

Psychometric properties of a Chinese version of 12-item Teachers' Sense of Efficacy Scale for Hong Kong in-service teachers

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Abstract:

Teacher efficacy is a powerful psychological construct which has been found to be significantly relating to positive teacher behaviours and students' outcomes. In view of the increasing trend towards the investigation into the cross-cultural validity of teacher efficacy measures, the aim of this study is to examine the psychometric properties of the Chinese version of 12-item Teachers' Sense of Efficacy Scale (TSES) in Hong Kong educational context. In particular, the factorial validity and the internal consistency reliability were tested by confirmatory factor analysis and Cronbach's Alpha test, respectively. A total of 447 secondary school teachers participated in this study. The results indicated teachers' individual efficacy beliefs were best represented by three factors (efficacies for instructional strategies, classroom management, and student engagement) instead of either one factor or two factors. These three factors could be further collapsed into one general dimension. Moreover, three subscales showed good internal consistency reliability. Therefore, the Chinese version of 12-item TSES is a valid and reliable measure to teacher efficacy of Hong Kong in-service teachers. Given that there is rich evidence of the construct validity of TSES in the West, this study provides additional support of it in East Asian countries, like Hong Kong.

Keywords: teacher efficacy scale, factorial validity, reliability, confirmatory factor analysis, Hong Kong

I. INTRODUCTION

The research on teacher efficacy has captured the attention of many educational scholars in recent decades. It is because it has proved to be significantly related to favourable teachers' and students' outcomes. Teacher efficacy is defined as teacher's belief in his or her abilities to bring about the valued outcomes of student learning, achievement, and engagement (Tschannen-Moran & Woolfolk Hoy, 2001). It has positive effects on teachers' instructional practice, classroom management, well-being, and job retention. Specifically, regarding instructional practice, teachers with a higher sense of efficacy have more positive attitudes toward the subject (Rubeck & Enochs, 1991). They are likely to prepare well about the lesson and enthusiastic in teaching (Allinder, 1994; Muijs & Reynolds, 2001). In order to promote student learning, they tend to implement more effective instructional strategies such as small group techniques (Chacón, 2005), cooperative learning (Dutton, 1990), constructivist-based teaching (Temiz & Topcu, 2013), and differentiated instruction (Dixon, Yssel, McConnell, & Hardin, 2014). They are more willing to try innovative methods (Cousins & Walker, 2000; Nie, Tan, Liau, Lau, & Chua, 2013; Pan & Franklin, 2011). Their teaching goals are to promote student development instead of covering the curriculum (Brookhart & Loadman, 1993). They are less likely to criticize students and more persistent in following up on student wrong answers (Ashton & Webb, 1986; Gibson & Dembo, 1984). With reference to classroom management, teachers with a higher sense of efficacy are likely to foster student independence (Midgley, Feldlaufer, & Eccles, 1988) and actively handle student behavioural problems (Korevaar, 1990). They seldom use custodial methods to manage the class (Woolfolk & Hoy, 1990). They tend to react with

warmth instead of hostility when students show frustration (Newberry & Davis, 2008; Panik, 2010). They are more likely to set learning goals instead of performance goals (Wolters & Daugherty, 2007). Concerning teachers' well-being and job retention, teachers with a higher sense of efficacy have higher self-esteem (Huang, Liu, & Shiomi, 2007), better health (Schwerdtfeger, Konermann, & Schönhofen, 2008), greater teaching commitment (Coladarci, 1992), less burnout (García-Ros, Fuentes, & Fernández, 2015), and higher job satisfaction (Høigaard, Giske, & Sundslid, 2011). They are less likely to leave the profession (Martin, Sass, & Schmitt, 2012).

Besides, teacher efficacy is important to cognitive, behavioural, and affective development of students. Higher teacher efficacy contributes to student achievement in certain subjects such as reading, language arts, social studies, and mathematics (Anderson, Greene, & Loewen, 1988; Ashton & Webb, 1986; Cantrell, Almasi, Carter, & Rintamaa, 2013; Chang, 2015; Guo, Connor, Yang, Roehrig, & Morrison, 2012; Mojavezi & Tamiz, 2012; Ross, 1992). It enhances motivation (Nelson, 2008) and self-esteem (Borton, 1991) of students. It helps students to develop higher academic efficacy (Bagaka's, 2011), less delinquent behaviours (Sørli & Torsheim, 2011), and more positive attitudes toward schools and teachers (Jimmieson, Hannam, & Yeo, 2010; Tai, Hu, Wang, & Chen, 2012). Despite a substantial body of evidence supports the positive influence of teacher efficacy on teachers and students, one cannot make any claim about these effects if valid measures to teacher efficacy are lacking. Thus, the validity of different existing teacher efficacy scales has been frequently examined.

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The TSES (Tschannen-Moran & Woolfolk Hoy, 2001) is regarded as one of the most promising measures to teachers' efficacy beliefs in the West. Historically, teacher efficacy instruments were developed under the influence of either Rotter's (1966) locus of control theory or Bandura's (1977) social cognitive theory. According to the Rotter's locus of control theory, human behavior is affected by generalized expectancies that outcomes are determined either by one's action or by external forces beyond one's control. The first measure of teacher efficacy was developed by the researchers from the RAND organization (Armor et al., 1976, p.84) and comprised two items: "When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environment." (Item 1) and "If I really try hard, I can get through to even the most difficult or unmotivated students." (Item 2). Teacher efficacy was measured by summing scores on these two items. However, the reliability of two-item scale had been questioned by some researchers. They then constructed longer and more comprehensive scales such as 28-item Teacher Locus of Control Scale (Rose & Medway, 1981), 30-item Responsibility for Student Achievement Scale (Guskey, 1981), and 7-item Webb Efficacy Scale (Ashton, Olejnik, Crocker, & McAuliffe, 1982). On the other hand, Bandura's social cognitive theory states that human functioning results from dynamic interplay among personal, behavioural, and environmental factors. In the conception of reciprocal determination, these three factors all operate as interacting determinants that affect one another bidirectionally. In fact, self-efficacy is regarded as one of the personal factors. It is defined as the "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainment" (Bandura, 1997, p.3). Teacher efficacy has been identified as one type of self-efficacy. Several measures to it were developed, such as 16-item Teacher Efficacy Scale (Gibson & Dembo, 1984) and 30-item Bandura's Teacher Self-Efficacy Scale (Bandura, 1997). Although many instruments were available to examine teacher efficacy, their validity were questioned by Tschannen-Moran and Woolfolk Hoy (2001), who pointed out the conceptual and methodological problems of these instruments. They then constructed the TSES based on Bandura's Teacher Self-Efficacy Scale. They applied the TSES to in-service and preservice teachers and examined the factorial validity of TSES using exploratory factor analysis (EFA). Afterwards, the final version of both TSES 24-item long form and 12-item short form were developed. They consisted of three subscales: "efficacy for instructional strategies", "efficacy for classroom management", and "efficacy for student engagement". The TSES is still the most frequently used measure to teachers' efficacy beliefs at the present time (Wyatt, 2014). It is thought to be superior to other measures because it has a stable factor structure and captures the wide range of capabilities related to good teaching (Hoy & Spero, 2005). Indeed, the construct validity of TSES has gained much empirical support in Western countries such as North America, England, Italy, Spain, Greek, and Turkey (e.g., Arata & Soto, 2012; Biasi, Domenici, Capobianco, & Patrizi, 2014; Di Fabio & Taralla, 2006; Fives & Buehl, 2010; Gibbs & Powell, 2012; Klassen et al., 2009; Shoulders & Krei, 2015; Tsigilis, Koustelios, & Grammatikopoulos, 2010). Moreover, the TSES is applicable

to assess capability beliefs of teachers in various contexts such as preservice teachers (Jamil, Downer, & Pianta, 2012), in-service teachers (Putman, 2012), early childhood teachers (Epstein & Willhite, 2015), special education teachers (Sarıçam & Sakız, 2014), and gifted education teachers (Reilly, 2015). In view of the fact that the TSES was developed in the West, the cross-cultural validity of it has been investigated in Asian countries.

Although the construct validity of TSES has gained empirical support in East Asian countries such as Korea, Singapore, Japan, and China, the three-factor structure of TSES has not been found in Hong Kong. Klassen et al. (2009) examined the cross-cultural validity of TSES across five countries including United States, Canada, Cyprus, Korea, and Singapore. They carried out multi-group confirmatory factor analysis and found evidence of measurement invariance and reliability across five countries. Nie, Lau, & Liao (2012) revised the TSES and then examined its factorial and predictive validity, and reliability. They showed the TSES to be a valid scale to assess teachers' efficacy beliefs in Singaporean context. Ruan et al. (2015) tested the stability of TSES across three East Asian countries including China, Korea, and Japan. Even though they found evidence of acceptable fit for the short form TSES, they further revised it and examined its factorial validity. They found the revised model had better model-data fit. Moreover, the results of multi-group confirmatory factor analysis revealed the measurement invariance of the scale across three countries. Consequently, the TSES can be used to assess teachers' efficacy beliefs in diverse cultural contexts. However, validation studies of the TSES for Hong Kong school teachers have failed to replicate the three-factor structure of TSES. Since the Chinese version of the 12-item short form TSES (C-TSES) has been developed by Kerry John Kennedy in 2004, its factorial validity was investigated in four studies. Kennedy and Hui (2006) administered the C-TSES to a group of 228 Hong Kong primary in-service teachers so as to measure the effectiveness of curriculum leadership training programme. Two factors, namely "efficacy in learning and teaching" and "efficacy in classroom management" were extracted by EFA with principal component analysis. In view of the paucity of the investigation into teacher efficacy of Hong Kong in-service teachers, Cheung (2006) applied the C-TSES to a group of 725 Hong Kong primary in-service teachers. Only one factor, namely general teacher efficacy, was extracted by the same factor analytic method. This result was also found in Cheung's (2008) study, which aimed to examine the differences in teacher efficacy between Hong Kong and Shanghai in-service teachers. Instead of using in-service teachers as participants, Hui, Kennedy, and Cheung (2006) applied the C-TSES to a group of 132 Hong Kong and Macao pre-service teachers. Two factors, namely "efficacy in learning and teaching" and "efficacy in classroom management" were extracted by EFA. Regarding the inconsistency of findings on the factor structure of C-TSES, Tsui and Kennedy (2009) addressed the translation adequacy of C-TSES and revised it. Then they applied the revised C-TSES to a group of 173 Hong Kong in-service primary teachers. However, two factors, namely "efficacy for teaching and support" and "efficacy for classroom

management” were identified by EFA with principal axis factor analysis. As a result, additional testing and validation are required before the TSES can be used as an appropriate tool to assess teacher efficacy of Hong Kong school teachers.

The purpose of this study is to employ the use of confirmatory factor analysis (CFA) to investigate the factorial validity of TSES in Hong Kong educational context. Prior research mainly used EFA to provide the preliminary idea about the dimensionality of C-TSES. Nevertheless, the final determination regarding the underlying factor structure of C-TSES should not exclusively based on EFA (Ang, 2005). More rigorous methods of statistical analysis such as confirmatory factor analysis are warranted (Gorsuch, 1983; Thompson & Daniel, 1996). In the present investigation, a three-factor model of original TSES was tested and compared with two-factor, one-factor and null models. Moreover, a second-order three-factor model was compared with the one-factor model.

II. METHOD

Sample

Participants were 447 full-time in-service secondary school teachers in Hong Kong. They came from 11 schools which were drawn through stratified random sampling. The population of 454 secondary schools has been divided into four strata according to their locations in Hong Kong. Three schools were then randomly selected from each stratum. One school dropped out of the study, leaving a total of 11 schools in the final sample. Totally 189 participants were males and 241 were females (17 cases unreported). Their ages ranged from 23 to 60 years ($M=38.5$ years, $SD=9.72$) with 61 cases unreported. Their teaching experience ranged from 1 to 39 years ($M=14.5$ years, $SD=9.24$) with 26 cases unreported. All participants were teaching staffs. Only 15.3% teachers were also responsible for administrative works (e.g., panel head).

Measure

The C-TSES was selected for this study. It was constructed from the original TSES through translation and back-translation procedures (Kennedy & Hui, 2004). Consistent with the three-factor structure of TSES, the C-TSES was designed to measure 3 factors of teacher efficacy, namely efficacy for instructional strategies (4 items; e.g., “How much can you do to implement alternative strategies in your classroom?”), efficacy for classroom management (4 items; e.g., “How much can you do to calm a student who is disruptive or noisy?”), and efficacy for student engagement (4 items; e.g., “How much can you do to help your students value learning?”). It was found to have good internal consistency reliability ranging from .87 to .95 (Cheung, 2006, 2008; Hui et al., 2006). Respondents were asked to indicate their level of agreement with each item on a 9-point Likert scale, ranging from 1 (nothing) to 5 (some influence) to 9 (a great deal). Besides, teachers’ background information, such as age, sex, years of teaching, and positions held in the school, were asked. All responses were collected anonymously.

Procedure

The C-TSES were administered to all teachers in the school. Their participation in this study was voluntary. Also, they

were assured that their data would be confidential and used for research purpose only.

Models Tested

Four factor models were postulated and tested against the null model. The first model (Model 1) was based on the results of Cheung (2006, 2008), who found that the internal structure of C-TSES could be sufficiently represented by only one general factor. Therefore, Model 1 examined was one-factor model. The second model (Model 2) was based on the results of Hui et al. (2006), Kennedy and Hui (2006), and Tsui and Kennedy (2009), who found that the internal structure was best described by two factors. One factor included all items which were originally classified as two distinct subscales: efficacy for instructional strategies and efficacy for student engagement in the TSES. Another factor contained all items which were originally classified as the efficacy for classroom management subscale in the TSES. Two factors were highly correlated. Thus, Model 2 tested was two-factor correlated model. The third model (Model 3) was based on the three-factor correlated model of the original TSES. The fourth model (Model 4) was based on the results of Nie et al. (2012), who found that three first level factors: efficacy for instructional strategies, efficacy for classroom management, and efficacy for student engagement could be collapsed into one general dimension. Thus, Model 4 tested was the second-order three-factor model. The fifth model (Model 5) was the null model in which all C-TSES items were specified to be uncorrelated and no common factor was postulated to underlie them.

Data analysis

CFA using LISREL 8.54 (Jöreskog & Sörbom, 1996) was used to examine the viability of the hypothetical factor models of C-TSES. Given that the data departed from multivariate normal distribution (Mardia’s multivariate skewness estimate = 2196.7, $p < .001$ and normalized kurtosis estimates = 60.86, $p < .001$; the plot of data in Q-Q plot did not produce a straight line passing through the origin at a 45° angle with the horizontal axis (See Appendix)) (Khattree & Naik, 1999), the robust maximum likelihood method (RML) was applied for all the CFA model estimation in this study (see Finney & Distefano, 2006). The fit of the postulated models was assessed based on the Satorra-Bentler Scaled Chi square ($SB\chi^2$) to degrees of freedom (df) ratio ($SB\chi^2/df$): < 5.00 = reasonable fit (Byrne & Shavelson, 1987); the standardized root-mean-square residual (SRMR): $< .08$ = a good fit (Hu & Bentler, 1999), the root-mean-square error of approximation (RMSEA): $< .05$ = a close fit, $.05 - .08$ = a fair fit, $.08 - .10$ = a mediocre fit, and $> .10$ = a poor fit (MacCallum, Browne, & Sugawara, 1996); the non-normed fit index (NNFI): $> .90$ = acceptable fit (Bentler & Bonett, 1980), the comparative fit index (CFI): $> .90$ = acceptable fit (Bentler & Bonett, 1980). In order to compare the competing and null models, the Akaike’s information criterion (AIC) was used. The model with the smaller value of AIC represented a better fit to the data (Hu & Bentler, 1995).

III. RESULTS

Table 1 presents the CFA results for Model 1 to Model 5. When comparing Model 3 with Models 1, 2, and 5, Model 3

had the smallest AIC value. Thus, Model 3 was superior to the two other models and the null model. Inspection of other fit indices indicated that Model 3 provided the adequate fit to the data. Consequently, the factor structure of C-TSES was best represented by three-factor correlated model for Hong Kong in-service teachers. Table 2 presents the factor loadings of items. All factor loadings were higher than .40 and significant ($p < .05$). Descriptive statistics, reliability, and inter-factor correlations of three factors were shown in Table 3. Three subscales showed good internal consistency reliability (a ranged from .76 to .87). Moreover, they were highly correlated (r ranged from .60 to .76).

Table 1: Fit indices of five models

	SB χ^2	df	SB χ^2 /df	NNFI	CFI	RMSEA	SRMR	AIC
Model 1	455.0	54	8.43	.84	.87	.130	.093	503.0
Model 2	237.5	53	4.48	.92	.93	.088	.069	287.5
Model 3	159.2	51	3.12	.94	.95	.069	.065	213.2
Model 4 ^a	160.2	52	3.08	.94	.95	.068	.065	212.2
Model 5	3369.9	66	51.06	.51	.51	.335	.390	3393.9

Note: SB χ^2 = Satorra-Bentler Scaled Chi square; df = degrees of freedom; SB χ^2 /df = Satorra-Bentler Scaled Chi square to degrees of freedom ratio; NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root-mean-square error of approximation; SRMR = standardized root-mean-square residual; AIC = Akaike's information criterion.

^a In order to assure that the second-order level of this model is over-identified, the variances of two latent factors (efficacy for classroom management and student engagement) were constrained to be equal. It is because their variances were found to be nearly the same in the analysis of Model 3 (see Byrne, 1998, p.172-173)

Table 2: Factor loadings of 12 items of C-TSES

Manifest variables	Factor Loadings (Standardized)			M (SD)
	CM	SE	IS	
1.How much can you do to control disruptive behaviour in the classroom?	.71			6.42 (1.49)
6.How much can you do to get children to follow classroom rules?	.83			6.59 (1.29)
7.How much can you do to calm a student who is disruptive or noisy?	.81			6.19 (1.50)
8.How well can you establish a classroom management system with each group of students?	.83			6.03 (1.47)
2.How much can you do to motivate students who show low interest in schoolwork?		.76		5.42 (1.43)
3.How much can you do to get students to believe they can do well in schoolwork?		.80		5.75 (1.39)
4.How much can you do to help your students value learning?		.81		5.70 (1.44)
11.How much can you assist families in helping their children do well in school?		.45		5.20 (1.55)
5.To what extent can you craft good questions for your students?			.64	6.11 (1.24)
9.To what extent can you use a variety of assessment strategies?			.70	5.66 (1.40)
10.To what extent can you provide an alternative explanation or example when students are confused?			.62	6.79 (1.21)
12.How well can you implement alternative strategies in your classroom?			.68	5.80 (1.27)

Note: CM = efficacy for classroom management; SE = efficacy for student engagement; IS = efficacy for instructional strategies; M = mean; SD = standard deviation. All factor loadings estimates are significant at .05 level.

Table 3: Factor means, SD, reliability, and inter-factor correlations

	Inter-factor correlation			M	SD
	CM	SE	IS		
CM	1.00 (.87)			6.31	1.23
SE	.60	1.00 (.78)		5.52	1.13
IS	.71	.76	1.00 (.76)	6.09	0.97

Note: CM = efficacy for classroom management; SE = efficacy for student engagement; IS = efficacy for instructional strategies; M = mean; SD = standard deviation. All inter-factor correlation estimates are significant at .05 level. Values in the parentheses are reliability (Cronbach's alpha). The reliability of total scale of teacher efficacy was .89.

When comparing Model 4 with Model 1 and 5, Model 4 had the smallest AIC value. As a result, Model 4 was superior to Model 1 and the null model. Inspection of other fit indices indicated that Model 4 provided the adequate fit to the data. Therefore, the second-order three-factor model (Fig.1) was appropriate for describing the structure of teacher efficacy for Hong Kong in-service teachers.

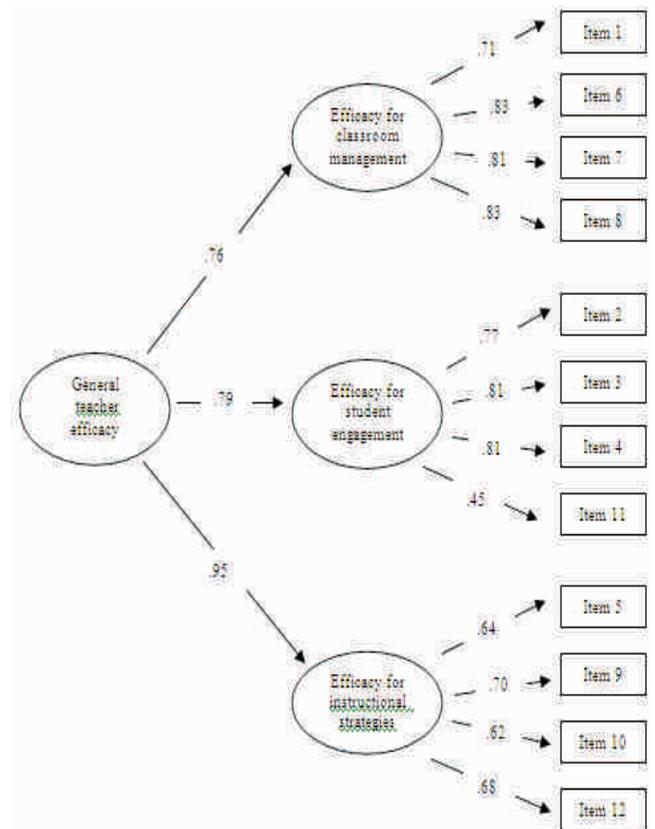


Fig. 1 Second-order, three-factor model of C-TSES. Entries are completely standardized estimates.

IV. DISCUSSION

This study aims to examine the psychometric properties of C-TSES. We found that the C-TSES comprised three factors and three subscales showed strong internal consistency reliability. Thus, the present findings provide convincing evidence of good psychometric properties of C-TSES.

CFA results supported the specificity of teacher efficacies on different teaching tasks. Instead of one-factor structure, the three-factor structure found in this study showed the adequate fit to the data. This factor structure is consistent with Tschannen-Moran and Woolfolk Hoy (2001)'s original conceptualization and the findings of validation studies conducted in countries outside United States (e.g., Arata & Soto, 2012; Biasi et al., 2014; Tsigilis et al., 2010). This finding further supports the stability of the factorial structure of TSES across different countries and cultures. Tsui and Kennedy (2009) found that the internal structure of C-TSES was best represented by two factors (one factor was the blend of efficacies for instructional strategies and student engagement, another factor was efficacy for classroom management) instead of three for Hong Kong in-service teachers. They explained their findings by means of Chinese-Confucian heritage and further suggested the need to take the cultural dimension into account when studying teachers' efficacy beliefs. However, the results of the present study, the study of Ruan et al. (2015) and the study of Klassen et al. (2009) indicate that the TSES is a culturally robust instrument which can be used to measure in-service teachers' efficacy beliefs in both Western and Asian countries.

Consistent with the findings in the study of Tschannen-Moran and Woolfolk Hoy (2001) and Nie et al. (2012), the second-order three-factor structure was found in this study. As it is superior to one-factor structure, the internal structure of TSES is also best represented by three task-specific factors and these factors can be further collapsed into one general factor. Therefore, the total score and three subscale scores could be calculated. In view of the increase in the use of the general teacher efficacy score to predict teachers' burnout, commitment, and job satisfaction (e.g., Chan, 2008; Chan et al., 2008; Moe, Pazzaglia, & Ronconi, 2010), the total score derived from three subscale scores is justified to use in regression analysis.

The present study employed the use of robust maximum likelihood estimation in CFA analysis. This practice is important because RML can adjust the chi-square (tends to be overestimated) and standard errors (tend to be underestimated) in the case of nonnormally distributed data. In fact, multivariate non-normality is usually taken into account in teacher efficacy research (e.g., Khani & Mirzaee, 2015; Ruan et al., 2015). The skewed distribution of TSES responses may due to a strong upward bias in teachers' self-reported efficacy beliefs (Heneman, Kimball, & Milanowski, 2006). Therefore, it is better for researchers in teacher efficacy to assess the multivariate normality of data before conducting any analysis with the use of structural equation modelling.

The present study provides empirical evidence of the factorial validity of C-TSES in Hong Kong educational context. Future research may need to further establish the construct validity of C-TSES by investigating the association of the C-TSES with external criteria such as burnout and job satisfaction. Moreover, the convergent and discriminant validity of C-TSES could be tested by examining the correlations among three subscales and specific related measures such as Behaviour management strategies scale and Instructional strategies scale, and Motivational strategies scale (see Nie et al., 2012).

V. CONCLUSION

The current results support the validity and reliability of the C-TSES. It is appropriate for use to assess teachers' efficacy beliefs of Hong Kong in-service teachers. Also, second-order CFA confirmed that three subscales of the C-TSES could be collapsed into one general dimension. The composite score of three subscales can be used as a valid predictor of teacher job satisfaction, commitment and burnout.

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APPENDIX

The Q-Q plot of C-TSES responses

