

Construct Validity to Examine the Latent Traits of Teacher Self-Efficacy Instrument

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Abstract

Teacher efficacy is an important debatable subject concerning its definition and measure. The purpose of this study was to evaluate the construct and convergent validity of Tschannen-Moran and Hoy (2001)'s 'Teacher Self-Efficacy Scale (TSES)'. The study used the short version (12-item) TSES scale and Teacher Efficacy Scale (TSE) developed by Gibson and Dembo (1984) as an alternative measure. Total 412 in-service public school teachers from four provinces of Pakistan were selected including 242 (58.74%) female and 170 (41.26%) male teachers. The results show that Principal Axis Factoring yielded three factors, accounting for 64% of the total variance. The factor loading ranged from .50 to .89. Communalities were in the range of 0.54 to 0.77 with an average of 0.64. There was significant a correlation between two efficacy measures, $r(410) = .58, p < .001$. Parallel analysis using 1000 sets of simulated data also suggested three factors of the TSES measure for in-service teachers. Female teachers tend to have higher sense of efficacy than male teachers. The findings of this study provide useful information about to psychometric properties of teacher efficacy scale which further encourages researchers to revise teacher efficacy scale for more reliable and valid measurement.

Keywords: Teacher efficacy, validity, factor analysis, in-service teachers

INTRODUCTION

The measurement of teacher's efficacy continues to interest psychometricians and efficacy experts for last four decades. Mainly, efficacy measure is grounded on one of the two most famous theories: Rotter's Social Learning Theory (Rotter, 1966) and Bandura's Social Cognitive Theory (Bandura, 1977). Rotter's (1966) social learning theory is based on internal and external locus of control beliefs. The concept of teachers with internal locus of control belief is defined as the teachers who believe that they have the abilities to teach unmotivated students and student's success/failure all depends on teacher's own controlled abilities. Whereas, teachers with external locus of control believe that the external classroom environment has more impact on student's learning than their own teaching abilities (Rotter, 1966).

Bandura's social cognitive theory (1977) is defined as individuals "function as contributors to their own motivation, behavior, and development within a network of reciprocally interacting influences" (Bandura, 1999, p. 169). In addition to other applications of social cognitive theory, self-efficacy is the main characteristic of this theory. Bandura's (1977) theory provides conceptual foundation for researchers to develop teacher efficacy measure. Bandura (1977)

defined self-efficacy as personal judgment of possessed capabilities for implementing course of actions to accomplish desired goals.

There have been several attempts made to develop teacher efficacy measure (RAND, 1976; Guskey, 1981; Webb Scale Ashton et al., 1982) which are based on Rotter's social learning theory (Rotter, 1966) and (Gibson and Dembo, 1984; Bandura, 1997; and Tschannen-Moran and Woolfolk Hoy, 2001) which are based on Bandura's social cognitive theory (Bandura, 1977). Bandura's Social Cognitive Theory (1977) is the main foundation of teacher efficacy and the theoretical foundation on which teacher efficacy is constructed.

Tschannen-Moran and Woolfolk-Hoy (1998) provided a definition of teachers' sense of self-efficacy as, "capabilities to organized and execute courses of action required to successfully accomplish a specific teaching task in a particular context" (p.233). Several researches have been conducted to develop teacher efficacy scales (Cantrell, Young, & Moore, 2003; Plourde, 2002). One of the most useful teacher efficacy instruments is the Teacher Sense of Efficacy Scale (TSES; Tschannen-Moran and Woolfolk Hoy, 2001) which is widely used by educational researchers to measure teachers' sense of efficacy and to evaluate the psychometric properties of the TSES for their specific population. However, in Pakistan the research regarding the measurement of teacher efficacy is relatively in initial stage. There has not been conducted any such teacher efficacy validation study so far. Therefore, the purpose of this study is to investigate the psychometric properties of the TSES as it serves as the major teacher efficacy instrument until now.

THEORETICAL FRAMEWORK

Teacher efficacy is an important debatable subject regarding its definition and measure (Tschannen-Moran et al., 1998). Tschannen-Moran and Woolfolk Hoy (2001) developed the TSES scale to measure the teachers' sense of efficacy with three sub-scales: student engagement, classroom management, and instructional practices. The TSES was developed by three separate samples. Originally, there were 52 items in TSES scale then Tschannen-Moran and Woolfolk Hoy (2001) proposed final extracted solution that included 18 retained items to measure three factors. These three factors were labeled as: efficacy in Instructional Practices, efficacy in Student Engagement, and efficacy in Classroom Management. These three factors explained aggregated 57% of overall variance and the inter-factor correlations among the three factors were ranging from .59 to .64. Score reliabilities were .82, .81, and .72, respectively. After adding more items for classroom management, finally the TSES was developed a short-form (12-item) and a long-form (24-item) of the measure. The validity of the TSES was demonstrated in the original study for US population. In their analyses, Tschannen-Moran and Woolfolk-Hoy (2001) assessed the factor structure, reliability, and validity of the TSES scale. They used samples of in-service ($n = 255$) and pre-service ($n = 111$) teachers and extracted a three-factor solution for in-service teachers but not for the pre-service teachers. The data for the pre-service teachers produced a one factor solution. This finding reflected the fundamental difference in the underlying factor structure of teachers' efficacy between in-service and pre-service teachers. Tschannen-Moran and Woolfolk Hoy (2001) proposed three-factor TSES model for in-service teachers and one-factor TSES model for pre-service teachers. However, Charalambous, Philippou, and Kyriakides's (2008) study found two-factor solution for pre-school teachers. In one study, Campbell (1996) found that in-service teachers in Scotland and the United States reported significantly higher efficacy beliefs than pre-service teachers.

There have been several attempts made to evaluate the constructs of the TSES for pre-service and in-service teachers in different countries (Fives & Buehl, 2010). Roberts and Henson (2000) tested two-factor model along with a confirmatory factor analysis approach for adequate theoretical prospects about the availability of different factors in the data. Under their proposed model, including three competing models, together with a single-factor model, a three-factor model was derived from modification of some other models. The hypothesized model proposed by Robert and Henson (2000) provided quit well fit of data as indicated by fit indices (CFI = .937, NFI = .876, GFI = .917, RMSEA = .057). These fit indices indicate acceptable data model under the criteria provided by Hu and Bentler's (1999) fit indices criteria to retain a model.

Klassen, Bong, Usher, Chong, Haun, Wong, and Georgiou (2009) evaluated the validity of the TSES in five countries: Canada, United States, Korea, Singapore, and Cyprus. They used the 12-item short form in their study. However, they used the translated versions of the TSES. The reliabilities of the composite scores of the TSES for Canada, United States, Korea, Singapore, and Cyprus were .83, .87, .92, .94, and .89 respectively. The results indicated that the factor structure of the TSES is not only valid for the teachers of the United States but also a valid efficacy instrument for Canadian, Korean, Singaporean, and Cyprus teachers.

Research indicates that teacher sense of efficacy is significantly related to student achievement (Holzberger, Philpp, & Kunter, 2013; Skaalvik & Skaalvik, 2007; Tracz & Gibson, 1986) and principal behavior (Walker & Slear, 2011). Teacher self-efficacy is also linked to teacher job satisfaction (Klassen & Chiu, 2010). When reviewing the literature, the female teachers' sense of efficacy is reportedly higher than male teachers. Ahmad, Khan, and Rehman's (2015) study found a significant difference between male and female teachers at the elementary level, $t(60) = 3.14, p = .002$ using the TSES composite scores.

OBJECTIVES

The objectives of this study was to evaluate convergent and construct validity of Tschannen-Moran and Woolfolk Hoy (2001)'s 'Teacher Self-Efficacy Scale (TSES)' also known as 'Ohio State Teacher Efficacy Scale (OSTES)' in the context of Pakistani in-service teacher population.

RESEARCH QUESTIONS

The main focus of this study was to validate the TSES scale and to examine the factor structure of the TSES. The research was guided by the following research questions:

1. How many factors in the TSES can be extracted with in-service teachers?
2. Do the items function sufficiently within a scale-level internal consistency framework?
3. Is there any significant difference in teacher efficacy belief between male and female teachers?

METHODOLOGY

Participants

Participants in this study were in-service teachers, who teach various subjects in different grade levels in Pakistani public schools. The sample size for this study consisted of 412 in-service teachers from all provinces of Pakistan (see Table 1). There were 242 (58.74%) female teachers and 170 (41.26%) male teachers. 58% participants had B. Ed degree, 29.37% had M. Ed degree, and 1.46% had M.S. degree. Teachers were from primary (N = 51), elementary (N = 69), secondary (N = 159), and university (N = 117) levels. According to Table 1, participants were from various teaching experiences groups: 16.26% teachers had less than two years teaching experience, 19.42% teachers had three to five teaching experience, 23.54%

participants had 6 to 8 years teaching experience, 16.26% teachers had 9 to 12 years teaching experience, 17.48% teachers had 13 to 20 years teaching experience, while around 7% participants had more than 20 years teaching experience.

Table 1: Background Characteristics of the Validation Sample (N = 412)

Gender	Frequency	Percentage
Male	170	41.26
Female	242	58.74
Professional Qualification		
B. Ed	240	58.25
M. Ed	121	29.37
M. Phil / MS	6	1.46
None	45	10.92
Teaching Experience		
Less than or 2 years	67	16.26
3 to 5 years	80	19.42
6 to 8 years	97	23.54
9 to 12 years	67	16.26
13 to 20 years	72	17.48
more than 20 years	29	7.04
Teaching at grade level		
Primary	51	12.38
Elementary	69	16.75
Secondary School	159	38.59
College/University	117	28.4
Does not apply	16	3.88
Province		
Sindh	107	25.97
Baluchistan	59	14.32
Punjab	112	27.18
KPK	64	15.53
FATA	29	7.04
ICT	32	7.77
AJK	9	2.18

Instruments

Teacher Sense of Efficacy (TSES; Techannen-Moran and Woolfolk Hoy, 2001). The latest instrument to measure teacher efficacy level is developed by Techannen-Moran and Hoy, (2001) called 'Teacher Self-Efficacy Scale (TSES)' also known as 'Ohio State Teacher Efficacy Scale (OSTES)'. TSES instrument was used in this study with original set of items to measure the teacher's belief about their teaching practices in the context of Pakistani schools. There are two versions of TSES scales: short version consists of 12 items and long version consists of 24 items. Fives and Buehl (2010) study found that means and reliability for both the short and long forms are similar to what was found in the Tschannen-Moran and Woolfolk Hoy (2001) validation study. They suggested that either the short or long form can be used for in-service teachers (Fives & Buehl, 2010). Therefore, the short version of the TSES scale was used in this study. The 12-items short version TSES scale has rate efficacy level for each of the three sub-scales of teaching (i.e., Classroom Management, Instructional Strategies, and Student Engagement). Each sub-scale contains four items. Each item is at 9-point Likert-type scale ranging from 1 (nothing) to 3 (very little) to 5 (some influence) to 7 (quite a bit) to 9 (a great deal). Higher values indicate higher level of sense of efficacy. The internal consistency reliabilities of each subscale and composite TSES are reported in Table 2.

Table 2: Correlation Matrix for 12-item TSES scale with Mean and Standard Deviation

		Pearson Correlation Coefficients, N = 412											
	1	2	3	4	5	6	7	8	9	10	11	12	
<i>M</i>	7.48	7.15	7.13	7.15	7.37	7.43	7.47	7.33	7.20	7.25	6.84	7.40	
<i>SD</i>	1.35	1.30	1.43	1.29	1.32	1.36	1.38	1.17	1.32	1.34	1.74	1.42	
Item1	1.00												
Item2	0.45	1.00											
Item3	0.38	0.54	1.00										
Item4	0.39	0.64	0.50	1.00									
Item5	0.33	0.51	0.30	0.48	1.00								
Item6	0.57	0.28	0.23	0.29	0.26	1.00							
Item7	0.48	0.32	0.27	0.29	0.25	0.51	1.00						
Item8	0.36	0.34	0.44	0.37	0.38	0.46	0.48	1.00					
Item9	0.25	0.47	0.32	0.48	0.58	0.34	0.41	0.49	1.00				
Item10	0.39	0.53	0.40	0.48	0.45	0.44	0.40	0.41	0.58	1.00			
Item11	0.46	0.49	0.41	0.56	0.33	0.33	0.43	0.39	0.33	0.36	1.00		
Item12	0.22	0.40	0.41	0.38	0.25	0.19	0.41	0.23	0.35	0.56	0.50	1.00	

Teacher Efficacy Scale. Gibson and Dembo (1984) developed a 30-item teacher efficacy scale with two factors: Personal Teaching Efficacy (PTE) and General Teaching Efficacy (GTE). The TES instrument was appropriate with 16-item based on significant loadings on of the factor (i.e., PTE & GTE). The original study yielded internal consistency reliabilities of .78 for 9-item Personal Teaching Efficacy (PTE) factor and .75 for 7-item General Teaching Efficacy (GTE) factor (Gibson & Dembo, 1984). Personal Teaching Efficacy works as a different factor than general teaching efficacy. In this study, 9-item Personal Teaching Efficacy subscale was used ranging from 1 (Strongly Disagree) to 6 (Strongly Agree). Higher levels indicate higher level of agreement on the teaching efficacy beliefs. This PTE subscale was used because these items seem to closely relate to the TSES (Techannen-Moran and Woolfolk Hoy, 2001). The purpose of this alternative measure was to evaluate the convergent validity of the TSES. The reliability of the PTE in this study was .78.

DATA ANALYSIS

The main focus of this study was to validate the TSES instrument. Exploratory Factor Analysis (EFA) was used as a main analysis procedure for this study. EFA was used to validate the factor structure of TSES scale and to examine the construct validity of the scale. A range of other statistical tests were also used to analyze the data besides EFA procedure. These tests includes: reliability analysis, validity analysis, one-way Multiple Analysis of Variance (MANOVA), and correlation analysis. The data was analyzed using SAS 9.4 (SAS Institute; Cary, NC) software. Statistical significance level was set at .05. Horn's (1965) parallel analysis procedure was used to determine the number of extracted factors instead of the Kaiser-Guttman (1960) rule (eigenvalues >1). Thompson and Denial (1996) recommended parallel analysis as a more sufficient factor extraction procedure that is more useful than traditional factor extraction methods.

RESULTS

The three subscales of the TSES: Student Engagement, Instructional Strategies, and Classroom Management consist of four items averages to create scale score ranging from 0 to 9. Descriptive statistics was used to check the normality assumption of each item and subscale. Item wise correlation matrix with mean and standard deviation is provided in Table 2.

Reliability Analysis

The three subscales of TSES: Student Engagement (ES), Instructional Strategies (IS), and Classroom Management (CM) consist of four items averages to create scale score ranges from 0 to 9. The internal consistency was calculated using Cronbach's alpha. According to Table 3, the reliability coefficients for SE, IS, CM, and general TSES are .81, .77, .79, and .89 respectively. These reliabilities indicate strong reliability with low standard error. Instructional Strategies has the lowest reliabilities among all scale. These reliabilities coefficients are almost consistent with the reliabilities of original study.

Table 3: Scale-Level Internal Consistency Reliability and Standard Error of Measurement (N=412)

		# of items	Mean	Std. deviation	Std. Error	Coefficient Alpha
Student Engagement	2,3,4,11	4	7.07	1.15	0.06	0.81
Instructional Strategies	5,9,10,12	4	7.30	1.04	0.05	0.77
Classroom Management	1,6,7,8	4	7.43	1.03	0.05	0.79
TSES		12	7.27	0.92	0.05	0.89

Inter-Scale Correlation

The Pearson product-moment correlation coefficients among three subscales of the TSES were evaluated. There was significantly strong correlation between Student Engagement (SE) subscale and Instructional Strategies (IS) subscale, $r(410) = .69$, $p < .001$. There was strong positive correlation between Student Engagement subscale and Classroom Management subscale, $r(410) = .57$, $p < .001$; and there was also strong positive correlation between student Instructional Strategies subscale and Classroom Management subscale, $r(410) = .57$, $p < .001$. While each subscale was also highly correlated with the total TSES scale, SE ($r = .88$), IS ($r = .87$), CM($r = .82$).

Convergent Validity

Another teacher efficacy measure was used to evaluate the convergent validity of the TSES. The TSE (Gibson & Dembo, 1984) scale was used as an alternative measure. There was significantly moderate correlation between general efficacy of the (Tschannen-Moran and Woolfolk Hoy, 2001) and Personal Teaching efficacy from (Gibson & Dembo, 1984) TSE scale, $r(410) = .58$, $p < .001$. This result strengthens the convergent validity of the TSES (Tschannen-Moran and Woolfolk Hoy, 2001).

Construct Validity

Principal-axis factoring with promax (oblique) factor rotation method was used for 12-item TSES, allowing for correlated factor loadings given that there were both research-substantiated and hypothesized relationship among scales. The principal-axis factoring of the 12-item yielded three factors with eigenvalues greater than one, accounting for 64% of the variance in the TSES' scores. A scree test also suggested three factors could be extracted.

The parallel analysis using SAS Macro (Kabakoff, 2003) is based on several randomly generated data sets. The eigenvalues of the factor analysis of the original datasets are compared with the mean eigenvalues from the randomly generated datasets. In this study, 1000 simulated data were generated based on real data using parallel analysis (Kabakoff, 2003). According to scree plot, parallel analysis using simulation data also suggests a 3-factors solution. This comparison is shown in scree plot (graph 1).

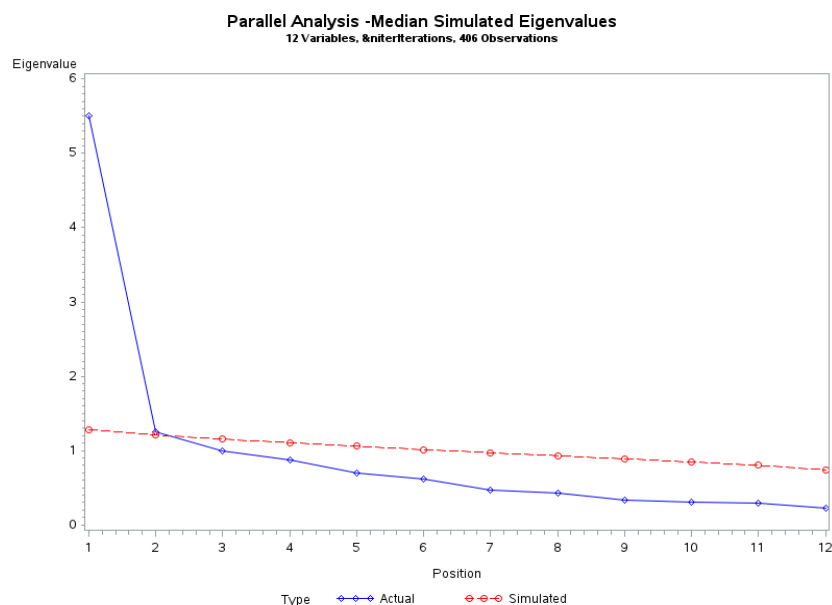


Figure 1. Scree plot of original data and simulated data using parallel analysis for 1000 randomly generated datasets

Preliminary eigenvalues for initial three factors were 5.44, 1.25, and 1.00. Each factor explained 45%, 10%, and 8% of the variance in the total TSES score. Communality values were in the range of .54 to .77 with an average of .64. SAS generated factor loading value of .44 standardized regression coefficients as a criterion for retaining an item in a scale. The factor loadings result are provided in Table 4. The 3-factor solution was largely effective in accounting for the variability in individual item responses, with a range of 54% to 77% of the item-level variability explained by the common factors. The factor loadings ranged from .64 to .77 on student engagement (SE) subscale, .50 to .89 on classroom management (CM) subscale, and .47 to .86 on instructional strategies (IS) subscale. The inter-factor correlation between factor 1 (SE) and factor 2 (CM) was .45, between factor 1 (SE) and factor 3 (IS) was .49, and between factor 2 (CM) and factor 3 (IS) was .40. One item was problematic based on its factor loading. Item-12, “How well can you keep a few problem students from ruining an entire lesson?” was loaded on student engagement factor instead of instructional strategy factor.

Table 4: Rotated Factor Pattern (Standardized Regression Coefficients) of 12-item of the TSES for 3-factor Solutions (N = 406)

		Factor1 (SE)	Factor2 (CM)	Factor3 (IS)
Item12	Instructional Strategies	77*		
Item11	Student Engagement	74*		
Item3	Student Engagement	71*		
Item4	Student Engagement	64*		
Item2	Student Engagement	64*		
Item6	Classroom Management		89*	
Item7	Classroom Management		76*	
Item1	Classroom Management		70*	
Item8	Classroom Management		50*	
Item9	Instructional Strategies			86*
Item5	Instructional Strategies			84*
Item10	Instructional Strategies			47*

Note: Printed values are multiplied by 100 and rounded to the nearest integer. Values greater than 0.440452 are flagged by an '*'.

A one-way MANOVA (Multivariate Analysis of Variance) indicated a significant multivariate effect at $\lambda = 0.05$ in gender, Wilks' $\lambda = .85$, $F(3, 408) = 23.50$, $p < .001$; concluded that there were significant differences among the set of three subscales of the TSES between male and female teachers. The follow-up analysis was conducted using Bonferroni correction to control Type I error rate. The univariate F-test showed significance differences in the efficacy of Student Engagement, $F(1, 410) = 57.00$, $p < .001$; efficacy of Instructional Strategies, $F(1, 410) = 47.89$, $p < .001$; efficacy of Classroom Management, $F(1, 410) = 43.18$, $p < .001$. Descriptive statistics for the scores on three subscales for male and female is reported in Table 5. According to Table 5, female teachers reported higher sense of efficacy than male teachers in all three subscales of the TSES.

Table 5: Descriptive Statistics of the Scores on Three Subscale and Composite TSES Scores for Male and Female Teachers (N=412)

Level of Gender	N	SE		IS		CM		TSES	
		M	SD	M	SD	M	SD	M	SD
Female	242	7.41	1.20	7.59	1.13	7.69	1.04	7.56	1.00
Male	170	6.59	0.88	6.90	0.74	7.05	0.87	6.85	0.57

DISCUSSION

The purpose of this study was to assess the construct and convergent validity of the Teacher Sense of Efficacy Scale (TSES). The three factor structure of the TSES measure the level of teachers' efficacy beliefs in three subareas: Efficacy for student engagement, Efficacy for instructional strategies, and Efficacy for classroom management. The participants were Pakistani public school teachers. Internal consistency coefficients indicated quite well reliability of the instrument. The inter-correlations among three subscales were consistent with the Techannen-Moran and Woolfolk Hoy, 2001 results. The correlation between Personal Teaching Efficacy (Gibson & Dembo, 1984) TSE scale and TSES was significant. The results indicated that 12-item TSES produced three-factor structure and these three factors accounted for 64% of the total variance. These results are consistent with teachers in the USA (Fives & Buehl, 2010; Techannen-Moran & Woolfolk Hoy, 2001) and also for Pakistani teachers (Yousuf Zai & Soomro, 2015). These studies suggested that the three-factor solution for teacher efficacy appears to be more appropriate for practicing teachers. According to analysis, item 12 was loaded on other factor than hypothesized factor. This item "How well can you implement alternative strategies in your classroom?" was supposed to be loaded on Instructional Strategy factor but it loaded on Student Engagement factor. This item needs to be revised/ clearly reworded according to the operational definition of the instructional strategy construct. Result indicates that 15% of the variation in the set of three subscales of the TSES is accounted for by the gender of the teacher. Female teachers tend to have higher sense of efficacy than male teachers in all three subscales of teacher efficacy measure (i.e., student engagement, classroom management, and instructional strategies).

LIMITATION AND IMPLICATION

This study contains several limitations. Firstly, this study was based on short version of the TSES. Secondly, participants were in-service teachers from public school and lastly, there is need to collect larger sample in order to use CFA procedure separately for in-service factor structure changed among job position. Despite the limitations, this study also provides useful information for educators. Teacher efficacy research must deal with the issue of efficacy change. Current evidence suggests that teacher efficacy is indeed flexible. However, increase in teacher efficacy can likely occur by engaging them in meaningful professional development

opportunities. The findings of this study provide useful information about to psychometric properties of teacher efficacy scale which further encourages researchers to revise teacher efficacy scale for appropriately more reliable and valid measurement for specific teacher sub-population. This study can be further extended for pre-service teachers and in-service teachers to see the fundamental difference in the factor structure of the TSES between pre-service and in-service teachers or between private practicing teachers and public practicing teachers.

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