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Relationship Between Teacher Efficacy and Self-Reported Instructional Practices: An Examination of Five Asian Countries/Regions Using TIMSS 2011 Data

Abstract Teacher efficacy in a particular content area is seen as an important factor shaping teaching practice and student learning in the Western literature. However, inadequate efforts have been made to examine this assumption empirically. Drawing on the Trends of International Mathematics and Science Study (TIMSS) 2011 mathematics teachers' data at the eighth grade level, this study examines the relationship between teacher efficacy in teaching mathematics and teachers' mathematical instructional practices in five Asian countries/regions. Guided with Bandura's social cognitive theory, this study finds that overall teachers in the five countries/regions reported much lower teacher efficacy in teaching mathematics and lower levels of instructional practices than the international norms. The relationship between teacher efficacy and instructional practices varied within these countries/regions. Teacher efficacies in teaching mathematics are not always statistically and positively related to their instructional practices in engaging students. Together, these findings challenge the theoretical assumption about the positive relationship between teacher efficacy and instructional practices. Possible reasons of these findings and future directions are discussed.

Keywords teacher efficacy, instructional practices, international comparison

Introduction

Teacher efficacy defined as the confidence that teachers hold about their

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capability to “successfully accomplish a specific teaching task in a particular context” (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998, p. 233) has been assumed as an important factor shaping instructional practices and consequently student learning (Ashton, 1984; Berman et al., 1977; Goddard, Hoy, & Woolfolk Hoy, 2000; Scharmann & Hampton, 1995). Empirical studies have indicated that teacher efficacy may influence different aspects of teachers’ work, such as teachers’ professional commitment (Coladarci, 1992; Lee, Zhang, & Yin, 2011; Ware & Kitsantis, 2007), teachers’ instructional behaviors (Ghaith & Yaghi, 1997; Gibson & Dembo, 1984; Skaalvik & Skaalvik, 2007; Tschannen-Moran & Woolfolk Hoy, 2001), teachers’ efforts and persistence in the face of difficulties (Soodak & Podell, 1996), and their openness to new teaching methods (Ghaith & Yaghi, 1997).

However, studies on the relationship among teachers’ efficacy, their instructional practices, and student achievement have often revealed mixed findings. For example, some researchers found that teacher efficacy influenced teachers’ instructional practices and students’ learning outcomes directly or indirectly (Ashton, 1984; Midgley, Feldlaufer, & Eccles, 1989; Ross, 1992; Tschannen-Moran & Woolfolk Hoy, 2001) while others did not (Brown, 2005). This situation fuels two interpretations.

The first interpretation was that teacher efficacy can be subject to cultural influences and thus, its influences on teachers’ teaching and students learning vary as a result (Lin & Gorrell, 2001; Yeom & Ginsburg, 2007). For example, some scholars (Klassen et al., 2009; Pajares, 2007) suggest that teacher self-efficacy may operate differently in Asian settings. Asian teachers would have much lower efficacy simply because Asian cultural values influenced by Confucianism tend to encourage people to identify their weaknesses while Western cultural values influenced by individualism encourage people to present their confidence (Baumeister, Tice, & Hutton, 1989). Many East Asian countries share the Confucian values of self-retrospection (Phuong-Mai, Terlouw, & Pilot, 2005), which may reflect in school contexts and in turn, shape teachers’ beliefs as well as their instructional practices (Klassen et al., 2008; Preus, 2007; Yeom & Ginsburg, 2007). The assumption about teacher efficacy as culturally and socially situated challenges the universality of the assumption regarding teacher efficacy and its direct effects

on their instructional practices. Thus, whether and to what extent teacher efficacy operates differently in Asian countries/regions compared with Western countries or international norms in relating to teachers' instructional practices deserve a careful examination (Heine, 2004; Klassen et al., 2011; Pajares, 2007). However, most of the studies in this field have developed their findings in western contexts with western participants, especially in North America. As suggested by Klassen et al. (2011) in a literature review study based on 218 studies published during 1998–2009, 57% of studies selected participants from North America, 18% from Europe, and only 15% from Asia.

The second interpretation is that most studies in the literature treat teacher efficacy as a general entity instead of a particular entity in a specific content domain or area (Klassen et al., 2011). A closer look at the studies in the field indicates that only limited studies directly examine the relationship between teacher efficacy and instructional practices in a specific subject (Brown, 2005; Pan & Franklin, 2011), which may cause mixed results. Therefore, it is necessary to further investigate the relationship between domain-specific teacher efficacy in a specific content area and their instructional practices.

Drawing on the Trends of International Mathematics and Science Study (TIMSS) 2011 mathematics teachers' data at the eighth grade level, this study examines the relationship between teacher efficacy and their reported instructional practices in mathematics in five Asian countries/regions. They are the Republic of Korea (to be referred to as "Korea" for the rest of the paper), Singapore, Hong Kong Special Administrative Region (SAR, to be referred to as "Hong Kong" for the rest of the paper), Chinese Taipei, and Japan. Specifically, this study examines the following three research questions: 1) What are the characteristics of teacher efficacy in teaching mathematics and instructional practices in five Asian countries/regions? 2) Whether and to what extent is teacher efficacy in teaching mathematics significantly related to instructional practices in five Asian countries/regions? 3) Whether and to what extent are the patterns of the relationship between teacher efficacy in teaching mathematics and instructional practices consistent across the five Asian countries/regions?

Literature Bases

Theoretical Frameworks

Two theoretical assumptions frame the research questions and the design of this study. The first assumption is the theory of the cyclical nature of teacher efficacy (Tschannen-Moran et al., 1998), which is built on Bandura's social cognitive theory (1986, 1997). According to social cognitive theory, one's personal efficacy beliefs represent "the key factor of human agency" that have diverse effects on "the courses of action people pursue, how much efforts they put forth in given endeavors, how long they will persevere in the face of obstacles and failures,... and the level of accomplishments they realize" (Bandura, 1997, p. 3). Thus, "a strong sense of efficacy increases human accomplishment and people with a high level of confidence in their capabilities approach difficult tasks as challenges to be mastered rather than as threats to be avoided" (Çakiroğlu & İşiksal, 2009, p. 134). Following this assumption, the theoretical model of "the cyclical nature of teacher efficacy" has been developed to guide the study of teacher self-efficacy (Tschannen-Moran et al., 1998) with three major ideas.

The first idea is that teacher self-efficacy is domain-specific and task-specific. Thus, teachers who feel efficacious in teaching mathematics may not feel efficacious in teaching other subject areas. The second idea is that the major sources that influence teachers' efficacy beliefs include verbal persuasion, vicarious experience, physiological arousal, and mastery experience. The third idea is that teacher self-efficacy influences how individual teachers set teaching goals, make efforts to achieve their goals, and exercise their persistence when facing challenges and difficulties in a specific subject content, and thus, engage their students in learning (Tschannen-Moran et al., 1998). This study is designed to examine the assumption that the higher level of self-efficacy a mathematics teacher develops, the more likely he or she will cognitively engage students in mathematics learning.

The second theoretical assumption is that teacher self-efficacy and its effects on teaching are shaped by the social cultural contexts where they are teaching (Heine, 2004; Lin & Gorrell, 2001). For example, in the culture of western individualism, one's self-confidence is highly important as a means to show his or her individualities in order to be recognized by others (Heine & Lehman,

1999) and thus, people are encouraged to present themselves to be self-confident (Baumeister et al., 1989). However, in contrast, Asian cultures especially those influenced by the Confucius values of learning and self-fulfillment tend to encourage people to examine their weaknesses rather than their strengths as shown in Japanese culture where teachers may have lower self-confidence (Heine, Takata, & Lehman, 2000). Following this assumption, teachers in Asian countries whose cultures stress the self-reflection of what one does would develop much lower self-confidence. This study has been developed to examine this assumption with teachers in five Asian countries/regions, Korea, Singapore, Hong Kong, Chinese Taipei, and Japan in which Confucius cultural values are prominent (Park, 2011).

Empirical Literature Review

To situate this study in context, an empirical literature review was conducted by searching three databases, Education Resources Information Center (ERIC), PsycARTICLES, and PsycINFO, for the relevant peer-review journal studies, books, and dissertations. The terms “efficacy or self-efficacy” and “instructional practices” were used in the searches. The review of the relevant literature identified in the search process revealed the following results. A number of empirical studies have examined the relationship between teacher efficacy and teachers’ professional commitment to teaching (Coladarci, 1992; Lee et al., 2011) and attitudes toward instructional innovations (Charalambous & Philippou, 2010; Ghaith & Yaghi, 1997; Guskey, 1988) while few examined the relationship between teacher efficacy and specific instructional practices in specific domain in the non-western contexts.

Teacher Efficacy and Attitudes toward Instructional Innovations

Two studies are found in the literature related to the relationship between teachers’ efficacy beliefs and their positive attitudes toward instructional innovations. Drawing on data from 16 middle school teachers and nine high school teachers in Lebanon, Ghaith and Yaghi (1997) examined the difference between low and high personal teaching efficacy teachers in their perceptions of the congruence, cost, importance, and difficulty of implementing Student Teams

Achievement Divisions (STAD). The results indicated that more efficacious teachers viewed STAD to be more important. There was no significant difference between groups of low and high efficacious teachers with regard to their perceptions of the cost and difficulty of implementing STAD. Charalambous and Philippou (2010) examined 151 elementary mathematics teachers' self-efficacy beliefs about using the reform- or pre-reform teaching approaches and their concerns about this educational reform in Cyprus. The results showed that teachers with more confidence in using the reform approaches to teach problem solving had fewer intense management and consequence concerns than did teachers with less confidence. However, teachers who were comfortable with pre-reform approaches tended to be more critical to the reform, exhibited more intense concerns about their capacity to manage the reform, and were more worried about its consequences on student learning.

The reviewed studies identified the possible relationship between teacher efficacy and teachers' attitudes toward educational reforms, but there were obvious limitations in these studies that justify the necessities of this current study. First, both studies used relatively a small sample size, especially Ghaith and Yaghi's (1997) study, which may hinder the understanding of a big picture of the relationship between teacher efficacy and instructional practices in a specific domain. Second, these studies were built on an ambiguous assumption that if teachers had more positive attitudes toward educational innovations, they would be more likely to adopt new instructional practices and teach well, which itself has not been carefully examined. Third, none of these studies directly examined teachers' instructional practices in Asian contexts where the Confucian values of learning have substantial influences (Klassen et al., 2010; Pajares, 2007). Fourth, while Charalambous and Philippou (2010) examined mathematics teachers' efficacy, Ghaith and Yaghi's (1997) study failed to reveal the subjects those teachers taught. Whether or not the relationship is sustained for mathematics teachers remains unanswered. This study is designed to examine the relationship between teacher efficacy and instructional practices in mathematics in five Asian countries/regions comparatively.

Teacher Efficacy and Instructional Practices

Three studies that explore the relationship between teacher efficacy and

instructional practices were all conducted in the U.S. contexts with no study conducted in Asian contexts, which yielded mixed and conflicting findings about the relationship between teacher efficacy and instructional practices. Using the phenomenological approach of qualitative design based on the in-depth interviews with 36 U.S. practicing teachers who teach a variety of subjects, Flowerday and Schraw (2000) examined the direct linkage between teacher efficacy beliefs and instructional choice. They found that the amount of choices that teachers gave to students changed as teachers' teaching experience increased and their efficacy enhanced. This study suggested that teacher efficacy was one of the important determinants of their instructional choice. However, the authors cautioned that whether highly efficacious teachers offer more choices to their students than low efficacy teachers needs more evidence. This finding was supported by another study using data from 379 in-service teachers in the US (Pan & Franklin, 2011), in which, teachers who were less self-efficacious in using Web 2.0 tools were less likely to integrate Web 2.0 in their instructional practices.

In contrast, Brown (2005) conducted a study in the US on the relationships among early childhood teachers' self-efficacy, beliefs about the importance of mathematics, and mathematics instructional practices, which challenges the above findings. Drawing on data from 94 prekindergarten teachers and educators and using the correlational analysis, the study found that while teacher mathematics beliefs were correlated with their efficacy measured with the efficacy subscales related to student engagement, instructional strategies, and classroom management, teacher efficacy and teacher mathematics beliefs were not significantly related to the observed teachers' mathematics instructional practices.

The mixed and conflicting findings about the relationship between teacher efficacy and instructional practices challenge the universality of the assumption about the relationship between teacher efficacy and instructional practices in the U.S. context. In addition, as these three studies were conducted in the US, the relationship between teacher efficacy and instructional practices has not been examined in Asian contexts. Using TIMSS 2011 assessment, this study is designed to address the limitations of the existing relevant literature by examining the relationship between teacher efficacy and instructional practices in the context of teaching mathematics in Asian contexts.

Methods

Participants and Data Sources

To examine the research questions, I selected eighth-grade mathematics teachers from five Asian countries/regions that participated in TIMSS 2011 assessment. Participants involved in this study were 5,170, 5,927, 4,149, 5,042, and 4,593 eighth grade mathematics teachers from Korea, Singapore, Hong Kong, Chinese Taipei, and Japan, respectively. These five countries/regions were selected for this study based on three considerations.

First, among all 45 countries and 14 benchmarking entities participating in TIMSS 2011 eight grade assessment, these Asian countries/regions demonstrated the top mathematics achievements. For example, Korea, Singapore, and Chinese Taipei outperformed all other countries, followed by Hong Kong and Japan (Mullis, Martin, Foy, & Arora, 2012). Following the assumption, teacher efficacy may directly or indirectly relate to student learning outcomes (Goddard et al., 2000; Moore & Esselman, 1992, April; Ross, 1992), teachers in these countries/regions are reasonably assumed to have higher teacher efficacy in mathematics teaching, which deserves further verification.

Second, all five countries/regions share a Confucian culture which stresses collectivist social values (Phuong-Mai et al., 2005) and emphasizes effort, perseverance, and humility (Kim, 2005; Park, 2011). These cultural values encourage people to look at their weaknesses rather than strengths in self-reflection, which may encourage teachers to develop lower self-efficacy (Heine et al., 2000). Following this assumption, participants from Asian cultural settings might respond differently regarding their efficacy beliefs in teaching mathematics than their international counterparts, which again is worth a careful empirical examination. I chose to compare the five Asian countries/regions with the international average for the reason of simplifying the comparison so that I would not go through the complication of specific comparisons with various individual western countries, which could make the analysis too daunting to accomplish in the study of this scale.

Finally, the reason for selecting mathematics teachers at eighth grade level was that TIMSS 2011 assessment designed teacher questionnaires for eighth grade teachers who taught different subjects such as mathematics or science respectively. As a result, it is more accurate for researchers to focus on either

mathematics or science teachers' efficacy due to its domain-specificity of teacher efficacy. However, I choose to focus on mathematics in this study as I am more familiar with the literature related to mathematics teachers although both mathematics and science are potentially useful for the purpose of this study.

As the data source of this study, TIMSS 2011 collected a rich array of background information and the information about teachers' career satisfaction, mathematics teaching, teacher efficacy in teaching mathematics, and instructional practices in engaging students in learning mathematics using a questionnaire with each teacher. These data sources enabled us to focus on one subject area, specifically mathematics, to examine whether the relationship between teacher efficacy and instructional practices differs across the five Asian countries/regions. To examine the research questions of this study, I chose two sets of data from the TIMSS 2011 dataset including items in the teacher questionnaire related to teachers' self-efficacy in teaching mathematics and items related to teachers' instructional practices.

Variable Construction

TIMSS assessment has been administrated since 1995 in a four-year cycle. With each assessment cycle, a special committee of experienced National Research Coordinators (NRCs) guides the process of updating the questionnaires, called the Questionnaire Item Review Committee, with a collaborative effort among the TIMSS & PIRLS International Study Center, the Questionnaire Item Review Committee, and the IEA Data Processing and Research Center. The process included a series of reviews of draft questionnaires, a field test of the questionnaires, a review of field test data, and a revision of the field test instruments for use in the main data collection (Olson, Martin, & Mullis, 2008). These processes ensure that the background questionnaires are valid and reliable although I recognize the weakness of using questionnaire to assess teachers' efficacy.

The independent variable of this study is teacher efficacy with various components in teaching mathematics. According to *TIMSS 2011 Assessment Frameworks* (Mullis et al., 2012), teacher efficacy refers to a teacher's sense of personal ability to organize and execute their teaching. This definition is consistent with the definition of the relevant literature in which teacher efficacy

is the confidence that they hold about their capability to “successfully accomplish a specific teaching task in a particular context” (Tschannen-Moran et al., 1998, p. 233). Such teacher efficacy is presumeably related to their teaching behavior (Bandura, 1997; Henson, 2002).

Built on these theoretical frameworks, TIMSS 2011 measured mathematics teachers’ efficacy in teaching mathematics by asking teachers to indicate how confident they feel about doing each of the following:

- 1) answer students’ questions about mathematics,
- 2) show students a variety of problem solving strategies,
- 3) provide challenging tasks for capable students,
- 4) adapt my teaching to engage students’ interest, and
- 5) help students appreciate the value of learning mathematics.

Each of these five items was followed by three choices: 1) “very confident,” 2) “somewhat confident,” and 3) “not confident.” These items were recoded for data analysis so that the higher scores indicate higher levels of teacher efficacy in teaching mathematics. Using item response theory (IRT) scaling methods, specifically the Rasch partial credit model (Masters & Wright, 1997), TIMSS 2011 data constructed a scale of the Teacher Efficacy in Teaching Mathematics (TETM) based on teachers’ responses to how confident they feel about doing each of five activities aforementioned. I used the TETM scale score and its items as the independent variables of the study. The Cronbach’s alphas of the Teacher Efficacy in Teaching Mathematics (TETM) scale were acceptable, which were .81, .73, .69, .74, and .80, for Korea, Singapore, Hong Kong, Chinese Taipei, and Japan, respectively.

The dependent variable of the study is teachers’ instructional practices in engaging students in learning mathematics measured by Question 14 in mathematics teacher questionnaire. This question asked mathematics teachers to indicate how often they do the following in teaching the class:

- 1) summarize what students should have learned from the lesson,
- 2) use questioning to elicit reasons and explanations,
- 3) encourage all students to improve their performance,
- 4) praise students for good effort.

These items (TIMSS, 2012) are consistent with strategies teachers are expected to employ to encourage and engage students to learn mathematics in the literature, such as focusing on increasing students’ motivation, relating what

students learn to their daily lives, providing extrinsic rewards and praise, and asking them to solve problems and explain their answers (Pintrich, 2003). Each of these questions was followed by four choices: 1) “every or almost every lesson,” 2) “about half of the lessons,” 3) “some lessons,” and 4) “never.” These items were recoded before data analysis so that the higher score indicates the higher frequency to engage students in mathematics learning.

Using IRT scaling methods, specifically the Rasch partial credit model (Masters & Wright, 1997), TIMSS 2011 data constructed a scale of instruction to engage students in learning (IES) based on teachers’ responses to how often they used each of four instructional practices described above. This scale score was used as the dependent variable for this study. The Cronbach’s alphas of the IES scale were acceptable, which were .70, .70, .70, .76, and .68, for Korea, Singapore, Chinese Hong Kong, Chinese Taipei, and Japan, respectively.

Data Analysis

TIMSS 2011 assessment applied a two-stage stratified cluster sample design by which a random sample of schools was selected at the first stage and afterward one or two fourth or eighth grade classes and their teachers were sampled at the second stage (Foy, Arora, & Stanco, 2013). That means that the teacher sample was not randomly selected. This complex sampling approach resulted in a complex structure of TIMSS data in which sampling weights should be applied for TIMSS data analysis and a re-sampling technique such as the Jackknife should be employed to estimate sampling variances correctly (Foy et al., 2013).

The method used to produce estimates of totals from TIMSS data was “through a simple weighted sum of all the responding records for the variable of interest. Estimates of percentages or means then were taken as ratios of these estimated totals” (Olson, Martin, & Mullis, 2008, p. 165). The sampling weights in TIMSS 2011 data were calculated based on a three-step procedure involving selection probabilities for schools, classrooms (teachers), and students. The actual sample size estimated for each country was not the sample size included in this study, it is much bigger than the sample size. For example, 5,042 Chinese Taipei teachers’ data were used to estimate 304,307 eighth grade mathematics teachers’ efficacy in teaching mathematics due to the sampling weights. For this reason, the means of overall scale scores for teacher efficacy and instructional practices were

not the sample sums of the total scores from each individual items in teacher efficacy and instructional practices for each country or international average.

Therefore, the International Database (IDB) Analyzer (IEA, 2009), developed specifically for TIMSS data by the IEA Data Processing and Research Centre (IEA DPC), was utilized for the data analysis, which allowed us to analyze the data with consideration of overall teacher weight and weights for mathematics teachers. This IDB software also enabled us to calculate estimates of teacher efficacy and instructional practice scores and their standard errors, combining both sampling variance and imputation variance. In addition, the General Linear Model with Univariate Analysis of Variance in SPSS 20 was used to examine the mean differences among the five countries/regions and set them against the international averages on the TETM and IES scores. This approach allowed us to include weight for mathematics teacher data in the analysis, as suggested by Foy et al. (2013). Before conducting data analysis, the IDB analyzer was used to merge teacher data files from each country/region, in addition to merging all other countries as international data.

For the specific analysis, I first conducted descriptive statistical analysis for the means and standard deviations of teacher efficacy and instructional practices for each Asian country/region and for international data and then compared the results from Asian country/region with the international averages of teacher efficacy and instructional practices. Then, I applied the General Linear Model with Univariate Analysis of Variance in SPSS 20 to determine whether there are significant differences between Asian country/region and the international norm and within these Asian countries/regions on the TETM and IES scale scores. Post hoc procedures were applied with Tukey's HSD for an overall significant country effect because Tukey's HSD can be adopted to an unequal sample sizes (Keppel & Wickens, 2004) as in this study.

Then, I conducted simple regression using the TETM scale score as the predictor and IES scale as the outcome variable. Afterward, I conducted multiple regression on the IES scale with each item on the TETM scale to examine how each individual item of teacher efficacy in teaching mathematics relates to the IES scale score after controlling for the other four items. Finally, I compared the patterns of the relationship between teacher efficacy and instructional practices across the five countries/regions to address the third research question.

Limitations of the Study

The study did have several limitations. First, the correlational nature of the study does not allow us to infer causal relations. Future studies may include school- and/or country-level factors by using structural equation modeling or hierarchical linear modeling approaches. Second, TIMSS 2011 used a self-reported teacher questionnaire as instructional practice data, which may not warrant their instructional practices as identified from observations and from students' perspectives. Future studies may consider direct observation or student evaluation about instructional practices (Henson, 2002), which could triangulate with quantitative data and provide richer data sources for instruction. Finally, I compared five Asian countries/regions with the international norms instead of involving more Western countries for more balanced representations. Therefore, the interpretation and generalization of the findings of this study should be cautioned.

Results

The analysis of this study yielded several findings relevant to the research questions. Together, they posed a challenge to the theoretical assumption about the positive relationship between teacher efficacy in teaching mathematics and their instructional practices in engaging students in learning mathematics.

Levels of Teacher Efficacy and Instructional Practices

First, the descriptive statistical analysis of this study showed that teachers in each of the five countries/regions showed much lower overall teacher efficacy in teaching mathematics among which, Japanese teachers reported relatively low scores on each individual items of teacher efficacy than their colleagues from other four countries/regions. As indicated in Table 1, the overall scale of teacher efficacy in teaching mathematics for eighth grade Korean, Singaporean, Hong Kong, Chinese Taipei, and Japanese mathematics teachers were 8.57, 9.14, 8.89, 9.44, and 8.04, respectively, which were all significantly lower than the international average (10.23), $ps < .01$. Japanese teachers rated all the individual efficacy items lower than the international average for the relevant items.

Table 1 Means and Standard Deviations of Eighth Grade Mathematics Teachers' Efficacy and Instructional Practices for Each Country/Region

Item	International	Korea (1)	Singapore (2)	Hong Kong (3)	Chinese Taipei (4)	Japan (5)
Teacher efficacy						
Answer students' questions	2.83	2.72	2.89	2.90	2.88	2.73
Show students a variety of problem solving strategies	2.64	2.54	2.71	2.72	2.81	2.43
Provide challenging tasks for capable students	2.47	2.45	2.48	2.44	2.65	2.33
Adapt my teaching to engage students' interest	2.31	2.32	2.38	2.28	2.41	2.17
Help students appreciate the value of learning mathematics	2.22	2.29	2.29	2.15	2.28	2.08
Overall TETM score	10.23	8.57**	9.14**	8.89**	9.44**	8.04**
Country / Region comparisons		> 5	> 1, 5	> 5	> 1, 2, 3, & 5	< 1, 2, 3, & 4
Instructional practices						
Summarize what students should have learned	3.53	3.65	3.43	3.52	3.42	3.64
Use questioning to elicit reasons and explanations	3.41	3.48	3.37	3.33	3.35	3.50
Encourage all students to improve their performance	3.33	3.46	3.41	3.24	3.15	3.32
Praise students for good effort	3.32	2.64	2.32	2.51	2.27	2.12
Overall IES score	10.16	9.28**	9.01**	8.68**	8.37**	8.84**
Country/ Region comparisons		> 3, 4, & 5	> 4	> 4	< 1, 2, 3, & 5	< 1

Note. ** $p < .01$, indicating significantly lower than the international average; > : suggesting a significant higher score than other countries at .05 or .01 level; < : suggesting a significant lower score than other countries at .05 or .01 level.

Second, there were substantial differences in rating their efficacy in teaching mathematics within these Asian countries/regions. For example, among the five countries/regions, Japanese teachers reported relatively low scores on each item of teacher efficacy than their colleagues from other four countries/regions. Table 1 showed that the overall scale of teacher efficacy in teaching mathematics for eighth grade Korean, Singaporean, Hong Kong, Chinese Taipei, and Japanese mathematics teachers were 8.57, 9.14, 8.89, 9.44, and 8.04, respectively. The Univariate Analysis of Variance indicated that differences among these five countries/regions were statistically significant except for those between Singaporean and Hong Kong teachers. Tukey's post hoc tests suggested that teacher efficacy for Chinese Taipei teachers was significantly higher than teachers from the other four countries, with $p < .01$, $.05$, $.01$, and $.01$ for Korean, Singaporean, Hong Kong, and Japanese teachers, respectively. Japanese teachers' efficacy in teaching mathematics was significantly lower than teachers from the other four countries/regions, $ps < .01$ for Korean, Singaporean, Hong Kong, and Chinese Taipei teachers, respectively. Teacher efficacy for Singaporean teachers was significantly higher than teachers from the other two, with $ps < .01$ for Korean and Japanese teachers, respectively. However, there were no significant efficacy differences between teachers from Singapore and Hong Kong, $p > .05$.

Third, the frequency levels of teachers' instructional practices in engaging students in learning mathematics in all five Asian countries/regions were lower than the international average. For example, Table 1 showed that the IES scale scores for teachers from Korea, Singapore, Hong Kong, Chinese Taipei, and Japan were 9.28, 9.01, 8.68, 8.37, and 8.84, respectively, which were all significantly lower than the international averages (10.16), with $ps < .01$. The results suggested that overall teachers in the five countries/regions less frequently employed these instructional practices than their international colleagues.

Finally, significant differences were also identified with regard to teachers' instructional practices in engaging students between some of the five Asian countries/regions. Tukey's post hoc tests suggested that overall Korean teachers had significantly higher ratings than teachers from Hong Kong, Chinese Taipei, and Japan, $ps < .01$, respectively. Teachers from Chinese Taipei also had significantly lower ratings of teaching practices than the other four countries/regions, $ps < .01$. However, there were no significant differences

between teachers from Singapore and Hong Kong, Singapore and Japanese, Singapore and Korea, Japanese and Hong Kong in terms of their engagement of students, $ps > .05$.

Patterns of Relationship between Teacher Efficacy and Instructional Practices

The simple regression analysis indicated that overall teacher efficacy in teaching mathematics was significantly related to their instructional practices in all five Asian countries/regions. However, when using individual items of teacher efficacy as predictors and instructional practices as the outcome variable, I found that individual items of teacher efficacy yielded inconsistent results on teachers' instructional practices across the five countries/regions (see Table 2).

As shown in Table 2, when controlling for the other four items on the teacher efficacy scale, Korean teachers' efficacy in 2) "showing students a variety of problem solving strategies," 4) "adapting teaching to students' interest," and 5) "helping students appreciate the value of learning mathematics," were significantly related to teachers' instructional practices, $p < .01$, $p < .01$, and $p < .05$, respectively. For Singaporean teachers, their efficacy in 1) "answering students' questions" and 5) "helping students appreciate the value of learning mathematics," were significantly and positively related to their instructional practices, $p < .05$ and $p < .01$, respectively. In Hong Kong, teachers' efficacy in 4) "adapting teaching to students' interest" and 5) "helping students appreciate the value of learning mathematics," were significantly related to teachers' instructional practices, $ps < .05$. For Japanese teachers, 4) teacher efficacy in "adapting teaching to students' interest," was significantly related to teachers' instructional practices, $p < .05$. For Chinese Taipei teachers, none of the five items of teaching efficacy was significantly related to their instructional practices, $ps > .05$.

From the above results, I identified three patterns of the relationship between teacher efficacy and instructional practices: First, the two items, 4) teacher efficacy in adapting teaching to engage students' interest and 5) teacher efficacy in helping students appreciate the value of learning mathematics, were significantly and positively related to teachers' mathematics teaching practices among Korean and Hong Kong teachers, respectively. Second, some teachers'

Table 2 Multiple Regression Coefficients of Teacher Efficacy on Instructional Practices for Each Country/Region

Country/ Region	Confidence	Regression Coefficient	Regression Coefficient SE	Regression Coefficient (<i>t</i> -value)	Standardized Coefficient (<i>t</i> -value)	Standardized Coefficient SE	Standardized Coefficient (<i>t</i> -value)
Korea	(CONSTANT)	5.12	.93	5.49			
	Answer students' questions	−0.58	.37	−1.55	−0.12	.08	−1.53
	Show students a variety of problem solving strategies	.88	.28	3.15	.20	.06	3.18**
	Provide challenging tasks for capable students	.13	.24	.55	.03	.06	.54
	Adapt my teaching to engage students' interest	.76	.29	2.62	.19	.07	2.64**
Singapore	Help students appreciate the value of learning mathematics	.62	.26	2.34	.16	.07	2.35*
	(CONSTANT)	1.73	1.15	1.51			
	Answer students' questions	.90	.39	2.30	.12	.05	2.32*
	Show students a variety of problem solving strategies	.45	.30	1.47	.09	.06	1.48
	Provide challenging tasks for capable students	.16	.21	.74	.04	.05	.74
Hong Kong	Adapt my teaching to engage students' interest	.47	.26	1.85	.12	.06	1.83
	Help students appreciate the value of learning mathematics	.86	.24	3.57	.22	.06	3.62**
	(CONSTANT)	5.62	2.27	2.48			
	Answer students' questions	−0.34	.70	−0.49	−0.05	.10	−0.48
	Show students a variety of problem solving strategies	.08	.40	.21	.02	.09	.21
	Provide challenging tasks for capable students	.09	.40	.23	.02	.10	.23

(To be continued)

(Continued)

Country/ Region	Confidence	Regression Coefficient	Regression Coefficient SE	Regression Coefficient (<i>t</i> -value)	Standardized Coefficient (<i>t</i> -value)	Standardized Coefficient SE	Standardized Coefficient (<i>t</i> -value)
Chinese Taipei	Adapt my teaching to engage students' interest	.88	.37	2.38	.22	.10	2.27*
	Help students appreciate the value of learning mathematics	.75	.38	1.96	.22	.11	2.03*
	(CONSTANT)	1.00	2.03	.49			
	Answer students' questions	.44	.86	.51	.05	.11	.51
	Show students a variety of problem solving strategies	.91	.75	1.22	.13	.11	1.23
	Provide challenging tasks for capable students	.17	.54	.32	.03	.10	.32
	Adapt my teaching to engage students' interest	.83	.46	1.79	.17	.10	1.76
	Help students appreciate the value of learning mathematics	.47	.46	1.04	.10	.10	1.04
	(CONSTANT)	4.62	1.18	3.92			
	Answer students' questions	.21	.46	.46	.04	.09	.46
Japan	Show students a variety of problem solving strategies	−0.21	.49	−0.42	−0.05	.12	−0.43
	Provide challenging tasks for capable students	.74	.44	1.67	.17	.10	1.68
	Adapt my teaching to engage students' interest	.74	.34	2.14	.19	.08	2.21*
	Help students appreciate the value of learning mathematics	.40	.31	1.30	.10	.08	1.30
	(CONSTANT)						

Note. * $p < .05$, ** $p < .01$

efficacy items were only significantly related to instructional practices for teachers in one country/region: 1) “answering students’ questions” for Singaporean teachers; and 2) “showing students a variety of problem solving strategies,” for Korean teachers. Third, the efficacy item, 3) “providing challenging tasks for capable students,” was not significantly related to teachers’ teaching in any of the five countries/regions.

Discussions and Conclusions

Results from the present study have led to several understandings relevant to the research questions. First, overall teacher efficacy in teaching mathematics in all five Asian countries/regions was lower than the international average as compared with the international average. This finding is consistent with those of other studies (Heine & Hamamura, 2007; Lin & Gorrell, 2001; Neuman & Bekerman, 2000) that Asian teachers tend to rate their efficacy in teaching as lower than international or Western counterparts.

Thus, this finding indirectly supports the assumption about the cultural influences on teacher self-efficacy and its effects on teaching (Lin & Gorrell, 2001; Heine, 2004). Following this argument, Asian teachers have lower efficacy simply because Confucian cultural values stressing self-reflection on what one does tend to encourage people to identify their shortcomings (Baumeister et al., 1989). In Western individualist cultures, people are encouraged to present themselves as confident because it is highly valued as a means to be recognized by others (Heine & Lehman, 1999).

Interestingly, among the five countries/regions, Japanese teachers reported relatively low scores on each individual items of teacher efficacy than their colleagues from other four countries/regions. This echoes the finding in the study by Kaiser, Leung, Romberg, and Yaschenko (2002, August) regarding mathematics teachers’ lower confidence in Asian countries, in particular, Japanese teachers using TIMSS-Repeated assessment. This result also confirms what Heine and Renshaw (2002) and Heine et al. (2000) have found in that Japanese people are more likely to maintain a self-critical attitude toward themselves, since this attitude enables them to pursue tasks relevant within their cultural context (Heine, Lehman, Markus, & Kitayama, 1999).

However, how the specific cultural processes influence teacher efficacy in

teaching mathematics in a particular country is beyond the scope of this study. To develop such an explanation, it is necessary for researchers to use more qualitative research approach to examine the specific cultural process in which teachers develop their mathematics teaching efficacies in a particular Asian country/region.

Second, there are no consistent patterns in light of mathematics teaching efficacies among teachers from all five Asian countries/regions. As the study indicated, there were substantial significant differences among teachers in rating their efficacy in teaching mathematics within these Asian countries/regions. This finding indicates that the cultural influences on teacher efficacy in mathematics teaching in each of these Asian countries/regions, if they do occur, can be more complex and varied in spite of the fact that Confucian values are important in all places (Park, 2011).

Again, this study helps to bring these differences to the light, but it is unable to offer a data-based explanation about how these specific differences occurred in these countries. Perhaps, in the future, researchers need to use a more qualitative research approach to examine interactions of Confucius values, if they are influential, and other contextual and cultural factors in a particular country and how these interactions are associated with teachers' efficacy and mathematics instructional practices (Holzberger, Philipp, & Kunter, 2013).

Third, teachers in these Asian countries/regions were less frequent users of the instructional practices that engage students in learning mathematics measured in the study. As shown in the results of this study, the average frequency level of teachers' use of mathematics instructional practices that engage students in learning was significantly lower than the international average in each of the five Asian countries/regions although variations existed among the five countries/regions. More interestingly, teachers from the five countries/regions less frequently praise students for their good effort. It suggests a very popular phenomenon in some Asian countries that teachers are not used to encouraging students even they are doing well (Leung, 2002).

This finding, plus the first finding that teachers in the five Asian countries/regions also have lower assessment of their efficacies in teaching mathematics, supports previous studies (Czerniak & Lumpe, 1996; Flowerday & Schraw, 2000; Pan & Franklin, 2011) from an opposite direction. In these studies, teachers with high efficacy in teaching are more likely to apply instructional strategies that are powerful but more challenging.

Fourth, on the surface, the overall teacher efficacy in each of the five Asian countries/regions was associated with their mathematics instructional practices based on simple regression, which seems consistent with the claim about the relation between these two from previous studies (Flowerday & Schraw, 2000; Pan & Franklin, 2011). It seem to support the theoretical assumption about the positive relationship between teacher efficacy and instructional practices as a universal and context- and culture- free construct (Tschannen-Moran et al., 1998).

However, there were no consistent patterns about the relationship between teacher efficacy in teaching mathematics and their various instructional practices across all five Asian countries/regions when the predicting power of specific teacher efficacy items for their mathematics teaching was considered. For example, in this study, only Singaporean teachers' efficacy in answering students' questions was significantly related to teachers' instruction in engaging students. Korean teachers' efficacy in showing students a variety of problem solving strategies was only significantly related to teachers' instruction in engaging students. In addition, none of the teacher efficacy items were significantly related to teachers' instruction in engaging students in learning mathematics for Chinese Taipei teachers. More interestingly, teacher efficacy in providing challenging tasks for capable students was not significantly related to teachers' instruction in engaging students in all five countries/regions. These inconsistent patterns in the relationship between teacher efficacy and their instructional practices at the specific level, to an extent, pose a challenge to the assumption that teacher efficacy was positively related to their instructional practices as a context- and culture- free construct applied to every context at a deeper level (Tschannen-Moran et al., 1998).

Finally, teachers in some of the five Asian countries/regions shared some patterns in light of the relationship between specific teacher efficacy in teaching mathematics and their instructional practices. For example, teacher efficacy in adapting teaching to engage students' interest was significantly related to teachers' instructional practice in engaging students in learning mathematics for Korean, Hong Kong, and Japanese teachers. Teacher efficacy in helping students appreciate the value of learning mathematics was significantly related to teachers' instruction in engaging students in learning mathematics for Korean, Singaporean, and Hong Kong teachers. These findings confirm the argument that teacher efficacies in adapting teaching to students' interest and in helping

students appreciate the value of learning mathematics were more likely related to teachers' instruction in engaging students in learning (Pintrich, 2003; Woolfolk, Rosoff, & Hoy, 1990).

However, teaching is a complex process in which many contextual factors may be involved in instructional practices (e.g., Cochran-Smith, 2003; Raudenbush, Rowan, & Cheong, 1992). Teaching contexts in the five selected countries/regions in this study actually differ from each other in terms of their teacher preparation, academic standards, and teacher evaluations (Yeom & Ginsburg, 2007). This variation may account for the mixed results. Therefore, to deepen the understanding of the relationship between teacher efficacy and instructional practices, it is essential that future studies investigate those influential contexts in different countries to understand the complex relationship between teacher efficacy and instructional practices as moderated through these teaching contexts in different countries.

Overall, the findings of this study challenge the simplistic assumption that teacher efficacy beliefs about mathematics teaching are positively related to their instructional practices and thus, suggest that teachers with higher self-efficacy in teaching mathematics do not necessarily provide higher quality instruction to engage students in learning mathematics across the five Asian countries/regions. The policy implication of this finding is that teacher efficacy may not be the most important factor that enhances instructional practices (Holzberger et al., 2013) and policymakers need to reconsider the practices of teacher education and development that are intended to improve instructional practices and student performance through strengthening teachers' self-efficacy. This study also contributes to the knowledge that teacher efficacy and instructional practices might not be closely related with each other. Even if some relationships exist, these relationships have a few shared patterns in the Asian contexts. Consequently, the theoretical assumption about the positive relationship between teacher efficacy and instructional practices as a universal and context- and culture-free construct is substantially shaken.

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