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Assessing Preservice Teachers' Teaching Self-Efficacy and Anxiety: A Structural Equation Modeling Approach

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Abstract. The study examined preservice management teachers' teaching self-efficacy and anxiety about teaching practicum. The correlation design was employed for the study. Through the census survey, the study recruited 120 preservice teachers. The Teacher Sense of Efficacy Scale and Student Teacher Anxiety Scale, validated through Confirmatory Factor Analysis were used to gather data on preservice teachers' teaching self-efficacy and anxiety respectively. Structural Equation Modeling through Smart-Partial Least Squares path modeling algorithm was used to analyse the data. Results showed that preservice teachers' teaching self-efficacy had a significant negative influence on their teaching anxiety. The implication is that teacher educators should focus on increasing preservice teachers' teaching self-efficacy by enhancing their mastery of content and pedagogical knowledge to meet their learning and target needs. Teacher educators can give enough opportunities to preservice teachers to practise teaching during the coursework of the teacher education programme to reduce their teaching anxiety before the start of teaching practicum. This will help to assess their true teaching performance for certification.

Keywords: anxiety, confidence, practicum, preservice teacher, self-efficacy, teaching

Introduction

In the world all over, the training of teachers for schools follows a rigorous structure. This structure is meant to boost the self-confidence of student-teachers being trained to teach various subjects in schools. As part of the structure, student-teachers are taught the content of their prospective subject areas; this provides them with content knowledge. They are also taken through the pedagogy of teaching to develop their knowledge in transmitting content to their students. Teacher educators further equip student-teachers with knowledge in educational psychology, knowing very well the diversities in how learners learn. In all these, student-teachers are prepared to appreciate teaching and to teach confidently when they get the opportunity. The teaching opportunity is provided to the student-teachers through the teaching practice (or teaching practicum) component of the teacher education programme, which assesses their development of relevant teaching skills and readiness to teach. This teaching practice is regarded as the most important component of the entire teacher education programme (Tschannen-Moran, Woolfolk Hoy & Hoy, 1998). It provides teaching experience for student-teachers to go through to appreciate the work of a professional teacher (Smith & Lev-Ari, 2005; Pendergast, Garvis & Keogh, 2011) and helps student-teachers transition smoothly into the teaching profession.

Available evidence (e.g. Ngidi & Sibaya, 2003; Otanga & Mwangi, 2015; Kwarteng, 2018; Önder & Öz, 2018) show that these student-teachers are anxious about the teaching practice component of their teacher education programme. Such teaching anxiety creates the impression that they are not confidently prepared to teach. It is noted that teaching anxiety can stifle student-teachers' creativity in teaching (Burns, 2004), as it focuses their minds on task-irrelevant information that competes with task-relevant information for space in the processing system (Eysenck, 1979). Campbell and Uusimaki (2006) noted that if preservice teachers gain

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adequate knowledge during their coursework, then they are likely to build confidence in themselves (self-efficacy) to teach. DeCleene Huber et al. (2015) realised that subject content knowledge increased confidence in teaching (teaching self-efficacy). Hence, there is a high probability for one to assume an inverse relationship between teaching self-efficacy and teaching anxiety. However, the results of empirical studies on this are not consistent. For example, in USA, Gresham (2008), through the Pearson Product Moment Correlation Coefficient (PPMCC) found a significant negative moderate relationship between mathematics anxiety and mathematics teachers' efficacy. El-Okda and Al-Humaidi (2003) found a negative relationship between preservice teachers' language teaching anxiety and language teaching efficacy. Güngör and Yaylı (2012) employed Spearman's rank correlation coefficient and found that preservice foreign language teachers' teaching anxiety was not related to their teaching self-efficacy. In Turkey, Merc (2015) also found a negative moderate relationship between foreign language student teachers' anxiety and their perceived self-efficacy beliefs. In a recent study, Tahsildar and Kabiri (2019) observed that these variables (self-efficacy and anxiety) were positively related. In a study in Turkey, Peker (2016) adopted Linear Structural Relationship (LISREL) and found that preservice mathematics teachers' teaching anxiety had a significant negative influence on their teaching self-efficacy. Senler (2016) used path analysis, through Analysis of Moment Structures (AMOS) and found a negative influence of preservice science teachers' teaching anxiety on their teaching self-efficacy. It can be observed that both Peker (2016) and Senler (2016) conceptualized teaching anxiety as an exogenous variable. In a different conceptualization, Unlu, Ertekin and Dilmac (2017) through AMOS found out that preservice teachers' self-efficacy toward the teaching of mathematics negatively influenced their mathematics teaching anxiety.

In examining the nexus between teaching self-efficacy and anxiety, the analytical tools mainly used were PPMCC and Structural Equation Modeling (SEM) through AMOS. Most of the quantitative studies (e.g. El-Okda & AlHumaidi, 2003; Çubukçu, 2008; Gresham, 2008; Güngör & Yaylı, 2012; Tsai, 2013; Merc, 2015a; Tahsildar & Kabiri, 2019) on teaching self-efficacy and teaching anxiety only established contradictory correlational findings (positive, negative and no relationship). However, three qualitative studies (Gunning & Mensah, 2010; Szymańska-Tworek, & Turzańska, 2016; Halet & Sanchez, 2017) inferred a causal relationship between teaching self-efficacy and teaching anxiety. It is, therefore, important to validate the aforementioned relationship and to establish the predictive ability of preservice teachers' teaching self-efficacy on their teaching anxiety.

This current study employed SEM through the Smart-Partial Least Squares (Smart-PLS) path modeling algorithm to confirm the relationship between preservice teachers' teaching self-efficacy and teaching anxiety, and to examine the predictive ability of preservice teachers' teaching self-efficacy on their teaching anxiety. The rest of the study is organised into various sections. Following the introduction, the theoretical framework for the study is presented. Next, extant empirical studies are reviewed to situate the current study. The methods employed for the current study are then described. After that, the results that were obtained are presented; this is followed by the discussion of the results. Finally, conclusions are drawn and recommendations made for practice in preservice teacher education.

Theoretical Framework: Self-Efficacy Theory

The self-efficacy theory, developed by Bandura (1997) clearly espouses the specific beliefs individuals have about their coping abilities to execute a task. This belief, he called "self-efficacy". Thus, he defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). Self-efficacy theory postulates that when a teaching task is to be performed by preservice teachers, they will first consider their capacity to perform based on cognitive evaluations

(Sebastian, 2013). When they perceive that they are capable to execute the teaching task (self-efficacy), they are less likely to entertain negative emotional tendencies such as fear, stress or anxiety. This implies that high teaching self-efficacy will reduce teaching anxiety. In this study, teaching self-efficacy is conceptualised as preservice teachers' belief in their capabilities to meet the learning needs of their students. Teaching anxiety is defined as worry, fear and tension expressed by preservice teachers in teaching as they employ various pedagogical strategies in delivering content to students.

The self-efficacy theory supports the use of path analysis in studying the influence of preservice teachers' teaching self-efficacy on their teaching anxiety (Hair, Risher, Sarstedt, & Ringle, 2019). The path analysis is concerned with testing the self-efficacy theoretical framework from a predictive perspective. Prediction and theory testing is the primary focus of PLS-SEM (Shmueli, 2010). The path observed is that teaching self-efficacy is likely to influence teaching anxiety: teaching self-efficacy → teaching anxiety. Hence, the hypothesis formulated is that *preservice teachers' teaching self-efficacy will significantly predict their teaching anxiety*.

From the review, the few studies (e.g. Peker, 2016; Senler, 2016) which examined the causal relationship between teaching self-efficacy and anxiety conceptualised teaching self-efficacy as an endogenous variable and teaching anxiety as an exogenous variable, using mainly SEM through AMOS to examine the relationship. In line with the self-efficacy theory, the current study conceptualised teaching self-efficacy as an exogenous variable and teaching anxiety as an endogenous variable. Those studies (e.g. Okda & Al-Humaidi, 2003; Tahsildar & Kabiri, 2019) which also examined the relationship through PPMCC provided contradictory findings. The PPMCC mostly used in the examination of the relationship is highly influenced by the mean as a centre of distribution (requires normal distribution). Yet, the distribution of scores for most of the studies remained unknown, which could mean that the centre of the distribution might have been affected by outliers. Once the centre (mean) changes, there is the possibility for the relationship to change. Using a different approach to study the relationship will help to clarify the relationship between the two variables. The current study, therefore, employed PLS-SEM to examine, beyond correlation, the predictive ability of preservice teachers' teaching self-efficacy on their teaching anxiety. This is because PLS-SEM is effective for predictive purposes and it is better in estimating coefficients that maximize R^2 values in endogenous variables (Hair, Sarstedt, Pieper, & Ringle, 2012). Again, it has greater statistical power; hence, it is robust in determining statistical significance when it exists in a population (Hair et al., 2019). Therefore, the authors considered PLS-SEM the preferred statistical method when examining the predictive ability of preservice teachers' teaching self-efficacy on their teaching anxiety.

Methods

Research Design, Population and Sampling

The study employed the correlational design to determine the influence of preservice teachers' teaching self-efficacy on their teaching anxiety. The population of the study was all third-year preservice management teachers (N = 120) at the University of Cape Coast for the 2018-2019 academic year. They were being trained through the mainstream of the management teacher education programme (other streams are distance and sandwich). The census method was used to involve all the preservice teachers in the study. This, according to Kothari (2004), is good since no element of chance was left.

Instrumentation

Teacher Sense of Efficacy Scale (TSES)

The TSES, also referred to as the Ohio State Teacher Efficacy Scale (OSTES), developed by Tschannen-Moran and Woolfolk Hoy in 2001, was adapted and used to gather data on preservice management teachers' teaching self-efficacy. The instrument is made up of three principal factors: instructional strategies efficacy (8 items), classroom management efficacy (8 items) and student engagement efficacy (8 items). Its 24 items were originally structured on a 9-point Likert scale, ranging from 'nothing' to 'a great deal'. However, this was reduced to a five-point Likert-type scale and its items were converted to statements to parallel it with the Student Teacher Anxiety Scale (STAS). The new response scale adopted was 'never = 1', 'rarely = 2', 'moderately = 3', 'much = 4', and 'very much = 5'.

Student Teacher Anxiety Scale (STAS)

The STAS was adapted for the study. It was originally developed by Hart (1987) on a 7-point Likert-type scale with 26 items, which measures the extent to which each of the sub-scales causes teaching anxiety. The instrument originally had four factors, namely, evaluation anxiety, pupil and professional concerns anxiety, class control anxiety and teaching practice requirements anxiety. However, Morton, Vesco, Williams and Awender (1997) modified the instrument into a five-point Likert-type scale with five factors: evaluation anxiety (8 items), class control anxiety (4 items), professional preparation anxiety (4 items), school staff anxiety (5 items), and unsuccessful lesson anxiety (5 items). The scale was structured as 'never = 1', 'rarely = 2', 'moderately = 3', 'much = 4', and 'very much = 5'. The current study used Morton et al.'s modified version of the STAS to gather data on the preservice management teachers' teaching anxiety about the teaching practicum.

Validity and Reliability of TSES and STAS

Vogt (2007) indicated that it is critical for researchers to always establish content and construct validity. The TSES adapted was validated by Tschannen-Moran and Woolfolk Hoy (2001) through a 10-member expert who reviewed the items on the instrument for content validity before testing. The items were also subjected to factor analysis by the developers with high factor loadings of .4 and above. However, the items were modified and their content validity was ascertained by the researchers. In that case, Samuels (2016) suggested that a Confirmatory Factor Analysis (CFA) should be used to re-confirm the factors. Said, Badru and Shahid (2011) earlier emphasised that CFA should be run on a standardised instrument using AMOS and focus placed on the results of the regression weights. Therefore, the TSES was piloted on 40 selected fourth-year preservice management teachers based on the guideline provided by Baker (1994). Baker stated that 10-20% of the actual study's sample can be selected for a pilot test. However, the study selected 33% for the pilot. To confirm the three-factor self-efficacy construct, CFA was run on the pilot data (this was also done for the actual data gathered).

The result of the CFA test on the three-factor self-efficacy measurement model of eight items each for its sub-construct was estimated through the Maximum Likelihood (ML) technique. The goodness of fit indices determine whether exact fit (χ^2 not significant) or approximate fit (SRMR $\leq$ .08) is tenable (Asparouhov & Muthen, 2018) to allow for the examination of the standardised regression weights (loading) and Average Variance Extracted (AVE) for construct validity. Table 1 presents the goodness of fit results.

Table 1. Goodness of Fit Indices for Teaching Self-Efficacy Scale

Fit Indices	Efficacy			Threshold	Reference
	Pilot	Time 1	Time 2		
χ^2	313.53*	354.40**	424.53**	> .05	Hair et al. (2006)
CMIN/DF	1.29	1.47	1.76	≤ 2 or 3	Schreiber et. al (2006)
CFI	.90	.93	.91	≥.90	Kline (2013)
NFI	.67	.82	.81	≥.90	Kline (2013)
IFI	.90	.93	.91	≥.90	Kline (2013)
TLI	.88	.92	.89	≥.90	Kline (2013)
RMSEA	.08	.06	.08	≤ .08	Schreiber et. al (2006)
SRMR	.08	.05	.06	≤ .08	Kline (2016)

Note: CMIN/DF: Ratio of $\chi 2$ to df; CFI = Comparative Fit Index; NFI = Normed Fit Index; IFI = Incremental Fit Index; TLI = Tucker-Lewis Index; RMSEA= Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Residual; *p < .05; **p < .001.

Source: Fieldwork (2019).

Exact fit is not obtained since the $\chi^2 = 313.53$ (Pilot), $\chi^2 = 354.40$ (Time 1) and $\chi^2 = 424.53$ (Time 2) are statistically significant ($p = .002$, $p < .001$, $p < .001$ respectively). However, except for the NFI, the rest of the FIT indices communicate that an approximate fit has been attained for each period. It is, therefore, concluded that the data gathered during the Pilot, Times 1 and 2 approximately fit the three-factor self-efficacy model proposed by Tschannen-Moran and Woolfolk Hoy (2001). Table 2 presents the item loadings and AVE.

Table 2. Teaching Self-Efficacy Item Loadings and AVE

Factors	Items	Loading 1	AVE 1	Loading 2	AVE 2	Loading 3	AVE 3
Instructional Strategies	IS1	.664**	.57	.729**	.50	.643**	.54
	IS2	.748**		.747**		.736**	
	IS3	.777**		.732**		.739**	
	IS4	.765**		.780**		.747**	
	IS5	.792**		.677**		.786**	
	IS6	.831**		.689**		.720**	
	IS7	.742**		.632**		.736**	
	IS8	.685**		.637**		.758**	
Classroom Management	CL9	.858**	.61	.701**	.50	.796**	.58
	CL10	.725**		.682**		.811**	
	CL11	.772**		.631**		.808**	
	CL12	.773**		.626**		.750**	
	CL13	.681**		.710**		.620**	
	CL14	.863**		.743**		.714**	
	CL15	.775**		.738**		.765**	
	CL16	.766**		.628**		.790**	
Student Engagement	SE17	.472**	.50	.695**	.51	.727**	.51
	SE18	.677**		.726**		.691**	
	SE19	.565**		.569**		.632**	
	SE20	.429*		.633**		.533**	
	SE21	.671**		.839**		.775**	

	SE22	.882**		.712**		.818**	
	SE23	.813**		.770**		.785**	
	SE24	.782*		.744**		.709*	

Note: *$p < .03$, **$p < .001$

Source: Fieldwork (2019).

The minimum and maximum standardised loadings for the items are .429 and .882 respectively for the Pilot; .569 and .839 respectively for Time 1; and .533 and .818 respectively for Time 2. All the items are statistically significant at $p < .05$. The AVE estimates are also .50 and above with the highest estimate being .61 (classroom management) suggesting that convergent validity has been achieved (Fornell & Larcker, 1981).

Next is the reliability of the TSES. The original Cronbach's alpha for the TSES was .94. Specifically, instructional strategies efficacy, classroom management efficacy and student engagement efficacy had an original Cronbach's alpha of .91, .90 and .87 respectively. In the current study, Cronbach's Alpha was computed to confirm the reliability coefficients. The results are presented in Table 3.

Table 3. TSES Reliability Coefficient

Variable	Subscales	Alpha Pilot	Alpha Time1	Alpha Time2
Self-Efficacy	Instructional Strategies	.91	.89	.90
	Classroom Management	.92	.88	.91
	Student Engagement	.88	.89	.90
Cronbach Alpha	TSES	.96	.95	.96

Source: Fieldwork (2019).

The overall Cronbach's Alpha is .96, which shows an improvement in the instrument's reliability as compared to the original instrument's Cronbach's alpha level (.94). At the Pilot, the alpha for instructional strategies does not change (.91). However, there is an improvement of the alpha for classroom management (.92) and student engagement efficacy (.88). At Time 1, improvement is observed for the overall reliability coefficient (.95) over the original scale coefficient (.94), however, a marginal decline is observed in instructional strategies (.89) and classroom management efficacy (.88) alpha. Also, improvement can be seen for student engagement efficacy alpha (.89) over the original (.87) and Pilot test alpha (.88).

Finally, at Time 2 (After teaching practice), the overall Cronbach's Alpha is .96, still an improvement over the original (.94) and Time 1 (.95) Cronbach's alpha. Instructional strategies alpha (.90) falls marginally below the original alpha (.91), but an improvement over Time 1 (.89) is observed. Both classroom management (.91) and student engagement (.90) efficacy alpha shows an improvement in the original constructs (.90 and .87 respectively). The TSES is, therefore, judged reliable for gathering quality data based on two reasons. First, the overall reliability of the instrument at each time point is higher than the original instrument. Secondly, the Cronbach's alpha obtained at each time point is above the threshold of .7, which suggests that the instrument gathered credible data (Fraenkel & Wallen, 2000; Büyüköztürk, 2002; Huck, 2004).

A similar procedure was followed for the STAS. The result of the CFA test on the five-factor anxiety measurement model comprising evaluation anxiety (8 items), class control anxiety (4 items), professional preparation anxiety (4 items), school staff anxiety (5 items) and unsuccessful lesson anxiety (5 items) was examined through the ML estimation technique. Table 4 presents the goodness of fit indices.

Table 4. Goodness of Fit Indices for Teaching Anxiety Scale

Fit Indices	Anxiety			Threshold	Reference
	Pilot	Time 1	Time 2		
χ^2	491.48*	489.30*	525.03*	> .05	Hair et al. (2006)
CMIN/DF	1.72	1.75	1.88	≤ 2 or 3	Schreiber et. al (2006)
CFI	.84	.91	.92	≥.90	Kline (2013)
NFI	.69	.82	.85	≥.90	Kline (2013)
IFI	.84	.91	.92	≥.90	Kline (2013)
TLI	.81	.90	.91	≥.90	Kline (2013)
RMSEA	.14	.08	.08	≤ .08	Schreiber et. al (2006)
SRMR	.07	.05	.05	≤ .08	Kline (2016)

Note: CMIN/DF: Ratio of $\chi 2$ to df; CFI = Comparative Fit Index; NFI = Normed Fit Index; IFI = Incremental Fit Index; TLI = Tucker-Lewis Index; RMSEA= Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Residual; *p < .001

Source: Fieldwork (2019).

Again, exact fit is not obtained since the χ^2 = 491.48 (Pilot), χ^2 = 489.30 (Time 1) and χ^2 = 525.03 (Time 2) are statistically significant (p < .001). However, except for the NFI, the rest of the FIT indices communicate that an approximate fit has been attained for each time. It is, therefore, concluded that the data gathered at the Pilot, Times 1 and 2 approximately fit the five-factor anxiety model. Table 5 presents the item loading and AVE.

Table 5. Teaching Anxiety Item Loadings and AVE

Factors	Items	Loading 1	AVE 1	Loading 2	AVE 2	Loading 3	AVE 3
Evaluation	AE1	.797**	.64	.674**	.50	.579**	.58
	AE2	.802**		.614**		.775**	
	AE3	.807**		.709**		.745**	
	AE4	.733**		.670**		.732**	
	AE5	.772**		.685**		.760**	
	AE6	.778**		.709**		.842**	
	AE7	.866**		.723**		.755**	
	AE8	.821*		.815**		.847**	
Class Control	ACC9	.838**	.70	.731**	.66	.874**	.75
	ACC10	.761**		.857**		.894**	
	ACC11	.885**		.854**		.845**	
	ACC12	.867**		.798*		.847**	
Professional Preparation	APP13	.633**	.66	.711**	.56	.707**	.66
	APP14	.868*		.760**		.847**	
	APP15	.836**		.758**		.844**	
	APP16	.876**		.759**		.836**	
School Staff	ASS17	.929**	.79	.782**	.64	.861**	.72
	ASS18	.900*		.820**		.817**	
	ASS19	.861**		.825**		.831**	
	ASS20	.871*		.815**		.906**	
	ASS21	.880**		.757*		.818**	
Unsuccessful Lesson	AUL22	.846**	.67	.766**	.59	.771**	.66
	AUL23	.798**		.749**		.797**	

	AUL24	.728**		.788**		.796**	
	AUL25	.836**		.801**		.818**	
	AUL26	.881**		.723**		.887**	

Note: *$p < .03$, **$p < .001$
Source: Field data (2019).

The minimum and maximum standardised loadings for the items are .633 and .929 respectively for the Pilot; .614 and .857 respectively for Time 1, and .579 and .906 respectively for Time 2. All the items are statistically significant at $p < .05$. The AVE estimates are also .50 and above with the highest estimate of .79 (school staff anxiety) signifying that convergent validity has been achieved (Hair et al., 2019). Reliability analysis was also conducted to confirm the original instrument's reliability coefficient, which was .91 (Hart, 1987). The Cronbach's alpha was used to examine the reliability of the STAS. The results obtained are presented in Table 6.

Table 6. STAS Reliability Coefficient

Variable	Factors	Alpha Pilot	Alpha Time 1	Alpha Time 2
Anxiety	Evaluation	.94	.90	.92
	Class Control	.90	.88	.93
	Professional Preparation	.89	.85	.89
	School Staff	.95	.91	.94
	Unsuccessful Lesson	.91	.88	.90
Cronbach Alpha	STAS	.98	.97	.98

Source: Fieldwork (2019).

The whole scale reliability coefficient (Cronbach's Alpha) of the STAS after the Pilot (.98) is greater than the original reliability coefficient (.91). Hart (1987) did not provide the specific reliability coefficients for each anxiety sub-construct. When the instrument is compared with Morton et al. (1997), except for professional preparation with a coefficient of < .9, each anxiety construct's reliability is greater, thus evaluation > .87, classroom management > .87, school staff > .84. Apart from professional preparation anxiety, which is again marginally low in Time 1, the rest of the reliabilities of the sub-constructs are higher as compared to that of Morton et al. (1997). At Time 2, each anxiety construct's reliability is higher than that of Morton et al. (1997). It can be seen that the reliabilities obtained on the anxiety constructs at Time 2 marginally improves over Time 1. The whole STAS reliability coefficient at each time point appears the same, proving the internal consistency of the instrument over time. The STAS is, therefore, judged credible for data gathered at each time point of the study.

Generally, both TSES and STAS meet the homogeneity and equivalence attributes of reliability as suggested by Heale and Twycross (2015). Homogeneity is the extent to which all the items on a scale measure one construct. Equivalence focuses on the consistency among responses of multiple users of an instrument or among alternate forms of an instrument. Kerlinger (2000) noted that a reliable instrument will always provide an identical score as obtained for the scales at each time point.

Empirical Model

Structural Equation Modeling through the Smart-PLS path modeling algorithm was used to examine the predictive ability of preservice teachers' teaching self-efficacy on their teaching anxiety about teaching practicum. The objective of the Smart-PLS was to determine the effect of preservice teachers' teaching self-efficacy on their teaching anxiety. The use of the Smart-PLS was appropriate because the relatively small population restricts the sample size (Hair et al., 2019). It was also effective in explaining and predicting preservice teachers' level of teaching anxiety.

The SEM (through Smart-PLS) was simply stated as

$$ANX = f\ (EFF)$$

$$ANX = \beta_0 + \beta_1 EFF + \varepsilon, \quad (1)$$

where the variables are defined as;

ANX	=	Anxiety (endogenous variable)
EFF	=	Efficacy (exogenous variable)
β_0	=	Constant
β_1	=	Path coefficient

Administration of Instrument

Permission was obtained from the Centre of Teacher Professional Development and other relevant authorities at the University of Cape Coast before the administration of the instrument. Respondents were informed about the purpose of the study. They were assured that the exercise was not meant to victimise them but to generally understand their teaching self-efficacy and anxiety before and after the teaching practicum. They gave written consent and their telephone and registration numbers were documented to trace them for the second administration. They completed the first survey (face-to-face) before the start of the teaching practice.

Right after the face-to-face survey, the preservice teachers were informed that an internet address would be sent to them through their WhatsApp group page to follow to complete an online survey about their teaching self-efficacy and anxiety after the teaching practicum. The online survey captured the same items on the adapted TSES and STAS. The respondents were reminded that the exercise was important to understand their teaching self-efficacy and anxiety. Although some of the respondents called for the internet address to complete the online survey a day before the end of the teaching practice, it was sent to them on the WhatsApp group page at the end of the exercise. The instructions on the instrument showed respondents how to go through the process in completing it and what they should expect when the online survey was successfully submitted. A 7-day window was earmarked for the completion of the online exercise. On the 5th day, about 80% of the respondents had completed it. A reminder was again sent to the respondents who were yet to complete the survey on the WhatsApp group page. By the end of the 7th day, all the respondents who were involved in the first data collection had completed the online survey. Comprehensive data was gathered on all the variables for the first and second administration from 119 preservice management teachers (99.17%).

Data Analysis

The hypothesis examined the predictive ability of preservice teachers' teaching self-efficacy on their teaching anxiety. To obtain the factor loadings on each construct as well as the path coefficient simultaneously, Smart-PLS was considered appropriate. Bhakar et al. (2012) indicated that it allows for simultaneously estimating both measurement and structural models. The Smart-PLS technique depends on an iterative mix of principal components analysis and regression. The measurement model evaluates the relationship between latent variables (teaching efficacy and teaching anxiety) and manifest variables (observed items). Through the assessment of the validity and reliability of the constructs measured, the model is tested for accurate prediction. By this, only reliable and valid constructs measured are used for assessing the relationship between teaching self-efficacy and anxiety in the model (Hulland, 1999). The structural model specifies relations between teaching self-efficacy and anxiety constructs. To test the structural model, the path coefficient between the constructs is estimated and analysed. The path coefficient is the model's predictive power. The R^2 assists in explaining the variance in the teaching anxiety variable as explained by teaching self-efficacy. Frost (n.d.) indicated that studies that predict preservice teachers' success in teaching should expect R^2 between 10% and 15%. This is because human behaviour inherently has much more unexplainable variability.

Normality Test

The Quantile-Quantile plot (Q-Q plot) was generated to test the normality of the variables. This was to help with the visual examination of the observed data against an expected normal diagonal distribution line. Field (2009) indicated that normality can be assumed when the observed data is on or close to the expected normal diagonal line generated from a theoretical probability distribution. Figures 1 and 2 present the normality for teaching self-efficacy and teaching anxiety variables respectively before the teaching practicum.

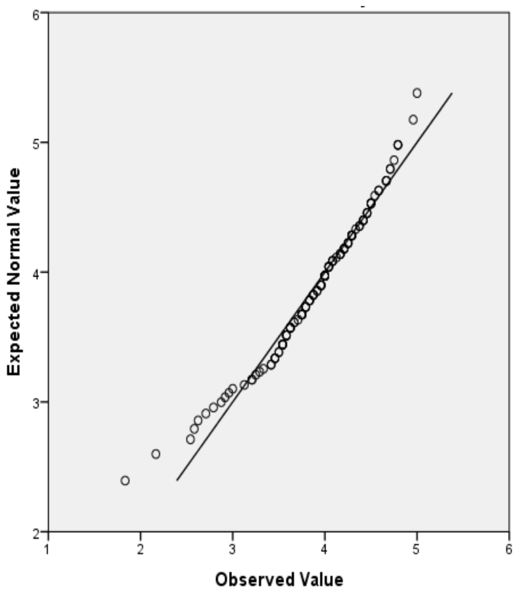

Figure 1. Q-Q plot for teaching self-efficacy (before teaching practice)
Source: Fieldwork (2019)

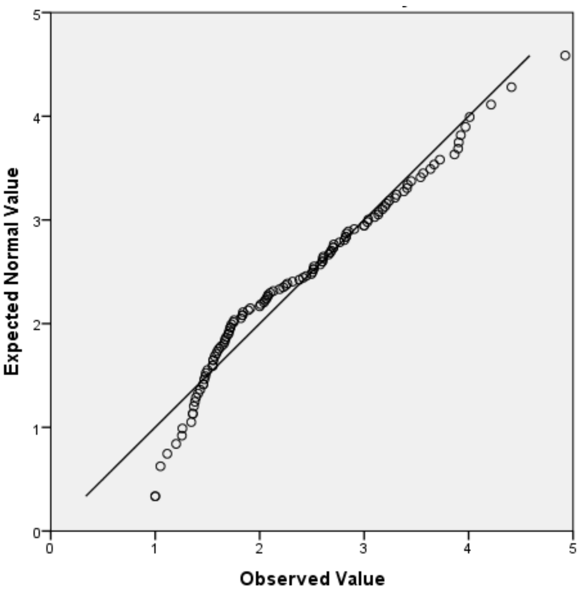

Figure 2. Q-Q plot for teaching anxiety (before teaching practice)
Source: Fieldwork (2019)

The normal Q-Q plot for teaching self-efficacy shows that the observed scores are very close to the diagonal line with marginal deviations at the tails. Also, with that of teaching anxiety, the observed scores are very close with little deviations at the centre and tails. These deviations observed are not widely far from the expected normal distribution line, hence the two variables are confirmed to be approximately normal. The normality results after the teaching practicum for teaching self-efficacy and anxiety are also presented in Figures 3 and 4.

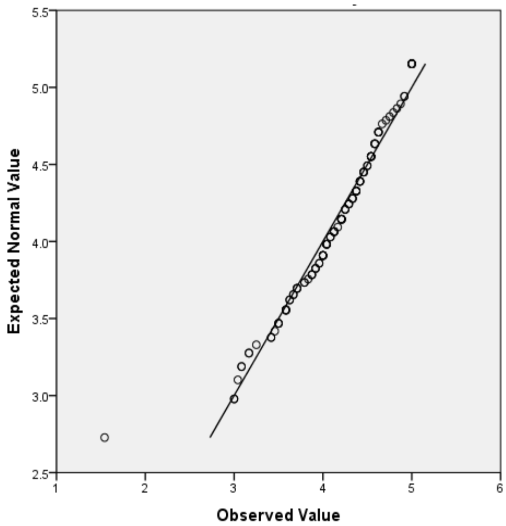

Figure 3. Q-Q plot for self-efficacy (after teaching practice)
Source: Fieldwork (2019)

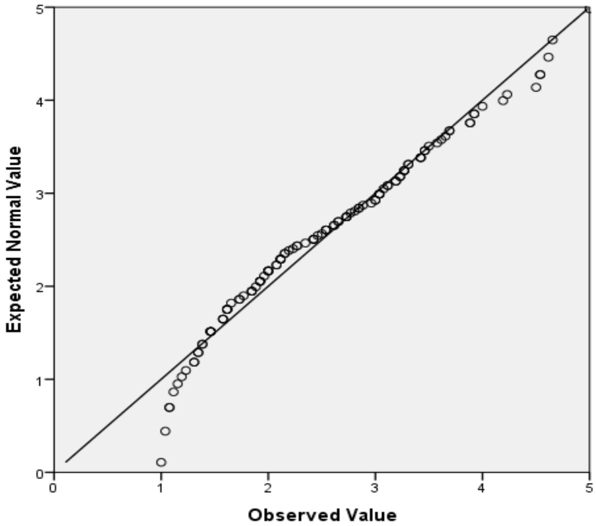

Figure 4. Q-Q plot for anxiety (after teaching practice)
Source: Fieldwork (2019)

The results obtained from data collected after the teaching practicum provide a similar acceptable marginal deviation of the observed scores from the expected normal diagonal line as seen in Figure 3 for teaching self-efficacy and Figure 4 for teaching anxiety.

Results

Influence of Preservice Management Teachers' Teaching Self-Efficacy on Teaching Anxiety

Hypothesis was formulated to determine the predictive ability of teaching self-efficacy on teaching anxiety. The rationale was to assess the possibility of decreasing teaching practicum anxiety with increasing self-efficacy about teaching practicum. SEM through the Smart-PLS path modeling algorithm was employed to examine the causal relationship.

Structural Equation Modeling Results from Smart-PLS

Through the bootstrap re-sampling tool of Smart-PLS, the estimates of the path coefficient, composite reliability, AVE and R^2 were obtained to explain the variance of the model's constructs. Frazier, Tix and Barron (2004) stated that Smart-PLS places minimal demands on measurement scales, residual distributions, and sample size. Figure 5 (Time 1) and Figure 6 (Time 2) show the results of the measurement and structural models.

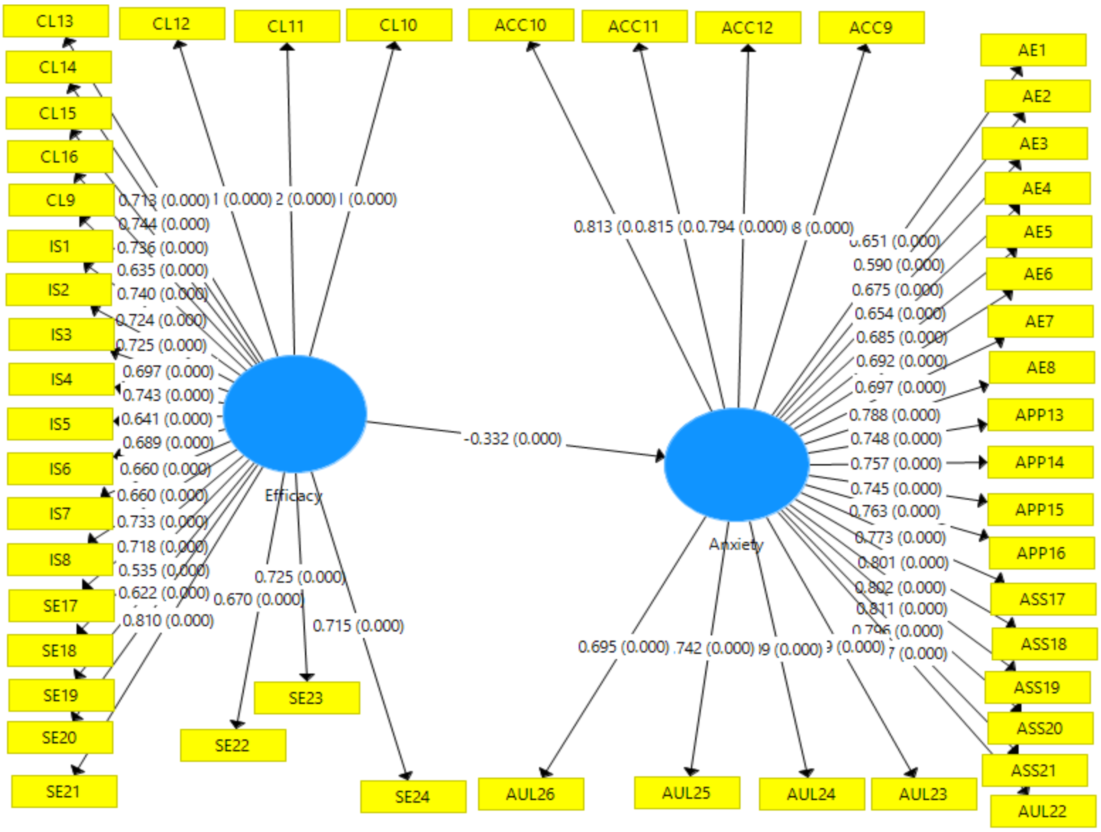

Figure 5. Efficacy-Anxiety nexus (before teaching practice)
Source: Fieldwork (2019).

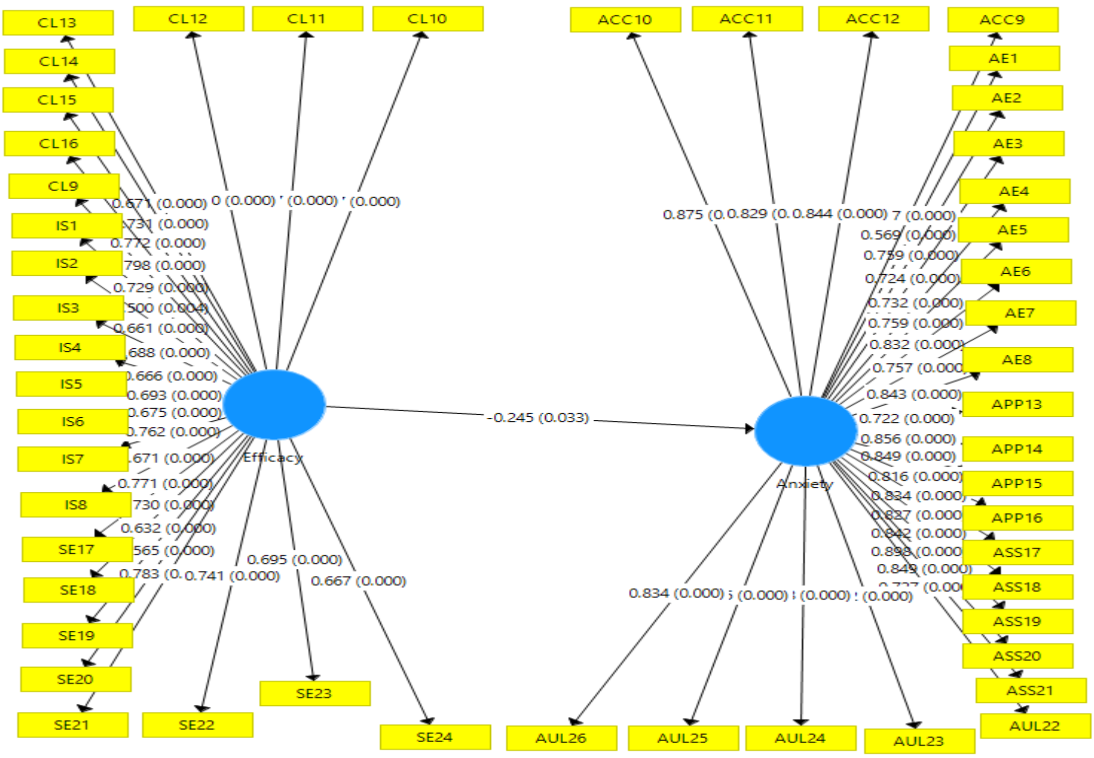

Figure 6. Efficacy-Anxiety nexus (after teaching practice)
Source: Fieldwork (2019).

Construct Reliability and Validity

The measurement models were examined for construct reliability, convergent validity and discriminant validity. This was done before the hypothesis was analysed, that is, the structural models were examined.

Convergent Validity and Construct Reliability

The construct reliability was established using the composite reliability. As evident in Table 7, all the constructs have composite reliabilities greater than the threshold of .7, an indication that construct reliability has been ensured (Straub, 1989). Apostolakis and Stamouli (2006) provided a simple criterion for assessing standardised reflective constructs. By this criterion, all standardised construct loadings must be at least .5.

Table 7. Convergent Validity and Construct Reliability for Teaching Self-efficacy and Teaching Anxiety

Time	Construct	Composite Reliability	Average Variance
1	Anxiety	.969	.548
	Efficacy	.958	.501
2	Anxiety	.979	.639
	Efficacy	.960	.503

Source: Fieldwork (2019).

The results of the CFA (Tables 2 and 5) show that each of the items loaded very well on the constructs for both periods. A cursory examination of the measurement model in Figure 5 and Figure 6 show that all the items have loadings above .5. In achieving convergent validity, Fornell and Larcker (1981) suggested a minimum AVE of .5 for a construct to show convergent validity. This is observable for all the constructs with the least AVE of .501 (Table 7).

Discriminant Validity

Lastly, to validate the measurement model, discriminant validity was determined. Brown (2006, p. 3) asserted that discriminant validity is evident when "indicators of theoretically distinct constructs are not highly intercorrelated", which suggests that the constructs are different from each other. Fornell and Lackers (1981) specified that discriminant validity is confirmed if the elements in the matrix diagonal, which also represent the square roots of the AVE are greater than the off-diagonal values of all the corresponding rows and columns. Table 8 shows the results for discriminant validity.

Table 8. Discriminant Validity for Self-efficacy and Anxiety

Time	Construct	Fornell-Larcker Criterion		Heterotrait-Monotrait Criterion		
		Anxiety	Efficacy	HTMT Ratio	*LLCI*	*ULCI*
1	Anxiety	**.740**				
	Efficacy	-.332	**.697**	.312	.191	.508
2	Anxiety	**.799**				
	Efficacy	-.245	**.709**	.200	.152	.393

Source: Fieldwork (2019).

Discriminant validity has, therefore, been met since .740 and .697 in Time 1, and .799 and .709 in Time 2 are greater than their off-diagonal values of -.332 and -.254 respectively. Hair et al. (2019) also indicated that the Heterotrait-Monotrait (HTMT) ratio should be less than .90 for conceptually similar constructs and .85 for conceptually different constructs. Its ULCI should also be significantly different from one or the threshold value. The confidence interval helps in determining the significance of the HTMT ratio when it lies between the LLCI and the ULCI without the presence of zero within the confidence interval (Hair et al., 2019).

The HTMT ratios for Time 1 (.312) and Time 2 (.200) are lesser than .90 and .85 and statistically different from the threshold value or one for Time 1 (95% CI [.191, .508]) and Time 2 (95% CI [.152, .393]). It is palpable that discriminant validity has been achieved from both criteria.

Structural Models

After confirming that the measurement models meet the conditions of construct and indicator reliability in addition to the convergent and discriminant validity, the hypothesis that *preservice teachers' teaching self-efficacy will significantly predict their teaching anxiety* was examined. The examination focused on the direction and strength through the path coefficient (β), level of significance with p-values using 500 bootstrap samples, a coefficient of determination (R^2), and effect size (f^2) estimated by Smart-PLS 3.0. Table 9 presents the path coefficient results.

Table 9. Path Coefficient of Teaching Self-Efficacy on Teaching Anxiety

	Time 1	Time 2
Efficacy -> Anxiety	-.332	-.245
SD	.07	.12
t-value	4.737	2.134
p-value	<.001	.033
R^2	.110	.060
f^2	.124	.064

Source: Fieldwork (2019).

Evidently (see Table 9), the negative significant path coefficients between preservice teachers' teaching self-efficacy and anxiety at Time 1 (β = -.332, p < .001) and Time 2 (β = -.245, p = .033) show that teaching self-efficacy negatively influences teaching anxiety. This implies that a 1% increase in standard deviation in preservice teachers' teaching self-efficacy is likely to result in a reduction in the standard deviation of their teaching anxiety by 33.2% (Time 1) and 24.5% (Time 2). Teaching self-efficacy seems to explain 11% of the variation in anxiety at Time 1 and 6% at Time 2 (see R^2 estimates). The differences observed in the R^2 could be as a result of the variations in the dispersion estimates in both periods. The lower the dispersion estimate, the possibility of a higher R^2 estimate. This could explain why the R^2 (.11) obtained at Time 1 is higher than the R^2 (.06) at Time 2. The effect sizes show that self-efficacy has a medium effect (f^2 = .124) on teaching anxiety at Time 1 and low effect (f^2 = .064) at Time 2. The researchers' hypothesis that *preservice teachers' teaching self-efficacy will significantly predict their teaching anxiety* is supported by the evidence, permitting the conclusion that an inverse causal relationship exists between teaching self-efficacy and teaching anxiety. Therefore, the fitted models for Time 1 (Equation 2) and Time 2 (Equation 3) are as follows:

$$ANX = -.332EFF \quad (2)$$
$$ANX = -.245EFF \quad (3)$$

Discussion

Researchers (e.g. Gunning & Mensah, 2010; Szymańska-Tworek, & Turzańska, 2016; Halet & Sanchez, 2017) have conceptually perceived self-efficacy and anxiety to be negatively related. While some authors (e.g. Gresham, 2008; Merc, 2015) claim that there exists a negative relationship between anxiety and self-efficacy, others (e.g. Tahsildar & Kabiri, 2019) support a positive relationship. The uncertainty might be due to the use of PPMCC, since the statistical tool is based on a measure of centre, precisely, the mean which is not robust to outliers.

However, most of these studies have not provided evidence on the nature of the distribution of teaching self-efficacy and anxiety variables, which creates some kind of doubt in their findings. It may be needful to consider other robust correlation measures such as order statistic correlation or PPMCC with the centre as a median. The current study employed SEM in determining beyond relationship the predictive ability of preservice teachers' teaching self-efficacy on their teaching anxiety. Hence, the hypothesis formulated was that *preservice teachers' teaching self-efficacy will significantly predict their teaching anxiety*.

The study found preservice teachers' teaching self-efficacy to have a negative influence on their teaching anxiety. The finding was consistently proven for both periods in which the examination was conducted. However, the R^2 for both periods fell within the range of 6% and 11%; this is considered satisfactory because the prediction of human behaviour has a lot of variations and preservice teachers' teaching anxiety is not an exception (Frost, n.d.; Hair et al., 2019). Both Times 1 and 2 results clearly emphasise a negative relationship between teaching self-efficacy (exogenous variable) and teaching anxiety (endogenous variable), which is statistically significant ($p < .05$). This suggests that the intrinsic relationship underlying the data is indeed negative regardless of the time of estimation. The basic interpretation of the observed relationship is that increasing preservice teachers' level of teaching self-efficacy will assist in decreasing their level of teaching anxiety.

The finding sits well within Bandura's self-efficacy theory that increasing self-efficacy can reduce negative emotional tendencies. By the current evidence, increasing preservice teachers' teaching self-efficacy can reduce their teaching anxiety. Further, the current finding supports the negative correlation found between self-efficacy and anxiety in the literature (e.g. Gresham, 2008; Merc, 2015; Unlu, Ertekin & Dilmac, 2017). It is clear that teaching self-efficacy and teaching anxiety are indirectly related as found in the current study, and not unrelated (e.g. Çubukçu, 2008; Güngör & Yaylı, 2012) or positively related (e.g. Tahsildar & Kabiri, 2019). In addition to the findings of previous studies, the current study clearly states that a causal relationship exists between teaching self-efficacy and teaching anxiety and therefore proffers a simple mathematical equation describing such a relationship. Thus, the study provides a standard way for estimating the teaching anxiety of preservice teachers for a given teaching efficacy score.

Conclusion and Recommendations

The significant negative causal relationship between preservice teachers' teaching self-efficacy and teaching anxiety indicates that teaching self-efficacy has the potency to reduce teaching anxiety. By this, if preservice teachers' level of teaching self-efficacy increases, their level of teaching anxiety will reduce. Thus, it is expedient in enhancing preservice teachers' teaching self-efficacy during the coursework of the teacher education programme. It is, therefore, recommended that teacher educators should focus on increasing preservice teachers' level of teaching self-efficacy by ensuring their mastery of content and pedagogical knowledge. Also, teacher educators should provide enough opportunities to the preservice teachers during the coursework of the teacher education programme to enable them to practice teaching. It is strongly believed that if preservice teachers are allowed to practice teaching, their self-confidence to teach will be enhanced so that they can transition into the teaching profession with the appropriate confidence needed to achieve professional success. This study focused on teaching self-efficacy as the only exogenous variable influencing teaching anxiety, hence, the relatively low R^2. More exogenous variables in a model enhance the R^2 and hence the predictive power of the model. Therefore, other exogenous variables can be considered together with teaching self-efficacy in examining the predictive ability of preservice teachers' teaching self-efficacy on their teaching anxiety. The relationship can also be modelled using logistic regression to determine the probabilities.

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