowledge of the teacher . . . may be a transfer of the Confucian ethic of filial piety, coupled with an emphasis on strictness of discipline and proper behavior” (p. 43).

Current scholars (Cheng, 2000; Dahlin & Watkins, 2000; Kennedy, 2002) challenge these views of Chinese students as stereotypes and point out that those earlier scholars (e.g. Murphy) failed to build a complete image of Chinese learners. The debate between these two camps is ongoing, and the majority of scholars focus their attention on searching for cultural factors that explain Chinese learning behaviors. This study is intended to test a related but underexplored explanation of different learning behaviors from the perspective of cognitive processes, particularly thinking styles. The major purpose of the study is to investigate whether Chinese and American students tend to
differ in their thinking styles, and, if so, whether differences in thinking style are related to their dissimilar learning behaviors.

**Debate Concerning the Cross-cultural Differences in Learning Behaviors**

Many scholars (Biggs, 1991; Kember & Gow, 1991; Samuelowicz, 1987) have noted that, in western countries (e.g., the U.S.A., the U.K., and Australia), stereotypes have developed about Asian students. In particular, students from Eastern Asian countries (i.e., China, Japan, Korea, and Singapore) are viewed as exhibiting similar learner behaviors, many of which are seen to be incompatible with the system of teaching and learning that exists in western cultures. Purdie (1996) suggested two of the most commonly cited behaviors relate to memorization and the relationship between student and teacher.

As Purdie (1996) summarized in his study, the stereotypical view presents Asian students as rote learners who tend to reproduce what is learned and have little concern for achieving insights or true understanding of the material. Knowledge is viewed by them as something handed down by teachers, parents or others who are in authority, and stored in one's memory. Hence, students do not question teachers’ statements or textbooks, and they expect the teacher to tell them the “right” answer even when there may be no answer. The typical behaviors of Chinese students in a classroom are described as: no appearance of participation, lack of questioning, no indications of understanding or lack of understanding, lack of critical or independent thinking, dependency in teacher-student relationship, and lack of autonomy in study practices. In sum, they are viewed as passive learners, exhibiting obedience, dependence, docility and a reliance on memorization to
absorb knowledge. In contrast, western students are generally viewed as more active in their approaches to learning. They are characterized by assertiveness, independence, self-confidence, acceptance of diversity, and a willingness to question and explore alternative ways of thinking and acting (Ballard, 1987).

Eastern Asian students were considered as presenting similar learning traits in comparison to their western peers. The observation of Asian students as passive learners has also been reported in eastern countries (e.g., China, Japan, Singapore, Korea) (Murphy, 1987; Scollon & Scollon, 1995); thus, the behavioral traits of Asian learners in western countries cannot be simply attributed to second language issues. To focus on the Chinese group in this study, their passive learning style is often attributed to their collectivist culture, to Confucian legacies, to a strong sense of hierarchy in social structures, or to the importance of face (Ho & Crookall, 1995; Cortazzi & Jin, 1996; Littlewood, 1999). For instance, Brick (1991) suggests that the obedient attitude that Chinese students show to their teachers is due to the Confucian ethic, wherein the hierarchical relationship between teacher and student is one of five such relationships that are said to constitute the basis of society. Scollon and Scollon (1995) write about the Confucian teacher-student relationship in contemporary Hong Kong, as do Ho and Crookall (1995), who remark that “some aspects of Chinese culture appear to be impediments to autonomy” (p. 235).

The role of ‘face’ (mien-tzu), or having status in front of others, in Chinese students’ behaviors has been discussed by quite a few scholars (e.g., Bond, 1996; Chang & Holt, 1994; Tsui 1996). It is considered by Chinese students to be selfish and shameful to cause someone to “lose face”. Being modest and self-effacing, not “blowing
“your own horn” is praiseworthy, while wasting other students’ class time by expressing independent judgments is egotistical and selfish. Besides, such challenges are considered to be disrespectful to teachers and may cause them to lose face (Chang & Holt 1994). Tsui (1996) claims that such a culturally unique notion of face promotes conformity and reinforces passive, compliant roles in class. As a result, students are not encouraged to speak out, to question and to criticize, and are unwilling to commit themselves for fear of being wrong and thus losing face.

Furthermore, for many Chinese students and teachers, books are thought of as an embodiment of knowledge, wisdom and truth that can be taken out and put inside students’ heads. These notions urge students to take passive, compliant roles in class, which in turn promote surface learning—merely repeating information without a real understanding of meaning or processing the information in a critical or creative way. Chinese students are usually characterized as hard-working and diligent but lacking in creativity and originality, “even though Chinese students do better than western students in mathematics and sciences, they are not known for their creativity and original thinking” (Salili, 1996, p. 100).

**Some Recent Re-interpretations of the Learning Behaviors of Chinese Students**

The discussions of the relationship between Chinese learning styles and cultural values have been extensive but mostly theoretical and without much empirical evidence. The notion of a limited or ineffective learning style of Chinese students, with the cultural causes that were discussed above, has been undergoing debate since the 1990s. The “Confucian values” of collectivism and conformity are often stressed in seeking understanding of Chinese Learners. However, as Lee (1996) says, this is only part of the
story. Confucius also had much to say about individuality in learning, and education is only meaningful if it leads to the perfection of the self. Lee claims that “the purpose of learning is to cultivate oneself as an intelligent, creative, independent, autonomous being” (p. 34). Cheng (2000) points out that the Chinese term “knowledge” is made up of two characters: One is “xue” (to learn) and the other is “wen” (to ask). This means that the action of enquiring and questioning is central to the quest for knowledge.

The process commonly labeled rote learning, which was described as being heavily relied on by Chinese students, is frequently criticized by western educators as undesirable strategy in learning because it leads to surface learning and discourages students from deep thinking and understanding. Traditionally, however, there is another perception of repetition which has been viewed by the Chinese as a route to understanding (Hess & Azuma, 1991). Kennedy (2002) suggests that in Confucian culture, repetition or memorization has never been seen as an end in itself but as a prelude to deeper understanding. The treasured knowledge mentally “photocopied” at earlier stages of learning becomes a resource inspiring wisdom and insights later by enabling the learner to reflect on the knowledge, and to integrate it with his or her learning and life experiences. Students are encouraged to learn from the traditional Confucian wisdom, which recommends “Read it one hundred times, and understanding will follow spontaneously,” and “Seeing knowledge without thinking is labor lost; thinking without seeing knowledge is perilous”.

The Confucian perspective on rote learning is supported by recent research evidence. Marton, Dell and Tse (1996) report on a study exploring the conceptions of
learning of 20 English teachers from China. What emerges is a firm belief among these teachers that with each successive reading of a text will come a new understanding—“a notion of deeper understanding through repetition” (p. 288). Dahlin and Watkins (2000) compared German and Hong Kong Chinese learners’ views on the role of repetition in memorization and found that the Hong Kong Chinese learners were aware of “two possibilities inherent in repetition: creating a deep impression on the mind and discovering new meaning” (p. 66). The emerging evidence presents a challenge to some western educators who view memorization as synonymous with surface learning. Ho et al. (1999) remind us that, in situations such as preparing for an examination or a performance, “memorising lines or already understood facts may be required to ensure success and is considered to be a deep approach” (p. 48).

A reliance on memorization is only one aspect of the stereotyped Chinese learner. The picture of passive, non-participative Chinese learners and teacher-dominated, authoritarian classrooms is common (e.g., Scollon & Scollon, 1995; Flowerdew & Miller, 1995). However, as Cortazzi and Jin (1996) suggest, it may be that “students are not passive but reflective . . . Chinese students value thoughtful questions which they ask after sound reflection . . . less thoughtful questions may be laughed at by other students” (p. 191). According to Cortazzi and Jin (1996), the Chinese teacher-student relationship also should not be simplified as cold or “authoritarian” as they at first appear. There is much interaction outside class with the teacher for “students with problems in class expect the teacher to realize this and offer help after class, whereas western teachers will assume that students with problems will ask for help” (p. 169). After reviewing recent studies concerning Chinese students, Kennedy (2002) concluded that Chinese learning
styles are more subtle and complex than they appear to be in some (western) misrepresentations of them.

Nevertheless, even those scholars (e.g., Dahlin & Watkins, 2000; Kennedy 2002) who criticized the stereotyped views of Chinese learners, do not intend to deny that Chinese students seem more silent or passive in class, as compared to their western peers. New theories are needed to explain their distinct learning behaviors. Most scholars have been focusing their attention on searching for evidence to overthrow the western stereotypes but failing to provide convincing alternative explanations (e.g., Dahlin & Watkins, 2000; Ho, et al., 1999). One may argue that the Confucian culture still explains the learning style of Chinese students. This study does not aim to debunk such an argument but rather to explore a new possibility; that students’ thinking styles may play a role in influencing their learning behaviors.

Thinking Style and Learning Behavior

According to Zhang (2002), thinking style refers to our preferred way of using cognitive abilities. Riding (1996), and Liao and Chuang (2007) suggested that holistic-analytic dimensions of thinking style have certain influence on learning processes. Analytic thinking, according to Alesandrini, Wittrock and Langstaff (1984), “enables an individual to reduce information such as a stimulus array to its essential component parts—that is, to extract what is relevant from potentially distracting surroundings” (p. 153). Analytic ability in a learner manifests itself by the use of deep processing strategies to critically categorize and classify information in learning. Schmeck and Geisler-Brenstein (1989) suggest that analytic processing involves a narrower attentional focus,
retention of facts and details, noticing differences, more interest in parts than wholes, and preferences for ordered (usually sequential) presentations of information.

Holistic processes, on the other hand, seem to involve habitual preference for “a broad focus of attention, formation of impressions, noticing similarities, more interest in wholes than in component parts, and preferences for more random, less orderly presentations of information” (p. 96). Holistic thinking enables an individual to put the discrete parts of an information presentation together into a meaningful whole, and to see how new information relates to prior knowledge— that is, how the new part fits into the existing whole of cognitive structure. Thus, the most prominent distinction between an analytical and a holistic style of thinking is defined by the tendency of the individual to focus either on details of a situation or the whole picture (Jonassen & Grabowski, 1993).

The relationship between thinking style and learning behavior in the classroom has not been directly addressed by researchers. However, since learners tend to develop distinct sets of behavior that they are most comfortable with (Liao & Chuang, 2007), it is reasonable to speculate that thinking style may influence learning behaviors in the classroom. Thinking style, which some researchers (Nisbett, 2003) claim manifest differently in Westerners and East Asians, presents a topic worth the researcher’s attention.

The learning behavior defined in this study is the “active” or “passive” behavioral traits presented by students in the classroom, which are indicated by raising questions, indicating understanding, independent thinking, and so on. The terms “active” and “passive” were used as neutral or objective descriptions of the activity level in the classroom, without any subjective preferences.
Statement of the Problem

The distinctive learning behaviors presented by Chinese and American students have been observed and discussed by teachers, educators and researchers. However, despite the intensive discussions, no direct measures have been employed to evaluate and compare the learning behaviors of the two groups. Those researchers who dispute the stereotypes held by some educators usually searched for reasonable explanations or defenses of the Chinese way of learning, rather than denying that Chinese students are typically quieter in the classroom than American students. An alternative perspective is that Chinese students are as diligent as American students and have their own way of showing understanding, participating in class, and achieving understanding. There is a need to assume direct measures to investigate and compare the behavioral patterns for Chinese and American students in detail. Unfortunately, no instrument is available for this purpose in the current research field. Thus, to develop an appropriate instrument is necessary for this and future studies.

The influence of thinking styles on learning processes is evident for many scholars. Some researchers (Riding & Rayner, 1999) suggests that the holistic-analytic dimension of thinking style interacts with the structure and organization of the contents of instruction and learning. However the exact relationships between thinking style and learning processes are still unclear and await further exploration. Although Riding’s work represents a rare effort to shed light on this issue, one particular topic in need of investigation is the relationship between thinking style and learning behavior in the classroom. Toward this end, exploratory inquiry is needed to reveal whether thinking
style plays a role in explaining perceived differences in the learning behaviors of Chinese and American learners.

**Purpose of the Study**

As a result of careful examination of the literature, the author speculated that thinking style might at least partly explain the behavioral differences in the classroom between Chinese and American students. It was hypothesized that Chinese students tend to assume a holistic orientation toward learning, which implies that achieving a whole view of knowledge and building connections within information is more common than digging deeply into a piece of knowledge. During this holistic learning process, Chinese students may present passive traits, as they might hold on to questions and wait for teachers to present knowledge as a structure, and only then bring out their challenges or questions based on the belief that they have achieved a full understanding of the knowledge. It is further hypothesized that, in contrast, western students tend to assume an analytic orientation which implies that they tend to think deeply about a piece of information, and present active traits by inquiring from different angles and raising questions promptly.

The purpose of this study is to examine this conjecture by subjecting four assumptions to investigation:

1. Cultural group, as an independent variable, is significantly correlated with self-reported learning behaviors. In other words, there are significant behavioral differences between cultural groups (Chinese students and American students).
2. Chinese and American students tend to differ in thinking style, with Chinese students reporting more holistic traits and American students reporting more analytic traits.

3. Thinking style is statistically significantly correlated with learning behavior in the classroom.

4. Thinking style mediates the relationship between cultural group and learning behavior.

If these four assumptions are supported by this study, the conjecture that differences in thinking style at least partially explain the distinct learning behaviors demonstrated in the classroom by American and Chinese students would be supported, and further experimental study can be conducted to verify or dispute the causal relations.

The researcher predicted that, due to exposure to western culture, Chinese students studying in the U.S. might present a shift in behavioral and cognitive traits indicating the influence of changing cultural environment. Evidence of such a shift—or a lack of clear evidence—would contribute to a better understanding of the nature of learning behavior and thinking style as either a relatively stable trait or a more malleable state. Therefore, three sample groups were included in this study: American students, Chinese students in China, and Chinese students in the U.S.

In addition, a highly relevant variable, i.e., academic motivation, should not be excluded from consideration. The association between motivation and learning behavior in the classroom, according to Albrecht, et al. (2009), was solidly supported by evidence from researchers’ observations and student assessments of their own performances in the classroom. Lyke and Kelaher (2006) suggest that low motivation tends to result in less
effort, lethargic attitudes, and misconduct behaviors in the classroom, whereas high motivation is usually related to positive learning behaviors in the classroom. In regard to this study, it was predicted that students with low motivation level might present low activity level and less responses in the classroom, no matter which thinking style they are inclined to have. The correlation between thinking style and learning behavior is more likely to be found in students reaching certain levels of academic motivation. Thus, whether or not motivation moderates the relationship between thinking style and learning behavior was investigated in this study.

Based on all above considerations, four research questions were asked:

**Research Questions**

1. Are there significant differences between the mean scores of American students, Chinese students in China and Chinese students in the U.S. on a self-report measure of learning behavior, indicating different learning behaviors in the classrooms?
2. Are there significant differences between the mean scores of American students, Chinese students in China and Chinese students in the U.S. on a self-report thinking style measure?
3. Do regression slopes suggest that thinking style variables predict learning behavior in the classroom? If so, is the association between the thinking style variables and learning behavior in the classroom moderated by motivation?
4. Do regression slopes and indirect effects suggest that thinking style predicts learning behavior in the classroom across cultural groups?

**Significance of the Study**
This study has the potential to contribute to the field of educational psychology by illuminating the relationship between thinking style and learning behavior. In the current literature, the association between thinking style and learning behavior has been suggested by scholars. However, questions such as how thinking style influences students’ learning behavior, and how holistic and analytic individuals differ in behavioral traits, remain unanswered. This study was designed to explore the relation between the two variables within and across cultures.

Extensive discussion exists in the literature concerning the different learning styles of American and Chinese students. However, no existing instrument has been developed for the purpose of comparing the classroom learning behaviors of the two groups. The Questionnaire of Learning Behavior in the Classroom designed for this study could be regarded as an attempt to fill in this gap. This questionnaire (or its improved version in future) enables us to subject the learning behaviors of American and Chinese students to indirect measurement and comparison, to look for behavior patterns that distinguish the two groups, and to search for evidence supporting, challenging, and/or explaining the current images of American and Chinese learners.

Searching for plausible explanations of Chinese learning behaviors is still a crucial topic under the current situation, with the number of Chinese students seeking education in western countries consistently increasing. It is essential for western teachers have an accurate understanding of the learning styles of Chinese students. Nieto (2002) suggests that learning cannot take place in the classroom when there is a discontinuity or mismatch between students’ learning approaches and teachers’ instructional approaches. Teachers’ basic assumptions determine how they will implement curriculum in their
classrooms (Fine & Weis, 2003; Sleeter, 2001), and Tucker (2003) observed inefficient teaching outcomes when western instructors failed to recognize the distinct cultural values and learning traits of Asian students. The results of this study might contribute to the establishment of healthy and constructive relationships between western teachers and Chinese students, as well as promote improvements in instructional efficiency for some western teachers.
CHAPTER 2

Literature Review

Chapter 1 presented a recapitulation of the debates regarding the different behavioral traits presented by Chinese students and their western peers in the classroom, and proposed that thinking style might play a role in the behavioral differences across cultural groups. In the current chapter, theoretical and empirical evidence supporting this assumption are presented. The review starts with an introduction to the concept of thinking style, followed by a discussion of how this construct relates to culture and learning behavior. Finally, a summary is made to clarify and illuminate the logic upon which the research was based.

The literature review was based on a pool of references generated by searching on two databases (i.e., ERIC and Psychoinfo) using such key words as thinking style, cognitive style, holistic style, analytic style, learning behavior, Asian student, Chinese student. A primary screen of hundreds of article abstracts generated approximately 47 items which were related to thinking style, learning behavior, or cultural issues. An inspection of the citations in these articles further generated a list of articles and books which lead to a total amount of 79 references stored in the bibliographic software (Endnote) for the purpose of literature review.

Defining the Concept of Thinking Style

One possible alternative explanation for behavioral differences in the classroom between American and Chinese students could be that the two groups differ in their thinking style: i.e. analytic versus holistic thinking. The concept of thinking style has long been accepted and studied in the fields of memory, cognition, concept formation,
and problem solving as a construct to distinguish individuals in terms of their habitual
approaches or modes in processing, perceiving and organizing information. Zhang (2002)
states that thinking style is defined as our preferred way of using cognitive abilities.
Sternberg (1997) believes that, just as there are many ways of governing our society,
there are many ways to govern or manage our daily activities. These different ways of
managing our activities or of using our abilities are called thinking styles. This concept,
sometimes equal to the term “cognitive style”, is considered by many researchers (e.g.,
McElroy & Seta, 2003; McKay, Fischler & Dunn, 2003) as composed of two major types
of cognitive processes: analytic versus holistic (or analytic versus wholistic, local versus
wholistic, serial versus holistic).

Analytic thinking is defined by Alesandrini, Wittrock and Langstaff (1984) as
that which “enables an individual to reduce information such as a stimulus array to its
essential component parts—that is, to extract what is relevant from potentially distracting
surroundings” (p. 152). Analytic ability in a learner should facilitate learning by
contributing to the learner’s use of deep processing strategies to critically categorize and
classify information. During analytic processing, the learner attends to the parts rather
than the whole. Holistic thinking, on the other hand, enables an individual to put the
discrete parts of an information presentation together into a meaningful whole by
focusing on the whole rather than on the parts. A learner use holistic thinking to see how
new information relates to prior knowledge—that is, how the new part fits into the
existing whole of the cognitive structure.

The distinctions between analytic and holistic modes of processing have been
discussed and elaborated in the literature. Three major points were emphasized by
various researchers: a focus on the details of a situation versus a focus on the whole picture; a step-by-step approach to situations versus skipping steps, trusting feelings and impressions; having focused attention versus making connections among components.

**A focus on the details of a situation versus a focus on the whole picture.** The distinction between an analytical and a holistic style of thinking is defined by the tendency of the individual to focus either on details of a situation or on the whole picture (Jonassen & Grabowski, 1993). Schmeck and Geisler-Brenstein (1989) suggest that analytic processing involves a narrower attentional focus, retention of facts and details, noticing differences, more interest in parts than wholes, and preferences for ordered (usually sequential) presentations of information. Holistic processes seem to involve habitual preference for “a broad focus of attention, formation of impressions, noticing similarities, more interest in wholes than in component parts, and preferences for more random, less orderly presentations of information” (p. 87).

Riding and Sadler-Smith (1999) state that analytic individuals will process and organize information into its component parts; wholistic (i.e. holistic) individuals will retain a global or overall view of information. For wholists there is the danger that the distinction between the parts of a topic may become blurred. For analytics, the separation of the whole into its parts may mean that one aspect of the whole may be focused on at the expense of the others and hence its overall importance exaggerated.

**A step-by-step approach to situations versus skipping steps, trusting feelings and impressions.** Individuals with an analytic cognitive style prefer a systematic approach and sequential processing of information. Calcaterra (2005) states that analytic individuals are inclined to do things one after the other, to process items serially, and to
reason logically by considering the relevant elements and by drawing consequences in systematic ways. While individuals with a holistic cognitive style prefer parallel processing of information, they are inclined to skip steps, to trust feelings and impressions, to identify suddenly and simultaneously the critical aspects of situations, and to ground conclusions on insights (Riding, Glass, & Douglas, 1993; Riding & Rayner, 1998).

Having focused attention versus making connections among components.

Kemler-Nelson (1984) stated that, “in the analytic mode, stimuli are compared and contrasted according to their constituent properties or attributes; in the nonanalytic or holistic mode, they are related according to global relations of overall similarity” (p. 735). After reviewing research supporting the distinction between the two modes of processing, Kemler-Nelson concluded, “together these findings suggest that holistic processing, guided by global similarity relations rather than abstracted stimulus properties, may be frequent, fundamental, and primitive in human cognition” (p. 739). Holistic individuals are more inclined to make connections between new and existing knowledge by referring to real life experiences.

In spite of the distinctions between holistic style and analytic style, they are generally considered to be one dimension of cognitive processing, located at the two ends of a thinking style continuum (Riding & Rayner, 1999). The validity evidence of analytic-holistic thinking style as a theoretical and practical construct was provided by quite a few studies. For example, Zhang (2002) implemented the Style of Learning and Thinking Questionnaire (SOLAT), an instrument developed by Tolerance (1983), to 212 American university students. Results from convergent statistical analysis procedures
indicated that the holistic mode of thinking is significantly related to more creativity-generating and more complex cognitive processes. In a study by Denny and Wolf (1980), after implementing the SOLAT and other psychometric tools to 171 American undergraduates, it was found that the analytic scale was associated with verbal learning style, preference for simplicity, preference for language and scientific disciplines, practical interests, verbal problem solving, convergent thinking, accuracy, and a conservative attitude; the holistic scale emerged as associated with a visual learning style, creativity, tolerance for ambiguity, non-verbal thinking, preference for humanistic disciplines, broad-mindedness, aesthetic interests, and intuitive problem solving.

Beyler and Schmeck (1992) adopted four measures including the SOLAT in assessing analytic-holistic thinking processes among 300 undergraduate students at an American university. They reported that construct validity evidence came from both the convergence of measures that should theoretically assess the holistic-analytic dimension and the divergence of measures assessing a dimension theoretically unrelated to the holistic-analytic construct. In the study by Tsakanikos (2006), ninety European undergraduates were tested on their ability to associate concurrent events (i.e. word--color) and were assessed on perceptual style (analytic vs. holistic). The analysis revealed that analytic style was related to better performance on associative learning, and that this relationship was retained after controlling for differences in intelligence, age, and gender.

The holistic-analytic dimension of thinking style have been treated as a valid psychological construct, and was subjected to extensive investigations of its relations with other well-established psychological constructs such as intelligence, creativity, personality, learning style, and social behavior (Riding & Rayner, 1999). For instance,
Riding and Wigley (1997) used a range of questionnaire-based measures of personality, along with a cognitive style measure in a study of 340 college students. The authors reported low or moderate correlations between personality factors and thinking styles. In another study, Riding and Pearson (1994) implemented intelligence and thinking style measures to a sample of 119 pupils (12-13 year olds). The correlations between the sub-tests of the intelligence measure and thinking styles were low and non-significant. These results suggest that thinking style appears to be largely independent of such psychological constructs as intelligence and personality.

**Distinctions between thinking style and learning style.** The terms cognitive or thinking style and learning style have been used indistinctly by theorists. Some, e.g. Entwistle (1988) believe the two terms have the same meaning and so have used the terms interchangeably; others, e.g. Das (1988a) consider the two to be different and attempt to define them as separate concepts. Ring and Rayner (1999) pointed out that “learning style” seems to have emerged as a more common term or a replacement term for cognitive style in the 1970s. The impression acquired in inspecting the usage of these terms is that those working under the umbrella of “learning style” take cognitive style into consideration, but are apparently more “action-oriented” by presenting interest in practical, educational or training applications, while the term cognitive style has been reserved for theoretical, academic descriptions. Therefore, whether or not cognitive style actually underlies learning style, the two terms differ to a certain degree.

Ring and Rayner (1999) stated that another main difference between cognitive and learning style is the number of style elements considered. Cognitive style is a bipolar dimension (i.e., holistic vs. analytic), whereas learning style involves many elements and
usually cannot be bipolarized. For instance, one could either have or do not have certain elements of learning style, and the absence of one element does not necessarily imply the presence of the opposite element.

**Distinctions between thinking style and personality style.** Thinking style sometimes has a blurry borderline with personality style. Personality style is defined as an individual's approach to adapting and assimilating information, which does not interact directly with the environment but is an underlying and relatively permanent personality dimension that is expressed indirectly and is apparent only when an individual's behavior is observed across many learning instances (Ring & Rayner, 1999). Rising (1991) states that measures of cognitive style traditionally occupy a middle ground between aptitude measures and personality measures. As such, its status has been unclear and this lack of clarity has meant that regular attempts to distinguish it from aptitude and personality measures have not successfully been made (Kogan, 1980). Nevertheless, researchers (e.g., Sternberg & Grigorenko, 1997) have described cognitive style as representing “a bridge between what might seem to be two fairly distinct areas of psychological investigation: cognition and personality” (p. 701).

**Distinguishing between the analytic-holistic dimension and other thinking styles.** Messick (1984) identified 19 cognitive styles. A literature search by Rising (1991) revealed over 30 labels referred to as cognitive/learning styles. However, it is widely argued (Rising, 1991) that these labels of cognitive styles could be categorized into two qualitatively different types of thinking. Among the terms used to describe one type are analytic, deductive, rigorous, constrained, convergent, formal and critical. Representative
of the terms used to describe the other type are synthetic, inductive, expansive,
unconstrained, divergent, informal, diffuse and creative.

Like Riding and Buckle (1990), Miller (1987) argued that the large number of
cognitive style labels reflects different conceptions of the same two dimensions. Rising
(1991) pointed out that analysis of these labels suggests that they may be grouped into
two principal cognitive styles: the wholistic-analytical (WA) dimension and the
verbaliser-imager (VI) dimension.

Thus, in Rising’s construct, the wholistic-analytic style is an umbrella concept
which comprises many other cognitive style labels. However, a careful investigation of
Rising’s research revealed that the wholistic-analytic style (or holistic-analytic style)
retained the definition and implications discussed at the beginning of this section.

**The Relation between Thinking Style and Culture**

There is growing evidence to demonstrate that perceptual and cognitive processes
are affected by culture. Masuda and Nisbett (2006) designed a series of experiments by
presenting participants with still photos and animated vignettes with changes in focal
object information and contextual information. The results indicated that Westerners and
East Asians tend to differ in their judgments about causality for events, both physical and
social. Westerners tend to locate causality in the object or person, whereas East Asians
are more likely to call on the field or context. Similar results were reported in other
studies (e.g., Norenzayan & Nisbett, 2000; Peng & Knowles, 2003). In a review of
related research, Nisbett (2003) claims that Westerners are more likely to use
categorization and rules in reasoning about everyday life events whereas East Asians are
likely to emphasize relationships and similarities. The research by Nisbett and his colleagues suggests that there are cultural differences in perceptual processes.

Empirical evidence of cultural differences in perceptual processing can also be found in studies (e.g., Ji et al. 2005; Kitayama et al., 2003) that adopted experimental designs using operational tools such as pictures and paradigms to assess how participants perceive and process focal object information and contextual information. These studies revealed that people in western cultures tend to engage in context-independent and analytic perceptual processes by focusing on a salient object (or person) independently from the context. On the other hand, people in East Asian cultures tend to engage in context-dependent and holistic perceptual processes by attending to the relationship between the object and the context in which the object is located. Nisbett (2005) states that cultural differences in the way people perceive similarities have been found both at the conceptual level and with more purely perceptual stimuli. Furthermore, differential patterns of perception are not confined to controlled stimuli stripped of any socio-cultural context, but also are demonstrated in everyday life events. In the study by Chua et al. (2005), a free recall of written narratives about personal experiences, written descriptions of events occurring to other people, and video presentations indicated that American and Chinese participants differed in mentioning events and actions involving the main character relative to the other characters.

Nisbett and his colleagues (Nisbett, Peng, Choi & Norenzayan, 2001) have argued that these different tendencies in causal attribution, as well as other perceptual and cognitive differences between Asians and Westerners, are due in part to differences in attention to the object versus the context. East Asians live in highly interdependent
societies, which require them to pay more attention to relationships with others. Westerners, in contrast, live in more independent societies allowing relatively higher focus on personal interests with respect to important objects. Since attention is directed toward relationships for East Asians, causality is seen to inhere in the context. As Markus and Kitayama (1991) put it, “If one perceives oneself as embedded within a larger context of which one is an interdependent part, it is likely that other objects or events will be perceived in a similar way” (p. 246). For Westerners, attention tends to be focused on salient objects, thus it is natural to attribute causality to objects.

Recent cross-cultural studies have been concentrating on causal attribution and perceptual processes (Nisbett, Peng, Choi & Norenzayan, 2001). However, no reliable scale has been executed using a large sample size to investigate whether western and Chinese students actually differ in holistic-analytic thinking style. Therefore, one of the major purposes of this study is to test the assumption suggested in literature that Chinese students present more holistic thinking traits, whereas western students present more analytic thinking traits.

**How Thinking Style Relates to Learning Behavior**

Scholars tend to agree that thinking style has a crucial influence on learning processes (Fierro, 1997). Ring and Rayner (1999) stated that the holistic-analytic dimension of cognitive style interacts with the structure and organization of the content of instruction, for example when information is presented in wholes or in parts, or with or without a content map (Riding & Sadler-Smith, 1999). In an early study, Riding (1992) offered three versions of a computer-presented instruction package on certain learning contents which differed in terms of their structure (e.g., large versus small step, the use of
advance organizer) to three groups of randomly allocated students. A significant interaction between the structure of instruction contents and cognitive styles was found.

Liao and Chuang (2007) categorized a group of students as having analytic or holistic styles based on their scores on the Style of Learning and Thinking questionnaire (SOLAT), and assigned them into different learning modes (i.e., traditional learning mode vs. internet-based learning mode). The difference between the two learning modes is that, at certain phase of the experiment, students in the traditional learning mode groups received a 50 minutes lecture by the first author in a meeting room, while students in the internet-based learning mode groups were provided with a multimedia based electronic learning system (integrated multimedia instructional material including PowerPoint slides and lecture notes), and were given 50 minutes to watch the online lecture. It was found that analytic individuals have better learning outcomes in the traditional learning mode, whereas holistic individuals have better learning outcomes in the internet-based learning mode. The results suggest that thinking styles interact with the approach to organizing and presenting learning contents, suggesting that students may learn more effectively in a learning environment where the contents are organized and presented in a way which matches his/her thinking style.

Riding (1997) argues that analytic individuals tend to take a structured approach to learning and will prefer information that is set out in a clearly organized way. They may impose order on information, events and experiences which are not inherently structured, and may even attempt to do so in situations where structuring is inappropriate (for example, in a brainstorming exercise). Holistic individuals, on the other hand, will not habitually take a structured approach and may therefore need help in imposing a
structure on some unstructured situations or experiences. These aspects of the holistic-analytical dimension of cognitive style may affect preferences for different types of instructional and learning methods (for example, role play versus distance learning), learning media (for example, text versus video), and learning performance. Riding (1991) also suggested that the holistic-analytical dimension of thinking style will affect social behavior: holistic individuals will tend to be interdependent and gregarious whilst analytic individuals will tend to be isolated and self-reliant. It may be expected that different instructional and learning methods, with their varying degrees of social interaction and autonomy, would be viewed more or less favorably by different cognitive style groups.

**Critique of Previous Studies**

As discussed above, evidence supporting cultural differences in cognitive processes and the influence of thinking style on learning processes has been found in empirical studies (Ji et al. 2005; Kitayama et al., 2003; Liao & Chuang, 2007; Riding, 1992). These studies usually assumed experimental designs which have the advantage of controlling irrelevant variables and revealing causal relations. However, the sample sizes in these studies tend to be small. The majority of them used 30 or 40 participants. The Asian participants were usually recruited in western countries, which suggests that they had been exposed to the influence of the new cultural environment. Hence, the generalizability of their findings might be questionable. More studies should be carried out using large sample sizes and recruiting Asian participants from their original countries in order to determine whether the current findings are applicable to western and
Asian populations. When large sample sizes are involved, self-report measures have advantages over experimental designs in saving time and cost.

Some good measures of thinking style exist. Take the SOLAT as an example, the evidence of its reliability and validity has been provided by a few scholars (e.g., Beyler & Schmeck, 1992; Calcaterra, 2005; Tsakanikos, 2006; Zhang, 2002). A more detailed discussion of this instrument is presented in chapter 3. In regard to measures assessing learning behaviors in the classroom, however, none of the existing instruments (e.g., the Classroom Behavior Survey, 1982; the Classroom Behavior Rating Scale, 1977) were designed for the purpose of comparing learning behaviors across cultural groups. Thus, a new measure capturing behavioral differences across cultural groups was developed for this and future studies.

**Summary**

Some progress has been made in illuminating the association between thinking style and learning processes. Scholars such as Riding, Stenberg, and Zhang represent the few scholars who have made efforts to clarify this relatively murky field. Nevertheless, no breakthrough findings have been suggested in the literature that could dominate the field and offer overarching guidance in research and educational practice. In particular, the relationship between thinking style and learning behavior in the classroom requires attention and exploration. The claim that East Asians differ in thinking style from that of Westerners requires more empirical evidence and support, especially from investigations using large samples. Riding and other scholars suggest that the holistic-analytic dimension of thinking style interacts with the structure and organization of the contents of instruction and learning, which inspires the notion that thinking style might have an
impact on the learning behavior in the classroom which, in turn, might at least partially explain the behavioral differences in the classroom between Chinese and American students.

In addition, motivation should be considered as a critical variable influencing classroom behaviors, and included in the investigation of the relationship between thinking style and learning behavior. Motivation, defined by Kostelecky and Hoskinson (2005) as “an internal state or condition that activates, guides, and maintains or directs behavior” (p. 438), is generally believed to have a connection with students’ ability to succeed both inside and outside the classroom. Albrecht et al. (2009) state that the lack of intrinsic motivation was related to the observation of such behaviors as: incomplete homework, truancy, poor effort for school related assignments/activities, lethargic attitudes, acting out or disrespectful conduct to teacher or peers in class, sleeping, student boredom, and student desire to complete the bare minimum required. On the other hand, high motivation results in increased student interest and positive learning behaviors inside and outside classroom. In Albrecht et al.’s study, the interventions designed to inspire students’ academic motivation, lead to significant increase of average observation of student willingness to participate in class. As the relationship between motivation and learning behavior in the classroom has been explicitly addressed by researchers, the potential impact of motivation on the association between thinking style and learning behavior was emphasized and evaluated in this study.

In previous research investigating the relationship between thinking style and learning processes (e.g., Kitayama et al, 2003; Liao & Chuang, 2007; Riding, 1993), experimental designs were usually adopted and small sample sizes were used. More
studies should be conducted to inspect the generalizability of their findings by implementing reliable measures to large samples. In particular, a new instrument measuring learning behaviors in the classroom is needed in order to capture the behavioral differences across cultural groups, if they exist.
CHAPTER 3

Methodology

The major purposes of this study are to examine the relationship between thinking style and learning behavior in the classroom, and whether their relationship can explain the different learning behaviors presented by American and Chinese students. Under the guidance of these purposes, the procedure of recruiting samples, developing instruments, and collecting data are described in the following sections.

Participants

Three undergraduate sample groups were used for the purposes of this research: American students, Chinese students in China, and Chinese students in the U.S. Due to exposure to western culture, Chinese students studying in the U.S. might or might not present a shift in cognitive and behavioral traits indicating the influence of changing cultural environment, which would contribute to a better understanding of the nature of learning behavior and thinking style as either relatively stable traits or more malleable states.

Chinese students in the U.S. are mostly aggregated in higher education institutions. To achieve an ideal sample size and make sample groups comparable, all the participants were recruited at the undergraduate level. The universities that were chosen for recruiting participants in the U.S. and China were large public universities roughly matched in terms of their academic reputation, educational quality, and student demographic profiles (e.g., age, grade, and major). However, due to the lack of common metrics or criteria, it was the researcher’s judgment to make such comparison.
To determine the sample size needed for this study, calculations were conducted for both one-way ANOVA and multiple regression approaches that were used to analyze the data. For one-way ANOVA, the minimal number of participants required to achieve the desired statistical power (0.8) is 105 (35 per cell), with the anticipated effect size delta being set to medium (0.75) and alpha level being set to .05. For a multiple regression with five predictors to achieve the same power level (0.8), 91 participants were needed. However, Gall, Gall and Borg (2003) suggested that, for a survey study, it is desirable to get a sample as large as possible to decrease sampling error. Nunnally (1967) recommended that having five to ten times as many subjects as items is preferable. Thus, with 50 items on the learning behavior questionnaire (which is larger than the number of items on the thinking styles questionnaire), 250 to 500 subjects seem necessary. In this study, 384 valid responses from participants were generated for data analyses.

American students. The group of American students was solicited based on enrollment in one public university located on the Northeastern part of the U.S., which offers degrees for a wide range of disciplines. The university is located in an urban setting, with student bodies comprised of people from throughout the state, and to a lesser extent, from other states and countries. One hundred and thirty six participants were recruited through personal contact (face-to-face, e-mail, and phone) between the author and instructors who were teaching undergraduate courses. A formal letter was e-mailed to instructors, in conjunction with face-to-face solicitation. Through data screening, five of the initial sample of 136 American participants were deleted because they chose one single score for all items, or failed to complete one or more sections. Two cases in this
sample were identified as outliers following the procedure described in Chapter 4. Of the remaining 129 participants, mean substitution was adopted to impute missing data for six participants who skipped one item in a section. Tabachnik and Fidell (2001) suggest that mean substitution is an appropriate strategy when less than 20% of the data are missing. Missing data were imputed with the mean score of the rest of the items in that particular section, which generated complete data for 129 American participants.

The demographic traits of this group are presented in Table 3.1. Of these participants, 68.2% were female (vs. 31.8% male), 65.1% were between 18 and 21 years of age (vs. 14% under 18 years old, and 20.9% between 22 and 24), 33.3% were freshman (vs. 20.9% sophomore, 23.3% junior, and 22.5% senior), 79.8% were Caucasian (vs. 10.1% Hispanic, 6.9% African American, 1.6% Asian/Pacific, and 1.6% identified as other). As many as 16 majors were indicated by subjects who were recruited from courses across departments. Students with majors in psychology (18.6%), sociology (9.3%), and history (9.3%) were identified as relatively large groups in this sample.

Table 3.1

<table>
<thead>
<tr>
<th>Demographic characteristics of American participants (n = 129)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
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<tr>
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</tr>
<tr>
<td>Gender</td>
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<tr>
<td>Male</td>
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<tr>
<td>Female</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Under 18</td>
</tr>
<tr>
<td>18-21</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>22-24</td>
</tr>
</tbody>
</table>

**Current Academic Status**

- **Freshman**: 43 students (33.3%)
- **Sophomore**: 27 students (20.9%)
- **Junior**: 30 students (23.3%)
- **Senior**: 29 students (22.5%)

**Major**

- **Psychology**: 24 students (18.6%)
- **Sociology**: 12 students (9.3%)
- **Communication**: 8 students (6.2%)
- **English**: 8 students (6.2%)
- **Spanish**: 5 students (3.9%)
- **Math**: 7 students (5.4%)
- **Business**: 5 students (3.9%)
- **Biology**: 7 students (5.4%)
- **History**: 12 students (9.3%)
- **Science**: 10 students (7.7%)
- **Economics**: 4 students (3.1%)
- **Public policy & management**: 4 students (3.1%)
- **Urban planning**: 8 students (6.2%)
- **Others**: 5 students (3.9%)
- **Undecided**: 10 students (7.7%)

**Ethnicity**
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>103</td>
<td>79.8%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>13</td>
<td>10.1%</td>
</tr>
<tr>
<td>African American</td>
<td>9</td>
<td>6.9%</td>
</tr>
<tr>
<td>Asian/pacific</td>
<td>2</td>
<td>1.6%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

**Chinese students in China.** The group of Chinese students was solicited at a comprehensive university located on the Southeastern part of China. The university was chosen because of its comparable academic reputation and education quality with the university selected in the U.S.; the comparability of the universities was based on the subjective judgment of the researcher. The approach to recruitment was much the same as that used in the U.S.: Faculty members were contacted through personal means (face-to-face, e-mail and phone) for approval of collecting data in their classes. The institution is located on an urban setting, with the major body of students from throughout Zhejiang province, and a small number of students from nearby provinces. The same data screening procedure for American participants was followed to identify invalid cases and outliers, which led to the elimination of eight cases from further data analyses. After mean substitution for 12 cases, complete data were generated for 134 Chinese participants.

As presented in Table 3.2, the group of Chinese students in China included 43.3% males and 56.7% females. They were from three academic majors: transportation management (57.5%), psychology (22.4%), and elementary education (20.1%). The majority (63.4%) of them were aged between 18 and 21 (vs. 21.6% under 18, 12.7%
between 22 and 24, and 2.2% older than 25). The majority (42.5%) were senior students (vs. 20.1% freshman, 17.9% sophomore, and 19.4% junior).

Table 3.2

*Demographic characteristics of Chinese participants in China (n = 134)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>58</td>
<td>43.3%</td>
</tr>
<tr>
<td>Female</td>
<td>76</td>
<td>56.7%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 18</td>
<td>29</td>
<td>21.6%</td>
</tr>
<tr>
<td>18-21</td>
<td>85</td>
<td>63.4%</td>
</tr>
<tr>
<td>22-24</td>
<td>17</td>
<td>12.7%</td>
</tr>
<tr>
<td>Older than 25</td>
<td>3</td>
<td>2.2%</td>
</tr>
<tr>
<td>Current Academic Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>27</td>
<td>20.1%</td>
</tr>
<tr>
<td>Sophomore</td>
<td>24</td>
<td>17.9%</td>
</tr>
<tr>
<td>Junior</td>
<td>26</td>
<td>19.4%</td>
</tr>
<tr>
<td>Senior</td>
<td>57</td>
<td>42.5%</td>
</tr>
<tr>
<td>Major</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation Management</td>
<td>77</td>
<td>57.5%</td>
</tr>
<tr>
<td>Psychology</td>
<td>30</td>
<td>22.4%</td>
</tr>
<tr>
<td>Primary education</td>
<td>27</td>
<td>20.1%</td>
</tr>
</tbody>
</table>
Chinese students in the U.S. The group of Chinese students in the U.S. were recruited by personal contact (face-to-face, e-mail), and an e-mail invitation sent via the International Student Offices at the same university from which the American group was drawn, as well as another two higher education institutions also located on the Northeastern part of the U.S. The additional two higher education institutions are also public universities, located in urban settings, with the majority of students from throughout the state, and providing undergraduate and graduate education. The invitation e-mail contained a description of the study and contact information of the author. Students who fit the profile (i.e., Chinese undergraduates who have been studying in the U.S. for more than six months) were encouraged to contact the author and to receive the survey by mail. To inspire interest in participation, movie tickets were offered as rewards to 15 randomly selected subjects. A total of 159 surveys were mailed or distributed to those students who responded to the email or face-to-face invitation, and 132 surveys were mailed back to the author. The data screening procedure led to the elimination of 11 cases. After mean substitution for 7 cases, complete data were generated for 121 Chinese participants in the U.S.

The demographic traits of this group are presented in Table 3.3. Of these participants, 75.2% were female (vs. 24.8% male), 54.5% aged between 18 and 21 (vs. 14.9% under 18 years old, and 30.6% between 22 and 24), 33.1% were sophomore (vs. 19.8% freshman, 29.8% junior, and 17.4% senior), 38% have studied in the U.S. from 12 to 24 months (vs. 24.8% from 6 to 12 months, 19.8% from 25 to 36 months, 9.9% from 37 to 48 months, and 7.4% more than 48 months). As many as 13 majors were indicated by the participants. Students majoring in accounting or finance accounted for a little less
than half of the group (43%, vs. 14% economics, 5.8% engineering, 5.8% undecided, 5% communication, 5% business, 5% biology, and so on).

Table 3.3

Demographic Characteristics of Chinese Participants in the U.S. (n = 121)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>30</td>
<td>24.8%</td>
</tr>
<tr>
<td>Female</td>
<td>91</td>
<td>75.2%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 18</td>
<td>18</td>
<td>14.9%</td>
</tr>
<tr>
<td>18-21</td>
<td>66</td>
<td>54.5%</td>
</tr>
<tr>
<td>22-24</td>
<td>37</td>
<td>30.6%</td>
</tr>
<tr>
<td>Current Academic Status</td>
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<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>24</td>
<td>19.8%</td>
</tr>
<tr>
<td>Sophomore</td>
<td>40</td>
<td>33.1%</td>
</tr>
<tr>
<td>Junior</td>
<td>36</td>
<td>29.8%</td>
</tr>
<tr>
<td>Senior</td>
<td>21</td>
<td>17.4%</td>
</tr>
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<td></td>
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<tr>
<td>From 6 to 12 months</td>
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<td>24.8%</td>
</tr>
<tr>
<td>From 12 to 24 months</td>
<td>46</td>
<td>38%</td>
</tr>
<tr>
<td>From 25 to 36 months</td>
<td>24</td>
<td>19.8%</td>
</tr>
<tr>
<td>From 37 to 48 months</td>
<td>12</td>
<td>9.9%</td>
</tr>
<tr>
<td>More than 48 months</td>
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Major

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<td>43%</td>
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</tr>
<tr>
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<td>14%</td>
</tr>
<tr>
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<td>5%</td>
</tr>
<tr>
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</tr>
<tr>
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<tr>
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<tr>
<td>Business</td>
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</tr>
<tr>
<td>Biology</td>
<td>6</td>
<td>5%</td>
</tr>
<tr>
<td>Science</td>
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<td>2.5%</td>
</tr>
<tr>
<td>Public policy &amp; managmnt</td>
<td>3</td>
<td>2.5%</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>1.7%</td>
</tr>
<tr>
<td>Undecided</td>
<td>7</td>
<td>5.8%</td>
</tr>
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Instruments

Two instruments were used in this study. One existing questionnaire, the Style of Learning and Thinking Questionnaire (SOLAT-Youth Form; Torrance, 1988) was adapted to measure the thinking style of participants. Another self-developed questionnaire, the Questionnaire of Learning Behavior in the Classroom (QLBC), was used to assess the learning behaviors of participants.

The Style of Learning and Thinking Questionnaire (SOLAT-Youth Form).

The SOLAT (Youth Form) is a self-report inventory consisting of 28 items. Each item allows individuals to choose one or both of two statements; one statement is
characterized by the analytic mode of thinking and the other by the holistic mode of thinking. Choosing both statements results in scoring on the integrative mode of thinking. The following is an example: a) I am good at remembering verbal materials. b) I am good at remembering sounds and tones. Choice a) is scored as the analytic mode of thinking; choice b) is scored as the holistic mode of thinking; choosing both a) and b) is scored as the integrative mode of thinking. Thus, the use of the inventory produces three separate total scores for each test taker. A score of 120 is regarded as identifying a dominant pattern.

Reliability and validity statistics for the SOLAT (Youth Form) have been reported in the SOLAT Administrator’s Manual (Torrance, 1988). Cronbach’s alpha was .77 for the Analytic scale and .74 for the Holistic scale. No reliability data were reported for the Integrative scale. In Zhang’s study (2002), the reported Cronbach alpha was .75 for the Analytic scale, .70 for the Holistic scale, and .85 for the Integrative Scale. In the current study, the Cronbach alpha was .74 for the Analytic scale, .75 for the Holistic scale, and .81 for the Integrative scale.

Although little evidence of validity is reported in the SOLAT manual, Calcaterra (2005) pointed out a few studies supporting the validity of the SOLAT. For instance, Coleman and Zenhausern (1979) investigated the relationships between the SOLAT and memory processing. They presented discrimination tasks to a sample of undergraduates and reported that holistic style subjects performed better on tasks which required parallel-holistic processing of information, while analytic style subjects scored higher on tasks which needed sequential processing of information. In another study, Torrance and Ball (1979) found that students exhibiting the holistic style, in comparison with students
exhibiting the analytic style, are more creative in mapping learned contents. In these studies, the significant associations between SOLAT scores and theoretically related constructs (e.g., creativity, learning style, memory processing), provided evidence for criterion validity. Evidence of construct validity was suggested by Beyler and Schmeck (1992). In their study, the authors adopted four measures including the SOLAT in assessing analytic-holistic thinking processes. It was reported that construct validity evidence comes from both the convergence of measures that theoretically assess the holistic-analytic dimension and the divergence of measures assessing a dimension theoretically unrelated to the holistic-analytic construct.

The SOLAT is criticized by some scholars for being based on theory and research concerning the specialized cerebral functions of the left and right hemispheres, which has been largely debunked (Kiewra, 1992). However, Zhang (2005) believes that the inventory is, in fact, measuring two different modes of thinking—holistic and analytic. She claimed that this contention can be supported by recent research findings (e.g., Banich, 1998; Beeman & Chiarello, 1998) on the study of hemispheric asymmetries. For instance, in discussing the evolving perspectives on the specialization of the two hemispheres, Banich and Heller (1998) asserted that the two hemispheres are more dynamic than static, and that they are more interactive than was believed 20 years ago. The authors argued that it is not that the left brain processes verbal information and the right brain processes spatial information. Instead, the left brain can be conceptualized as being specialized for processing information in a piecemeal, analytic, and sequential manner, which simply happens to be a good way for processing verbal information. The right brain can be conceptualized as being specialized for processing information in a
holistic manner, which happens to be good for processing spatial information. The use of both modes allows the two hemispheres to process information dynamically. These more recent research findings indicate that what people used to call cerebral dominance is actually mode of thinking.

Zhang (2005) stated that there are two major arguments in support of the use of the SOLAT in her studies. First, the inventory is clearly cognition centered. The SOLAT assesses people’s preferred ways of processing information—analytic, holistic, and integrative. The second reason for choosing the SOLAT is that it is one of the major inventories that have resulted in findings that have important implications for curriculum development, teaching strategies, and assessment formats. For example, Bracken, Ledford, and McCallum (1979) found that students designated by SOLAT as left-brain dominant correctly completed significantly more multiple-choice questions than did right-brain dominant students. The authors concluded that right-brain dominant students may be penalized in instructional situations in which multiple-choice measures are used exclusively.

The SOLAT uses a dichotomous scoring format, meaning respondents choose one or both of two statements that applies to them for each item. Each respondent acquires three scores: a holistic, an analytic, and an integrative score. For the convenience of employing regression models, it is preferred that a difference score is calculated to locate the respondent on the holistic-analytic continuum. McElroy, et.al (2007) stated that to justify the calculation of a difference score, the dichotomous scores should present a significantly negative relationship. The results of linear regression analysis indicated that holistic scores and analytic scores were negatively correlated at a significant level ($t = -$
A difference score was then calculated for each subject by subtracting his or her holistic score from the analytic score. A high or positive difference score indicates an analytic thinking style, and a low or negative difference score indicates a holistic thinking style.

This approach to calculating and interpreting difference score was based on the assumption suggested by scholars (e.g., Beyler & Schmeck, 1992; Riding & Rayner, 1999) that holistic style and analytic style represent two extremes of a one-dimensional construct of thinking style. The evidence from this study, however, indicated that holistic style and analytic style might be two relatively independent constructs, which complicated the interpretation of the results related to difference score. The author elaborates on this issue in chapter 5.

The integrative score was not included in this process of calculating difference score because it does not affect the result of the calculation. Due to the lack of literature in support of the use of integrative score, scholars (e.g., Calcaterra, 2005; Liao, & Chuang, 2007) tend to exclude it from analysis in their studies. However, since integrative style was included as an independent category of thinking style in the SOLAT, ignoring this score raises the issue of overlooking data. Therefore, the results using integrative style as a variable in the data analyses were reported and discussed in this dissertation.

Since some of the participants in this study were recruited from China, the English version of SOLAT was translated into a Chinese version. The procedure of inverse translation was followed to ensure the translation accuracy.
Questionnaire of Learning Behaviors in the Classroom (QLBC). Due to the lack of an appropriate instrument for the purpose of this study, the author developed a questionnaire to assess the learning behaviors of students in the classroom (QLBC). The questionnaire contained one subscale assessing motivation and six subscales measuring learning behaviors in the classroom. The items of the motivation subscale were extracted and adapted from existing instruments such as the Learning and Study Strategies Inventory (Weinstern, Schulte & Palmer, 2002), the Survey of Academic Self-Regulation (Dugan, 2006). In order to develop items to measure the distinct classroom behaviors exhibited by students, 14 relevant articles were found as a result of searching in the ERIC database using key words such as “Chinese learn*”, “Asian learn*”, “learning style”, and “learning behavior”. All relevant paragraphs describing the learning behaviors of American and Chinese students were extracted to compose a list for qualitative analysis. An open coding procedure (Creswell, 1998) was followed to examine the extracts for salient categories of information. Using the constant comparative approach, the researcher attempted to saturate the categories by searching for new information that represented the categories until no further common themes were identified. This process resulted in reducing the extracts to a small set of categories that summarize the major behavioral traits discussed by previous researchers. The final product of this procedure was a list comprising six behavioral traits: appearance of participation, raising questions, indication of understanding, independent thinking, the use of memory skills, and degree of independence in teacher-student relationship.

Items were generated for each trait after consulting relevant instruments (e.g., the Classroom Behavior Survey, 1982; the Classroom Behavior Rating Scale, 1977), and
brainstorming by the author. The first draft of the questionnaire was composed and presented in the EPSY 743 class (Laboratory in Test Construction, a seminar supervised by Dr. R. McMorris, a measurement scholar). The draft was revised according to feedback from the supervisor and peer doctoral students. The second draft of the questionnaire was then reviewed by dissertation committee members. A further revision based on their feedback produced the final draft of questionnaire ready for pilot study.

The pilot study involved samples from both America and China. An English version and a Chinese version of the questionnaire were required. Thus, each version of the questionnaire was examined via pilot study, using samples from purposive populations. The questionnaire was first administered on an American sample of 68 students. The item analysis procedure described by Berk (2006) was followed to identify disturbing items with extreme means or limited standard deviations. No disturbing item was identified. However, three sections had particularly low reliabilities (.49, .53, and .50 for independent thinking, the use of memory skills, and independence in teacher-student relationship, respectively). The reliability coefficients for other sections were all above .65. The items for the sections with low reliability coefficients were carefully read and examined for possible errors. The researcher also used SPSS to identify those items that lowered the reliabilities. As a result, five items were rephrased or revised. The Chinese version of the questionnaire was translated from the revised English version by the researcher, and was used to conduct a pilot study with a Chinese sample of 59 participants. A similar procedure was followed and four items were rephrased or revised because of low reliabilities.
The final questionnaire was generated based on the results of the pilot studies. The questionnaire consists of seven sections with five items for each of the sections, except eight items for section one. Section one contained a self-report measure of academic motivation of participants. It was anticipated that motivation level would have an influence on students’ behaviors in the classroom, thus it should be measured as a control variable. Section two is a scale related to “appearance of participation” in the classroom, using items such as “I would hold ideas and thoughts to myself rather than share with others during classes”. Section three is related to “raising questions”, including items such as “I quite often ask questions in classes”. Section four is related to the “indication of understanding”, using items such as “I ask the teacher to elaborate when I get confused during instruction”. Section five is related to “independent thinking”, using items such as “I tend to handle problems encountered in learning by myself”. Section six focuses on “the use of memory skills”, using items such as “I try to understand rather than memorize content conveyed in classes”. Section seven is related to “independence in teacher-student relationships”, using items such as “I often depend on teachers to tell me what to do for a course”. All the seven sections adopted 6-point Likert style scales, including strongly agree, agree, slightly agree, slightly disagree, disagree, and strongly disagree. This is a response format without a neutral value in order to emphasize the difference between negative and positive responses (Antonak & Larrivee, 1996).

Section six, which was designed to assess the use of memory skills, was excluded from the data analyses because of its consistently low reliabilities in the pilot studies and the main study. Therefore, the learning behaviors of participants were evaluated based on their responses on five sections of the QLBC. A mean score was calculated for each
section, with a high score indicating high level of activity, and low score indicating low level of activity. An overall average mean was calculated for the five sections to indicate the general activity level in the classroom. The calculation of overall average means would facilitate the data analysis and the interpretation of results by using one score to represent a subject’s general performance on the learning behavior measure. However, it also risks blurring the distinctions between subscales, and might conceal the fact that a respondent may have high scores on certain subscales and low scores on others. To solve this issue, respondents’ performance on the learning behavior measure should not only be assessed and compared at the overall mean level, but also at the subscale level.

Evidence of reliability and validity. Reliability is defined as a measure of the degree of true score variation relative to the observed score variation (Nunally, 1978). The reliability coefficients for each section generated in the main study are presented in Table 3.4. The Cronbach coefficients ranged from .68 to .81 for the American group, from .67 to .79 for Chinese students in China, and from .64 to .84 for Chinese students in the U.S. All these coefficients were above the threshold necessary to establish an acceptable degree of internal consistency (Nunnally & Bernstein, 1994).

Table 3.4

<table>
<thead>
<tr>
<th>Subscales</th>
<th>USA</th>
<th>CN1</th>
<th>CN2</th>
</tr>
</thead>
<tbody>
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<td>Motivation</td>
<td>.76</td>
<td>.70</td>
<td>.74</td>
</tr>
<tr>
<td>AP</td>
<td>.82</td>
<td>.79</td>
<td>.84</td>
</tr>
<tr>
<td>RSQS</td>
<td>.75</td>
<td>.71</td>
<td>.76</td>
</tr>
<tr>
<td>IU</td>
<td>.72</td>
<td>.69</td>
<td>.75</td>
</tr>
</tbody>
</table>
Content validity of the questionnaire was established through a comprehensive review of the literature related to the comparison of learning behaviors between Asian and American students (e.g., Murphy, 1987; Peng & Knoles, 2003; Purdie & Hattie, 1996). In addition, the questionnaire was reviewed in terms of content and face validity by professionals who have either expertise in instrument development or are knowledgeable in the field.

**Demographic information.** To collect demographic data, as well as help establish the comparability of cultural group and to explore possible impacts of individual characteristics, a separate personal information sheet (see Appendix D) was distributed to each participant along with the two instruments. Subjects were asked to indicate the following: (1) gender, (2) age, (3) current academic year, (4) major, (5) ethnic background, (6) native or international student, (7) the number of months studying in the U.S. for an international student.

**Procedure**

IRB approval was granted by the University at Albany Office of Research Compliance before the commencement of the study. To recruit participants for the
American group, three instructors in the Department of Education and the Department of Geography and Planning were contacted by face to face meeting or emails introducing the study and asking for their permission to administer the survey in their classes. In each class, a brief statement was made by the researcher to inform participants of their rights, the purpose of the study, the estimated time to complete the questionnaires, and appreciation for participation. A consent form and the surveys were then distributed to each participant. Participants spent 15 to 20 minutes completing the survey within their classrooms. The researcher stayed in the classroom until the data were collected.

To recruit Chinese students in China, instructors in selected universities who had personal contact with the researcher were contacted via emails and phone calls for their permission to administer the survey in their classes. The time of administering the survey in China was approaching the end of the semester. Some of the classes were suspended in the target universities. Also, due to the inconvenience of travel, the researcher was unable to present a brief statement in front of participants. The consent letter and survey were distributed and collected by the instructors in their classes or meetings with students. Under these circumstances, the researcher was unable to be fully involved in the process of administering the survey.

There were no classes that assembled Chinese students in U.S. Due to the refusal of the test publisher to grant permission to create an electronic version of the SOLAT, setting up an online survey link was impossible. Therefore, this sample group had to be recruited through personal contacts and mails. A recruiting letter was forwarded to the Chinese students via listserv systems held by the International Student Office of three universities, informing potential participants of the purpose of the study and their rights
as participants. A movie ticket lottery was used to encourage participation. Students who responded to the recruiting announcements were mailed a copy of the survey along with an envelope which was stamped and addressed to the researcher.

Data Analysis

For the purposes of this study, a combination of data analysis methods was used, including descriptive statistics, correlational analysis, one-way ANOVA, hierarchical regression analysis, and tests of mediation effects. Descriptive statistics were used to make primary comparisons of mean differences on the learning behavior and thinking style measures for the cultural groups. Correlational analysis was used to explore the correlations between motivation, thinking style variables, and learning behavior. The uses of one-way ANOVA, hierarchical regression analyses, and tests of mediation effects are discussed below, in terms of each research question.

One-way ANOVA was used to address the first research question. To answer the first research question, which was whether American students, Chinese students in China, and Chinese students in the U.S. present mean differences on the learning behavior measure, six separate one-way ANOVAs, in conjunction with post hoc analyses, were used to compare the mean scores on five learning behavior scales and their overall mean (i.e. appearance of participation, raising questions, indication of understanding, independent thinking, independence in teacher-student relationship, and behavioral mean score) for the three sample groups. The independent variable was cultural group, and the dependent variables were the five learning behavior scales and behavioral mean score. Based on real-life observations and previous studies, it was expected that American students would have higher mean scores on the learning behavior scales, which indicate
active behavioral traits; Chinese students in China would present lower mean scores on learning behavior scales, which indicate passive behavioral traits; while Chinese students in the U.S. might have mean scores somewhere between the other two groups suggesting that their learning behaviors were subject to the influence of the change in cultural environment.

**One-way ANOVA used to address the second research question.** To answer the second research question, which is whether American students, Chinese students in China, and Chinese students in the U.S. present mean differences on the thinking style measure, four separate one-way ANOVAs, in conjunction with post hoc analyses, were used to compare the mean scores on holistic style, analytic style, integrative style and difference score, respectively, for three sample groups. The independent variable was cultural group, and dependent variables were the four thinking style variables. The comparison of difference score was used to reveal whether the cultural groups differ on the thinking style continuum, while the comparisons of holistic style, analytic style, and integrative style revealed whether the groups differ in terms of a specific style. Given the results of previous studies in cognitive processes, it was expected that Chinese students in China would present higher mean scores on holistic style, American students would have higher mean scores on analytic style, and Chinese students in the U.S. might appear somewhere in between, due to their exposure to western culture. There are no existing theories or evidence suggesting cross-cultural difference on integrative style. Therefore, no hypothesis was made concerning how the sample groups differ on integrative style.

**Hierarchical regression analyses were used to address the third research question.** To answer the third question, which was whether thinking style predicts
learning behavior in the classroom, a series of hierarchical regression analyses were conducted to examine the relationship between thinking style variables and learning behavior. It was anticipated that motivation has an impact on learning behaviors in the classroom and might moderate the relationship between thinking style and learning behavior. Students with low motivation may present passive behavioral traits in the classroom no matter which thinking style they are inclined to use. Thus, the inclusion of relatively unmotivated participants in the analyses might weaken or conceal any high correlations between thinking style variables and learning behavior for highly motivated participants. To estimate the extent that thinking style predicts learning behavior in the classroom, and to test for the presence of any moderation effect, hierarchical regression analyses were conducted for each thinking style variable by entering motivation as a moderator variable and creating interaction terms between the predictors in sequential steps.

In the hierarchical regression analyses, the predictors were motivation and the four thinking style variables: i.e., holistic style, analytic style, integrative style, and difference score. The outcome variable was learning behavior. The reason for using holistic style, analytic style, and integrative style as predictors in separate hierarchical regression analyses was to estimate whether the relationship between thinking style and learning behavior differs on subscales. It is possible that a significant relationship would be found for one thinking style variable but not for another. It was anticipated that holistic style would negatively predict learning behavior, which suggests that holistic individuals tend to exhibit passive learning behaviors indicated by low scores on the learning behavior measure. Analytic style and difference score would positively predict
learning behavior, which suggests that analytic individuals tend to perform active
learning behaviors indicated by high scores on the learning behavior measure. The
relationship between integrative style and learning behavior has not been discussed in any
of the available literature. Therefore, no assumption concerning integrative style was
made. It was further hypothesized that the relationships between thinking style variables
and learning behavior would be moderated by motivation. In other words, these
relationships would be strengthened with an increase in motivation level.

The tests of mediation effects in the fourth research question. The author
hypnotized that there is causal sequence among three variables: cultural group, thinking
style, and learning behavior. It was proposed that a linkage might exist between cultural
group and learning behavior, and this linkage is through some aspect of thinking style. In
other words, it was assumed that cultural group might cause some differences in thinking
style which, in turn, cause the Chinese and American students to present different
learning behavior traits. In this sequence, thinking style is considered a mediator, cultural
group as the independent variable, and learning behavior as the dependent variable.
Baron and Kenny (1986) suggested that a variable may be called a mediator “to the
extent that it accounts for the relation between the predictor and the criterion” (p. 1176).
Or, as addressed by Tabachnick and Fidell (2007), a mediator (or indirect effect) is a
variable in the causal sequence that represents at least part of the chain of events leading
to changes in the dependent variable.

Preacher and Hayes (2004) stated that mediation hypotheses are frequently tested
in psychological research, and mediation analyses are most often guided by the
procedures outlined by Baron and Kenny. According to Baron and Kenney (1986), to
confirm a variable as a mediator, four conditions should be fulfilled: 1) there is a
significant relationship between the IV and the DV; 2) there is a significant relationship
between the IV and the mediator; 3) the mediator still predicts the DV after controlling
for the IV; and 4) the relationship between the IV and the DV is reduced when the
mediator is in the equation. When the effect of the IV on the DV decreases to zero with
the inclusion of mediator in the equation, perfect mediation is said to have occurred.
When the effect of the IV on the DV decreases by a nontrivial amount, but not to zero,
partial mediation is said to have occurred.

Sobel (1982) suggests a formal test of the indirect effect of the mediator, in which
the mediation effect is tested as the difference between the relationship of the IV and the
DV with and without consideration of the mediator variable. If the relationship between
the IV and DV is reduced by adding the mediator to the equation, the existence of the
mediating effect is confirmed. The Sobel test requires just one significant test for
mediation, unlike the Baron and Kinney procedure requiring the satisfaction of four
conditions.

In practice, the Baron and Kenny procedure was much more frequently used in
studies than the Sobel test (MacKinnon et al., 2002), perhaps due to the inconvenience of
computation of the latter. However, the Baron and Kenny test was criticized by some
scholars (Mallinckrodt, et al., 2006) for its low statistical power: We may find a
mediation effect even without meeting the Barron and Kenny criteria. In other words,
even if the four conditions were not met in a Barron and Kenny test, we cannot be sure
that mediation does not exist. Baron and Kenny (1986) themselves clearly indicated that
additional procedures are required to examine the magnitude of the mediating effect and
its statistical significance. Preacher and Hayes (2004) also pointed out that a weakness of the Baron and Kenny procedure is its tendency to make Type 1 or Type 2 errors in certain situations; they discussed the necessity of performing a formal significance test of the indirect effect, even if the Baron and Kenny criteria have been met.

Preacher and Hayes suggest that the Sobel test has greater statistical power than that of the Baron and Kenny procedure. But the Sobel test has its own problem with its assumption of normal distribution of paths product (i.e., \(ab\) product, with \(a\) denoting the path between the IV and mediator, \(b\) denoting the path between the IV and the DV) tending to be violated under most circumstances. One alternative to the Baron and Kenny test and the Sobel test is a method described by Shrout and Bolger (2002) who used bootstrap data-resampling procedures to test the statistical significance of an indirect effect. Preacher and Hayes created SPSS and SAS macros (aggregations of syntaxes and commands to run all the proposed analyses in one execution rather than several), which provide a test of the indirect effect relying on a nonparametric bootstrapping procedure, producing an estimate of the indirect effect (\(ab\) product), an estimated standard error, and both 95% and 99% confidence intervals for a population value of \(ab\). As a nonparametric approach to effect size, the bootstrapping procedure was suggested by Shrout and Bolger (2002) as a way of circumventing the power problem introduced by the violation of the assumption of normality in the sampling distribution. The macros also provide output needed in order to assess mediation using the Sobel test and the Baron and Kinney criteria.

Although the Baron and Kinney test was criticized for its low statistical power, it remains the most popular approach in testing for a mediation effect (MacKinnon, et al.,
In order to use this type of analysis, it is necessary to demonstrate that the data meet the four criteria defined by Baron and Kinney. First, there must be a significant relationship between cultural group and learning behavior. Second, there must be a significant relationship between cultural group and the thinking style variable. Third, the thinking style variable must predict learning behavior after controlling for cultural group. Finally, the relationship between cultural group and learning behavior must be reduced when the thinking style variable is in the equation. The Sobel test and bootstrapping method will be used to circumvent the power problem and provide further evidence of a mediation effect, if the estimated indirect effect is found to be statistically significant.

**The distinction between moderation effect and mediation effect.** The tests of moderation and mediation effects were sometimes inconsistently or interchangeably used in literature. Although there is a lack of conceptual and statistical clarity in the study of mediation and moderated effects, the distinct features of these two approaches have been discussed by some scholars (e.g., Baron and Kenny, 1986; Frazier, Tiz and Barron, 2004). According to Baron and Kenny, a moderator variable is one that affects the relationship between two variables, so that the nature of the impact of the predictor on the criterion varies according to the level or value of the moderator. In the current study, it was hypnotized that motivation might affect the relationship between thinking style and learning behavior, and the impact of thinking style on learning behavior may vary according to the level of motivation. Thus, motivation was considered and tested as a moderator variable. Moderated relationships often are called interaction effects, however, the two terms should not be considered equal. According to Jaccard and Turrisi (2003), there are many ways in which interaction effects have been conceptualized in the social
sciences and there is controversy about the best way to think about the concept. However, one popular school of thought conceptualizes interaction effects in terms of moderated relationship. In a moderated relationship, an interaction effect is said to exist when the effect of the independent variable on the dependent variable differs depending on the value of the moderator variable.

Frazier, Tiz and Barron (2004) suggest that multiple regression can be used to examine moderator effects whether the predictor or moderator variables are categorical or continuous. When both the predictor and moderator variables are categorical, analysis of variance (ANOVA) procedures also can be used, although multiple regression is preferred because of the flexibility in options it provides for coding categorical variables (Cohen et al., 2003).

The mediator variable, on the other hand, was described as “the generative mechanism through which the focal independent variable is able to influence the dependent variable of interest” (Baron and Kenny, 1986, p. 1173). The nature of the mediated relationship is that the independent variable influences the mediator which, in turn, influences the outcome. In the current study, thinking style was considered a mediator variable, through which, the independent variable (i.e. cultural group) causes the behavioral differences in the classroom. The terms mediated effects and indirect effects are sometime used interchangeably, however they should also not be considered equal. A mediated effect is usually thought of as the special case of indirect effects when there is only one intervening variable. To distinguish these two terms, Holmebeck (1997) adopted an example to illuminate that the existent of mediation effect implies that the
total effect from independent variable to criterion variable was present initially, but there is no such assumption in the assessment of indirect effects.

According to MacKinnon, et al. (2002), the most common method for testing mediation in psychological research was developed by Kenny and his colleagues (Baron & Kenny, 1986). The four steps of this approach were discussed in the last section. Other than Sobel test and bootstrapping method, structural equation modeling (SEM) also presents a popular approach to test mediation effects. Among various ways to test mediation models in SEM, Holmbeck (1997) described a strategy that is virtually identical to that used in the Baron and Kenny procedure (i.e., testing the fit of the predictor–outcome model and the fit of the predictor–mediator–outcome model, as well as the predictor–mediator and mediator–outcome paths). The SEM approach is particularly appropriate and useful when one has multiple indicators for the latent variables under investigation. In the current study, only one instrument was implemented to measure each variable, therefore, the Baron and Kenny procedure along with the Sobel test and bootstrapping method were adopted for their succinct logic.

The distinction between mediators and moderators can be further demonstrated diagrammatically (see Figure 1; in Holmbeck, 1997). In the top model in figure 1, B serves as a mediator which falls in the causal pathway between A (predictor variable) and C (criterion variable); that is, if A is significantly associated with C, and if A influences B and B influences C, then B is a mediating variable between A and C. In the bottom model in Figure 1, B is considered as a moderator, for A is expected to be related to C, but only under certain conditions of B.

Figure 1. Diagrams of moderator and mediator effects
CHAPTER 4

Results

To investigate the relations between thinking style variables and learning behavior, and whether these relations imply a potential explanation of the distinct learning behaviors in the classroom presented by American and Chinese students, four research questions were asked in the first chapter. In this chapter, results of data analyses were organized in an order to answer these questions:

1. Are there significant differences between the mean scores of American students, Chinese students in China, and Chinese students in the U.S. on the QLBC, indicating different learning behaviors in the classroom?

2. Are there significant differences between the mean scores of American students, Chinese students in China, and Chinese students in the U.S. on the self-report thinking style measure?

3. Do regression slopes suggest that thinking style variables predict learning behavior in the classroom? Is the association between thinking style variables and learning behavior in the classroom moderated by motivation?

4. Do regression slopes and indirect effects suggest that thinking style mediates the relationship between cultural group and learning behavior in the classroom?

Research Question 1: Are There Significant Differences between the Mean Scores of American Students, Chinese Students in China and Chinese students in the U.S. on the QLBC, Indicating Different Learning Behaviors in the Classroom?

Identification of outliers and tests of assumptions. To identify outliers, Tabachnick and Fidell (2007) suggested the calculation of z scores for continuous
variables, and cases with standardized scores in excess of 3.29 ($p < .001$, two-tailed $t$ test) are potential outliers. Boxplots provide visual support to locate extreme cases. In this study, both z scores and boxplots were generated for all continuous variables. As a result, six cases were identified as outliers and eliminated from further analyses.

To answer the first research question, one-way ANOVA was used to test the mean differences among sample groups. According to Keppel and Wickens (2004), in order to perform an ANOVA test, five assumptions concerning the error values should be fulfilled: 1) independence, 2) identical distribution (within group), 3) identical distribution (between groups), 4) normal distribution, and 5) homogeneity of variance. The first two assumptions are considered random sampling assumptions and are likely to be satisfied when subjects have been randomly sampled from a larger population or have been randomly assigned to groups. However, it is impossible to satisfy this assumption using a non-experimental design in which the groups constitute natural populations to which random assignment is impossible. To solve this problem, researchers sometimes try to find evidence that no differential sampling bias has occurred. In this study, the sample groups were drawn from various disciplines at universities with relatively equivalent academic reputations, and educational quality. As shown in Table 3.1, Table 3.2 and Table 3.3 in chapter 3, the groups are similar in terms of characteristics such as age and education.

To assess identical distribution (between groups), Keppel and Wickens (2004) suggested that the most important factor that might lead to the violation of this assumption is variance. Thus, the assessment of identical distribution (between groups) involves the inspection of homogeneity of variance. Using SPSS, a Levene statistic was
calculated for each learning behavior variable to test homogeneity of variance. As shown in Table 4.1, Levene statistic values reached a statistically significant level for four variables (i.e., appearance of participation, raising questions, indication of understanding, and behavioral mean scores), which indicated the violation of homogeneity of variance. However, Tabachnick and Fidell (2007, p.86) recommended the use of $F_{\text{max}}$ in conjunction with sample-size ratios, which is a more tolerant and preferred way of assessing homogeneity of variance than other tests. $F_{\text{max}}$ refers to the ratio of the largest cell variance to the smallest cell variance. Under the condition that the ratio of largest to smallest cell sizes is 4:1 or less, an $F_{\text{max}}$ as great as 10 is acceptable. In this analysis, the largest sample-size ratio was 1.13, and the $F_{\text{max}}$ values ranged from 1.19 to 2.86 (see Table 4.2). Therefore, the assumption of homogeneity was retained.

To assess normality, a significance test is usually used via the calculation of $z$ scores by dividing skewness and kurtosis values by their standard errors. However, Tabachnick and Fidell (2007) suggested that, when the sample size is large, it is preferable to look at the shape of the distribution instead of using the significance test. Because the standard errors for both skewness and kurtosis decrease with an increase in $N$, the $z$ scores are likely to reach statistical significance in large samples when there are only minor deviations from normality. Thus, the assumption of normality in this study was tested by creating a scatterplot matrix of dependent and predictor variables. An assessment of the bivariate scatterplot shows the plots to be fairly elliptical for all variables, indicating normal distributions.
**Table 4.1**

Levene Values for Six Learning Behavior Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP</td>
<td>22.04</td>
<td>2</td>
<td>381</td>
<td>.00</td>
</tr>
<tr>
<td>RQ</td>
<td>10.80</td>
<td>2</td>
<td>381</td>
<td>.00</td>
</tr>
<tr>
<td>IU</td>
<td>4.80</td>
<td>2</td>
<td>381</td>
<td>.01</td>
</tr>
<tr>
<td>IT</td>
<td>.44</td>
<td>2</td>
<td>381</td>
<td>.65</td>
</tr>
<tr>
<td>ITSR</td>
<td>.90</td>
<td>2</td>
<td>381</td>
<td>.41</td>
</tr>
<tr>
<td>BMS</td>
<td>7.37</td>
<td>2</td>
<td>381</td>
<td>.00</td>
</tr>
</tbody>
</table>

\*AP = appearance of participation, RQ = raising questions, IU = indication of understanding, IT = independent thinking, ISTR = independence in teacher-student relationship, and BMS = behavioral mean score.

**Table 4.2**

$F_{max}$ Values for Six Learning Behavior Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>USA b</th>
<th>CN1 c</th>
<th>CN2 d</th>
<th>F_{max}</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP</td>
<td>.45</td>
<td>1.27</td>
<td>.62</td>
<td>2.86</td>
</tr>
<tr>
<td>RQ</td>
<td>.35</td>
<td>.78</td>
<td>.63</td>
<td>2.22</td>
</tr>
<tr>
<td>IU</td>
<td>.38</td>
<td>.59</td>
<td>.49</td>
<td>1.56</td>
</tr>
<tr>
<td>IT</td>
<td>.37</td>
<td>.44</td>
<td>.40</td>
<td>1.19</td>
</tr>
<tr>
<td>ITSR</td>
<td>.47</td>
<td>.54</td>
<td>.58</td>
<td>1.23</td>
</tr>
<tr>
<td>BMS</td>
<td>.14</td>
<td>.24</td>
<td>.22</td>
<td>1.78</td>
</tr>
</tbody>
</table>
Descriptive statistics. The correlation matrix among subscales is presented in Table 4.3. It shows that all the subscales were significantly correlated, which supports the calculation and use of behavioral mean scores. The means and standard deviations for sample groups on the learning behavior measure are presented in Table 4.4. Compared to Chinese students in China, American students had higher mean scores on appearance of participation, raising questions, indication of understanding, independence in teacher-student relationship, and behavioral mean score, but Americans had a slightly lower mean score on independent thinking. Chinese students in the U.S. have means between the other two groups on behavioral mean score and two subscales (i.e., indication of understanding, independence in teacher-student relationship), but have the highest mean for independent thinking, and the lowest means for appearance of participation and raising questions.

Table 4.3

<table>
<thead>
<tr>
<th>Variable a</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RQ</td>
<td>.58***</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IU</td>
<td>.60***</td>
<td>.45***</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.4

Means and Standard Deviations for Six Learning Behavior Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>USA^b</th>
<th>CN1^c</th>
<th>CN2^d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 129)</td>
<td>(n = 134)</td>
<td>(n = 121)</td>
</tr>
<tr>
<td>Variable</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>AP</td>
<td>3.52</td>
<td>.67</td>
<td>3.46</td>
</tr>
<tr>
<td>RQ</td>
<td>3.19</td>
<td>.59</td>
<td>3.00</td>
</tr>
<tr>
<td>IU</td>
<td>3.82</td>
<td>.61</td>
<td>3.49</td>
</tr>
<tr>
<td>IT</td>
<td>3.71</td>
<td>.61</td>
<td>3.81</td>
</tr>
<tr>
<td>ISTR</td>
<td>3.29</td>
<td>.69</td>
<td>2.88</td>
</tr>
<tr>
<td>BMS</td>
<td>3.50</td>
<td>.37</td>
<td>3.33</td>
</tr>
</tbody>
</table>

^aAP = appearance of participation, RQ = raising questions, IU = indication of understanding, IT = independent thinking, ISTR = independence in teacher-student relationship, and BMS = behavioral mean scores.

^bUSA = American students. ^cCN1 = Chinese students in China. ^dCN2 = Chinese students in the U.S.
Results of one-way ANOVA. One-way ANOVA was used to test whether the mean differences for the three cultural group on the learning behavior variables reach a statistically significant level. As shown in Table 4.5, four main effects were statistically significant for cultural group on (1) raising questions, $F(2, 381) = 3.31, p = .04$; (2) indication of understanding, $F(2, 381) = 7.29, p = .00$; (3) independence in teacher-student relationship, $F(2, 381) = 10.70, p = .00$; (4) and behavioral mean score, $F(2, 381) = 4.96, p = .01$.

Table 4.5

<table>
<thead>
<tr>
<th>Variable a</th>
<th>SS</th>
<th>MS</th>
<th>Df</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP as dependent variable</td>
<td>Between groups</td>
<td>1.88</td>
<td>.94</td>
<td>2</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>300.72</td>
<td>.38</td>
<td>381</td>
<td></td>
</tr>
<tr>
<td>RQ as dependent variable</td>
<td>Between groups</td>
<td>3.90</td>
<td>1.95</td>
<td>2</td>
<td>3.31</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>224.54</td>
<td>.59</td>
<td>381</td>
<td></td>
</tr>
<tr>
<td>IU as dependent variable</td>
<td>Between groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

aAP = appearance of participation, RQ = raising questions, IU = indication of understanding, IT = independent thinking, ISTR = independence in teacher-student relationship, and BMS = behavioral mean score.
bUSA = American students. cCN1 = Chinese students in China. dCN2 = Chinese students in the U.S.
Between groups  7.04  3.52  2  7.29  .00  
Within groups  184.13 .48  381  

**IT as dependent variable**

Between groups  1.02  .51  2  1.25  .29  
Within groups  154.76 .41  381  

**ISTR as dependent variable**

Between groups  11.36  5.68  2  10.70  .00  
Within groups  202.14 .53  381  

**BMS as dependent variable**

Between groups  1.98  .99  2  4.96  .01  
Within groups  75.98 .20  381  

\(^a\)AP = appearance of participation, RQ = raising questions, IU = indication of understanding, IT = independent thinking, ISTR = independence in teacher-student relationship, and BMS = behavioral mean score.

Post-hoc analysis was then used to determine which pair of groups showed mean differences on the four learning behavior variables. The results, based on the Tukey HSD estimation (see Table 4.6) revealed that, compared to Chinese students in China, American students had significantly higher mean scores on (a) indication of understanding (mean difference = .33, \(SE = .09, p = .00\)); (b) independence of teacher-student relationship (mean difference = .41, \(SE = .09, p = .00\)); and (c) behavioral mean score (mean difference = .17, \(SE = .06, p = .01\)). Compared to Chinese students in the U.S., American students had significantly higher mean score on raising questions (mean difference = .12, \(SE = .09, p = .04\)). Chinese students in the U.S. had significantly higher
mean scores than those of Chinese students in China on (a) indication of understanding 
(mean difference = -.22, SE = .09, p = .04); and (b) independence in teacher-student 
relationship (mean difference = -.26, SE = .09, p = .01).

Table 4.6

Post hoc for Cultural group on Six Learning Behavior Variables

<table>
<thead>
<tr>
<th>Variablea</th>
<th>Means</th>
<th>Mean difference</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP as dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USAb vs. CN1c</td>
<td>3.52</td>
<td>3.47</td>
<td>.05</td>
<td>.11</td>
</tr>
<tr>
<td>USA vs. CN2d</td>
<td>3.52</td>
<td>3.35</td>
<td>.17</td>
<td>.11</td>
</tr>
<tr>
<td>CN1 vs. CN2</td>
<td>3.47</td>
<td>3.35</td>
<td>.12</td>
<td>.11</td>
</tr>
<tr>
<td>RQ as dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA vs. CN1</td>
<td>3.19</td>
<td>3.00</td>
<td>.19</td>
<td>.09</td>
</tr>
<tr>
<td>USA vs. CN2</td>
<td>3.19</td>
<td>2.95</td>
<td>.12</td>
<td>.09</td>
</tr>
<tr>
<td>CN1 vs. CN2</td>
<td>3.00</td>
<td>2.95</td>
<td>-.06</td>
<td>.09</td>
</tr>
<tr>
<td>IU as dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA vs. CN1</td>
<td>3.82</td>
<td>3.49</td>
<td>.33</td>
<td>.09</td>
</tr>
<tr>
<td>USA vs. CN2</td>
<td>3.82</td>
<td>3.71</td>
<td>.10</td>
<td>.09</td>
</tr>
<tr>
<td>CN1 vs. CN2</td>
<td>3.49</td>
<td>3.71</td>
<td>-.22</td>
<td>.09</td>
</tr>
<tr>
<td>IT as dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA vs. CN1</td>
<td>3.71</td>
<td>3.81</td>
<td>-.10</td>
<td>.08</td>
</tr>
<tr>
<td>USA vs. CN2</td>
<td>3.71</td>
<td>3.82</td>
<td>-.11</td>
<td>.08</td>
</tr>
<tr>
<td>CN1 vs. CN2</td>
<td>3.81</td>
<td>3.82</td>
<td>-.01</td>
<td>.08</td>
</tr>
<tr>
<td>ISTR as dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
USA vs. CN1   3.29  2.88  .41  .09  .00
C USA vs. CN2  3.29  3.14  .15  .09  .24
CN1 vs. CN2   2.88  3.14  -.26  .09  .01

**BMS as dependent variable**

USA vs. CN1   3.50  3.33  .17  .06  .01
USA vs. CN2   3.50  3.39  .11  .06  .13
CN1 vs. CN2   3.33  3.39  -.06  .06  .51

\(^a\)AP = appearance of participation, RQ = raising questions, IU = indication of understanding, IT = independent thinking, ISTR = independence in teacher-student relationships, and BMS = behavioral mean score.

\(^b\)USA = American students. \(^c\)CN1 = Chinese students in China. \(^d\)CN2 = Chinese students in the U.S.

**Research Question 2: Are There Significant Differences between the Mean Scores of American Students, Chinese Students in China, and Chinese Students in the U.S. on the self-report Thinking Style Measure?**

**Test of assumptions.** To answer the second question, one-way ANOVA was used to test the mean differences for cultural groups on four thinking style variables. To assess identical distribution (between groups) and homogeneity of variance, both Levene statistic and F\(_{max}\) values were calculated for each variable. As shown in Table 4.7, the Levene statistic value was significant for integrative style (p = .00), and was close to significant for holistic style (p = .06). However, Tabachnick and Fidell (2007) suggested the use of F\(_{max}\) values as a preferred way of assessing homogeneity of variance. The F\(_{max}\) values for the four thinking style variables (see Table 4.8) were ranged from 1.28 to 1.59,
which were less than the criterion 10, and thus, the assumption of homogeneity of variance was retained.

Normality was then analyzed by creating a scatterplot matrix between dependent and predictor variables. An inspection of the bivariate scatterplots shows the plots to be fairly elliptical, indicating normal distributions.

Table 4.7

_Levene Values for Four Thinking Style Variables_

<table>
<thead>
<tr>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holistic</td>
<td>2.90</td>
<td>2</td>
<td>381 .06</td>
</tr>
<tr>
<td>Analytic</td>
<td>1.52</td>
<td>2</td>
<td>381 .22</td>
</tr>
<tr>
<td>Integrative</td>
<td>6.04</td>
<td>2</td>
<td>381 .00</td>
</tr>
<tr>
<td>Difference score</td>
<td>1.05</td>
<td>2</td>
<td>381 .35</td>
</tr>
</tbody>
</table>

Table 4.8

_F_{max} Values for Four Thinking Style Variables_

<table>
<thead>
<tr>
<th>Cell Variance</th>
<th>Variable</th>
<th>USA\textsuperscript{a}</th>
<th>CN1\textsuperscript{b}</th>
<th>CN2\textsuperscript{c}</th>
<th>(F_{max})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holistic</td>
<td>16.76</td>
<td>19.20</td>
<td>25.14</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>Analytic</td>
<td>20.76</td>
<td>28.05</td>
<td>24.11</td>
<td>1.35</td>
<td></td>
</tr>
<tr>
<td>Integrative</td>
<td>17.60</td>
<td>25.96</td>
<td>27.95</td>
<td>1.59</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>54.51</td>
<td>66.35</td>
<td>69.54</td>
<td>1.28</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}USA = American students. \textsuperscript{b}CN1 = Chinese students in China. \textsuperscript{c}CN2 = Chinese students in the U.S.
**Descriptive statistics.** The means and standard deviations for the sample groups on the thinking style variables are presented in Table 4.9. Both Chinese students in China and Chinese students in the U.S. had higher mean scores on holistic style and integrative style than those of American students. American students had the highest means for the analytic style and difference score, while Chinese students in the U.S. had the lowest means for these two variables.

Table 4.9

*Means and Standard Deviations for Four Thinking Style Variables*

<table>
<thead>
<tr>
<th>variable</th>
<th>USA(^a)</th>
<th>CN1(^b)</th>
<th>CN2(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(M)</td>
<td>(SD)</td>
<td>(M)</td>
</tr>
<tr>
<td>Holistic</td>
<td>10.89</td>
<td>4.09</td>
<td>12.97</td>
</tr>
<tr>
<td>Analytic</td>
<td>11.72</td>
<td>4.56</td>
<td>10.78</td>
</tr>
<tr>
<td>Integrative</td>
<td>3.60</td>
<td>4.20</td>
<td>6.54</td>
</tr>
<tr>
<td>Difference</td>
<td>.82</td>
<td>7.38</td>
<td>-2.19</td>
</tr>
</tbody>
</table>

\(^a\)USA = American students. \(^b\)CN1 = Chinese students in China. \(^c\)CN2 = Chinese students in the U.S.

**Results of one-way ANOVA.** One way ANOVA was used to test the mean differences for cultural group on the four thinking style variables, i.e., holistic style, analytic style, integrative style, and difference score, respectively (see Table 4.10). The results revealed significant main effects for cultural group on all four variables: (1) holistic style, \(F(2, 381) = 7.84, p = .00\); (2) analytic style, \(F(2, 381) = 5.40, p = .01\); (3)
integrative style, \( F(2, 381) = 12.15, p = .00 \); and (4) difference score, \( F(2, 381) = 7.95, p = .00 \).

Table 4.10

One-way Analysis of Variance Examining the Main Effect of Cultural Group on Four Thinking Style Variables as Dependent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>SS</th>
<th>MS</th>
<th>Df</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holistic style as dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>317.68</td>
<td>158.84</td>
<td>2</td>
<td>7.84</td>
<td>.00</td>
</tr>
<tr>
<td>Within groups</td>
<td>7716.31</td>
<td>20.25</td>
<td>381</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analytic style as dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>263.04</td>
<td>131.52</td>
<td>2</td>
<td>5.40</td>
<td>.01</td>
</tr>
<tr>
<td>Within groups</td>
<td>9281.45</td>
<td>24.36</td>
<td>381</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrative style as dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>577.80</td>
<td>288.90</td>
<td>2</td>
<td>12.15</td>
<td>.00</td>
</tr>
<tr>
<td>Within groups</td>
<td>9060.38</td>
<td>23.78</td>
<td>381</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference score as dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>1007.33</td>
<td>503.67</td>
<td>2</td>
<td>7.95</td>
<td>.00</td>
</tr>
<tr>
<td>Within groups</td>
<td>24145.83</td>
<td>63.38</td>
<td>381</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post hoc analysis was then used to determine which pair of groups showed mean differences on each of the variables. The results, based on the Tukey HSD estimation (see Table 4.11), showed that both Chinese students in China and Chinese students in the U.S. had significantly higher mean scores than the American group on holistic style (mean difference = -2.08, \( SE = .56, p = .00 \); mean difference = -1.72, \( SE = .56, p = .01 \),
respectively), and on integrative style (mean difference = -2.94, \(SE = .60, \ p = .00\); mean difference = -1.89, \(SE = .61, \ p = .01\), respectively). There were no statistically significant mean differences between Chinese students in China and Chinese students in the U.S. on holistic style (mean difference = .36, \(SE = .56, \ p = .80\), or on integrative style (mean difference = 1.05, \(SE = .61, \ p = .20\)). American students had a significantly higher mean score on analytic style than Chinese students in the U.S. (mean difference = 2.05, \(SE = .62, \ p = .00\)). Chinese students in China did not differ significantly on analytic style from either American students or Chinese students in the U.S. (mean difference = .94, \(SE = .61, \ p = .27\); mean difference = 1.11, \(SE = .62, \ p = .17\), respectively). American students had a significantly higher mean difference score than both Chinese students in China (mean difference = 3.01, \(SE = .98, \ p = .01\), and Chinese students in the U.S. (mean difference = 3.76, \(SE = 1.01, \ p = .00\)). There was no significant mean difference between Chinese students in China and Chinese students in the U.S. on difference score (mean difference = .75, \(SE = 1.00, \ p = .73\).

Table 4.11

*Post Hoc Analysis Results for Cultural Group on Four Thinking Style Variables*

<table>
<thead>
<tr>
<th></th>
<th>Means</th>
<th>Mean difference</th>
<th>SE</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Holistic style as dependent variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA(^a) vs. CN1(^b)</td>
<td>10.89</td>
<td>12.97</td>
<td>-2.08</td>
<td>.56</td>
</tr>
<tr>
<td>USA vs.CN2(^c)</td>
<td>10.89</td>
<td>12.61</td>
<td>-1.72</td>
<td>.56</td>
</tr>
<tr>
<td>CN1 vs. CN2</td>
<td>12.97</td>
<td>12.61</td>
<td>.36</td>
<td>.56</td>
</tr>
<tr>
<td><strong>Analytic style as dependent variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA vs. CN1</td>
<td>11.72</td>
<td>10.78</td>
<td>.94</td>
<td>.61</td>
</tr>
</tbody>
</table>
USA vs. CN2  11.72  9.67  2.05  .62  .00
CN1 vs. CN2  10.78  9.67  1.11  .62  .17

**Integrative style as dependent variable**

USA vs. CN1  3.60  6.54  -2.94  .60  .00
USA vs. CN2  3.60  5.49  -1.89  .61  .01
CN1 vs. CN2  6.54  5.49  1.05  .61  .20

**Difference score as dependent variable**

USA vs. CN1  .82  -2.19  3.01  .98  .01
USA vs. CN2  .82  -2.94  3.76  1.01  .00
CN1 vs. CN2  -2.19  -2.94  .75  1.00  .73

\(^a_{USA} = \text{American students.} \; ^b_{CN1} = \text{Chinese students in China.} \; ^c_{CN2} = \text{Chinese students in the U.S.}\)

**Research Question 3: Do Regression Slopes Suggest That the Thinking Style Variables Predict Learning Behavior in the Classroom? Is the association between thinking style variables and learning behavior in the classroom moderated by motivation?**

**Test of assumptions.** To answer the third question, a series of hierarchical regressions was used to examine the relationships between thinking style variables and learning behavior. Prior to analysis, the thinking style variables, motivation and learning behavior were examined to identify outliers and to evaluate the fulfillment of test assumptions utilizing guidelines discussed in Tabachnick and Fidell (2007) and in Meyers, Gamst, and Guarino (2006).
The procedure of identifying outliers had already been implemented for these variables at the start of data analyses, and the results were reported in research question 1. However, Tabachnick and Fidell recommend the calculation of Mahalanobis distance values in screening outliers when applying regression procedures. Mahalanobis distance is evaluated as $x^2$ with degrees of freedom equal to the number of variables. The critical value of Mahalanobis distance with one variable at $p = .001$ is 10, according to a chi-square table. The calculation of Mahalanobis distance values was based on the data after removing those cases identified as outliers judging by their outranged standardized scores in research question 1. None of the rest of the cases was found with Mahalanobis distance which exceeded the critical value. Thus, no more outliers were identified and eliminated.

Linearity was then analyzed by creating a scatterplot matrix between dependent and predictor variables, and by completing correlation analysis for all the variables. An assessment of the bivariate scatterplots shows the plots to be fairly elliptical, indicating normality and linearity. Homoscedasticity was examined through the generation of a residuals plot within preliminary regression analysis. The distribution of the residuals was fairly linear and thus, homoscedasticity is assumed.

Finally, the independent variables were assessed for possible multicollinearity problems through the tolerance statistic available using the regression feature in SPSS. Tolerance values range from 0 to 1; multicollinearity is indicated for a particular variable if the tolerance value is .01 or less (Meyers, Gamst, & Guarino, 2006). In this study, the tolerance values ranged from .703 to .999 for the predictors, and thus multicollinearity was not a concern.
**Descriptive statistics.** The means, standard deviations, and correlations for thinking style variables, motivation, and learning behavior are presented in Table 4.12. Learning behavior was significantly related to holistic style ($r = -.24, p < .001$), and difference score ($r = .16, p < .01$), but was not significantly related to analytic style ($r = .04, p > .05$), or integrative style ($r = .09, p > .05$). Holistic style and analytic style were negatively correlated ($r = -.21, p < .001$). Integrative style was negatively correlated with holistic style ($r = -.39, p < .001$), and analytic style ($r = -.57, p < .001$). As expected, difference score was highly correlated with holistic style ($r = -.83, p < .001$) and analytic style ($r = .86, p < .001$), since it was generated by subtracting holistic scores from analytic scores. Motivation was significantly correlated with learning behavior ($r = .40, p < .001$), analytic style ($r = -.21, p < .001$), integrative style ($r = -.22, p < .001$), and difference score ($r = -.14, p < .01$). The risk of multicollinearity caused by the significant correlations between thinking style variables and motivation were examined and eliminated through the calculations of a tolerance statistic, as discussed in the last section.

Table 4.12

Means, Standard Deviations and Correlations for Learning Behavior, Motivation and Four Thinking Style Variables (N = 384)

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Behavior</td>
<td>3.41</td>
<td>.45</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Motivation</td>
<td>4.35</td>
<td>.73</td>
<td>.40***</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Holistic</td>
<td>12.16</td>
<td>4.58</td>
<td>-.24***</td>
<td>.03</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Analytic</td>
<td>10.75</td>
<td>4.99</td>
<td>.04</td>
<td>-.21***</td>
<td>-.43***</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Integrative</td>
<td>5.22</td>
<td>5.02</td>
<td>.09</td>
<td>.22***</td>
<td>-.39***</td>
<td>-.57***</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>
Results of regression analysis. The correlation matrix in Table 4.11 indicates significant relationships between holistic style, difference score, motivation and learning behavior. The correlation between integrative style and learning behavior was close to but did not reach the level of statistical significance \((p = .07)\). The third research question requires an examination of (a) the extent to which thinking style variables and learning behavior are correlated; and (2) whether these relationships are moderated by motivation. A series of hierarchical regression analyses with a specific sequence were conducted for these purposes.

In Step 1, one thinking style variable was entered as single predictor to examine the extent to which the thinking style variable was related to learning behavior. In Step 2, in addition to the thinking style variable, motivation was entered as another predictor to generate an \(R^2\) that would be used to estimate the \(R^2\) change with the addition of an interaction term in the next step. In Step 3, the two-way interaction between the predictors was entered to examine whether motivation moderated the relationship between the thinking style variable and learning behavior. The interaction term was created by multiplying the centered means of the predictors (Aiken & West, 1991). By following this sequence of variable entry, the \(R^2\) differences from Step 1 to Step 3 would

---

3 According to Aiken and West, the interaction term should be created by multiplying the predictors. In this study, I need to multiply each value of motivation with that of holistic style. However, before multiplication could be done, I need to center the variables to avoid possible problems with multicollinearity: if the variables were not centered first, their product would be highly correlated with the original variables. The steps were described in detail on the following webpage:
http://www.psychwiki.com/wiki/Interaction_between_two_continuous_variables
reflect the effects of adding motivation and interaction term in the analyses, thus allowing for a determination of whether and how much variance in learning behavior could be accounted for by the two-way interaction.

The results of hierarchical regression analysis using holistic style as a predictor are presented in Table 4.13. As can be noticed in Step 1, holistic style predicted a significant amount of variance in learning behavior, with $R^2$ equal to .06 ($p < .001$). The addition of motivation in Step 2 remarkably improved the prediction by adding 16% to the variance accounted for in learning behavior ($p < .001$). In step 3, the interaction effect accounted for an additional 1% of the variance in learning behavior ($p < .01$). Thus, the final model in Step 3 was suggested with the best model fit, and accounted for 23% of the variance in learning behavior ($p < .001$).

In the final model, holistic style was a significant negative predictor of learning behavior at the mean level of motivation ($\beta = -.2$, $p < .01$). Motivation was a significant positive predictor of learning behavior at the mean level of holistic style ($\beta = .35$, $p < .001$). The interaction effect was statistically significant ($\beta = -.02$, $p < .05$). According to Cohen et al. (2003), there are a variety of interaction patterns, which suggest that the interaction may strengthen or weaken the relationship of the predictor to the dependent variable with the increase in the moderator variable. The precise nature of the interaction will depend on the signs of all first order and interaction coefficients and the relative magnitudes of these coefficients. In this analysis, the predictors had regression coefficients of opposite signs, and the interaction coefficient had negative sign: The regression of learning behavior on holistic
style was strengthened with the increase of motivation level\textsuperscript{2}. A separate regression analysis using holistic style as the single predictor for participants with above mean scores on the motivation subscale revealed a decrease in the regression coefficient from -.24 to -.33, and increased effect sizes from 6% to 10.6%.

Table 4.13

*Results of Hierarchical Regression Analyses Predicting Learning Behavior by Holistic Style and Motivation (N = 384)*

<table>
<thead>
<tr>
<th>Step</th>
<th>B</th>
<th>SEB</th>
<th>β</th>
<th>R\textsuperscript{2}</th>
<th>ΔR\textsuperscript{2}</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Model fit</td>
<td>.06***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holistic</td>
<td>-.02*** .01</td>
<td>-.24***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Model fit</td>
<td>.22*** .16***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holistic</td>
<td>-.03*** .00</td>
<td>-.25***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td>.25*** .03</td>
<td>.40***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Model fit</td>
<td>.23*** .01**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holistic</td>
<td>-.02*** .00</td>
<td>-.24***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td>.25*** .03</td>
<td>.41***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holistic * Motivation</td>
<td>-.02** .01</td>
<td>-.12**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{2} According to Cohen et al., in a regression equation involving an interaction term, the resulting regression coefficient for the predictor (X) is the slope estimate where the moderator variable (Z) is set to be 0. When the predictors (X and Z) were centered, the coefficient was the slope estimate at the mean value of moderator variable (Z). See Cohen et al. pages 260 and 261. To obtain regression coefficients for the predictor (X) at other values of moderator variable (Z), we need to examine the simple slopes at specific values of the moderator (Z). The examination of simple slopes stated by Cohen as “post hoc probing of interactions” (p. #) parallels the process of post hoc probing of simple main effects in ANOVA (see p. 272). Thus, I tested the simple slopes as post hoc probing in the next paragraph, with Table 4.13.
As suggested by Cohen et al. (2003) and Jaccard and Turrisi (2003), the significant interaction effect was then further interpreted by examining simple regression lines for low, moderate, and high levels of motivation. As shown in Table 4.14, it was found that holistic style was a significant positive predictor of learning behavior for the high motivation level ($\beta = -.36, p = .00$), and moderate motivation level ($\beta = -.24, p = .00$), but not for low motivation level ($\beta = -.12, p = .06$), though it approached statistic significance level.

Table 4.14

**Post Hoc Probing of Interaction for Learning Behavior on Centered Holistic Style at Three Values of Centered Motivation (N = 384)**

<table>
<thead>
<tr>
<th>Value of motivation</th>
<th>$B$</th>
<th>SEB</th>
<th>$\beta$</th>
<th>$t$ test</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean-1 SD</td>
<td>-.01</td>
<td>.01</td>
<td>-.12</td>
<td>-1.89</td>
<td>.06</td>
</tr>
<tr>
<td>Mean</td>
<td>-.02</td>
<td>.00</td>
<td>-.24</td>
<td>-5.40</td>
<td>.00</td>
</tr>
<tr>
<td>Mean+1 SD</td>
<td>-.04</td>
<td>.01</td>
<td>-.36</td>
<td>-5.94</td>
<td>.00</td>
</tr>
</tbody>
</table>

The results of hierarchical regression analysis using difference score as a predictor are presented in Table 4.15. As can be noticed in Step 1, difference score predicted a significant amount of variance in learning behavior, with $R^2$ equal to .03 ($p < .01$). The addition of motivation in Step 2 accounted for an additional 17% of the variance in learning behavior ($p < .001$). In Step 3, the interaction effect accounted for an additional 1% of the variance in learning behavior ($p < .05$). Thus, the final model in Step 3 was suggested with the best model fit, and accounted for 21% of the variance in learning behavior ($p < .001$).

In the final model, difference score was a significant positive predictor of learning behavior at the mean level of motivation ($\beta = .22, p < .01$). The interaction effect was statistically significant ($\beta = .09, p < .05$). In this analysis, all the coefficients had positive
signs, which suggested that the regression of learning behavior on difference score was strengthened with the increase of motivation level.

Table 4.15

Results of Hierarchical Regression Analyses Predicting Learning Behavior by Difference Score and Motivation (N = 384)

<table>
<thead>
<tr>
<th>Step</th>
<th>B</th>
<th>SEB</th>
<th>β</th>
<th>R²</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Model fit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference score</td>
<td>.01**</td>
<td>.00</td>
<td>.16**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Model fit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference score</td>
<td>.01**</td>
<td>.00</td>
<td>.22**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td>.27***</td>
<td>.03</td>
<td>.43***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Model fit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference score</td>
<td>.01**</td>
<td>.00</td>
<td>.22**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td>.27***</td>
<td>.03</td>
<td>.43***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holistic * Motivation</td>
<td>.01*</td>
<td>.00</td>
<td>.09*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05. **p < .01. ***p < .001

The significant interaction effect was then further interpreted by examining simple regression lines for low, moderate, and high levels of motivation. As shown in Table 4.16, it was found that difference score was a significant positive predictor of learning behavior for high motivation level (β = .31, p = .00), and moderate motivation level (β = .22, p = .00), but not for low motivation level (β = .13, p = .06). A separate regression analyses using difference score as the single predictor for participants with
above mean scores on the motivation subscale revealed an increase in regression coefficients from .16 to .31, and in effect sizes from 3% to 9.5%.

Table 4.16

*Post Hoc Analysis of Interactions for Learning Behavior on Centered Difference Score at Three Values of Centered Motivation (N = 384)*

<table>
<thead>
<tr>
<th>Value of motivation</th>
<th>B</th>
<th>SEB</th>
<th>β</th>
<th>t test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean-1 SD</td>
<td>.01</td>
<td>.00</td>
<td>.13</td>
<td>1.87</td>
<td>.06</td>
</tr>
<tr>
<td>Mean</td>
<td>.01</td>
<td>.00</td>
<td>.22</td>
<td>4.68</td>
<td>.00</td>
</tr>
<tr>
<td>Mean+1 SD</td>
<td>.02</td>
<td>.00</td>
<td>.31</td>
<td>4.88</td>
<td>.00</td>
</tr>
</tbody>
</table>

Since the correlation between integrative style and learning behavior approached significance (p = .07), a hierarchical regression analysis using integrative style as a predictor was performed; the results are presented in Table 4.17. As can be noticed in Step 1, integrative style failed to predict a significant amount of variance in learning behavior, with $R^2$ equal to .01 (p > .05). The addition of motivation in Step 2 accounted for an additional 15% of the variance in learning behavior (p < .001). In Step 3, the interaction effect accounted for an additional 1% of the variance in learning behavior (p > .05), which is not statistically significant. In the final model, integrative style was not a significant predictor of learning behavior ($\beta = .00, p > .05$). The interaction effect was not statistically significant ($\beta = .01, p > .05$).

Table 4.17

*Results of Hierarchical Regression Analyses Predicting Learning Behavior by integrative style and Motivation (N = 384)*

<table>
<thead>
<tr>
<th>Step</th>
<th>B</th>
<th>SEB</th>
<th>β</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Model fit</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Integrative style .01 .01 .09

2. Model fit .16*** .15***
   Integrative style .00 .00 .01
   Motivation .25*** .03 .39***

3. Model fit .17*** .01
   Integrative style -.00 .00 -.01
   Motivation .25*** .03 .40***
   Integrative * Motivation .01 .01 .09

*p < .05. **p < .01. ***p < .001

Since analytic style was not found to be significantly correlated with learning behavior, hierarchical regression analysis was not performed to examine the scope of correlation and the interaction effect of motivation for this thinking style variable.

Research Question 4: Do Regression Slopes and Indirect Effects Suggest that Thinking Style Mediates the Linkage between Cultural Group and Learning Behavior in the Classroom?

Results of tests of medication effects. To answer the fourth research question, whether thinking style variables mediate the linkage between cultural group and learning behavior, Preacher and Hayes’s SPSS macro was used to produce output related to all the Baron and Kinney criteria, the Sobel test, and the bootstrapping method. The results for testing the Baron and Kinney criteria and using holistic style as the mediator are presented in the Table 4.18. In this table, b(YX) denotes the regression slope between learning behavior and cultural group, b(MX) denotes the regression slope between holistic style and cultural group, b(YM.X) denotes the regression slope for learning
behavior and holistic style controlling for cultural group, and $b(YX.M)$ denotes the regression slope for learning behavior and cultural group controlling for holistic style.

It was shown that Cultural group was significantly related to learning behavior ($B = -.14, p = .00$), holistic style was significantly related to cultural group ($B = -1.90, p = .00$), holistic style was significantly related to learning behavior when controlling for cultural group ($B = -.02, p = .00$), and the association between cultural group and learning behavior was still significant but substantially reduced when controlling for holistic style ($B = -.10, p = .04$). Thus, all the Baron and Kinney criteria were met and supported the role of holistic style as a mediator.

The results for the Sobel test and bootstrapping method are presented in Table 4.19 and Table 4.20. It was shown that the indirect effect was significant in the Sobel test ($ab = -.04, p = .00$). The bootstrapped estimate of the indirect effect lies between -.08 and -.01 with 99% confidence. Because zero was not included in the 99% confidence interval, it was concluded that the indirect effect was significantly different from zero at $p < .01$ (two tailed). Thus, the results of both the Sobel test and bootstrapping method indicated a statistically significant indirect effect, suggesting that holistic style is a mediator between cultural group and learning behavior in the classroom.

Table 4.18.

Direct and total effects testing the Baron and Kinney criteria using holistic style as the mediator ($N = 384$)

<table>
<thead>
<tr>
<th>Slopes</th>
<th>$B$</th>
<th>$SEB$</th>
<th>$t$</th>
<th>$p$ (two tails)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b(Y^X,M)$</td>
<td>-.14</td>
<td>.05</td>
<td>-2.95</td>
<td>.00</td>
</tr>
<tr>
<td>$b(M^X)$</td>
<td>1.90</td>
<td>.49</td>
<td>3.91</td>
<td>.00</td>
</tr>
</tbody>
</table>

83
b (YM,X)  -.02  .01  -4.37  .00  
b (YX.M)  -.10  .05  -2.10  .04  

\(^a\)Y = learning behavior, \(^b\)X = cultural group, \(^c\)M = holistic style

Table 4.19

**Indirect effect for Sobel test using holistic style as the mediator (N = 384)**

<table>
<thead>
<tr>
<th>Value</th>
<th>SEB</th>
<th>LL 95 CI</th>
<th>UL 95 CI</th>
<th>z</th>
<th>p (two tails)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ab(^a)</td>
<td>-.04</td>
<td>.01</td>
<td>-.07</td>
<td>-.01</td>
<td>-2.87</td>
</tr>
</tbody>
</table>

\(^a\)ab = indirect effect

Table 4.20

**Bootstrap Results for Indirect effect using holistic style as the mediator (N = 384)**

<table>
<thead>
<tr>
<th>Value</th>
<th>SEB</th>
<th>LL 95 CI</th>
<th>UL 95 CI</th>
<th>LL 99 CI</th>
<th>UL 99 CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ab(^a)</td>
<td>-.04</td>
<td>.01</td>
<td>-.07</td>
<td>-.02</td>
<td>-.08</td>
</tr>
</tbody>
</table>

\(^a\)ab = indirect effect

The results for testing the Baron and Kinney criteria and using difference score as the mediator are presented in the Table 4.21. cultural group was significantly related to learning behavior (\(B = -.14, p = .00\)), difference score was significantly related to cultural group (\(B = -3.37, p = .00\)), difference score was significantly related to learning behavior (\(B = -.01, p = .01\)) controlling for cultural group, and the association between cultural group and learning behavior was still significant but substantially reduced when controlling for difference score (\(B = -.12, p = .02\)). Thus, all the Baron and Kinney criteria were met, and supported the hypothesis that difference score mediate the relationship between cultural group and learning behavior.
The results for the Sobel test and bootstrapping method are presented in Table 4.22 and Table 4.23. It was shown that the indirect effect was significant in the Sobel test \((ab = -.025, p = .030)\). The bootstrapped estimate of the indirect effect lies between -.063 and -.001 with 99% confidence. Because zero was not included in the 99% confidence interval, it was concluded that the indirect effect was significantly different from zero at \(p < .01\) (two tailed). Thus, the results of both the Sobel test and bootstrapping method indicated significant indirect effects supporting difference score as the mediator between cultural group and learning behavior in the classroom.

**Table 4.21**

*Direct and total effects testing the Baron and Kinney criteria using difference score as the mediator (N = 384)*

<table>
<thead>
<tr>
<th>Slopes</th>
<th>(B)</th>
<th>(SEB)</th>
<th>(t)</th>
<th>(p) (two tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b (Y^a X^b))</td>
<td>-.14</td>
<td>.05</td>
<td>-2.95</td>
<td>.00</td>
</tr>
<tr>
<td>(b (M^c X))</td>
<td>-3.37</td>
<td>.86</td>
<td>-3.92</td>
<td>.00</td>
</tr>
<tr>
<td>(b (YM.X))</td>
<td>.01</td>
<td>.00</td>
<td>2.68</td>
<td>.01</td>
</tr>
<tr>
<td>(b (YX.M))</td>
<td>-.12</td>
<td>.05</td>
<td>-2.39</td>
<td>.02</td>
</tr>
</tbody>
</table>

\(^aY = learning\) behavior, \(^bX = cultural\) group, \(^cM = difference\) score

**Table 4.22**

*Indirect effect for Sobel test using difference score as the mediator (N = 384)*

<table>
<thead>
<tr>
<th>Value</th>
<th>(SEB)</th>
<th>LL 95 CI</th>
<th>UL 95 CI</th>
<th>(z)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect effect</td>
<td>-.025</td>
<td>.012</td>
<td>-.049</td>
<td>-.002</td>
<td>-2.165</td>
</tr>
</tbody>
</table>

Table 4.23
Bootstrap results for indirect effect using difference score as the mediator \((N = 384)\)

<table>
<thead>
<tr>
<th>Value</th>
<th>SEB</th>
<th>LL 95 CI</th>
<th>UL 95 CI</th>
<th>LL 99 CI</th>
<th>UL 99 CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect effect</td>
<td>-.026</td>
<td>.012</td>
<td>-.053</td>
<td>-.004</td>
<td>.063</td>
</tr>
</tbody>
</table>

Since analytic style and integrative style were not significantly correlated with learning behavior, which clearly violate one of the conditions of the Baron and Kinney test and the assumption of indirect effect test. The tests of mediation effect were not performed for these two thinking style variables.
CHAPTER 5

Discussion

This final chapter contains the discussion of the results of this study and their theoretical and practical implications. The limitations of the study are acknowledged, and finally a call is made for future studies to confirm the findings and make further explorations.

Summary of Findings

This study was designed to compare American and Chinese students in terms of learning behaviors in the classroom and thinking style, to examine the relationship between thinking style and learning behavior, and to test whether thinking style at least partially explains the typical behaviors presented by American and Chinese students in the classroom. Based on the analyses results using the data from 384 respondents (including 129 American students, 134 Chinese students in China, and 121 Chinese students in the U.S.), the key findings regarding the four research questions are summarized and discussed in the following sections.

Research Question 1: Are There Significant Differences between the Mean Scores of American Students, Chinese Students in China, and Chinese students in the U.S. on the QLBC, Indicating Different Learning Behaviors in the Classroom?

According to the results of one-way ANOVA analyses of the cultural group on the learning behavior measure, significant mean differences were found between American students and both groups of Chinese students on raising questions, indicating understanding, independence in teacher-student relationship, and behavioral mean score, with American students presenting higher mean scores on all of these subscales and the
general mean. As discussed in chapter 1, Chinese students were frequently described as quiet learners by some western educators (e.g., Olaussen, 1999; Purdie, 1996). The results of this study suggested that Chinese students are less likely to raise questions, to indicate understanding, and to be independent of the teacher-student relationship, which supported the “passive” images of Chinese learners portrayed in the literature.

However, significant mean differences were not found for cultural groups on appearance of participation, and independent thinking. It seems that Chinese students and American students self-rated equally in terms of their participation level in classes and in the degree of independent thinking. In other words, according to their own ratings, although Chinese students might not ask questions or indicate understanding as much as American students, they did not consider themselves as being reluctant to be involved in the classroom activities or to carry out independent thinking. Interestingly, both Chinese students in China and Chinese students in the U.S. have slightly higher ratings on independent thinking than that of American students. This finding challenged the view of Chinese students as passive knowledge receivers, and raises a caution in interpreting their learning behaviors. Based on the current results, one alternative view of Chinese learners might be that they are quiet but independent thinkers. In general, however, the hypothesis of this study that there are significant behavioral differences between American and Chinese students was supported.

Chinese students in the U.S. obtained higher mean scores on four of six variables on the learning behavior measure than those of Chinese students in China, which perhaps indicates a cultural transmission of American learning behaviors to this group. In the American classroom, they rated themselves as being more likely to indicate
understanding, think independently, and be independent in teacher-student relationship. The increased mean scores on the learning behavior measure for this group may reflect real changes in behavioral patterns but could also be due to the response bias of social desirability. In other words, the students may have reported socially desired and valued behaviors.

**Research Question 2: Are There Significant Differences between the Mean Scores of American Students, Chinese Students in China, and Chinese Students in the U.S. on the Self-report Thinking Style Measure?**

Previous studies (e.g., Ji et al. 2005; Kitayama et al, 2003) have shown that people in western cultures tend to engage in context-independent and analytic cognitive processes by focusing on a salient object (or person) independently from the context, while people in East Asian cultures tend to engage in context-dependent and holistic cognitive processes by attending to the relationship between the object and the context in which the object is located. However, these findings were based on small sample sizes. Whether or not these findings could be generalized to larger populations was uncertain. Using relatively large samples in the current study, results of one-way ANOVA analyses revealed that there were mean differences for American and Chinese students on all four thinking style variables. The two groups of Chinese students have higher mean scores on holistic style and integrative style, while American students have higher mean scores on analytic style and difference score. These findings were generally consistent with previous studies (Nisbett, Peng, Choi, & Norenzayan, 2001), and suggested that Chinese students tend to use a holistic thinking style, and American students tend to use an analytic thinking style. Chinese students have both higher mean scores on holistic style
and integrative style, which perhaps implied that they are more flexible in the way of processing cognitive information than American students, since a high integrative score can be interpreted to mean the students report using both holistic and analytic thinking styles. In general, the hypothesis that Chinese and American students tend to differ in self-reported thinking style was supported.

The mean scores for Chinese students in the U.S. did not consistently appear to be between the other two groups: They were closer to those of Chinese students in China. In comparison to learning behavior, for which there is some evidence of a shift toward active participation by Chinese students in the U.S., thinking style might be more stable and resilient to the influence of a change in environment. However, since the results of this study also indicate that Westerners and East Asians tend to differ in cognitive style, which are consistent with the findings of previous studies (e.g., Masuda & Nisbett, 2006; Norenzayan & Nisbett, 2000), the conclusion might be that cognitive processes are affected by culture over a longer time period. This conjecture could be further tested by examining the relationship between thinking style and the time period living in the U.S. of Chinese students, but the performance of this analysis would require a larger sample.

**Research Question 3: Do Regression Slopes Suggest that the Thinking Style Variables Predict Learning Behavior in the Classroom? Is the association between thinking style variables and learning behavior in the classroom moderated by motivation?**

Scholars (e.g., Riding, 1996) claimed that the holistic-analytic dimension of thinking style influences learning processes. However, the exact relationship between thinking style and learning behavior in the classroom has never been investigated. As
discussed in chapter 2, holistic and analytic individuals tend to assume different cognitive approaches in organizing, managing and processing learning contents (e.g., a focus on the details of a situation versus a focus on the whole picture), which could lead to distinct learning behaviors in the classroom. The author hypothesized that holistic individuals might withhold their responses in the classroom until a big picture is achieved and connections are made, which leads to relatively “quiet” or “passive” behavioral traits. Analytic individuals, on the other hand, due to their focus on the details of a situation and tendency to use a systematic and logical approach to information, might make instant responses in the classroom, which leads to “active” behavioral traits.

The results of hierarchical regression analyses in this study indicated that there was a significant relationship between holistic style, difference score and learning behavior in the classroom. Holistic style was a significant negative predictor of learning behavior, and difference score was a significant positive predictor of learning behavior. The difference scores were originally calculated to represent a holistic-analytic continuum, with a high difference score indicating analytic style and a low difference score indicating holistic style. If this is the case, the significant correlation between difference score and learning behavior suggests that holistic individuals tend to report “passive” behavioral traits, and analytic individuals tend to report “active” behavioral traits in the classroom.

However, the correlation between analytic style and learning behavior was not statistically significant, which brought difficulty to interpreting the results. In the literature, holistic style and analytic style are considered one dimension of cognitive style, and are generally located at the two ends of a thinking style continuum (Riding & Rayner,
If this is true, it should be expected that holistic style and analytic style were highly and negatively correlated with each other, and both of them should simultaneously present correlation or non-correlation with other psychological or physical constructs such as learning behavior. In this study, however, holistic style and analytic style were only moderately correlated ($r = -.43$), and a significant correlation exists between holistic style and learning behavior, but not between analytic style and learning behavior.

Do these results suggest that holistic and analytic styles might function independently to a certain degree? Should the notion of the holistic style and analytic style as one dimensional construct be challenged? If more evidence is found supporting the results of this study and indicating that holistic style and analytic style might be related but discrete constructs, existing theories of thinking style would face a challenge. Future research will need to subject the basic assumptions and models of thinking style to serious investigation, and new theories and models might be built to achieve a more accurate understanding of this construct.

To summarize, the significant correlations were found for holistic style, difference score and learning behavior, but not for analytic style, integrative style and learning behavior. One interpretation of the results would be that individuals with high holistic scores tend to report “passive” behavioral traits, and individuals with low holistic scores tend to report “active” behavioral traits in the classroom. Thus, the hypothesized relationship between thinking style and learning behavior was only partially supported.

In spite of the statistically significant relationships between two thinking style variables and learning behavior, the effect sizes were relatively small for both holistic style and difference score in the hierarchical regression analyses. Holistic style and
difference score only account for 6% and 3% of the variance in learning behavior in the classroom, respectively. However, the results of analyses also indicated significant interaction effects after including motivation as the moderator. Simple slope analyses suggest that the correlations between holistic style, difference score and learning behavior were significant for high and moderate motivation levels, but not for the low motivation level. By including participants with low motivation level in the analyses, the effect size could be underestimated for participants with high motivation level. A separate regression analyses for participants with above mean scores on the motivation subscale revealed an increase in effect sizes from 6% to 10.6% for holistic style, and from 3% to 9.5% for difference score, supporting the hypothesis that thinking style is more likely a significant predictor of learning behavior for highly motivated students than for lowly motivated students.

**Research Question 4: Do Regression Slopes and Indirect Effects Suggest that Thinking Style Mediates the Relationship between Cultural Group and Learning Behavior in the Classroom?**

As discussed in the section on research question three, significant associations between thinking style variables and learning behavior were found: Individuals with high holistic scores and low difference scores self-reported more “passive” behavioral traits, and individuals with low holistic scores and high difference scores self-reported more “active” behavioral traits. Thus, it could be further hypothesized that the differences in thinking style presented by American and Chinese students might be somehow related to their differences on the learning behavior measure. The hypothesized causal sequences among cultural group, thinking style and learning behavior were investigated by
assessing the mediation effects of thinking style variables on the relationship between cultural group and learning behavior. According to the results of data analyses using Preach and Hayes’s SPSS macro (Preach & Hayes, 2003), the existence of mediation effects were supported by all the Baron and Kinney criteria, the Sobel test, and the bootstrapping method. Thus, the hypothesis that thinking style variables, more specifically holistic style and difference score, mediate the relationship between cultural group and learning behavior, were confirmed in this study. It could be concluded that, to a certain degree, Chinese students tend to assume a holistic approach in cognitive processes, which explains their “quiet” or “passive” behavioral traits, whereas American students are less likely to assume a holistic approach in cognitive processes, which explains their “active” behavioral traits in the classroom. Since analytic style was not a mediator between cultural group and learning behavior, the mediation effect could be attributed to holistic style, which partially explains the behavioral differences between American and Chinese students.

The use of Baron and Kinney criteria indicated that the association between cultural group and learning behavior, after controlling for holistic style and difference score, was substantially reduced but still significant, which suggests that the mediation effects of holistic style and difference score were partial. The thinking style variables do not completely explain the behavioral differences presented by the American and Chinese groups in the classroom. Although searching for cultural or other causes of behavioral patterns in the classroom is not the task of this study, the partial mediation effects of thinking style variables revealed in this study do suggest the existence of unmeasured variables that have certain influences on the learning behavior of cultural groups. These
variables might include cultural factors, traditional approaches to instruction, or something else which should be explored in future studies.

To summarize, the hypothesized correlation between thinking style and learning behavior, and the mediation effect of thinking style were partially affirmed in this study. However, the functional mechanism of thinking style which might lead to the behavioral differences in the classroom is still unclear. The researcher speculates that Chinese students, who tend to approach learning materials in a holistic way, may pay more attention to achieving a whole picture of knowledge and building structures of knowledge. This structure-oriented learning process might lead to the presence of passive behavioral traits for Chinese students, as they hold on to questions and wait for teachers to present knowledge as a structure, and then bring out their challenges or questions based on the belief that they have achieved a full understanding of the knowledge. In contrast, Western students, who tend to approach learning materials in a less holistic way, might be less likely to delay their responses in the classroom for the sake of achieving a big picture of knowledge, and present active behavioral traits by raising questions, and indicating understanding or confusions promptly to support their learning. Therefore, the influence of thinking style on learning behavior might operate through such learning approaches of students: structure-oriented learning vs. non-structure oriented learning. This speculation should be tested in future studies.

**Limitations of the study**

The major limitations of this study include the following.

Because of resource constraints (time and funding) for this study, both of the instruments in this study were self-report questionnaires, which raises the issue of
potential response bias due to respondents’ subjectivity and misunderstanding (Paulhus, 1991). In future, solid evidence using more objective measures should be obtained to support the findings of this study.

The three sample groups were recruited from universities where the researcher has personal contacts. Although the universities were roughly compared in terms of their educational quality, academic reputation, and student profile, the comparison was not based on established metrics or criteria, and the participants should not be considered randomly chosen, representative samples of the populations in either country.

In addition, the three sample groups were not completely comparable on such characteristics as age, grade, and major. For example, there were more Chinese students in China who were seniors or under 18 years old than American students. The American group was more diverse in majors than Chinese students in China. Females were also overrepresented in the sample groups, especially for American participants and Chinese participants in the U.S. The possible impact of participants’ demographic variables (e.g., gender, age, ethnicity, and major) was not investigated or addressed in this study.

The use of the Style of Learning and Thinking in this study produced three types of scores: holistic, analytic and integrative. The interpretation of the results related to holistic and analytic style was based on a wealth of discussion and research in the literature, therefore it is relatively easy to make sense of the reported findings. However, the use of integrative score has not been discussed by other researchers, which brought difficulty to the interpretation of the related results. Their theoretical and practical meaning might have not been sufficiently revealed in this dissertation, which awaits further exploration and discussion in future.
Other variables that might have an impact on learning behavior (e.g., traditional instructional approaches) were not measured or included in the data analyses. Thus, the possibility of existing confounding factors for thinking style and learning behavior was not considered in this study.

Finally, although this study investigated causal relations, the tests of mediation effects involved tests of correlation or regression analyses. Any causal inference should be made with caution. Replications or experimental designs are required before we draw the conclusion that thinking style partially causes behavioral differences in the classroom for cultural groups.

Theoretical Contributions and Educational Implications

This study has the potential to contribute to the field of educational psychology by illuminating the relationship between thinking style and learning behavior. In the current literature, an association between thinking style and learning behavior has been suggested by scholars (cites). However, questions such as how thinking style influences students’ learning behaviors, and how holistic and analytic individuals differ in behavioral traits, remain unanswered. This study was designed to cast a beam of light on this unclear area in the research field, and to inspire theoretical development. More studies are required to confirm the findings of this study. Suppose that the correlation between thinking style and learning behavior is supported by later research, we still face the challenge of revealing the functional mechanism between thinking style and learning behavior. The proposed explanation of this mechanism in previous section (i.e., structure-oriented learning vs. non structure-oriented learning) should be certainly subject to the examination of rigorous research designs. In a sense, the findings of this study might
make a significant contribution to the field by advocating and inspiring more effort and
deeper explorations in the future.

Searching for plausible explanations of Chinese learning behaviors is still a
crucial topic under the current situation, in which the number of Chinese students seeking
education in western countries consistently increasing. It is essential for western teachers
have an accurate understanding of the learning style of Chinese students. The results of
this study might help to overcome certain cultural stereotypes and contribute to the
establishment of a healthy and constructive relationship between western teachers and
Chinese students. The results of this study might be helpful in improving the efficiency of
instruction by western teachers who are eager to achieve a better understanding of the
typical Chinese learning style, and who desire a more effective way of interacting with
Chinese students.

In addition, the statistically significant correlation between thinking style and
learning behavior was found across cultural groups. Within each ethnic group, there are
individual behavioral differences in the classroom, in which thinking style might play a
role. A further exploration and illumination of the underlying mechanisms will help
instructors achieve a better understanding of distinct behavioral traits in the classroom not
only between ethnic groups, but also within ethnic groups. For instance, supposing that
the mechanism proposed by the researcher that thinking style mediates learning behavior
via structure-oriented learning vs. non structure-oriented learning is true, instructors may
need to expect longer time periods for holistic individuals to process information and
produce responses, unlike analytic individuals, who would raise questions and indicate
understanding or confusion more promptly.
Directions for Future Research

First, because controversial debates exist regarding the use of the SOLAT, more reliable and valid instruments may need to be developed to measure thinking style. The learning behavior measure developed in this study should be subject to close examination of its validity, and revision if it is needed.

Second, the statistically significant relationship between thinking style and learning behavior, and the mediation effects of thinking style found in this study should be verified and investigated more thoroughly and deeply through replications or other research designs.

Third, the holistic-analytic thinking style was generally considered as one dimension of thinking processes. However, this study only revealed a moderate correlation between the two variables and they tended to differ in relation to learning behavior in the classroom, which conflicts with the theoretical assumption of one dimension. Thus, the question of whether the holistic-analytic thinking style could be regarded as one dimensional construct should be investigated in future research.

Fourth, other relevant variables that have an influence on learning behavior and thinking style should be included in future study. For example, the traditional approaches to instruction differ in American and Chinese classroom, which may also take certain responsibility in explaining the behavioral patterns of the two groups. In addition, confounding effects produced by cultural factors might exist in the relationship between thinking style and learning behavior. By including all these related variables in the investigation, it would not only help us achieve a better understanding of behavioral
patterns of American and Chinese students, but also further illuminate the role of thinking style on shaping and molding learning behaviors.

Finally and most importantly, the mechanism underlying the relationship between thinking style and learning behavior is an essential topic awaiting theoretical and practical exploration. The researcher conceived a theory to decipher this mechanism: the structure-oriented learning vs. non structure-oriented learning. However, this conjecture needs to be tested, and other explanations should be considered and investigated.
References


Frazier, Tiz and Barron (2004)


Kennedy, P. (2002). Reading literature in Hong Kong; the beliefs and perceptions of three groups of adult learners. In J. Cribbin & P. Kennedy (Ed), *lifelong learning in action: Hong Kong practitioners’ perspectives*. Hong Kong: Hong Kong University Press.


APPENDIX A
Institutional Review Board Consent Forms for the University at Albany

April, 2009

Dear Student:

It has been long noticed that different student groups present dissimilar learning behaviors in classroom (e.g., American students Vs. Chinese students or other ethnic groups). The purpose of this study is to search for explanations for the distinct learning behaviors from perspectives other than cultural influences. Please complete the attached two questionnaires which totally will take about 15-20 minutes. Please read each question carefully and answer it to the best of your ability.

Your honest answers to the questionnaires are mostly critical for the success of the present research. Results of the study will help teachers to achieve better understanding of the learning behaviors of different ethnic groups, and thus to adjust their instruction to suit the best interests of students.

Your responses are completely anonymous. You don’t need to provide your name. In addition, other necessary measures will be taken to keep the data collected from you confidential. Upon completion of the research, all questionnaires will be destroyed. Therefore, there is no risk that the information given to me will be traced back to you.

Participation in the study is voluntary. It is your decision whether to join in my study or not. There will be no negative consequences for non-participation in this research or withdrawal from this research. Completing the questionnaires is your consent to participate in the study.

If you have any questions about the study, I can be reached at (518) 364-6158 or email cjsqu@yahoo.com.cn. The advisor of the research, Dr. Heidi Andrade, can be reached at (518) 442-5055 or e-mail HAndrade@uamail.albany.edu. If you have any questions concerning your rights as a research participant that have not been answered by the investigator or if you wish to report any concerns about the study, you may contact the University at Albany Office of Regulatory Research Compliance at 518-442-9050 (toll free 800-365-9139) or orrc@uamail.albany.edu. I thank you personally for your time and for considering my request to participate in my study.

Sincerely,

Hongyu Cheng,
Doctoral Student
Department of Educational and Counseling Psychology
State University of NY at Albany
Phone: (518) 364-6158
April, 2009

Dear Instructor:

It has been long noticed that different student groups present dissimilar learning behaviors in classroom (e.g., American students Vs. Chinese students or other ethnic groups). The purpose of this study is to search for explanations for the distinct learning behaviors from perspectives other than cultural influences.

I am requesting your permission to administer two questionnaires in your class regarding this topic which will take approximately 20 minutes to complete. A draft copy for each questionnaire is attached. Confidentiality will be assured in that students will not be identified individually. Completed surveys will be kept in a locked file cabinet and individual answers will be kept confidential. Only an aggregation of the information will be included in the final report.

If you have any questions about the study, I can be reached at (518) 364-6158 or e-mail cjsqu@yahoo.com.cn. The advisor of the research, Dr. Heidi Andrade, can be reached at (518) 442-5055 or e-mail HAndrade@uamail.albany.edu. If you have any questions concerning the rights as a research subject that have not been answered by the investigator or if you wish to report any concerns about the study, you may contact the University at Albany Office of Regulatory Research Compliance at 518-442-9050 (toll free 800-365-9139) or orrc@uamail.albany.edu.

I need your written permission before administrating the survey in your class. If you agree to this research, could you kindly fill out the permission form? I have included copies of the cover letter for students and the student questionnaires for your examination. I will contact you to confirm your permission, arrange for survey time and answer any additional questions you may have. Thank you for your time and cooperation.

Sincerely

Hongyu Cheng, Graduate Student
Educational Psychology Program
State University of NY at Albany
Albany, NY 12222
Phone: (518) 364-6158
Instructor Agreement Form

Instructor Name: ______________ ____________

Course Name: __________________________

Hongyu Cheng has permission to survey students in my class.

I understand that students’ participation is strictly voluntary and that Hongyu Cheng will explain to the students that their participation is strictly voluntary. I further understand that their individual results will be kept confidential and only an aggregation of information will be shared in the final report and that Hongyu Cheng will explain the confidentiality to the students.

________________________                      _________  _________
Signature                                                Date
APPENDIX B
Style of Learning and Thinking

Style of Learning and Thinking (SOLAT®)
Youth Form
By: Torrance, McCarthy, & Kolesinski

Name: ____________________________ Age: ________ Sex: ________
School: __________________________ Grade: ________ Date: ________

Directions: Place a check mark in the blank if the statement is true of you. You may check one or both of the statements in a pair or neither—whatever fits you.

1. _____ I like to read explanations of what I am supposed to do.
   _____ I like to have things explained by showing them to me.

2. _____ I am good at body language.
   _____ I am not good at body language; I prefer to say what I think and depend on what people say.

3. _____ I enjoy classes where I listen to the teacher.
   _____ I enjoy classes in which I move around and try things.

4. _____ I tend to solve problems with a playful approach.
   _____ I tend to solve problems with a serious, business-like approach.

5. _____ I use only the proper materials to get a job done.
   _____ I will use whatever is available to get a job done.

6. _____ I like class or work to be planned so I know exactly what to do.
   _____ I like class or work to be open-ended with opportunities for change as I go along.

7. _____ I like to play hunches or guess.
   _____ I would rather not guess or play hunches.

8. _____ I like to express feelings in plain language.
   _____ I like to express feelings in poetry, song, dance, or art.

9. _____ I like to learn about things we are sure of.
   _____ I like to learn about hidden possibilities.

10. _____ I like to take ideas apart and think about them separately.
    _____ I like to put a lot of ideas together.

11. _____ I am good at using logic in solving problems.
    _____ I am good at using feelings and intuitions in solving problems.

12. _____ I like to see and imagine things when I solve problems.
    _____ I like to analyze problems by reading and listening to teachers who know.

13. _____ I learn easily from teachers who explain with words.
    _____ I learn easily from teachers who explain by movement and action.
14. _____ When I remember or think about things, I do well with words.
    _____ When I remember or think about things, I do well with pictures and images.

15. _____ I like to see something that is finished or completed.
    _____ I like to organize and complete something that is unfinished.

16. _____ I am intellectual.
    _____ I am intuitive.

17. _____ I am good at learning details and specific facts.
    _____ I am good at learning from a general overview, the whole picture.

18. _____ I learn and remember those things specifically studied.
    _____ I learn and remember details and facts I pick up from things happening around me.

19. _____ I like to read stories about things that really happen.
    _____ I like to read stories about made up things.

20. _____ It is fun to plan what I am going to do.
    _____ It is fun to dream.

21. _____ I like listening to music while reading or studying.
    _____ I like total quiet when reading or studying.

22. _____ I enjoy copying and filling in details.
    _____ I enjoy drawing my own images and ideas.

23. _____ It is exciting to invent something.
    _____ It is exciting to improve something.

24. _____ I learn well by exploring.
    _____ I learn well by examining.

25. _____ I like ideas presented in order.
    _____ I like ideas presented with relationships.

26. _____ I am good at remembering verbal materials.
    _____ I am good at remembering sounds and tones.

27. _____ I am absentminded often.
    _____ I am almost never absentminded.

28. _____ I enjoy summarizing.
    _____ I enjoy outlining.
APPENDIX C
Questionnaire of Learning Behaviors in the Classroom

Please circle a score from the scale 1 to 6 on the right to indicate the extent to which you disagree or agree with each description of your behaviors in classes.

<table>
<thead>
<tr>
<th>Strongly agree = 6</th>
<th>Agree = 5</th>
<th>Slightly agree = 4</th>
<th>Slightly disagree = 3</th>
<th>disagree = 2</th>
<th>Strongly Disagree = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

**Section 1**

1. I am generally interested in taking courses in school.  
2. Courses have little to do with anything that is important to know.  
3. It is important that others see me as intelligent.  
4. I have set high academic standards for myself.  
5. I always feel bored in classes.  
6. I know that I will do well on class tasks.  
7. I want to master the things I am learning about.  
8. I find excuses for not doing my assignments or studying.  

**Section 2**

1. I tend to play an active role in activities in classes.  
2. I enjoy group discussion with classmates.  
3. I tend to keep ideas and thoughts to myself rather than share them with others during classes.  
4. I tend to promptly raise my hand to answer questions asked by teachers.  
5. I tend to wait for other people to answer questions asked by teachers.  

**Section 3**

1. I tend to raise questions promptly when they occur to me in classes.  
2. I usually have very few questions in classes.  
3. I quite often ask questions in classes.  
4. I only ask questions in classes under necessary circumstances (e.g. it is relevant to tests).  
5. I prefer to ask questions after class.  

**Section 4**

1. I ask the teacher to elaborate when I get confused during instruction.  
2. I let teachers know that I am following the instruction by nodding, or making eye contact.
3. I often ask classmates to clarify their ideas during class discussions. 1 2 3 4 5 6
4. I usually keep quiet even when there are aspects of content that I don’t understand. 1 2 3 4 5 6
5. I prefer to keep disagreements with others to myself during class. 1 2 3 4 5 6

Section 5
1. -I tend to handle problems encountered in learning by myself. 1 2 3 4 5 6
2. -I prefer to cooperate with peers to solve problems. 1 2 3 4 5 6
3. I often need to ask other people’s opinion before making a decision. 1 2 3 4 5 6
4. I ask for help only after making efforts on my own that have failed. 1 2 3 4 5 6
5. It is important to keep my thoughts independent 1 2 3 4 5 6

Section 6
1. I rely on memorization to grasp content conveyed in classes. 1 2 3 4 5 6
2. I tend to focus on the big ideas in a class rather than on memorizing details. 1 2 3 4 5 6
3. I take thorough notes to help me remember important content. 1 2 3 4 5 6
4. I attempt to recall key content repeatedly (or read notes repeatedly) after class to avoid forgetting. 1 2 3 4 5 6
5. I try to understand rather than memorize content conveyed in classes. 1 2 3 4 5 6

Section 7
1. I tend to accept the teacher’s perspective when there are conflicts between my ideas and the teacher’s ideas. 1 2 3 4 5 6
2. I often depend on teachers to tell me what to do for a course. 1 2 3 4 5 6
3. When there is a question, I expect teachers to give a correct answer. 1 2 3 4 5 6
4. I regard teachers as authority figures. 1 2 3 4 5 6
5. I tend to stick to my own ideas even if teachers disagree with me. 1 2 3 4 5 6

Section 8. This section is to assess your general learning style, but not restricted to the learning behavior in classroom
1. I always try to get a whole picture of the knowledge that teachers are trying to convey in classes. 1 2 3 4 5 6
2. When a course has ended, I can tell all the major topics covered in the course. 1 2 3 4 5 6
3. I often try to relate new knowledge to what I already know. 1 2 3 4 5 6
4. I make simple charts, diagrams, or tables to help me organize course material. 1 2 3 4 5 6
<p>| | | | | | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>5.</td>
<td>As the teacher moves through the course content, I make connections among the topics presented over time.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>6.</td>
<td>I often relate what I am learning to my life experiences.</td>
<td>1</td>
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<td>7.</td>
<td>I often consider alternative points of view about a topic.</td>
<td>1</td>
<td>2</td>
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<td>8.</td>
<td>When one solution to a problem is identified, I am usually content and stop trying other solutions.</td>
<td>1</td>
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<tr>
<td>9.</td>
<td>I tend to look deeply into certain topics in a course rather than to cover all topics in a course.</td>
<td>1</td>
<td>2</td>
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<td>10.</td>
<td>I treat the course material as a starting point and try to develop my own ideas about it.</td>
<td>1</td>
<td>2</td>
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<td>4</td>
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<tr>
<td>11.</td>
<td>I often employ thorough exploration to certain topics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12.</td>
<td>I pay attention to all course topics as long as they are referred to by the teacher.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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</table>

Thanks for your participation!
APPENDIX D
Personal information

Please circle or write the answer that applies to you. Personal information will not be used to identify you. You do not have to put your name on this survey, so no names will ever be reported.

1. Your gender:
   A. Male  B. Female

2. Your age:
   A. under 19  B. 19 - 21  C. 22 - 24  D. older than 24

3. Your current academic year:
   A. Freshman  B. Sophomore  C. Junior  D. Senior  E. Graduate

4. Your major: ____________

5. Please indicate your racial/ethnic background
   A. Caucasian  B. Hispanic  C. African American  D. Asian/Pacific Islander
   E. Other ____________(Please specify)

6. Are you an international student?
   ____ Yes  ____ No

   If yes, please specify the number of years studying in the U.S: ____________