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Abstract

This study investigated the relationship between thinking styles and preferred teacher interpersonal behavior based on the Model for Interpersonal Teacher Behavior (MITB, Wubbels, Créton & Hooymayers, 1985) among 247 Hong Kong secondary school female students. This study also examined the applicability of the Questionnaire for Teacher Interaction (QTI, Wubbels, et al, 1985) to this student sample. Research results showed that, in general, the QTI had acceptable reliability and validity, indicating that it can be used to the Hong Kong context. Moreover, Type I global and liberal thinking styles positively and negatively predicted the student-centered teacher interpersonal behavior respectively, while Type I legislative and judicial styles negatively and positively predicted the teacher-centered interpersonal behavior respectively. Type II conservative and executive styles positively predicted the teacher-centered interpersonal behavior; while Type II executive and conservative styles positively and negatively predicted the student-centered interpersonal behavior respectively. Implications of the research findings are discussed.

Key words: teacher interpersonal behavior, QTI, thinking styles, teacher-student interaction, secondary school students

Thinking Styles and Preferred Teacher Interpersonal Behavior among Hong Kong Secondary School Students

1. Introduction

It has long been accepted that teachers' teaching behavior plays an important role in students' learning, such as acquiring knowledge, thinking critically, analyzing, synthesizing and making inference (Gijbels, Coertjens, Vanthournout, Struyf & Van Petegem, 2009; Segers, Dochy & Cascallar, 2003). Research has found that students have their preferred teacher interpersonal behavior (Laight, 2006; Watkins & Akande, 1993; Wubbels & Levy, 1993). It has also been suggested that students' personal characteristics, such as their learning approaches or needs, influence their preference for teachers' teaching behavior (Entwistle & Tait, 1990; Ozkal, Tekkaya, Cakiroglu & Sungur, 2009). For example, Hativa and Birenbaum (2000) claimed that students with particular needs in learning preferred instructors who accommodated these needs.

Thinking styles, based on Sternberg's theory of mental self-government, refer to individuals' preferred ways of thinking (Sternberg, 1997). Thinking styles indicate the qualitative difference in students' preference for learning, and may influence their preference for learning environments (Sternberg, 1997). Moreover, Zhang and Sternberg (2006) observed that students' thinking styles bear some relationship with their preference for teachers' teaching styles (Zhang, 2004; Zhang, Huang, & Zhang 2005). For example, teachers' teaching styles that encourage rule following and simple ways of information processing were valued almost exclusively by students who had norm-favoring thinking styles, including the executive, monarchic, local, and conservative styles (Sternberg, 1997). Lewin (1936) also proposed that an individual's behavior can be explained by the variances

in his or her thinking. In other words, students with predominant preference for specific thinking styles may prefer specific teaching behavior. From these observations, one question emerges: Are students' thinking styles in learning correlated with their preferred teacher interpersonal behavior?

While a comprehensive understanding the above issue is highly desirable, little research has been conducted to examine the relationships between student preferred teacher interpersonal behavior and his or her thinking styles. To address this gap, the present study aimed at exploring how thinking styles are related to students' preferred teacher interpersonal behavior among Hong Kong secondary school students. Students' thinking styles are represented by 13 thinking styles proposed in the theory of mental self-government (Sternberg, 1997). Students' preference for teachers' interpersonal behavior is defined by the Model for Interpersonal Teacher Behavior (MITB, Wubbels, Créton & Hooymayers, 1985). In addition, the present study also tended to investigate whether or not the MITB can be used to describe Hong Kong secondary school students' preferred teacher interpersonal behavioral profiles.

The significance of the present study is two-fold: At the theoretical level, findings of the study are essential for enhancing the understanding of how students' typical mode of thinking is associated with their preferred teacher interpersonal behavior. At the empirical level, this study provides secondary school teachers in Hong Kong with insights into students' preferred teacher interpersonal behavior. Teacher interpersonal behavior, which reflects the interaction between students and teachers in classroom, constructs students' classroom learning environment (Fraser, 1986, 2002; Fraser & Walberg, 2005; Wubbels & Brekelmans, 1998; Wubbels & Levy, 1993). Thus, this knowledge may help teachers to construct appropriate classroom learning environment by better aligning students' preferred teacher interpersonal

behaviors with their thinking styles if effective teaching and learning are to be attained.

1.1 Teacher Interpersonal Behavior

The conceptualization of teachers' interpersonal behavior in this study is based on the Model for Interpersonal Teacher Behavior (MITB, Wubbels, Créton & Hooymayers, 1985). The MITB was developed from Leary's (1957) work on interpersonal behavior, who originally developed 16 interpersonal behavior scales as a framework to conceptualize interpersonal interaction between teachers and students. Later, researchers used Leary's (1957) model and reduced the 16 interpersonal scales into eight scales, which plotted on a two-dimensional coordinate system (Wubbels, Créton & Hooymayers, 1985).

A Figure in Appendix A presents the interpersonal behavior map, which shows the two dimensions in interpersonal communications. Dimension of proximity depicts that individual communications spread along the continuum between the cooperation and opposition. Dimension of influence emphasizes individual dominance over submission in the communication process (Wubbels, Créton & Hooymayers, 1985). Based on the two dimensions, eight teacher interpersonal behaviors (leadership, helpfulness, understanding, student freedom, uncertainty, dissatisfaction, admonishment, and strictness) are identified and form the MITB model. The characteristics of the eight teacher interpersonal behaviors are described in Appendix B.

On the one hand, the eight interpersonal behaviors can be organized into four types: dominance (leadership and strictness), cooperation (helpfulness and understanding), submission (student freedom and uncertainty), and opposition (dissatisfaction and admonishment). On the other hand, the eight teacher interpersonal behaviors can be regrouped into a student-centered approach and a teacher-centered approach based on the student-centered and teacher-centered distinctions identified by Gow and Kember (1993).

Student-centered teaching behaviors (leadership, helpfulness, understanding, and student freedom) allow students to actively participate in learning and construct their knowledge. At the same time, teachers are more likely to share teaching and learning responsibilities with students. In contrast, teacher-centered teaching behaviors (uncertainty, dissatisfaction, admonishment, and strictness) emphasize control and order, and value knowledge transmission from teachers to students, rather than knowledge construction through teacher-student interaction. The student- and teacher-centered distinctions were adopted by the present study in that the two factors were extracted via exploratory factor analysis.

Most of the early studies based on the MITB model have been conducted in Western countries (Fraser, 1998). The psychometric properties of the MITB measure have been established in the Netherlands, U.S., and Australia (Brekelmans, Wubbels, & Creton, 1990; den Brok, 2001; Fisher, Fraser, & Wubbels, 1993; Wubbels, Creton, & Hooymayers, 1985; Wubbels & Levy, 1991). Later, further research has examined and confirmed the construct validity of the MITB in another six countries, namely, the Netherlands, U.S.A., Australia, Slovakia, Singapore, and Brunei (den Brok, Fisher, Brekelmans, Rickards, Wubbels, & Levy, 2003). More recently, the MITB has been tested among students from the Netherlands, Turkish, Moroccan, and Surinamese, and satisfactory psychometric properties were obtained (den Brok, Tartwijk, Wubbels, & Veldman, 2010).

In the last decade, Asian researchers in Indonesia (Margianti, Fraser, & Aldridge, 2001), Singapore (Fraser & Chionch, 2000), Korea (Kim, Fisher, & Fraser, 1999; Lee & Fraser, 2001) and Brunei (Scott & Fisher, 2001) started making contributions to this field. Chen and Chen (2001) examined the MITB among 900 Hong Kong secondary school students and obtained acceptable internal consistencies of the eight teacher interpersonal scales with a revised short version. Recently, two studies conducted in China showed that the measure of

the MITB had acceptable reliability and validity (Jiang, 2001; Wei, den Brok, & Zhou, 2009).

Given that the research on the MITB in Hong Kong still remains cursory and preliminary, the present study aimed to further validate the MITB model and its measure of teacher interpersonal behavior among another Hong Kong secondary school student sample. Based on existing literature, the MITB and its measure of the eight teacher interpersonal behaviors may be appropriate for the current Hong Kong secondary school students.

1.2 Thinking styles

Among various style theories, Sternberg's theory of mental self-government is a more general one. In this theory, 13 thinking styles describe people's typical mode of thinking, remembering, problem solving, and tendency to think in a certain manner (Sternberg, 1997). The 13 thinking styles fall along five dimensions, namely, function, form, level, scope, and leaning. Legislative, executive, and judicial thinking styles are the three functions in human being's mental self-government. Monarchic, hierarchical, oligarchic, and anarchic thinking styles are the four different mental self-government forms that people take. Global and local thinking styles are two levels that people use their abilities. Internal and external, as well as liberal and conservative, thinking styles are two scopes and two leanings of mental self-government respectively (see details in Sternberg, 1997). Appendix C summarizes the characteristics of the 13 thinking styles.

Some recent research, based on a series of empirical studies, have grouped the 13 thinking styles into three major types: Type I, Type II, and Type III (Zhang 2000a, 2000b, 2001b, 2001c, 2002a, 2002b; Zhang & Huang, 2001). Type I styles include legislative, judicial, hierarchical, global, and liberal thinking styles. Type II styles consist of executive, monarchic, local, and conservative thinking styles. The rest of the four thinking styles

(oligarchic, anarchic, internal, and external) falls into Type III styles. Individuals with Type I thinking styles prefer engaging in creative-generating activities, whereas those with Type II thinking styles prefer working in the environment with clear and specific rules and regulations. People with Type III thinking styles tend to manifest the characteristics of either Type I or Type II thinking styles (Zhang & Sternberg, 2006).

1.3 The present study

The present study has two objectives. First, it intends to examine the linkage between thinking styles and preferred teacher interpersonal behaviors among a group of Hong Kong secondary school students. Second, this study attempts to test the MITB and its measure of teacher interpersonal behaviors among this group of Hong Kong secondary school students. Based on the available findings, it was hypothesized that the MITB and the eight scales for assessing teacher interpersonal behavior will achieve acceptable psychometric properties for the current student sample. Regarding the relationship of thinking styles to preferred teacher interpersonal behavior, hypotheses were formulated mainly on the nature of thinking styles and interpersonal behavior given that little research has been conducted in the relationship between the two constructs.

To begin with, students' personal characteristics, such as learning approaches or needs, have been found to influence their preferences for teaching characteristics and behaviors (Entwistle & Tait, 1990; Ozkal, Tekkaya, Cakiroglu & Sungur, 2009). For example, Entwistle and Tait (1990) commented that students who adopted a deep learning approach showed a clear preference for an environment which was likely to promote understanding, while those preferred a surface learning approach tended to use rote learning. Hativa and Birenbaum (2000) proposed that students who preferred learning activities with analytical and critical

works did not prefer the knowledge transmission type instructor. Nevertheless, students who preferred teachers to give clear and concise instruction did not prefer learning-oriented type teachers.

Then, based on the nature of thinking styles, Type I thinking styles is characterized to be creative-generating and fond of processing complex and less structured information, while Type II styles is conservative and preferred handling simple and structured information. Moreover, Type I and Type II thinking styles are related to deep and surface learning approaches respectively (Zhang, 2001; Zhang & Sternberg, 2000). Therefore, it is reasonable to believe that individuals with Type I thinking styles may prefer teachers to promote in-depth understanding of knowledge instead of simply transmitting knowledge to students. Individuals with Type II thinking styles may prefer teachers to conduct a clear and concise instruction.

Therefore, theoretically, Type I thinking styles (legislative, judicial, hierarchical, global, and liberal thinking styles) will be positively correlated with teacher interpersonal behaviors oriented toward the student-centered approach (leadership, helpfulness, understanding, and student freedom), which allow students to construct their knowledge. Type II thinking styles (executive, monarchic, local, and conservative thinking styles) will be positively correlated with teacher interpersonal behaviors oriented toward the teacher-centered approach (uncertainty, dissatisfaction, admonishment, and strictness), which value control and order, and knowledge transmission from teachers to students. In terms of the rest of the four Type III thinking styles (oligarchic, anarchic, internal, and external), it was hypothesized that students with Type III thinking styles will prefer either the student-centered or the teacher-centered teacher interpersonal behaviors because individuals with Type III thinking styles tend to manifest the characteristics of either Type I or Type II thinking styles (Zhang &

Sternberg, 2006). But it is also worth mentioning here that at its preliminary stage, the present study only focused on the relationship of students' Type I and Type II thinking styles to their preferred teacher interpersonal behavior.

2 Method

2.1 Participants

Two hundred and forty-seven female students from a single gender secondary school in Hong Kong participated in this study. All the participants were born and grew up in Hong Kong and were studying a two-year pre-university preparation program. Among them, 135 and 114 students were from the second and the first year respectively. The ages of the participants ranged from 17 to 23 years with the mean age being 18.14 (SD=1.28) years.

In general, most of the participants were from the middle-class and their socio-cultural backgrounds were comparable to those of the high school students in Hong Kong. Specifically, 21.05% of the students' parents completed primary school education, 68.42% completed secondary school education, and 5.67% completed higher education. Moreover, 61.54% of the students' parents were employed and 28.34% were self-employed. A common feature of these students involved in the study is that they were the relatively lower academic achievers in the public examination.

2.2 Instruments

2.2.1 Questionnaire for Teacher Interaction

Teacher interpersonal behaviors were measured by the Questionnaire for Teacher Interaction (QTI, Wubbels, Créton & Hooymayers, 1985). Developed from the MITB (Wubbels, et al, 1985), the QTI has been used to assess eight teacher interpersonal behaviors: leadership, helpfulness, understanding, student freedom (freedom), uncertainty,

dissatisfaction, admonishment, and strictness. The original QTI was written in Dutch and later translated into English. Acceptable psychometric properties of the English version of the QTI have been reported in a series of studies, especially those conducted in the U. S. and Australia (den Brok, 2001; Rickards, den Brok, & Fisher, 2005). In a recent study conducted among college students in the Netherlands, Turkish, Moroccan, and Surinamese (den Brok, Tartwijk, Wubbels, & Veldman, 2010), the reliability coefficients for the eight scales ranged from .62 (freedom) to .88 (leadership), and the construct validity was supported by confirmatory factor analysis. Moreover, two uncorrelated dimensions (influence and proximity) were supported by the model fit indices (den Brok, Tartwijk, Wubbels, & Veldman, 2010).

In terms of the Chinese version of the QTI, researchers in Hong Kong (Chen & Chen, 2001) translated the 48-item English version into Chinese for their preliminary study among Hong Kong secondary school students. It was found that eight items in the English version were not applicable to the learning environment in Hong Kong and they shortened the questionnaire to contain 40 items (Chen & Chen, 2001). Research results showed that the Cronbach's coefficient alphas for the 8 scales ranged from .50 (strictness) to .85 (helpfulness) (Chen & Chen, 2001). Except for the admonishment (.56) and the strictness (.50) scales, the internal consistencies of the remaining six scales were above .70.

More recently, some researchers examined the 66- item Chinese version of the QTI in mainland China (Jiang, 2001; Wei, den Brok, & Zhou, 2009). The authors reported that the Cronbach's alpha coefficients for the eight teacher interpersonal scales ranged from .63 (uncertainty) to .86 (understanding and admonishment) (Jiang, 2001) and .42 (student freedom) to .79 (helpfulness and dissatisfaction) (Wei, den Brok, & Zhou, 2009). Exploratory factor analysis extracted two unrelated dimensions, with leadership, helpfulness,

understanding, and freedom loading on one dimension, and uncertainty, dissatisfaction, admonishment, and strictness loading on the other (Wei, den Brok, & Zhou, 2009).

This study adopted the 40-item Chinese version of the QTI used by Chen and Chen (2001) under the consideration that this version was revised for the Hong Kong school context. In this QTI, each teacher interpersonal behavior is measured by five items. However, the scale for the items was revised. Instead of using the original 5-point scale, each item in this research is rated on a 7-point scale, with 1 indicating that the item does not describe the participants well at all and 7 indicating that the item describes them extremely well.

2.2.2 Thinking style Inventory-Revised

Students' thinking styles were measured by the Chinese version of the Thinking Style Inventory-Revised (TSI-R) (TSI-R, Sternberg, Wagner, & Zhang, 2003). The TSI-R is a revised version of the Thinking Style Inventory (TSI, Sternberg & Wagner, 1992). This 65-item inventory contains 13 scales, each corresponding to a thinking style in Sternberg's (1997) theory of mental self-government. Each scale is composed of five items. Each item is a statement, allowing respondents to rate themselves on a 7-point scale, with 1 representing not at all well and 7 representing extremely well describing the way they normally carry out their tasks. Generally speaking, The TSI-R has acceptable reliability and validity. The internal consistency coefficients of the TSI-R have been found to range from .44 to .88 (Zhang, 1999, 2000, 2005; Zhang & Sachs, 1997; Murphy & Janeke, 2009).

2.3 Procedures

Given that it is not easy to get intensive cooperation from schools for psychological research in Hong Kong, the school for this study was selected by convenience sampling. This school is a renowned Christian secondary school in Hong Kong with over 138-year history

since its establishment. It provides secondary education for teenage girls who are in their final or final two years of secondary education. After finishing the secondary education, students will pursue higher education.

The present study obtained the ethical approval from the Human Research Ethics Committee for Non-Clinical Faculties at the University of Hong Kong. Consent of the participants was received from the school principal. Students who attended the research voluntarily were informed about the research purpose. They filled in the questionnaires that measured their preferred teacher interpersonal behaviors and thinking styles in classroom. Demographic information, including students' age, gender, subject major, traveling experiences, birth order, and parents' educational level and occupation were also collected.

2.4 Data Analysis

Cronbach's coefficient alpha was used to examine the internal consistency of the QTI and the TSI-R. Validity of the inventories was examined by exploratory factor analysis (EFA). Multivariate analyses of variance (MANOVAs) were performed to identify any group differences in teacher interpersonal behaviors and thinking styles based on the above demographical variables. A demographical variable would be controlled in the remaining analyses if its significant differences in thinking styles and teacher interpersonal behaviors were found. Zero-order correlation and hierarchical multiple regressions were carried out to explore the relations between thinking styles and preferred teacher interpersonal behavior among students.

3 Results

3.1 Psychometric properties of the QTI and the TSI-R

Reliabilities of the QTI and the TSI-R were assessed by the internal consistency

estimates of Cronbach's coefficient alpha. The Cronbach's coefficient alphas for the eight teacher interpersonal behavior scales were: .71 (leadership), .81 (helpfulness), .84 (understanding), .66 (student freedom), .60 (uncertainty), .72 (dissatisfaction), .45 (admonishment), and .58 (strictness). In general, the internal consistencies of the seven QTI scales were around or above .60 except for the admonishment scale. These results are consistent with those reported in Chen and Chen's (2001) study, in which the two lowest coefficients were .56 for the admonishment scale and .50 for the strictness scale. The alpha coefficients for the 13 thinking styles were, in general, above .70 except for the monarchic (.64), anarchic (.52), and global (.55) scales. These results are similar in magnitude to those reported in other studies (Zhang, 2001). The internal consistencies of the QTI and the TSI-R are shown in Table 1. Overall speaking, the Cronbach's alpha coefficients for the QTI and the TSI-R indicated that the sum scores of each scale can be used in the following data analysis, even though several scales (e.g., the admonishing scale of the QTI and the anarchic and global scales of the TSI-R) need further validation.

In terms of the EFA results, the principle component analysis with varimax rotation was used for the QTI. The number of factors was determined by the results of scree plot and the criterion of eigenvalues above 1.0. A two-factor solution was obtained, with one factor representing the student-centered and the other representing the teacher-centered interpersonal behaviors. The two factors are consistent with Kember's (1998) classification of teaching styles. The leadership, helpfulness, understanding, and student freedom loaded on the student-centered factor, with factor loadings ranging from .82 to .90. The uncertainty, dissatisfaction, admonishment, and strictness loaded on the teacher-centered factor, with factor loadings ranging from .59 to .85. The two factors accounted for 66.39% of the variance of the teacher interpersonal behavior measured by the QTI. A summary of the factor loadings

is reported in Appendix D.

Regarding the TSI-R, the principle component analysis with direct oblimin rotation was used to extract factors. After the examination on scree plot and the criterion of eigenvalues above 1.0, a four-factor solution was identified for the student sample. The first factor generally represented the scope dimension of thinking styles, with factor loadings being .96 for the internal scale, .77 for the legislative scale, and .49 for both of the monarchic and local scales. The second factor represented the Type II thinking styles, with factor loadings being .89 for the conservative scale, .87 for the executive scale, and .43 for the oligarchic scale. The third factor could be regarded as Type I thinking styles in that the liberal, hierarchical, and the judicial scales together loaded on it with factor loadings being -.65, -.60, and -.56 respectively, though the external, anarchic, local, and the oligarchic scales also negatively loaded on it with factoring loadings ranging from -.91 to -.41. The fourth factor denoted the level dimension of thinking styles because the global scale loaded on it with factor loadings being .85. The total four factors accounted for 72.06% of the variance of thinking styles measured by the TSI-R. Generally, the EFA results are consistent with the majority of findings previously reported for the TSI-R, as well as with the style types reconceptualized by Zhang and Sternberg (2006). A summary of the factor loadings is also reported in Appendix D.

3.2 Descriptive Statistics and Intercorrelations

Table 1 shows the mean score and the standard deviation of each of the QTI and the TSI-R scales. For the preferred teacher interpersonal behaviors, the higher scores clustered around the leadership, helpfulness, understanding, and the student freedom scales. The lower scores clustered around the strictness, uncertainty, dissatisfaction, and admonishment scales. It seems that the particular Hong Kong secondary school female student sample preferred the

student-centered teacher interpersonal behavior, that is, they wanted more leadership, helpfulness, understanding, and freedom in teachers' classroom instructions and interactions.

Zero-order correlations between thinking styles and preferred teacher interpersonal behavior are presented in Table 2. Because the current focus is on the relationship between Type I and Type II thinking styles and preferred teacher interpersonal behaviors, the examination of the relationship between Type III thinking styles and preferred teacher interpersonal behaviors was not described here.

Specifically, Type I legislative, judicial, hierarchical, and global styles and Type II executive, monarchic, local, and conservative styles were significantly and positively correlated with most of the student-centered interpersonal behaviors. Type I judicial, hierarchical, and global styles and Type II executive, local, and conservative styles were also significantly and positively correlated with strictness, one of the teacher-centered interpersonal behaviors. Furthermore, Type II executive and conservative styles were positively correlated with teacher-centered admonishment scale. Statistically significant correlations were not found between Type I legislative, judicial, hierarchical, global, liberal, and Type II monarchic and local styles with teacher-centered uncertainty, dissatisfaction, and admonishment behaviors. Type I liberal style was different from other Type I styles, as it was only positively correlated with student-centered freedom interpersonal behavior. The correlations indicated that Type I thinking styles were significantly associated with student-centered, and the strictness in the teacher-centered teacher interpersonal behaviors; Type II were significantly associated with student-centered and most of the teacher-centered teacher interpersonal behaviors. Moreover, both Type I and II thinking styles valued the preferences for leadership, helpfulness, understanding, freedom, and strictness teacher interpersonal behaviors.

3.3 Prediction of preferred teacher interpersonal behavior from thinking styles

MANOVA procedures were performed to examine the differences of demographic variables in the eight preferred teacher interpersonal behaviors and 13 thinking styles scales. No demographical variable differences were identified in any of the QTI and the TSI-R scales. Thus, no demographical variable was controlled in the subsequent multiple regressions analysis.

It was found that 11 thinking styles significantly predicted students' eight preferred teacher interpersonal behaviors ($p < 0.05$), among which, four were Type I (the legislative, judicial, liberal, and global) thinking styles, three were Type II (the executive, local, and conservative) thinking styles, and the rest were Type III thinking styles. Type I hierarchical and Type II monarchic styles did not significantly predict any preference for teacher interpersonal behaviors. The total contribution of thinking styles to teacher interpersonal behaviors was indicated by the R^2, ranging from .05 to .26. The nature of the unique contributions of thinking styles to teacher interpersonal behaviors were reflected by 26 βs at the .05 significance level, with the absolute values ranging from .13 to .40.

In terms of the prediction of the four types of student-centered preferred teacher interpersonal behavior from thinking styles, the executive, anarchic, and global styles positively predicted the leadership, explaining 18% of the variance of this behavior (see R^2 /adjusted R^2). The helpfulness was predicted by five thinking styles. The executive, external, and global styles were positive, while the conservative and liberal styles were negative predictors, explaining 21% of its variance. The understanding was also predicted by five thinking styles, among which, the anarchic, local, and external styles were positive, while the liberal and conservative styles were negative predictors. The five thinking styles interpreted

26% of the variance of the understanding. The global, anarchic, and external thinking styles positively predicted freedom, and they explained 24% of its variance.

Regarding the prediction of the student-centered preferred teacher interpersonal behavior from thinking style types, it was found that Type I global style, Type II executive style, and Type III anarchic and external styles significantly positively predicted the four student-centered interpersonal behaviors, with the β's between .14 and .34. That is, to enhance students' global, executive, anarchic, and external thinking styles would increase their preference for the four student-centered interpersonal behaviors. Type I liberal and Type II conservative styles significantly negatively predicted the helpfulness and understanding, two types of student-centered behavior, with the absolute values of the β's ranging from .15 to .28. The negative coefficients showed that weakening students' liberal or conservative styles would also increase their preferences for helpfulness and understanding behaviors.

In terms of the prediction of the teacher-centered preferred teacher interpersonal behavior from thinking styles, the internal and oligarchic thinking styles positively, while the legislative styles negatively, predicted the uncertainty behavior. The three thinking styles explained 11% of the variance (R^2 /adjusted R^2). Four thinking styles significantly explained 8% of the variance of the dissatisfaction, with the judicial and oligarchic styles being positive, whereas the legislative and external styles being negative predictors. The admonishment behavior was only positively predicted by the conservative thinking styles, which explained 5% of its variance. Finally, the executive and judicial styles positively predicted the strictness, explaining 17% of its variance.

Regarding the contribution of thinking style types to the teacher-centered teacher interpersonal behavior, Type II conservative styles positively predicted the admonishment, with the β value being .23. Type II executive and Type I judicial styles positively predicted

the strictness, with the β values being .37 and .13 respectively. Type I legislative styles were found to negatively, while Type III oligarchic styles positively, predicted the uncertainty and dissatisfaction. Type I judicial styles also positively predicted the dissatisfaction, with the β value being .25.

Table 3 provides a summary of the above research results. If the focus was put on the contribution of Type I thinking styles to both student-centered and teacher-centered preferred teacher interpersonal behavior, it was found that Type I global style positively predicted the student-centered leadership, helpfulness, and freedom behaviors, whereas Type I liberal style negatively predicted the student-centered helpfulness and understanding behaviors. Moreover, Type I legislative styles negatively predicted the teacher-centered uncertainty and dissatisfaction, while Type I judicial styles positively predicted the dissatisfaction and strictness.

When the emphasis was shifted to the contribution of Type II thinking styles to both student-centered and teacher-centered preferred teacher interpersonal behavior, it was shown that Type II conservative and executive styles positively predicted the teacher-centered admonishment and strictness respectively. Moreover, Type II conservative thinking styles also negatively predicted the student-centered helpfulness and understanding behaviors. In addition, Type II executive and local thinking styles positively predicted the student-centered leadership and helpfulness and understanding behaviors respectively.

Compared with the hypothesis regarding Type I thinking styles, it was found that expectedly, certain Type I thinking styles (the global) positively predicted student-centered behavior. Unexpectedly, certain Type I thinking styles (the liberal) negatively predicted student-centered behavior. Moreover, certain Type I thinking style also positively (the judicial) and negatively (the legislative) predicted teacher-centered behavior. Relating Type II thinking

styles, expectedly, certain Type II thinking styles positively (the conservative and executive styles) predicted teacher-center behavior. Unexpectedly, certain Type II styles also positively (the executive and local) and negatively (the conservative) predicted student-centered behavior. It seems that parts of the research hypotheses were supported. However, some unexpected findings necessitate further research to draw a more general conclusion.

4 Discussion

This study investigated the relationships between thinking styles and preferred teacher interpersonal behaviors among a group of Hong Kong secondary school female students. It also examined the psychometric properties of the QTI and the TSI-R, particularly the applicability of the QTI to this student sample. Both objectives were well achieved. Research findings first indicated that the QTI and the TSI-R had acceptable psychometric properties. More importantly, the QTI and its underlying MITB model might be applicable to this student group. Second, students' thinking styles significantly predicted their preferred student- and teacher-centered teacher interpersonal behaviors in different ways. In the following sections, discussion in relation to the research questions and hypotheses is presented in three parts. The first part addresses the psychometric properties of the QTI. The second part is about the relationship between students' Type I thinking styles and their preferred teacher interpersonal behaviors. The third part focuses on the relationship between students' Type II thinking styles and their preferred teacher interpersonal behaviors.

4.1 Psychometric properties of the QTI

In general, the eight teacher interpersonal behavior scales in the MITB appeared to be reliable to measure students' preferred teacher interpersonal behaviors in the Hong Kong context, except that several items need to be modified for the improvement of the scale

reliabilities. To be more specific, the current internal consistencies of the eight scales in the QTI ranged from .45 (admonishment) to .81 (helpfulness). These coefficients are consistent with those reported in Chen and Chen's (2001) study among Hong Kong secondary school students, which ranged from .50 (strictness) to .85 (helpfulness). These alphas are also comparable with those revealed by Wei, den Brok, & Zhou (2009) (ranging from .42 to .79), though slightly lower than those in Jiang's (2001) study (ranging from .63 to .86).

The EFA results showed that two factors were identified for the QTI. The first factor was named as student-centered interpersonal behaviors in that it included leadership, helpfulness, understanding, and student freedom behaviors. The second factor was named as teacher-centered interpersonal behaviors in that it included uncertainty, dissatisfaction, admonishment and strictness behaviors. The two factors are slightly inconsistent with the two dimensions: 1) influence—leadership, strictness, helpfulness, and understanding and 2) proximity--student freedom, uncertainty, dissatisfaction, and admonishment constructed in the MITB by Wubbels, Créton, and Hooymayers (1985) and tested by den Brok, Tartwijk, Wubbels, and Veldman (2010). However, the student-centered and teacher-centered approaches are consistent with those found by Jiang (2001) and Wei et al. (2009) in the Chinese context. It seemed that the eight teacher interpersonal behavior scales derived from the MITB were applicable to students in both Western and non-Western cultures. However, how the eight scales clustered might be culture-specific. The student- and teacher-centered approaches, instead of the influence and proximity dimensions, might be more appropriate for students in the Chinese context. Further studies with different student groups are called upon for a more general conclusion.

Two scales, the strictness and admonishment, with relatively lower reliabilities, need further modifications. After examining the item-remainder correlations of items in the two

mentioned scales, it was found that item “This teacher thinks that we don’t know anything.” from the strictness scale had lower item-remainder correlation (r_{it} = .19), which necessitates further modification. If it was deleted, the alpha estimate could have been improved from .58 to .60, which is a barely acceptable reliability value for exploratory research (Hair et al, 2006). Likewise, item “Teacher is sarcastic” (r_{it} = .11) and item “Teacher is too quickly to correct us when we break a rule” (r_{it} = .12) from the admonishment scale had lower item-remainder correlations which necessitate further modification as well. If they were deleted, the alpha estimate could have been improved from .45 to .52, which is also a barely acceptable reliability value for exploratory research (Hair et al, 2006).

Despite the room for improvement as regards the strictness and admonishment scales, this study indicated that, generally, the QTI and its underlying MITB were suitable to measure and describe teacher interpersonal behaviors among Hong Kong secondary school students. In future studies, researchers may use the QTI to assess Hong Kong students’ preferred and/or perceived teacher interpersonal behaviors in classroom. However, the lower reliabilities of the two scales indicated that it should be cautious in interpreting the prediction of the admonishment and strictness from thinking styles. In other words, further research is needed to confirm the current relevant research findings. Moreover, in future studies, confirmatory factor analysis at both item and scale levels are needed to achieve more convincing and assertive factor structure of the QTI.

4.2 The relationship of Type I thinking styles to preferred teacher interpersonal behaviors

Correlations and regression analyses showed that students with dominant Type I thinking styles preferred teachers to use both student-centered and teacher-centered interpersonal behaviors in teaching. However, some regression results supported the hypothesis that Type I thinking styles contributed to student-centered teacher interpersonal

behaviors. For example, Type I global thinking styles positively contributed to the student-centered leadership, helpfulness, and freedom interpersonal behavior. Some regression results contradicted the hypothesis in that Type I liberal thinking styles negatively predicted the student-centered helpfulness and understanding behavior. Also unexpectedly, certain Type I thinking styles, such as the judicial and legislative, positively and negatively predicted the teacher-centered dissatisfaction and strictness and uncertainty and dissatisfaction behavior respectively. The following discussion is organized by the research results that supported, contradicted, and those unexpected by, the research hypothesis.

The first point to be discussed is that students with the global style showed a preference for the leadership, helpfulness, and freedom teacher interpersonal behaviors. This result supported the research hypothesis. The reason may lie in the characteristics of global thinking styles and the nature of Hong Kong secondary school education. On the one hand, students with dominant global styles prefer to deal with relatively large and abstract issues, and tend to ignore or don't like details (Sternberg, 1997). Therefore, students with global thinking styles may want teachers to give them direction for learning, in teaching instead of detailed instructions (leadership behavior), and want teachers to be lenient, allowing them to learn with their preferred thinking styles (freedom behavior).On the other hand, Hong Kong secondary school education emphasizes memorization and reproduction of raw facts in learning (Biggs & Watkins, 1995), requiring students to work with concrete problems and details. Thinking styles that promoted a preference for working with concrete problems and details (the local style) were found to be positively associated with academic success (Zhang & Sternberg, 1998). Thus, students with global styles may find it difficult to cope with their learning. In this regard, students with global thinking styles may also want teachers to be friendly so that they would feel more comfortable to ask questions related to the topics in

teaching (helpfulness behavior).

Secondly, students with the liberal thinking styles were found to disfavor teachers to use helpfulness and understanding behaviors, which contradicted the hypothesis. At first glance, it seems unreasonable that students did not want teachers to behave helpfully and friendly, answering students' questions whenever they need. However, this may be due to the characteristics of liberal styles. People with dominant liberal styles prefer jobs that emphasize changes, prefer dealing with tasks that are somewhat ambiguous, or handling tasks with the methods that go beyond existing rules and procedures (Sternberg, 1997). Therefore, students with the liberal style might consider that teachers with helpfulness and understanding behaviors do not understand and even want to interfere or change their thinking styles. Subsequently, students may feel that autonomy in learning, especially using their preferred thinking styles in learning, is restricted.

Thirdly, among Type I thinking styles, the legislative style and the judicial style did not offer any positive predictions to student-centered behaviors. In contrast, students with legislative styles did not prefer teachers to use teacher–centered uncertainty and dissatisfaction behaviors in teaching, while students with judicial styles preferred teacher to use teacher–centered dissatisfaction and strictness behaviors in teaching. Given that the relationships between Type I thinking styles and preferred teacher-centered interpersonal behavior were left open in the hypothesis, these research findings might lend heuristic values to our understanding of the relationships between Type I thinking styles and teacher-centered interpersonal behavior in the Hong Kong context.

To be more specific, people with dominant legislative styles prefer to come up with their own ways of doing things, and like to decide for themselves what they will do and how they will do (Sternberg, 1997). Thus, students with dominant legislative styles decide their own

methods of learning and enjoy learning with freedom. However, teachers' uncertainty is characterized by hesitation and indecisiveness, which contradict the behavior manifested by legislative styles. Moreover, teachers' dissatisfaction indicates restricting students' learning freedom because teachers with a preference for dissatisfaction behavior would require students to comply with the classroom rules and orders. These characteristics may explain why students with dominant legislative styles dislike teachers to use uncertainty and dissatisfaction behaviors in teaching.

In terms of the explanation why students with judicial thinking styles preferred teachers to use dissatisfaction and strictness behaviors, first, students with dominant judicial styles like learning activities that require them to use analytical and evaluative thinking. However, this type of learning styles does not match the learning styles in Hong Kong secondary education (Zhang & Sternberg, 1998). In order to commit to learning and do well (Biggs & Tang, 2007), students with the judicial style might prefer teachers to be harsh in order to engage them in learning. Second, teachers with dissatisfaction and strictness behaviors prefer to use difficult questions to test students, or set higher marking standard. These teaching methods might be view by students with dominant judicial styles as matching their styles to use analytical and evaluative thinking.

To summarize, the relationships between students' Type I thinking styles and preferred teacher interpersonal behaviors varied depending on the extent to which teacher interpersonal behavior matched the characteristics of students' thinking styles. Students with dominant Type I thinking styles have a strong commitment in learning, want to do well, and to be engaged in higher cognitive level of processing information (Biggs & Tang, 2007). Thus, Type I style students would prefer learning with low degrees of structure and with only direction for learning (leadership behavior); prefer challenging activities to routinely

memorizing facts, and expect teachers to help them when they have troubles in learning (understanding behavior). Those students also prefer to develop good relationships with teachers, so that they can consult with teachers about their learning problems and teachers would listen to them and give them advice for learning (helpfulness behavior). Type I style students still want teachers to give them autonomy by allowing them to use their preferred thinking styles in learning (freedom behavior).

However, when teachers' helpfulness and understanding behaviors are perceived to interfere with student freedom in learning, students, such as those with the liberal style, will dislike them. Furthermore, students with judicial styles, especially in the Chinese context, respect teachers to exercise their authorities through dissatisfaction and strictness, and consider them to be a way teachers use to keep students' attention in learning.

One point needs to be made in relation to the gender differences in thinking styles because the current sample included only female students. It has been found that at both school and college levels, male students scored higher in global thinking styles than did their female counterparts (Zhang & Sachs, 1997; Cheung, 2002; Zhang, 2003). Thus, the research finding that students with global styles preferred leadership, helpfulness, and freedom teacher interpersonal behavior could be generalized to male school students. Moreover, E. Cheung (2002) and F. Cheung (2002) both found that male university students were more liberal and legislative in their thinking styles than were females. In this sense, the research results might also be generalized to the male school students that students with liberal styles did not prefer understanding and helpfulness behavior, and that students with legislative styles did not prefer teachers' uncertainty and dissatisfaction behavior.

4.3 The relationship of Type II thinking styles to preferred teacher interpersonal behaviors

Research results showed that Type II conservative and executive thinking styles were

positively associated with preferred teacher-centered admonishment and strictness, which supported the research hypothesis. However, it was also found that Type II conservative thinking styles negatively predicted preferred student-centered helpfulness and understanding, whereas Type II executive styles positively predicted preferred student-centered leadership and helpfulness. Furthermore, Type II local styles positively contributed to the student-centered understanding behavior. The latter two results extended the prediction in terms of the relationship between Type II thinking styles and student-centered interpersonal behavior, which was left open in the hypothesis. The following discussion is organized into three parts corresponding to the prediction of preferred teacher interpersonal behavior from Type II executive, conservative, and local thinking styles, in which the supported, contradicted, and unexpected relationships are discussed.

Students with executive thinking styles preferred teachers to use both teacher-centered strictness and student-centered leadership and helpfulness behavior. Students with dominant executive styles like to follow rules and prefer problems that have structures (Sternberg, 1997). On the one hand, they prefer learning activities that they can use their knowledge and/or existing rules to solve problems. They also prefer answering questions with objective facts and structured formats and following teachers' instructions and orders. All these meet the characteristics of strictness behavior, which are well-maintained with order and discipline. On the other hand, students with dominant executive styles may prefer teachers to give them clear instructional direction to follow and keep their attention in learning (leadership behavior); to act pleasantly and friendly so that students could rely on in case they make any mistakes in learning (helpfulness behavior). In this sense, it is understandable that executive styles significantly predicted students' preference for the strictness, leadership, and helpfulness behaviors.

Students with conservative thinking styles are fond of adhering to existing rules and procedures, minimize changes, avoid ambiguous situations where possible, and stick with familiar situations at work (Sternberg, 1997). In other words, they prefer structured, stable, and relatively predictable learning environments. The characteristics of admonishment and strictness might match the needs of conservative styles. Specifically, teachers with a preference for the admonishment behavior require students to pay attention in class. When a student breaks the rule, teachers will correct him or her immediately. Teachers with a preference for the strictness behavior require students to obey a series of rules and be silent in class. This type of teachers is generally regarded as harsh, and students are afraid of them. As a result, learning environments managed by admonishment and strictness are predictable with well-maintained order and discipline, which are valued by students with the conservative thinking style.

However, why did students with dominant conservative styles not prefer teachers to behave pleasantly and helpfully (helpfulness and understanding behavior)? It might be because when students do not understand the teaching materials, teachers with a preference for helpfulness and understanding behaviors are willing to explain the information again. They also allow students to discuss issues that are not closely related to teaching and learning. As a result, students with dominant conservative styles who are norm-favoring, and think that the main task for teachers is to teach subject knowledge, might complain that teachers use the instruction time to deal with irrelevant problems, instead of teaching knowledge.

Finally, the local style was the only Type II thinking styles that had positive relationship with the student-centered understanding behavior. This is probably because students with local styles like to handle concrete problems, work with details, and prefer teachers to teach every concrete detail. Therefore, they might frequently encounter many problems and need

seeking help from teachers to clarify the information presented in each lesson. In this circumstance, teachers with a preference for the understanding behavior who are trustworthy and willing to listen to and explain students' problems might be helpful to local style students.

To sum up, students with dominant Type II thinking styles, like the Type I thinking styles, preferred teachers to use both student-centered and teacher-centered behaviors in teaching. The relationships between Type II thinking styles and preferred teacher interpersonal behaviors varied depending on the extent to which teachers' interpersonal behavior matched the characteristics of students' thinking styles. Type II thinking styles are characterized by preferring norm-favoring activities, cognitive simplicity, high degrees of structure, conformity, and authority (Zhang & Sternberg, 2006). In this respect, students with dominant Type II thinking styles who like teachers to use leadership and strictness behaviors may suggest a respect of teachers' authority (conformity). Take helpfulness and understanding as another example, students with dominant Type II thinking styles who prefer teachers to use helpfulness and understanding behaviors may suggest that students want teachers to help them (helpfulness) and discuss with them (understanding) whenever they encounter any problem in learning.

5 Implications

The present study found that both Type I (the global and judicial) and Type II thinking styles (the executive and local) positively predicted leadership, helpfulness, freedom, understanding, and strictness teacher interpersonal behavior. Among the five types of teacher interpersonal behaviors, the former four are student-centered and the last one teacher-centered. It seems that secondary school students, particular the female students who are relatively lower achievers in Hong Kong, valued teachers to be helpful, understanding,

providing student with freedom, leading, and strict in teaching. These research findings provide Hong Kong secondary school teachers with heuristics values in how to construct a suitable learning environment and an adaptive teacher-student interaction for student learning.

Numerous studies have indicated that classroom perceptions are closely associated with students' learning outcomes, such as their attitudes towards subjects, motivation, preferences for subjects and teachers, and their learning achievement (Aldridge, Fraser & Huang, 1999; Goh & Khine, 2002; Khine & Fisher, 2001; Koul & Fisher, 2005; Wolf & Fraser, 2008; Wei, den Brok, & Zhou, 2009). For example, relationships between student perception of their teachers' interpersonal behavior and students' achievement were found (Brekelmans, Wubbels & den Brok, 2002; den Brok, Brekelmans, & Wubbels, 2004; Wei, den Brok, & Zhou, 2009; Wolf & Fraser, 2008). If teachers' interpersonal behavior were perceived to be supportive and allow freedom for students, students would demonstrate positive learning behavior. On the contrary, if teachers interacted with students in a way that led to conflicts, students would develop hostile behavior towards teachers and dampened their learning (Brekelmans, Levy, & Rodriguez, 1993).

In this sense, for those lower achiever students, especially the females, teachers need to adopt the student-centered and the strictness behavior as well, to promote student adaptive learning outcomes, such as positive learning attitudes, strong achievement motivation, and good academic achievement. For one thing, teachers need to give those students clear direction for studying, and even strict management in classroom; for another, teachers are also suggested to behave helpfully, to understand students' needs and problems, and to allow them to have enough freedom to use their preferred thinking styles in learning.

In particular, the strictness behavior needs some further attention. As mentioned earlier,

in the Chinese context, students are educated to show their respect to teachers and parents (Biggs & Watkins, 1995). Children view teachers' and parents' strictness as a way to show them their love and care. In this light, students perceive teachers' strictness as a gesture of concern for their successful learning. This might also be one of the reasons why Type I judicial styles positively predicted strictness teacher interpersonal behavior.

6 Contributions and limitations

The present study contributes to existing literature in the following three ways. First of all, at the theoretical level, the empirical data generated support the relation between thinking styles and teacher interpersonal behaviors. In this sense, the research findings bridge the research gap identified in the literature. Second, by examining the appropriateness of the MITB model and its measure--the QTI in the Hong Kong context, the present findings proved that the QTI is a reliable and valid instrument for students to evaluate their perceptions about teacher interpersonal behavior. The third contribution lies in the practical value in that the results suggest that, in reality, leadership, helpfulness, understanding, freedom, and strictness are the interpersonal behaviors receiving the relatively more attention of Hong Kong secondary school students. On the contrary, uncertainty, dissatisfaction, and admonishment are paid less attention by those students. These findings give an insight for teacher educators to design the teacher training program.

However, the current study also has two limitations. First, the limit sample size and the data that were only composed of lower achiever students of a single gender secondary school might influence the generalisibility of the results. In future studies, a larger sample including students from different backgrounds and achievement levels needs to be investigated. Second, although the QTI had acceptable reliabilities, several items in the strictness and admonishing

scales need modifications so as to improve the correspondent internal consistencies. Despite the limitations, the present study might trigger thoughts and ideas for future studies, by providing evidence of not only the adaption of the MITB in an Asian context, but also the relationship between students' thinking styles and their preferred teacher interpersonal behavior.

References

Aldridge, J. M., Fraser, B.J., & Huang, T. (1999). Investigating classroom environments in Taiwan and Australia with multiple research methods. *Journal of Educational Research*, 93, 48-62.

Biggs, J. B., & Tang, C. (2007). *Teaching For Quality Learning At University* (3rd ed.). Buckingham: Open University Press.

Biggs, J., & Watkins, D. (1995). *Classroom Learning: Educational Psychology For The Asian Teacher*. Singapore: Prentice Hall.

Brekelmans, M., Levy, J., & Rodriguez, R. (1993). A typology of teacher communication style. In T. Wubbels & J. Levy (Eds.), *Do you know what you look like? Interpersonal relationships in education* (pp. 46–55). London: Falmer Press.

Brekelmans, M., Wubbels, Th., & Créton, H.A. (1990). A study of student perceptions of physics teacher behavior. *Joumal of Research in Science Teaching*, 27, 335-350.

Brekelmans, M., Wubbels, T., & den Brok, P. (2002). Teacher experience and the teacher-student relationship in the classroom environment. In S. C. Goh & M. S. Khine (eds.), *Studies in educational learning environments an international perspective* (pp. 73-99). Singapore: World Scientific Publishing Co. Pte. Ltd.

Chen, Q., & Chen W. (2001). You in Your eyes of your students: Research of teacher-student interaction [Original in Chinese]. Unpublished manuscripts, Department of Applied Social Science, Hong Kong Polytechnic University, Hong Kong, China.

Cheung, E. (2002). *Students' thinking styles, learning approaches, and instructional preferences: Their relationships with academic achievement in different disciplines*. Unpublished manuscript. The University of Hong Kong.

den Brok, P. J. (2001). *Teaching and student outcomes: A study on teachers' thoughts and actions from an interpersonal and a learning activities perspective*. Utrecht: W.C.C.

den Brok, P., Brekelmans, M., & Wubbels, T. (2004). Interpersonal teacher behavior and student outcomes. *School effectiveness and school improvement*, 15, 407-442.

den Brok, P., Fisher, D., Brekelmans, M., Rickards, T., Wubbels, T., & Levy, J. (2003, April). *Students' perceptions of secondary science teachers' interpersonal style in six countries: A study on the validity of the Questionnaire on Teacher Interaction*. Paper presented at the American Educational Research Association, Chicago.

den Brok, P., Tartwijk, J., Wubbels, T., & Veldman, L. (2010). The differential effect of the teacher-student interpersonal relationship on student outcomes for students with different ethnic backgrounds. *British Journal of Educational Psychology*, 80, 199-221.

Entwistle, N. J., & Tait, H. (1990). Approaches to learning, evaluations of teaching, and preferences for contrasting academic environments. *Higher Education*, 19, 169-194.

Fisher, D., Fraser, B., & Wubbels, T. (1993). Interpersonal teacher behavior and school environment. In T. Wubbels & J. Levy (Eds.), *Do You Know What You Look Like? Interpersonal Relationships in Education* (pp. 103-112). London: The Falmer Press.

Fraser, B. J. (1986). *Classroom environment*, London; Croom Helm.

Fraser, B. J. (1998). Science learning environments: assessment, effects and determinants. In B. J. Fraser & K. G. Tobin (eds.), *International Handbook of Science Education* (pp.527-564). Great Britain: Kluwer Academic Publishers.

Fraser, B. J. (2002). Learning environments research: Yesterday, today and tomorrow. In S. C. Goh & M. S. Khine (eds.), *Studies in Educational Learning Environments An International Perspective* (pp. 1-25). Singapore: World Scientific Publishing Co. Pte. Ltd.

Fraser, B. J., & Chionh, Y. H. (2000). *Classroom Environment, Self Esteem, Achievement, and Attitudes in Geography and Mathematics in Singapore*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Fraser, B. J., & Walberg, H. J. (2005). Research on teacher–student relationships and learning environments: Context, retrospect and prospect. *International Journal of Educational Research*, 43, 1-2, 103-109.

Gijbels, D., Coertjens, L., Vanthournout, G., Struyf, E. & Van Petegem, P. (2009). Changing students' approaches to learning: a two-year study within a university teacher training course. *Educational Studies*, 35, 503–513.

Goh, S.C., & Khine, M.S. (Eds.). (2002). *Studies in Educational Learning Environments: An International Perspective*. Singapore: World Scientific.

Gow, L., & Kember, D. (1993). Conceptions of teaching and their relationship to student learning. *British Journal of Educational Psychology*, 63, 20-33.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis*, New Jersey: Pearson Education International.

Hativa, N., & Birenbaum, M. (2000). Who prefers what? Disciplinary differences in students' preferred approaches to teaching and learning styles. *Research in Higher Education*, 41, 209-234.

Jiang, G. R. (2001). *Classroom environment and its relations to teacher style and student development*. Unpublished doctoral dissertation, Chinese University of Hong.

Kember, D. (1998). Teaching beliefs and their impact on students' approach to learning. In B Dart and G Boulton-Lewis (eds.). *Teaching and Learning in Higher Education* (pp. 1-25), Camberwell: Australian Council for Educational Research.

Khine, M. S., & Fisher, D. L. (2001). *Classroom environment and teacher's cultural background in secondary science classes in Asian context*. Paper presented at the International Educational Research Conference of Australian Association of Research in Education, Perth.

Kim, H. B., Fisher, D. L., & Fraser, B. J. (1999). Assessment and investigation of constructivist science learning environments in Korea. *Research in Science and Technological Education*, 17, 239–249.

Koul, R. B., & Fisher, D. L. (2005). Cultural background and students' perceptions of science classroom learning environment and teacher interpersonal behavior in Jammu, India. *Learning environments research*, 8, 195-211.

Laight, D. W. (2006). Attitudes to concept maps as a teaching/learning activity in undergraduate health professional education: influence of preferred approach to

learning. *Medical Teacher*, 28, 2, 64–67.
Leary, T. F. (1957). *Interpersonal Diagnosis of Personality*, New York: Ronald Press.
Lee, S. S. U., & Fraser, B. J. (2001). *High school Science Classroom Learning Environments in Korea*. Paper presented at the annual meeting of the National Association for research in Science Teaching, St. Louis, MO.
Lewin, K. (1936). *Principles of Topological Psychology*, New York: McGraw-Hill.
Margianti, E. S., Fraser, B. J., & Aldridge, J. M. (2001). *Classroom Environment and Students' Outcomes Among University Computing Students in Indonesia*. Paper presented at the annual meeting of the American Educational Research Association, Seattle, WA.
Murphy, A. & Janeke, H. C. (2009). The relationship between thinking styles and emotional intelligence: an exploratory study. *South African Journal of Psychology*, 39, 357-375.
Ozkal, K., Tekkaya, C., Cakiroglu, J., & Sungur, S. (2009). A conceptual model of relationships among constructivist learning environment perceptions, epistemological beliefs, and learning approaches. *Learning and Individual Differences*, 19, 71-79.
Rickards, T., den Brok, P., & Fisher, D. (2005). The Australian science teacher: A typology of teacher–student interpersonal behavior in Australian science classes. *Learning Environments Research*, 8, 267-287.
Scott, R., & Fisher, D. (2001). *The Impact of teachers' Interpersonal Behaviour on Examination Results in Brunie*. Paper presented at the Annual conference of the Australian Association for Research in Education, Fremantle, Australia.
Segers, M., Dochy, F., & Cascallar, E. (2003). *Optimizing New Modes of Assessment: In Search For Qualities and Standards*. Boston, MA: Kluwer Academic Publishers.
Sternberg, R. J. (1997). *Thinking styles*, New York: Cambridge University Press.
Sternberg, R. J., & Wagner, R. K. (1992). *Thinking Styles Inventory*. Unpublished test.
Sternberg, R. J., Wagner, R. K., & Zhang, L. F. (2003). *Thinking Styles Inventory-Revised.* Unpublished test, Yale University.
Watkins, D., & Akande, A. (1993). Preferred and Actual Learning Environments and the Approach to Learning of Nigerian Students. *Journal of Social Psychology*, 133, 105-107.
Wei, M., den Brok, P., & Zhou, Y. (2009). Teacher interpersonal behavior and student achievement in English as a foreign language classrooms in China. *Learning Environments Research*, 12, 157-174.
Wolf, S., & Fraser, B. J. (2008). Learning environment, attitudes and achievement among middle-school science students using inquiry-based laboratory activities. *Research in Science Education*, 38, 321-341.
Wubbels, T., & Brekelmans, M. (1998). The teacher factor in the social climate of the classroom. In B. J. Fraser & K. G. Tobin (Eds.), *International Handbook of Science Education* (pp. 565–580). Dordrecht, The Netherlands: Kluwer.
Wubbels, T., & Levy, J. (1991). A comparison of interpersonal behavior of Dutch and American teachers. *International Journal of Intercultural Relations*, 15, 1-18.
Wubbels, T., & Levy, J. (eds.). (1993). *Do You Know What You Look Like? Interpersonal Relationships in Education*. London, England: The Falmer Press.
Wubbels, T., Créton, H. A., & Hooymayers, H. P. (1985). *Discipline problems of beginning teachers*, Paper presented at the Annual Meeting of The American Educational Research Association, Chicago (April). ERIC Document Reproduction Services No.

ED 260040.
Zhang, L. F. (1999). Further cross-culture validation of the theory of the mental self-government. *Journal of Psychology*, 133, 165-181.
Zhang, L. F. (2000a). Relationship between thinking styles inventory and study process questionnaire. *Personality and individual difference*, 29, 841-856.
Zhang, L. F. (2000b). Are thinking Styles and Personality Types Related?. *Educational Psychology*, 20, 271-283.
Zhang, L. F. (2001). Approaches and thinking styles in teaching. *The Journal of Psychology*, 135, 547-561.
Zhang, L. F. (2001b). Thinking styles, self-esteem, and extracurricular experiences. *International Journal of Psychology*, 36, 100-107.
Zhang, L. F. (2001c). Thinking styles and personality types revisited. *Personality and Individual Difference*, 31, 883-894.
Zhang, L. F. (2002a). Thinking styles and cognitive development. *The Journal of Genetic Psychology*, 163, 179-195.
Zhang, L. F. (2002b). Thinking styles and the big five personality. *Educational Psychology*, 22, 17-31.
Zhang, L. F. (2003). Are parents and children's thinking styles related. *Psychological Reports*, 93, 617-630.
Zhang, L. F. (2004). Thinking styles: University students' preferred teaching styles and their conceptions of effective teachers. *Journal of Psychology*, 138, 233-252.
Zhang, L. F. (2005). Does teaching for a balanced use of thinking styles enhance students achievement? *Personality and Individual Differences*, 38, 1135–1147
Zhang, L. F., & Huang, J. (2001). Thinking styles and the Five-factor Model of personality. *European Journal of Personality*, 15, 465-476.
Zhang, L. F., & Sachs, J. (1997). Assessing thinking styles in the theory of mental self-government: A Hong Kong validity study. *Psychological Reports*, 81, 915-928.
Zhang, L. F., & Sternberg, R. J (2000). Are learning approaches and thinking styles related? A study in two Chinese population. *Journal of Psychology*, 134, 469-489.
Zhang, L. F., & Sternberg, R. J. (1998). Thinking styles, abilities, and academic achievement among Hong Kong University students. *Educational Research Journal*, 13, 41-62.
Zhang, L. F., & Sternberg, R. J. (2006). *The Nature of Intellectual Styles*. Mahwah, NJ: Erlbaum.
Zhang, L. F., Huang, J., & Zhang, L. (2005). Preferences in teaching styles among Hong Kong and US university students. *Personality and Individual Differences*, 39, 1319-1331.

Table 1 Means, SDs, and the internal consistencies for the QTI and the TSI-R scales

	Scales	*Mean (SD)*	*alpha*
QTI	*Leadership*	*5.01 (.90)*	*.71*
	Helpfulness	*5.27 (1.01)*	*.81*
	Understanding	*5.46 (.98)*	*.84*
	Student Freedom	*4.51 (.83)*	*.66*
	Uncertainty	*2.59 (.78)*	*.60*
	Dissatisfaction	*2.75 (.96)*	*.72*
	Admonishment	*2.62 (.69)*	*.45*
	Strictness	*3.53 (.85)*	*.58*
TSI-R	*Legislative*	*4.85 (.91)*	*.76*
	Executive	*4.71 (.90)*	*.70*
	Judicial	*4.25 (1.03)*	*.78*
	Hierarchical	*4.39 (1.01)*	*.76*
	Monarchic	*4.52 (.93)*	*.64*
	Oligarchic	*4.54 (.97)*	*.72*
	Anarchic	*4.39 (.81)*	*.52*
	Global	*4.08 (.78)*	*.55*
	Local	*4.11 (.95)*	*.71*
	Liberal	*4.00 (1.03)*	*.82*
	Conservative	*4.22 (1.07)*	*.81*
	Internal	*3.77 (1.13)*	*.81*
	External	*4.94 (1.01)*	*.78*

Table 2 Zero-order correlations for the TSI-R and the QTI scales (N = 247)

	Student-centered interpersonal behavior					*Teacher-centered interpersonal behavior*		
Factors	*Lead*	*H/F*	*Und*	*Free*	*Unc*	*Dis*	*Adm*	*Str*
Type I Thinking styles								
Legislative	*.17**	*.14**	*.27****	*.21****	*-.10*	*-.11*	*-.06*	*.10*
Judicial	*.20****	*.10*	*.18****	*.27****	*.06*	*.11*	*.02*	*.20****
Hierarchical	*.25****	*.17****	*.31****	*.22****	*-.09*	*-.05*	*.09*	*.22****
Global	*.24****	*.24****	*.12*	*.33****	*.11*	*.05*	*.03*	*.18***
Liberal	*.04*	*.01*	*.07*	*.14**	*-.01*	*.03*	*-.06*	*.06*
Type II Thinking styles								
Executive	*.35****	*.31****	*.24****	*.26****	*-.03*	*.02*	*.16***	*.40****
Monarchic	*.18****	*.13**	*.16**	*.13**	*-.02*	*-.01*	*.06*	*.06*
Local	*.29****	*.21****	*.35****	*.24****	*-.08*	*-.01*	*.12*	*.28****
Conservative	*.19****	*.15**	*.11*	*.17***	*.03*	*.09*	*.23****	*.36****
Type III Thinking styles								
Oligarchic	*.32****	*.27****	*.20****	*.33****	*.08*	*.13**	*.14**	*.23****
Anarchic	*.31****	*.27****	*.41****	*.40****	*.00*	*-.01*	*.06*	*.21****
Internal	*.09*	*.00*	*.08*	*.10*	*.14**	*-.02*	*.04*	*.05*
External	*.28****	*.33****	*.34****	*.36****	*-.08*	*-.03*	*.08*	*.19****

Note. Lead = Leadership, H/F = Helpfulness, Und = Understanding, Free = Freedom, Unc = Uncertainty, Dis = Dissatisfaction, Adm = Admonishment, Str = Strictness; *** $p < .001$, ** $p < .01$, *$p < .05$.

Table 3 Predictions of preferred teacher interpersonal behavior from thinking styles (N = 247)

Scale	*Leadership*	*Helpfulness*	*Understanding*	*Freedom*	*Uncertainty*	*Dissatisfaction*	*Admonishment*	*Strictness*
R^2	*.18*	*.21*	*.26*	*.24*	*.11*	*.08*	*.05*	*.17*
Adjusted R^2	*.17*	*.19*	*.25*	*.23*	*.09*	*.06*	*.05*	*.17*
β	$.25_{Exe}$***	$.29_{Ext}$***	$.34_{Ana}$***	$.23_{Ana}$***	$.39_{Int}$***	$.16_{Oli}$*	$.23_{Con}$***	$.37_{Exe}$***
	$.17_{Ana}$**	$.32_{Exe}$***	$.26_{Loc}$***	$.24_{Glo}$***	$-.40_{Leg}$***	$-.24_{Leg}$**		$.13_{Jud}$*
	$.14_{Glo}$*	$.19_{Glo}$**	$-.28_{Lib}$***	$.20_{Ext}$**	$.13_{Oli}$*	$.25_{Jud}$**		
		$-.22_{Con}$**	$.20_{Ext}$***			$-.15_{Ext}$*		
		$-.15_{Lib}$*	$-.19_{Con}$**					
F	*17.17***	*12.48***	*16.99***	*25.76***	*9.55***	*5.10***	*14.09***	*25.38***
df	*3/243*	*5/241*	*5/241*	*3/243*	*3/243*	*4/242*	*1/245*	*2/244*

Note. Student-centered behaviors (the leadership, helpfulness, understanding, and freedom); teacher-centered behaviors (the uncertainty, dissatisfaction, admonishment, and strictness); *** $p < .001$, ** $p < .01$, *$p < .05$.

APPENDICES

Appendix A Figure 1

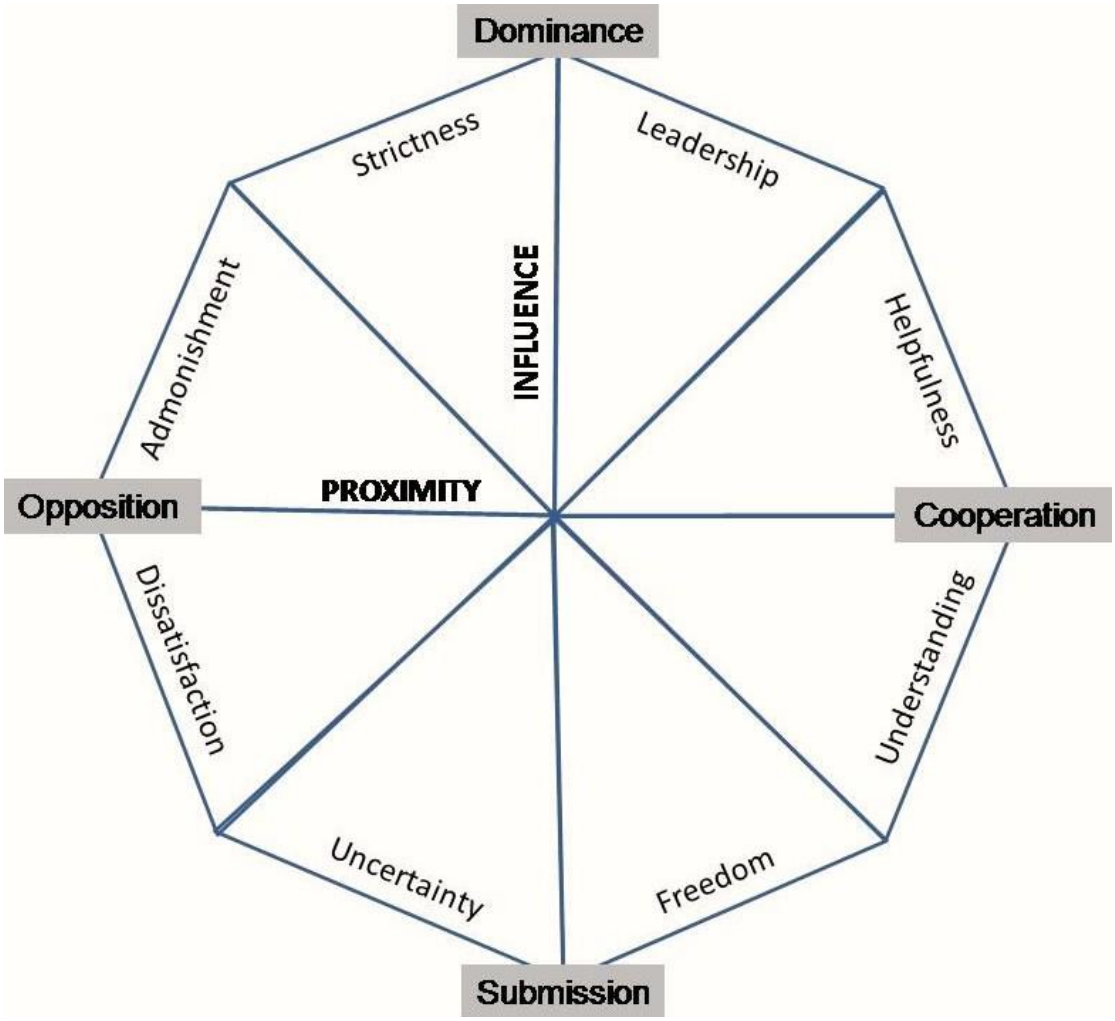

Figure 1: A circumplex model showing the variables in the Model of Teacher Interpersonal Behavior

Appendix B Descriptive information for the scales in the QTI

Scale	Description	Sample item
Leadership	In this class, the teacher provides leadership to the class and holds students' attention.	We all listen to this teacher.
Helpfulness	In this class, the teacher is friendly and helpful towards students.	The teacher is friendly.
Understanding	In this class, the teacher shows understanding/concern/care for students	The teacher trusts us.
Freedom	In this class, students are given opportunities to assume responsibility for their own activities.	The teacher gives us a lot of free time in class.
Uncertainty	In this class, the teacher exhibits his/her uncertainty.	This teacher doesn't seem sure.
Dissatisfaction	In this class, the teacher shows unhappiness/ dissatisfaction with students.	This teacher is unhappy.

Admonishment	In this class, the teacher shows anger/temper/ impatience in class.	This teacher gets upset quickly.
Strictness	In this class, the teacher is strict with and demanding of students.	This teacher is strict.

Appendix C Thinking styles in the theory of mental self-government

Dimension	Thinking style	Key characteristics
Function	Legislative	One prefers to work on tasks that require creative strategies; One prefers to choose one's own activities.
	Executive	One prefers to work on tasks with clear instructions and structures; One prefers to implement tasks with established guidelines.
	Judicial	One prefers to work on tasks that allow for one's evaluation; One prefers to evaluate and judge the performance of other people.
Form	Hierarchical	One prefers to distribute attention to several tasks that are prioritized according to one's valuing of the tasks.
	Monarchic	One prefers to work on tasks that allow complete focus on one thing at a time.
	Oligarchic	One prefers to work on multiple tasks to serve multiple objectives, without setting priorities.
	Anarchic	One prefers to work on tasks that would allow flexibility as to what, where, when, and how

		one works.
	Global	One prefers to pay more attention to the overall picture of an issue and to abstract ideas.
Level		
	Local	One prefers to work on tasks that require working with concrete details.
	Internal	One prefers to work on tasks that allow one to work as an independent unit.
Scope		
	External	One prefers to work on tasks that allow for collaborative ventures with other people.
	Liberal	One prefers to work on tasks that involve novelty and ambiguity.
Leaning		
	Conservative	One prefers to work on tasks that allow one to adhere to the existing rules and procedures in performing tasks.

Appendix D

Rotated component matrix of two-factor model for the QTI

	1	2
Leadership	.88	
Helpful	.90	
Understanding	.86	
Freedom	.82	
Uncertainty		.67
Dissatisfaction		.67
Admonishment		.85
Strictness		.59
% variance	44.04	22.34
Cumulative variance	44.04	66.39
Eigenvalue	3.52	1.79

Note: Variables with factor loadings of less than ｜.40｜are omitted

Pattern matrix of four-factor model for the TSI-R

	1	2	3	4
Legislative	.77			
Executive		.86		
Judicial			-.56	
Hierarchical			-.60	

Monarchic	.49			
Oligarchic		.43	-.41	
Anarchic			-.56	
Global				.85
Local	.49		-.42	
Liberal		-.49	-.65	
Conservative		.89		
Internal	.96			
External			-.91	
% variance	40.47	13.96	9.91	7.72
Cumulative variance	40.47	54.43	64.34	72.06
Eigenvalue	5.26	1.81	1.29	1

Note: Variables with factor loadings of less than ｜.40｜are omitted