

Article

The Roles of Transformational Leadership and Growth Mindset in Teacher Professional Development: The Mediation of Teacher Self-Efficacy

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Abstract: This study investigated the effects of school-related factors (i.e., transformational leadership) and teacher-related factors (i.e., teachers' growth mindset and self-efficacy) in teachers' sustainable professional development, as indicated by their reported desirable professional attitudes and their adoption of teaching strategies using the method of structural equation modelling. Based on a questionnaire survey of 1297 teachers in China, the results of this study showed that, compared with teachers' growth mindset, transformational leadership had a stronger effect on teacher self-efficacy; transformational leadership, rather than teachers' growth mindset, was significantly and directly related to teachers' professional attitudes towards classroom teaching and their adoption of desirable teaching strategies. Moreover, teacher self-efficacy significantly mediated the effects of transformational leadership and growth mindset on teachers' professional attitudes and the adoption of desirable teaching strategies. These findings highlight the importance of teachers' affective attributes (e.g., growth mindset, self-efficacy, and professional attitudes) in teacher professional development, and provide implications for school leaders and teachers to sustain effective teacher professional development.

Keywords: teacher self-efficacy; professional attitudes; growth mindset; transformational leadership; teaching strategies; sustainable teacher development



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1. Introduction

According to the OECD's report [1], many OECD countries are experiencing difficulties related to the recurring issue of how to retain a sufficient number of high-quality teachers. Apart from OECD countries, attracting qualified people to enter a teaching career and retaining the sustainable development of experienced teachers have become challenges for various countries over the past decade [2]. In China, there is evidence that nearly half of teachers have suffered long-term emotional disturbance such as heavy stress and burnout [3,4], which impedes teachers' professional development and even causes them to leave the teaching profession [4].

The roles of teacher emotion in educational settings have been steadily gaining prominence in educational research during the past 20 years [5]. However, how teachers' affective attributes facilitate their sustainable development is still an under-explored area. Various studies have demonstrated that teacher emotions have a significant impact on their well-being and teaching practices, such as teachers' engagement, satisfaction, effectiveness, and self-efficacy [6–8]. Previous studies have shown that teachers' emotions were associated with their personal characteristics such as the Big Five personality traits and emotional intelligence [6,8]. Additionally, the impact of contextual factors (e.g., trust in colleagues and

social support) on teacher emotions has been demonstrated in existing studies [9,10]. Nevertheless, more investigations on how different types of contextual factors influence teachers' emotions are needed, especially school-related factors such as principal leadership [5,11].

One of the most important affective attributes is teacher self-efficacy. Teacher self-efficacy has drawn long-term attention from researchers during the past 40 years [12,13]. It denotes teachers' beliefs about their abilities to influence students' learning and development. Teacher self-efficacy has been identified as an important predictor of teachers' well-being and teaching practice, including their satisfaction, commitment, attrition, and retention [12]. Although existing studies have widely recognized the significance of teacher self-efficacy in teacher professional development, research has rarely considered both the influencing factors and potential consequences of teacher self-efficacy [12]. Therefore, the present study investigated how school-related factors (i.e., transformational leadership) and teacher-related factors (i.e., teachers' growth mindset) affect teachers' self-efficacy and the indicators of professional development, namely, professional attitudes toward classroom teaching and the adoption of desirable teaching strategies in the classroom. In particular, the mediating role of teacher self-efficacy was examined.

2. Theoretical Perspectives

2.1. Teacher Self-Efficacy

Self-efficacy has been defined as individuals' beliefs or perceptions of their ability to successfully accomplish particular tasks [14]. Accordingly, teacher self-efficacy refers to teachers' beliefs in their capabilities to influence their students' learning and bring about desired outcomes for teaching and learning, despite facing some difficulties [15]. Teachers with high self-efficacy have acquired sufficient subject knowledge, are ready to fulfil their career aspirations, create good learning environments for their students using different teaching methods, and continue to explore the most suitable and enjoyable teaching strategies for their learners [16]. Teachers with high self-efficacy provide students with more effective learning experience than teachers with low self-efficacy.

The locus of control [17] and the social cognitive theory [18] serve as two theoretical foundations of teacher self-efficacy [15]. Rotter [17] proposed the attribution-based theory of locus of control, by which individuals are assumed to have different perceptions of whether outcomes are attributed to external control (i.e., luck, fate, or related to others) or internal control (i.e., a result of one's own action). Later, Bandura [18] further argued that an individual's behavior would be affected by both the individual's response–outcome expectancy for control (i.e., knowing that such actions result in desired outcomes) and their self-efficacy expectancy for control (i.e., believing in having the abilities to produce such actions). Based on the pioneering work of Rotter [17] and Bandura [14], Tschannen-Moran and Woolfolk Hoy [15] developed the Teachers' Sense of Efficacy Scale (TSES), which has been widely adopted in existing studies on teacher self-efficacy. This scale assesses three dimensions of teacher self-efficacy, namely, efficacy for instructional strategies (to what extent teachers believe that they can help students learn the content), classroom management (to what extent teachers can adopt various strategies to work with groups of students), and student engagement (to what extent teachers can inspire students' motivation to join in classes).

Factors influencing teacher self-efficacy have been reported in the existing literature. Frackler and Malmberg [13] found that teacher self-efficacy varied according to different levels of factors, including teachers' personal characteristics, classroom teaching experiences, school characteristics, and national characteristics. Previous studies have shown that teachers' formal teacher training, informal experiences in the classroom, and emotional intelligence are associated with teacher self-efficacy [19]. Moreover, it has also been shown that principal leadership (e.g., instructional leadership and transformational leadership) affected teacher self-efficacy through principals' interactions with teachers [11,13,20].

Existing research has demonstrated that teacher self-efficacy is significantly related to teachers' well-being, including positive well-being indicators (i.e., satisfaction, commitment,

and attrition) and negative well-being indicators (i.e., burnout and stress) [12]. Teachers with high self-efficacy usually have more confidence to teach, are more willing to introduce new teaching approaches and adopt effective classroom management strategies, and have higher levels of mastery/experience in classroom teaching [21,22]. In addition, teachers with higher self-efficacy are inclined to have positive attitudes towards teaching, especially when their principals require them to change [23].

2.2. Teacher's Growth Mindset and Its Relationship with Teacher Self-Efficacy

Two contrasting types of mindsets, namely, growth mindset and fixed mindset, have been proposed to describe the implicit theories people hold about personal qualities. A growth mindset is defined as individuals' belief about the malleability of personal qualities, whereas a fixed mindset denotes individuals' beliefs about the fixation and stability of personal qualities [24].

Growth mindset has been applied to educational research in recent years. Teachers' growth mindset means that teachers believe that their core professional competence in various fields is malleable, such as their ability to design curriculum, teach contents, assess students, and provide guidance for student development. Teachers with a growth mindset usually have the following characteristics: (1) Supporting individual learning processes. Teachers with a growth mindset have knowledge to help students overcome their learning barriers; (2) Promoting mastery orientation. Teachers with a growth mindset have the growth competency of expecting and persisting in fostering learning goals [25]; (3) Persisting on the part of the teacher. Teachers with a growth mindset are honest to accept "not yet" and show students that the teacher will not give up; (4) Fostering process-focused thinking. Teachers with a growth mindset usually focus on the processes of classroom practices which facilitate students' process-focused pedagogical thinking, psychological forces, emotional processes, and learning strategies. In contrast, teachers holding a fixed mindset are inclined to pay attention to students' existing traits and abilities, and often attribute students' problems to their fixed qualities [26].

Previous studies have demonstrated that teachers' growth mindsets are significantly associated with their set of personal beliefs, as well as motivational processes, including the teachers' sense of self-efficacy [27]. It is reported that teachers with a growth mindset believe in the flexible traits of teaching (e.g., fulfilling teaching tasks elastically and professionally), whereas teachers with a fixed mindset believe in the deep-seated traits of teaching (e.g., being risk-averse and showing low resilience when encountering failure) [24,27]. Accordingly, a growth mindset may encourage teachers to improve their self-efficacy beliefs and motivate them to perform better. However, this relationship has not been fully examined in previous research.

2.3. Transformational Leadership and Its Relationship with Teacher Self-Efficacy

The concept of transformational leadership is mostly based on the work of Bass [28], who defined it as leaders moving their followers by broadening their interests in the community, generating their acceptance of the mutual mission of the whole group, and inspiring them to look beyond their own benefits to those of the group. In educational settings, transformational school leadership means that school leaders are able to create collective beliefs about their capabilities among teachers through empowering them to set their personal expectations, shifting teachers' motivation from self-interest to the school's interest, enhancing their feelings of self-efficacy, and acting as a role model who demonstrates the behaviors desired by the school [29]. In the model suggested by Leithwood and Jantzi [30], school transformational leadership comprises three broad dimensions. First, setting directions, which means that school leaders should build school vision, develop school goals, plan priorities, and set high performance expectations of teachers. Second, developing people, which means that school leaders should provide intellectual stimulations, offer individualized support, and model desirable examples/values to teachers. Third, redesigning the organization, which means school leaders should develop a collaborative

school culture, foster teacher participation in school decision-making, and create productive community relationships. In the present study, we adopted the Transformational Leadership Scale developed by Leithwood and Jantzi [30] to assess teachers' perceived transformational leadership of their school leaders.

Researchers have suggested that transformational leadership is significantly associated with teachers' work and school improvements [31]. Frackler and Malmberg [13] found that school headteachers with high transformational leadership were better at building strong bridges between school and teachers, through creating a supportive culture for teacher development, establishing close links with school environments, and empowering teachers to bring their priorities into the school development. Moreover, school principals' transformational leadership has also been found to significantly influence teacher self-efficacy. Some variables related to transformational leadership styles, such as contingent reward and effectiveness, have been shown to be the best predictors of teacher self-efficacy [23].

Although existing studies have indicated the potential associations between school principals' transformational leadership and teacher self-efficacy [32], little work has been conducted on how leadership factors in conjunction with teachers' affective attributes (e.g., growth mindset) influence their self-efficacy and professional development. In addition, because most existing studies related to teacher emotions have been conducted in developed countries, very little is known about the situation in developing countries [33].

In short, the present study attempted to examine the roles of various types of factors (i.e., school- and teacher-related factors) in facilitating teachers' sustainable professional development in the Chinese context. Specifically, this study addresses three questions, as follows: (1) What are the effects of transformational leadership (a school contextual factor) and growth mindset (a personal teacher factor) on teacher self-efficacy?; (2) What are the effects of these two factors on teachers' professional attitudes towards classroom teaching and the adoption of desirable teaching strategies in the classroom?; (3) Are there any significant mediation effects of school- and teacher-related factors on teachers' sustainable development assessed by their reported professional attitudes and adoption of teaching strategies?

3. Methods

3.1. Participants

Consistent with research ethics review procedures, this study was carried out in accordance with the recommendations of the Survey and Behavioral Research Ethics Committee, at the institute where the second author works.

An online questionnaire survey was administered to teachers in 56 schools of eight districts in Shenzhen, a city in southern China, from September to December 2020. Finally, we received 1297 valid completed questionnaires.

The sample was predominantly female (69.9%). Participants' teaching experience varied from 1 to 30 years; 30% of participants were teaching in primary schools, and the remaining 70% were teaching in secondary or 1–9 through-trained schools. In terms of educational background, 101 (7.8%) participants had a doctoral degree, 897 (69.2%) had a master's degree, and 285 (22%) had a bachelor's degree. Regarding their posts in school, 56 (4.3%) of the participants were department directors, 151 (11.6%) were subject leaders, and 1046 (80.6%) were subject teachers.

3.2. Instruments

A questionnaire comprising five scales was used in this study. The details of these scales are provided in the following sections. The Chinese versions of these scales were administered in the present study. Translation and back-translation procedures were conducted by two researchers who are fluent in both Chinese and English.

3.2.1. Growth Mindset

The Chinese version of the 4-item Growth Mindset Inventory originally developed by Dweck et al. [24] was used to assess teachers' growth mindset. The Chinese version of this scale was adopted in Zeng et al.'s [33] study on Chinese teachers, in which the scale showed satisfactory reliability and validity. Item examples include "You can always substantially change how intelligent you are" and "Intelligence is difficult to change" (reversely coded). Teachers rated each item on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

3.2.2. Transformational Leadership

The 9-item Transformational Leadership Scale developed by Leithwood and Jantzi [30] was used to assess teachers' perceived transformational leadership of the school leaders. Three dimensions of transformational leadership practices were measured in this scale: setting directions (three items; e.g., "Those in positions of responsibility in your school provided useful assistance to you in setting short-term goals for teaching and learning"), developing people (three items; e.g., "Those in positions of responsibility in your school gave you individual support to help you implement the strategy"), and redesigning the organization (three items; e.g., "Those in positions of responsibility in your school encouraged collaborative work among staff"). The participants were asked to rate each item on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

3.2.3. Teacher Self-Efficacy Scale

The 12-item Teacher Self-Efficacy Scale (TSES) developed by Tschannen-Moran and Hoy [15] was used to assess teachers' self-efficacy beliefs. The Chinese version of the scale was validated by Yin et al. [10] with a sample of Chinese teachers. Three dimensions of teacher efficacy were measured in this scale: efficacy for instructional strategies (four items; e.g., "To what extent can you use a variety of assessment strategies"), efficacy for classroom management (four items; e.g., "How much can you do to control disruptive behavior in the classroom"), and efficacy for student engagement (four items; e.g., "How much can you do to get students to believe they can do well in their schoolwork"). Teachers rated each item on a 6-point Likert scale ranging from 1 (never) to 6 (a great deal).

3.2.4. Teacher Professional Attitudes towards Classroom Teaching

The 7-item scale developed by Sharp et al. [34] was used to assess desirable teacher professional attitudes towards classroom teaching. Item examples include "Teachers at this school are reluctant to teach" and "Teachers at this school have a strong motivation to ensure that their subject is taught at this school". Teachers were asked to rate each item on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

3.2.5. The Adoption of Desirable Teaching Strategies in the Classroom

The 8-item scale developed by Yin et al. [35] was used to assess teachers' adoption of desirable teaching strategies in the classroom. This is a Chinese language scale. An example of the items is "My classroom teaching pays close attention to students' individual differences". This scale was scored on a 6-point Likert scale from 1 (strongly disagree) to 6 (strongly agree).

3.3. Data Analyses

SPSS 22.0 (IBM, Chicago, IL, USA) and AMOS 17.0 (IBM, Chicago, IL, USA) were used to manage and analyze data in this study. Data analysis followed a two-step procedure. First, the construct validity and reliability of the five scales and their inter-correlations were determined. Confirmatory factor analysis (CFA) was performed to examine the factor structure. Then, the descriptive statistics and correlations were calculated using SPSS 22.0. Second, the method of structural equation modeling (SEM) was conducted using AMOS 17.0 to explore the relationships among all the variables. Bootstrapping was finally

employed to examine the mediating effects of teacher self-efficacy. Indexes such as χ^2 statistics, the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the root-mean-square error of approximation (RMSEA) were used to assess the goodness of fit of this model. An acceptable model fit requires the CFI and TLI values to be no less than 0.90, and the RMSEA value to be less than 0.08 [36].

4. Results

4.1. Reliability and Construct Validity

As shown in Table 1, the data analysis results revealed that the five scales used in this study had acceptable reliability coefficients, with Cronbach's alpha coefficients ranging from 0.72 to 0.96. CFA using AMOS 17.0 was conducted to examine the construct validity of the five instruments. The CFA results showed that the five scales used in this study fitted the data well, i.e., the Growth Mindset Scale ($\chi^2 = 6.724$, $df = 2$, $p < 0.001$, CFI = 0.99, TLI = 0.99, RMSEA = 0.04), the Transformational Leadership Scale ($\chi^2 = 172.657$, $df = 23$, $p < 0.001$, CFI = 0.99, TLI = 0.98, RMSEA = 0.06), the Teacher Self-Efficacy Scale ($\chi^2 = 376.108$, $df = 41$, $p < 0.001$, CFI = 0.98, TLI = 0.97, RMSEA = 0.08), the Teacher Professional Attitudes towards Classroom Teaching Scale ($\chi^2 = 161.729$, $df = 14$, $p < 0.001$, CFI = 0.96, TLI = 0.92, RMSEA = 0.08), and the Adoption of Desirable Teaching Strategies in Classrooms Scale ($\chi^2 = 79.882$, $df = 11$, $p < 0.001$, CFI = 0.99, TLI = 0.99, RMSEA = 0.07).

Table 1. Descriptive statistics and correlation matrix.

	1	2	3	4	5	6	7	8	9
1. Growth mindset	(0.77)								
2. Set direction	0.13 **	(0.94)							
3. Develop people	0.13 **	0.86 **	(0.93)						
4. Redesign	0.12 **	0.84 **	0.87 **	(0.94)					
5. Strategies	0.18 **	0.40 **	0.40 **	0.41 **	(0.92)				
6. Management	0.19 **	0.38 **	0.36 **	0.36 **	0.78 **	(0.95)			
7. Engagement	0.21 **	0.38 **	0.38 **	0.38 **	0.77 **	0.80 **	(0.92)		
8. Attitudes	0.15 **	0.50 **	0.52 **	0.52 **	0.47 **	0.39 *	0.44 **	(0.72)	
9. Adoption teaching	0.18 **	0.41 **	0.41 **	0.43 **	0.82 **	0.67 **	0.68 **	0.47 **	(0.96)
M	3.26	3.80	3.76	3.84	4.68	4.75	4.65	3.66	4.67
SD	0.80	0.47	0.53	0.50	0.57	0.52	0.58	0.53	0.66

Note: * $p < 0.05$; ** $p < 0.01$; Cronbach's alpha coefficients are in parentheses along the diagonal.

4.2. Descriptive Statistics and Correlations

The descriptive statistics of all factors and the correlation matrix among factors are displayed in Table 1. The four-item Growth mindset scale had acceptable reliability ($\alpha = 0.77$), with a mean score of 3.26 (SD = 0.80). Among the three dimensions of the Transformational Leadership Scale, the Cronbach's alpha coefficients ranged from 0.93 to 0.94, and the mean scores ranged from 3.76 to 3.84. Specifically, redesigning the organization in schools had the highest score (M = 3.84, SD = 0.50), followed by setting directions for teachers (M = 3.80, SD = 0.47), whereas developing people had the lowest score (M = 3.76, SD = 0.53). As for the three dimensions of the Teacher Self-Efficacy scale, teachers' efficacy for classroom management had the highest score (M = 4.75, SD = 0.52), whereas teachers' efficacy for student engagement (M = 4.65, SD = 0.58) was scored the lowest. Both the seven-item Teacher Professional Attitudes towards Classroom Teaching scale ($\alpha = 0.72$) and the eight-item Adoption of Desirable Teaching Strategies in Classrooms scale ($\alpha = 0.96$) had acceptable reliability. The adoption of desirable teaching strategies in the classroom (M = 4.67, SD = 0.66) scored more highly than professional attitudes towards classroom teaching (M = 3.66, SD = 0.53). As for the correlations of the factors, all variables observed in this study were positively correlated with each other.

4.3. SEM Analysis

An SEM model was constructed to test the effects of school- and teacher-related factors (i.e., transformational leadership and teachers' growth mindset) on teacher professional development indicated by their reported professional attitudes and adoption of desirable teaching strategies, mediated by teacher self-efficacy. The SEM results showed that this model achieved an acceptable data fit ($\chi^2 = 1666.17$, $df = 266$, $p < 0.001$, CFI = 0.95, TLI = 0.94, RMSEA = 0.06). The results are displayed in Figure 1.

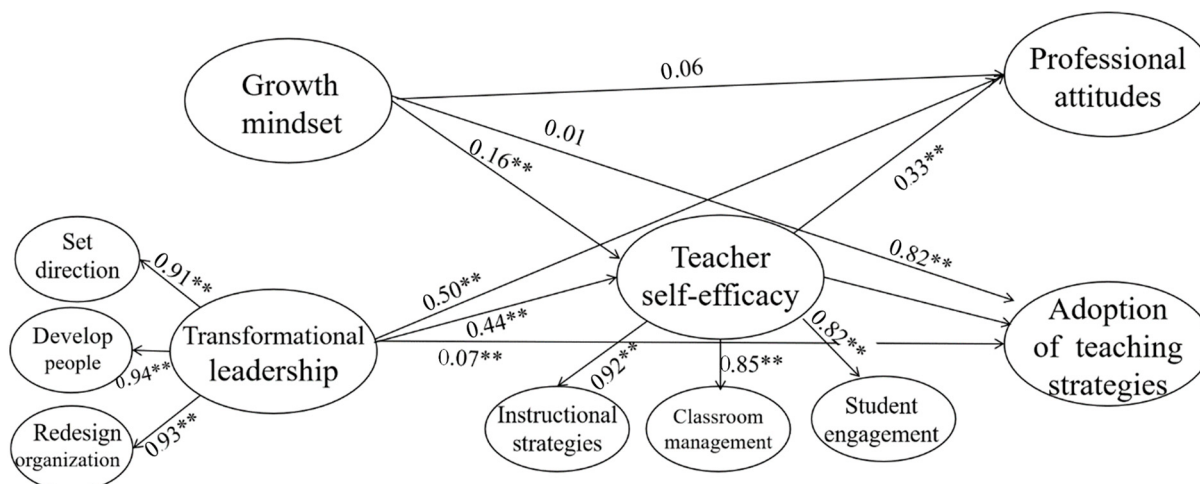


Figure 1. The effects of transformational leadership and teacher growth mindset on teachers' professional attitudes and the adoption of teaching strategies via teacher self-efficacy. Note: ** $p < 0.01$. $\chi^2 = 1666.17$, $df = 266$, $\chi^2/df = 6.26$, CFI = 0.95, TLI = 0.94, RMSEA = 0.06.

SEM analysis was used to exploring the effects of two types of factors, i.e., a school contextual factor (transformational leadership) and a personal teacher factor (growth mindset) on teachers' self-efficacy and teachers' professional attitudes towards classroom teaching, and adoption of desirable teaching strategies in the classroom. On the one hand, the results showed that teachers' self-efficacy was positively impacted by both teachers' perceived transformational leadership ($\beta = 0.44$, $p < 0.01$) and their growth mindset ($\beta = 0.16$, $p < 0.01$), and the former had a stronger positive effect than the latter. On the other hand, the results show that teachers' self-efficacy was positively associated with both their professional attitudes ($\beta = 0.33$, $p < 0.01$) and their adoption of desirable teaching strategies ($\beta = 0.82$, $p < 0.01$). In terms of the direct effects of transformational leadership and teachers' growth mindset, only teachers' perceived transformational leadership was significantly associated with their professional attitudes ($\beta = 0.50$, $p < 0.01$) and their adoption of desirable teaching strategies ($\beta = 0.07$, $p < 0.01$).

4.4. Mediation Analysis

To examine the mediating role of teacher self-efficacy on school-related factors (i.e., transformational leadership), teacher-related factors (i.e., growth mindset), and teachers' sustainable development, assessed by their reported professional attitudes and adoption of teaching strategies, mediation analysis was conducted using 1000 bootstrapping samples. The results of the mediation analysis are presented in Table 2, in which the point estimate of the indirect effect (ab) is reported, with a 95% confidence interval (CI). According to Hayes [37], the indirect effect is significant if zero is not located between the lower and upper boundaries of the 95% confidence interval. In the present study, the results showed that teacher self-efficacy had a significant mediation effect on the relationship between both transformational leadership and teacher growth mindset, and teacher professional development was indicated by their professional attitudes and the adoption of desirable teaching strategies.

Table 2. Mediation analysis of teacher self-efficacy on the effects of transformational leadership and growth mindset on teachers' professional attitudes and the adoption of teaching strategies.

Dependent Variable	Independent Variable	Mediation Analysis				
		Point Estimate	SE	<i>p</i>	BC 95% CI	
		ab			Lower	Upper
Professional attitudes	Leadership	0.152	0.016	0.000	0.123	0.185
	Growth mindset	0.053	0.011	0.019	0.035	0.080
Adoption of teaching strategies	Leadership	0.370	0.025	0.000	0.322	0.414
	Growth mindset	0.128	0.024	0.430	0.084	0.178

5. Discussion

5.1. The Effects of Intrapersonal and Interpersonal Factors on Teacher Self-Efficacy

Many researchers have acknowledged that teacher emotions are multi-componential, including the components at the intrapersonal and interpersonal levels [38]. In this sense, teachers' affective attributes include the components operating with the individual self or mind (intrapersonal), and the components existing between persons (interpersonal) [38]. One of teachers' most important affective attributes, teacher self-efficacy, was significantly influenced by teachers' intrapersonal (i.e., teacher growth mindset) and interpersonal (i.e., transformational leadership) factors in the present study.

On the one hand, the intrapersonal components of teacher self-efficacy have been confirmed to correlate with teachers' biological and psychological variables [39]. In this study, we found that teachers' growth mindset had a significant effect on their self-efficacy. Therefore, teachers' personal characteristics, such as their identities, values, and beliefs, which are related to growth mindset, need to be considered when understanding the influencing factors of teacher development [38]. Identities are considered as an overarching framework of teachers' self [40]. Teachers with growth mindset are always holding the identities of "I am not yet", and giving honest critical feedback to the developing self, which strengthens their efficacy to overcome all barriers they meet in teaching. Teachers' values and beliefs make them relive the experiences as a learner [41]. Teachers with growth mindsets usually focus on students' learning processes and adopt more diversified teaching strategies [25]. Therefore, teachers with a growth mindset are inclined to improve their self-efficacy for instructional strategies [13]. On the other hand, the interpersonal components of teacher self-efficacy are associated with social domains such as appraisals of teachers [42]. The appraisals that teachers receive from others can trigger and guide teachers' emotional expressions [43]. For example, an experienced school leader may be viewed as the teachers' role model; thus, teachers' appraisals for their teaching efficacy may be improved through the vicarious learning from the school leader. In this study, teacher's perceived transformational leadership, which could be seen as a form of appraisal information, was found to be a significant predictor of teacher self-efficacy. This findings is consistent with those of previous studies [13,23,42].

Although the intrapersonal and interpersonal model of teacher emotion has been constructed and acknowledged by researchers, the specific effects of these factors on teacher emotion are still underexplored. Pekrun and Schutz [44] believed that this is necessary for theories to encompass the multi-level, dynamic, and contextualized nature of emotions. In the present study, we compared the effects of these two domains and found that transformational leadership had a stronger effect on teacher self-efficacy. According to the theory of locus of control, individuals differed in their perceptions of whether outcomes were attributed to external control or internal control [17]. Bandura's [18] social cognitive theory proposed that teachers can develop their self-efficacy through the four sources of efficacy information, including teachers' mastery experiences, vicarious experiences, social persuasion, and physiological situation. Most of these sources associated with school contexts (i.e., transformational leadership) can be seen as school-related predictors of teacher self-efficacy. Firstly, teacher self-efficacy can be improved by their own successful teaching

practices, with the support of school leaders. For example, when teachers successfully receive positive evaluations about their teaching practices from their school leaders, they will strengthen their self-efficacy and interpret their successes as mastery experiences [22]. Secondly, teacher self-efficacy can be improved through the vicarious experiences provided by school leaders. Teachers are inclined to be more confident in teaching when they witness the successes of school leaders or other role models who have similar qualifications to their own. Thirdly, teacher self-efficacy can be enhanced through social persuasion provided by school leaders. When transformational principals persuade teachers with efficacy-related information such as useful suggestions, teachers are more likely to have promoted motivation and self-efficacy in teaching [23]. Finally, principals may also influence teachers' physiological and affective states such as stress, anxiety, or other moods through school-wide decision-making such as resource allocation and incentive policies, which might further affect teachers' judgement of self-efficacy in teaching. These findings are important for understanding transformational leadership for improving teacher self-efficacy, which leads to teachers' sustainable professional development.

5.2. The Mediating Role of Teacher Self-Efficacy

The SEM analysis demonstrated that teacher self-efficacy significantly mediated the effects of transformational leadership and growth mindset on teachers' professional attitudes towards classroom teaching and the adoption of desirable teaching strategies. Previous studies have shown that teacher self-efficacy functions as a mediator between some school factors and teacher professional development. For example, Hu et al. [45] found that teacher self-efficacy was a mediator of the relationship between school climate and preschool teacher stress. Huang et al. [46] further reported the mediating role of teacher self-efficacy by examining the effect of school organizational conditions on teacher professional learning. The current study contributes to the literature by demonstrating that school-related factors (i.e., transformational leadership) as well as teachers' growth mindset can affect teachers' professional development through the mediation of teacher self-efficacy.

The mediating effects of teacher self-efficacy may be explained by the role of teachers' emotions and affective attributes in teaching and teachers' lives. A narrative literature review conducted by Chen [5] suggested that there are extensive correlations between teachers' experiences, emotions, and different kinds of consequences. On the one hand, teachers' experiences may lead them to understand and influence the world around them. In this sense, when teachers have a growth mindset which leads them to the perseverance of effort and being flexible and creative in the classroom [33], they are inclined to engage in positive attributions and professional attitudes towards teaching [26]. On the other hand, when teachers experience strong supports from their principals in terms of setting working directions or development goals for them and encouraging a collaborative community, they are inclined to develop positive professional attitudes and perform proactive work behaviors [47]. According to Bandura's [18] social cognitive theory, these various kinds of teacher experiences can be seen as different sources of teachers' self-efficacy which further mediate the impact of teacher's perceived transformational leadership and growth mindset on their professional attitudes and teaching strategies.

5.3. Limitations and Directions for Future Research

Although this study yielded these findings about how to sustain teacher professional development, two limitations should be noted. First, this study only collected data from teacher participants in Shenzhen, a developed city in southern China. Considering that China is a vast country with huge regional differences, the generalizability of the findings needs to be considered with caution. Second, although the survey tools used in this study were proven to be valid and reliable, all data were self-reported, which makes it difficult to avoid common method bias. Future research should collect data through multiple sources such as observations and interviews, which would help to obtain in-depth information about the relationships of interest.

6. Conclusions and Implications

Most previous studies have explored the influencing factors and potential consequences of teacher self-efficacy from a single perspective. The present study thus contributed to consider both school-related factors (i.e., transformational leadership) and teacher-related factors (i.e., teachers' growth mindset) in influencing teachers' self-efficacy and their sustainable development. The findings not only revealed the roles of intrapersonal and interpersonal factors in predicting teacher self-efficacy, but also compared the importance of these two domains and found the stronger effect of interpersonal factors. Moreover, this study also provided some evidence about how school- and teacher-related factors affect teachers' professional development via their self-efficacy. The results of the present study bring some implications for teachers, school leaders, and educational administrators to improve teacher training, recruitment, and school leadership.

First, the positive relationship between growth mindset and teacher self-efficacy suggests that training on implicit theories in teacher education is necessary, with particular attention to praising teachers' personal qualities and strengthening control over teachers' teaching practice [48,49]. In order to enhance teachers' growth mindsets, teacher educators are advised to renew teachers' beliefs about the potential of the human brain, and to help teachers recognize the fabricability of their brain, especially when they learn new things or shift their ways of thinking [24,50]. Moreover, given that research-based teacher education programs and mindset theory are indispensable in teacher education, it would be worthwhile to enhance teachers' understanding of implicit theories and the associated incremental theory-provoking pedagogical practices [27]. Teachers are expected to overcome their own cultural barriers and fixed mindsets which may impact their behaviors, and fully develop malleability beliefs to guide their practices in the classroom.

Second, the results of this study indicated that school leaders' transformational leadership plays a crucial role in improving teacher self-efficacy and professional development. It is suggested that transformational school leaders sustain teacher professional development in the following ways. Firstly, school leaders should shape themselves to be role models to teachers [51]. In the context of China, people are significantly influenced by Confucian heritage culture and collectivist tradition. They used to emphasize the respect for authority and harmonious interpersonal relationship. Therefore, school leaders' image and decision-making have dramatic influence on teachers' thinking and behavior [52,53]. It is necessary for school leaders to undertake the role of a "good model" to influence teachers' behaviors in China. "The role model effect" can provide teachers with sufficient vicarious experiences in their teaching careers, by which their teacher self-efficacy can be improved [18]. Secondly, it is suggested that principals develop mutual visions, set directions for teachers, and monitor, persuade, and encourage teachers to improve their teaching competence [52,54]. For example, principals can empower teachers to participate in school development decision-making and adjust school development goals to cater for teachers' professional needs. Third, it is suggested that school leaders provide professional learning opportunities for teachers, rather than only asking them to comply with the superordinate and accept decisions made by educational authorities. Principals should create strong supportive relationships among colleagues with communicated, open-hearted, and cooperative goals. Teachers would thus be inclined to be more confident in sharing their ideas and could develop stronger efficacy beliefs [55,56], which would further strengthen their professional development.

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