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RESEARCH ARTICLE

The Role of Principals' Transformational Leadership and Kindergarten Organizational Climate in Shaping Teachers' Work Engagement: The Mediating Effect of Teachers' Self-Efficacy – Evidence from Jiangsu Province, China

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ABSTRACT

This study examines how principals' transformational leadership and the kindergarten organizational climate are associated with kindergarten teachers' work engagement, with a particular focus on the mediating role of kindergarten teachers' self-efficacy. A survey was conducted with 415 full-time kindergarten teachers across Jiangsu Province, China. Using structural equation modeling (SEM), the relationships among transformational leadership, organizational climate, self-efficacy, and work engagement were tested. The findings show that principals' transformational leadership is positively associated with teachers' work engagement. In addition, a positive kindergarten organizational climate, characterized by effective communication and mutual support, is positively associated with kindergarten teachers' self-efficacy, which in turn is associated with higher work engagement. The results indicate that self-efficacy plays a partial mediating role in the associations between transformational leadership, organizational climate, and teachers' work engagement. This study extends work on transformational leadership by applying it to Chinese kindergartens and underscores the role of self-efficacy in understanding teacher engagement. It highlights the importance of a supportive environment for strengthening teacher motivation and performance. Practical implications suggest that principals should receive training in emotional intelligence and adaptability, while kindergartens should foster a collaborative climate to help bolster teachers' self-efficacy and sustain their engagement.

Keywords: Transformational leadership; Organizational climate; Teacher work engagement; Self-efficacy; Early childhood education; Teacher motivation; Jiangsu Province

1. Introduction

In the context of global educational development, the quality of early childhood education (ECE) has become a central focus due to its profound impact on children's cognitive and socio-emotional development, as well as its broader influence on the educational system[1-3]. Kindergarten teachers, as primary educators in early childhood, play a vital role in shaping the quality of preschool education. Work engagement, defined as

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a multidimensional state marked by vigor, dedication, and absorption, significantly affects educational outcomes[4,5]. Work engagement is strongly linked to teaching quality and professional development, and is associated with lower levels of teacher burnout[6–8]. Research has demonstrated that higher work engagement enhances classroom performance, children's learning experiences, and overall educational environments[9,10]. Therefore, understanding the factors that influence teachers' work engagement in early childhood education is crucial. In this context, clarifying the mechanisms by which teachers' work engagement is shaped in kindergarten settings is theoretically and practically significant.

Among the various factors influencing work engagement, the organizational climate within kindergartens and principals' transformational leadership styles have attracted increasing attention[11,12]. However, research in early childhood education remains limited, particularly within the context of China. Organizational climate refers to the shared perceptions and affective atmosphere within an institution, which significantly influences teachers' work attitudes, experiences, and behaviors[13,14]. Studies indicate that positive aspects of organizational climate, such as effective communication, harmonious relationships, and support for professional development, are positively correlated with teachers' work engagement [15,16]. In early childhood settings, where care and education are integrated and home–school partnerships are strong, the empirically testable mechanism linking transformational leadership to teachers' work engagement through organizational climate has been insufficiently specified and tested.

Similarly, transformational leadership, introduced in the 1980s, has demonstrated positive effects on work engagement across various organizational settings [17,18]. In educational contexts, principals who adopt a transformational leadership style are associated with teachers' stronger sense of mission and professional growth, which in turn is related to higher work engagement[19,20]. Although existing literature has substantiated these effects, ECE-specific, theoretically integrated research is needed to develop a more comprehensive understanding of how transformational leadership influences teachers' work engagement.

In China, the growing focus on early childhood education, particularly after the adoption of the "two-child policy," has prompted a notable expansion of educational resources [21]. Improving the quality of early childhood education has thus become a pressing priority. Jiangsu Province, as an economically developed region with abundant educational resources, serves as a representative example of the rapid development of preschool education in China. Between 2014 and 2023, the number of kindergartens in Jiangsu increased from 5,072 to 8,073, while the teaching workforce grew from 115,900 to 162,864[22]. Challenges like teacher instability and the impact of leadership styles and organizational climate on teachers' work engagement continue to exist despite this increase. This underscores the need for further exploration of these relationships, with Jiangsu providing a policy-salient case that may offer transferable insights for regions facing similar challenges. Accordingly, the province offers a large-scale context in which to examine the leadership – climate – engagement nexus in early childhood education. We also report reliability and validity assessments and conduct common method bias and multicollinearity diagnostics to enhance the credibility of the findings.

Additionally, these dynamics are significantly shaped by teachers' self-efficacy. Self-efficacy, which is the belief in one's own ability to perform in specific activities, is directly linked to work engagement in educational contexts [23, 24]. Research shows that teachers with higher levels of self-efficacy are more likely to be innovative in their teaching methods and to be more involved in their profession[25]. However, limited research has examined how teachers' self-efficacy in early childhood education settings mediates the relationship between transformational leadership, organizational climate, and work engagement.

Building on this literature and guided by the Job Demands–Resources framework, this study addresses two questions: first, how principals' transformational leadership and kindergarten organizational climate

relate to teachers' work engagement; and second, whether organizational climate is indirectly related to engagement through teachers' self-efficacy. Testing this personal-resource pathway with a large sample from Jiangsu Province, China, extends leadership–engagement research to kindergarten settings and clarifies the mechanism connecting leadership, climate, self-efficacy, and engagement, while offering practical guidance for administrators seeking to build supportive climates and enhance teachers' efficacy.

From a practical perspective, the findings provide evidence to assist kindergarten administrators in optimizing organizational management, strengthening collaborative climate, and enhancing teachers' sense of efficacy to support sustained engagement and the excellent growth of preschool education. Focusing on Jiangsu Province, the study offers insights that may inform early childhood education research and practice in contexts with similar organizational demands.

2. Theoretical framework and hypotheses

This study adopts the Job Demands–Resources (JD–R) perspective as its core theoretical lens and draws on Transformational Leadership (TL) theory and Social Cognitive Theory (SCT) as supportive mechanisms to investigate the relationships between principals' transformational leadership, kindergarten organizational climate, teachers' self-efficacy, and teachers' work engagement in early childhood education. The theoretical foundations of this research therefore emphasize JD–R as the main explanatory framework, while TL and SCT clarify how principals can activate contextual resources and how efficacy beliefs channel these resources into engagement. To maintain parsimony, Work Motivation Theory (Vroom) is not used as a parallel framework; motivational implications are discussed in the Implications section. These frameworks provide a comprehensive lens to examine both organizational and individual factors influencing teachers' work engagement.

According to Transformational Leadership Theory, which was first put forth by Burns and then expanded by Bass, transformational leadership has been associated with improved performance and engagement through encouraging, supporting, and motivating followers [26, 27]. In educational settings, principals using transformational leadership foster a sense of mission and professional growth among teachers, and studies show that such leadership helps mitigate burnout, increases work engagement, and supports professional growth [28-31]. Consistent with the JD–R view, we conceptualize principals' transformational behaviors as triggers of job resources that are associated with a more supportive organizational climate in kindergartens.

In line with the JD–R model, the equilibrium between job demands and available resources is associated with both job performance and well-being[32]. Transformational leadership can be viewed as an essential tool that augments available job resources, aiding in stress reduction and supporting engagement[33,34]. In this study, we utilize the JD–R model to investigate how leadership behaviors and organizational climate offer the resources to manage job demands, which are related to higher teacher engagement. Within this pathway, organizational climate functions as a situational resource, and teachers' self-efficacy serves as a proximal psychological resource that transmits resource gains to teachers' work engagement.

In conjunction with the JD–R model, Social Cognitive Theory provides insights into how transformational leadership relates to teachers' self-efficacy[35]. Motivation and job engagement are closely linked to self-efficacy, which is the belief in one's own ability to succeed in particular tasks [36]. Teachers exhibiting higher self-efficacy tend to show greater energy, commitment, and absorption in their tasks, all of which are crucial elements of work engagement[37]. Studies show that transformational leadership is

positively associated with self-efficacy, which in turn is associated with higher work engagement and teaching quality[38–40].

Accordingly, instead of combining four parallel theoretical perspectives, the present study centers on JD–R to provide a coherent mechanism: transformational leadership and organizational climate supply contextual resources, teachers' self-efficacy operates as a proximal psychological resource, and these resources are associated with higher work engagement. Transformational leadership, organizational climate, and self-efficacy interact to shape teachers' engagement by addressing both external organizational conditions and internal motivational processes. It is anticipated that transformational leadership is positively associated with work engagement both directly and indirectly via its impact on organizational climate and teachers' self-efficacy.

Figure 1 presents the research model, illustrating the relationships among the key variables.

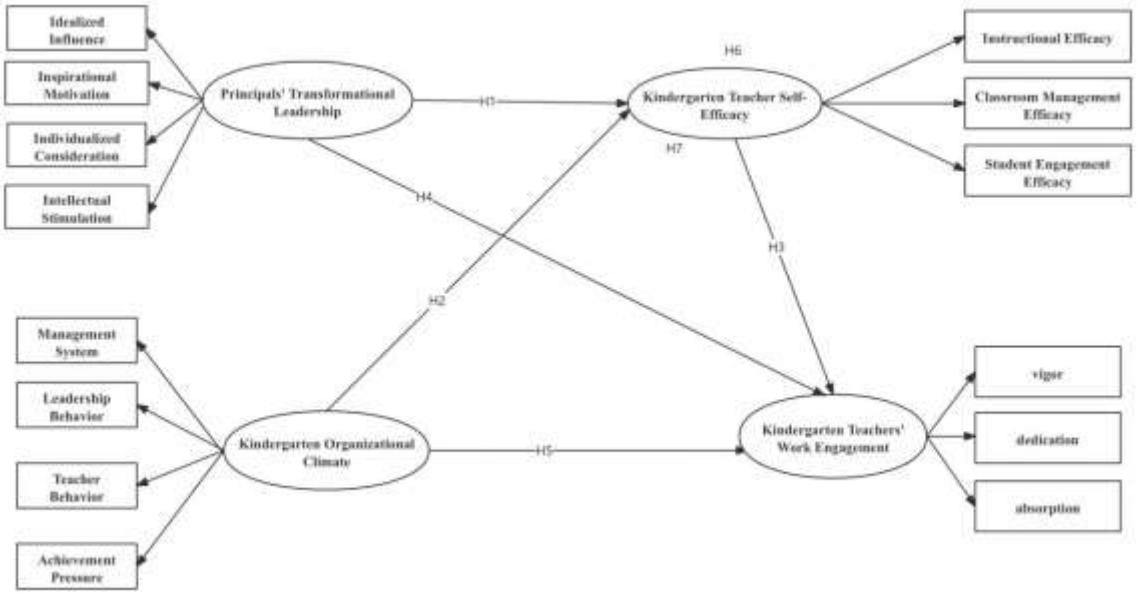

Figure 1. Structural model diagram

Based on the theoretical frameworks discussed earlier, the following hypotheses posit associations among transformational leadership, organizational climate, teachers' self-efficacy, and work engagement. In particular, the following hypotheses are put forward:

H1: Principals' transformational leadership is positively associated with teachers' self-efficacy.

H2: Kindergarten organizational climate is positively associated with teachers' self-efficacy.

H3: Kindergarten teachers' self-efficacy is positively associated with their work engagement.

H4: Principals' transformational leadership is positively associated with teachers' work engagement.

H5: Kindergarten organizational climate is positively associated with teachers' work engagement.

H6: Kindergarten teachers' self-efficacy mediates the association between transformational leadership and teachers' work engagement.

H7: Kindergarten teachers' self-efficacy mediates the association between organizational climate and teachers' work engagement.

These hypotheses aim to assess the direct and indirect effects of organizational climate, teachers' self-efficacy, and transformational leadership on work engagement. Structural Equation Modeling (SEM) will be used to empirically examine these relationships. SEM offers a comprehensive framework for investigating how the key variables interact and enables the simultaneous analysis of both direct and indirect effects between them.

3. Materials and methods

The present study adopted a quantitative approach to investigate the connections among principals' transformational leadership, kindergarten organizational climate, teachers' self-efficacy, and work engagement in preschool education in Jiangsu Province, China. The study aimed to understand these associations across public and private kindergartens and across urban and rural settings.

3.1. Sample size

A structured survey was administered to full-time teachers in public and private kindergartens in urban and rural areas of Jiangsu Province. A stratified random sampling technique was used to ensure the sample's representativeness across geographical regions (southern, central, and northern Jiangsu), kindergarten types (public and private), and location (urban and rural). An initial quota of 60% urban and 40% rural was set, and proportional allocation was applied across strata; minor post-stratification adjustments were used to improve balance.

Based on the total number of 162,864 full-time kindergarten teachers in Jiangsu Province in 2023[22], the minimum sample size was 399 at a 95% confidence level and a 5% margin of error.

$$n = \frac{N}{1 + N(e^2)}$$

Where:

n = sample size

N = total population (162,864)

e = margin of error (5%)

A design effect (DEFF) of 1.1, based on Kish's sampling theory, was applied to adjust for variance inflation due to subgroup heterogeneity [41]. The final target sample size was increased to 450 to provide adequate statistical power for subgroup analysis across kindergarten types, including rural public, rural private, urban private, and urban public [42].

3.2. Measurement instruments

This study employed well-established and culturally adapted instruments to measure the core constructs of transformational leadership, organizational climate, teachers' self-efficacy, and work engagement. The selection of these instruments was based on their proven reliability, validity, and cultural relevance within the context of Chinese kindergartens. To ensure their appropriateness, a thorough adaptation process was undertaken, including expert reviews, pilot testing, and confirmatory factor analysis (CFA), which supported both their cultural suitability and structural integrity.

Detailed information regarding the measurement instruments, including their respective dimensions and reliability statistics, can be found in Table 1.

Table 1. Measurement instruments

Measurement Tool	Dimensions	Cronbach's α	Source
Global Transformational Leadership (GTL)	Inspirational Motivation, Idealized Influence, Individualized Consideration, Intellectual Stimulation,	0.979	Carless et al. (2000)
Kindergarten Organizational Climate Scale (KOCS)	Management System, Leadership Behavior, Teacher Behavior, Achievement Pressure	0.919	Li Xiaowei et al. (2017), Hoy & Clover (1986)
Utrecht Work Engagement Scale (UWES-17)	Vigor, Dedication, Absorption	0.950	Schaufeli et al. (2002)
Teacher Self-Efficacy Scale (TSES)	Instructional Efficacy, Classroom Management Efficacy, Learner Engagement Efficacy	0.962	Tschannen-Moran & Hoy (2001), Wu & Zhan (2017)

Transformational Leadership. The Global Transformational Leadership (GTL) scale created by Carless et al. was used to evaluate the transformational leadership of principals[43]. The GTL comprises four dimensions: Idealized Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration. Through expert feedback and pilot testing, the Chinese adaptation of the GTL was supported, showing high internal consistency (Cronbach's α = 0.979).

Organizational Climate. To assess the organizational climate in kindergartens, the Kindergarten Organizational Climate Scale (KOCS) was based on the research of Li Xiaowei et al. [44] and adapted from Hoy and Clover's Organizational Climate Description Questionnaire (OCDQ–RE) [45]. The KOCS includes four components: Management System, Teacher Behavior, Leadership Behavior, and Achievement Pressure. Strong internal consistency was observed (Cronbach's α = 0.919), supporting the adapted scale's reliability.

Teachers' Work Engagement: Schaufeli et al. developed the Utrecht Work Engagement Scale (UWES–17) to assess teachers' work engagement [46]. The scale consists of three dimensions: Absorption, Vigor, and Dedication. The Chinese version of the UWES-17 was supported through expert review and pilot testing, and internal consistency was high (Cronbach's α = 0.950).

Teachers' Self-Efficacy: The Teacher' Self-Efficacy Scale (TSES), developed by Tschannen-Moran and Hoy and revised into Chinese by Wu and Zhan, was used to gauge teachers' self-efficacy [47,48]. The scale comprises three dimensions: Learner Engagement Efficacy, Classroom Management Efficacy, and Instructional Efficacy. Internal consistency was high (Cronbach's α = 0.962), supporting the reliability of the TSES.

3.3. Data collection

Data were collected from April to May 2025 via online surveys on the Wenjuanxing platform and paper-based surveys at institutions without digital infrastructure. The survey instrument was reviewed by an expert panel of five academic committee members, providing evidence of content validity. Approval from the relevant institutional review board (IRB) was obtained. Consent was obtained from each participant, with clear explanations regarding voluntary participation, confidentiality, and the study's objectives. Participation was anonymous, and no personally identifiable information was collected.

3.4. Data analysis

The data were analyzed in two stages. Initially, preliminary analyses, including descriptive statistics, t-tests, and Pearson correlations, were conducted using SPSS 27.0. The normality of the data distribution was checked prior to inferential analysis. Subsequently, AMOS 26.0 was used to conduct Structural Equation Modeling (SEM) to test the proposed links between latent variables. Fit indices such as TLI, RMSEA, CFI,

and chi-square (χ^2) were used to evaluate the model. According to Hu and Bentler's [49] and Kline's [50] recommendations, RMSEA < 0.08, CFI > 0.90, and TLI > 0.90 indicate a reasonable model fit.

4. Results

4.1. Sample description

After eliminating invalid responses, 415 valid responses were retained from the 450 questionnaires distributed (response rate = 92.2%). These valid responses came from full-time teachers in both public and private kindergartens, covering both urban and rural areas within Jiangsu Province. The gender distribution was predominantly female (90.1%), reflecting the gender composition typical of the early childhood education workforce. The age distribution indicated a youthful workforce, with the majority of teachers (56.4%) aged 30 or younger. The sample also revealed a wide variety of teaching experience, with 16.4% having more than 15 years of experience and a significant percentage (29.4%) having between 3 and 5 years. In terms of professional rank, the majority were second-level staff (54.7%), followed by first-level staff (16.9%).

These sample characteristics ensure a diverse representation of kindergarten teachers across different demographic and professional backgrounds, which lays a strong foundation for comprehending how leadership and organizational climate affect teachers' work engagement.

Table 2. The Basic Information Overview of Survey Respondents

Standard	**Category**	**Frequency**	**Percentage**
Kindergarten location	Urban	304	73.3%
	Rural	111	26.7%
Kindergarten type	Public (Government-funded)	288	69.4%
	Private (Independent)	114	27.5%
	International	13	3.1%
Ggender	Male	41	9.9%
	Female	374	90.1%
Age	≤ 25 years	115	27.7%
	26-30 years	119	28.7%
	31-35 years	84	20.2%
	36-45 years	52	12.5%
	46-55 years	29	7%
	≥ 55 years	16	3.9%
Teaching experience	≤ 2 years	57	13.7%
	3-5 years	122	29.4%
	6-8years	72	17.3%
	9-11years	58	14.0%
	12-14years	38	9.2%
	≥15 years	68	16.4%
Professional rank	Third-Level academic staff/Unranked	118	28.4%
	Second-Level academic staff	227	54.75
	First-Level academic staff's	70	16.9%

4.2. Difference analysis

This section reports group-differences analysis for principals' transformational leadership, kindergarten organizational climate, teachers' work engagement, and teachers' self-efficacy. The analysis compares three main groups: kindergarten location (urban vs. rural), gender (male vs. female), and kindergarten type (public, private, cooperative).

As presented in Tables 3–5, independent-samples t tests by location revealed no significant differences across the four key variables. While urban kindergartens showed slightly higher mean scores for principals' transformational leadership, organizational climate, work engagement, and self-efficacy, these differences were not statistically significant ($p > 0.05$). These results suggest that kindergarten location does not significantly influence teachers' perceptions of leadership, organizational climate, or engagement.

Table 3. T-Test for Comparison of Key Variables Across Kindergarten Locations

Variables	Region	N	M	SD	t(df)	p	Effect Size (d)
Principals' Transformational Leadership	Urban	304	4.29	0.815	1.066(413)	0.287	0.118
	Rural	111	4.19	0.95			
Kindergarten Organizational Climate	Urban	304	4.05	0.572	0.938(413)	0.349	0.104
	Rural	111	3.99	0.558			
Kindergarten Teachers' Work Engagement	Urban	304	4.16	0.629	1.019(413)	0.309	0.113
	Rural	111	4.09	0.587			
Kindergarten Teacher Self-Efficacy	Urban	304	4.37	0.512	1.075(413)	0.283	0.119
	Rural	111	4.31	0.476			

Table 4. T-Test for Kindergarten Teachers' Gender

Variables	Gender	N	M	SD	t(df)	p	Effect Size (d)
Principals' Transformational Leadership	Male	41	3.98	1.122	-2.274(413)	0.023*	-0.374
	Female	374	4.3	0.815			
Kindergarten Organizational Climate	Male	41	3.78	0.637	-2.987(413)	0.003**	-0.491
	Female	374	4.06	0.554			
Kindergarten Teachers' Work Engagement	Male	41	3.92	0.624	-2.390(413)	0.017*	-0.393
	Female	374	4.16	0.613			
Kindergarten Teacher Self-Efficacy	Male	41	4.21	0.49	-1.991(413)	0.047*	-0.328
	Female	374	4.37	0.502			

** indicates a significant correlation at P < 0.05; ** indicates an extremely significant correlation at P < 0.01.*

In contrast, significant gender differences were observed across all key variables. Female teachers reported higher scores than male teachers on principals' transformational leadership ($M = 4.30$ vs. $M = 3.98$, $p = 0.023$), organizational climate ($M = 4.06$ vs. $M = 3.78$, $p = 0.003$), work engagement ($M = 4.16$ vs. $M = 3.92$, $p = 0.017$), and self-efficacy ($M = 4.37$ vs. $M = 4.21$, $p = 0.047$). These findings indicate that gender plays a significant role in shaping teachers' perceptions and engagement, with female teachers generally providing more favorable assessments.

Regarding kindergarten type, one-way ANOVA showed a significant difference in work engagement ($F = 9.391$, $p < 0.001$), with teachers in private kindergartens reporting higher engagement ($M = 4.35$) than

those in public kindergartens (M = 4.06). However, subsequent multiple-comparison tests indicated that the public–cooperative (p = 0.979) and private–cooperative (p = 0.358) pairs were not significantly different.

These results highlight that while gender differences are evident across all variables, the effects of kindergarten location and type are more limited, particularly for principals' transformational leadership and organizational climate. These findings provide important insights into how demographic factors influence teachers' perceptions and work engagement, and point to areas for future research.

Table 5. Impact of Kindergarten Type on Work Engagement

	Kindergarten type	N	M	SD	F	p	Scheffe(p)		
							1	2	3
1	Public kindergarten	288	4.06	0.623			-		
2	Private kindergarten	114	4.35	0.571	9.391	<0.001***	<0.001***	-	
3	Cooperative kindergarten	13	4.10	0.493			0.979	0.358	-

*** *indicates a highly significant correlation at P < 0.001.*

4.3. Correlation analysis

This section presents the correlation analysis among the four core variables: principals' transformational leadership, kindergarten organizational climate, teachers' work engagement, and teachers' self-efficacy. As shown in Table 6, all four variables demonstrated significant positive correlations (p < 0.01).

Table 6. Correlation Matrix of Core Variables

	Variables	**M**	**SD**	**1**	**2**	**3**	**4**
1	Principals' Transformational Leadership	4.27	0.854	1			
2	Kindergarten Organizational Climate	4.03	0.568	0.866**	1		
3	Kindergarten Teachers' Work Engagement	4.14	0.618	0.605**	0.638**	1	
4	Kindergarten Teacher Self-Efficacy	4.35	0.503	0.485**	0.553**	0.750**	1

** *indicates an extremely significant correlation at P < 0.01.*

Principals' transformational leadership was strongly and positively associated with kindergarten organizational climate (r = 0.866, p <0.01) and teachers' work engagement (r = 0.605, p < 0.01), suggesting that higher reported transformational leadership is associated with a more positive work environment and higher levels of teacher engagement. There was also a favorable correlation between transformational leadership and teachers' self-efficacy (r = 0.485, p < 0.01).

Kindergarten organizational climate was positively associated with teachers' work engagement (r = 0.638), consistent with the view that more supportive environments coincide with higher engagement. The climate measure was also moderately and positively associated with teachers' self-efficacy (r = 0.553, p < 0.01). Finally, teachers' work engagement and self-efficacy were strongly and positively correlated (r = 0.750, p < 0.01), indicating that higher engagement tends to co-occur with higher self-efficacy. Taken together, these intercorrelations motivate the subsequent SEM to examine the proposed direct and indirect associations.

4.4. Analysis of structural equation results

This section reports the findings from the structural equation modeling (SEM) analysis, focusing on model fit, path analysis, and hypothesis testing. The analysis examines how principals' transformational leadership (PTL) and kindergarten organizational climate (KOC) relate to teachers' work engagement (KTWE), with teachers' self-efficacy (KTSE) as a mediator.

4.4.1. Model fit

The initial structural equation model, depicted in Figure 2, was evaluated using several fit indices, as summarized in Table 7. The χ^2/df ratio of 3.101 is slightly above the conventional 3.0 cutoff but within the commonly used acceptable range under a < 5 criterion, and the RMSEA value of 0.071 is below the threshold of 0.08, indicating adequate approximation. The RMR was 0.034 and the PGFI was 0.631, both meeting recommended guidelines (RMR < 0.08; PGFI > 0.50). Furthermore, the model fit indices—GFI (0.933), TLI (0.968), IFI (0.975), and CFI (0.975)—all exceed the recommended thresholds, which is consistent with overall acceptable fit. Overall, the model fit is acceptable and supports proceeding to the subsequent path and mediation analyses.

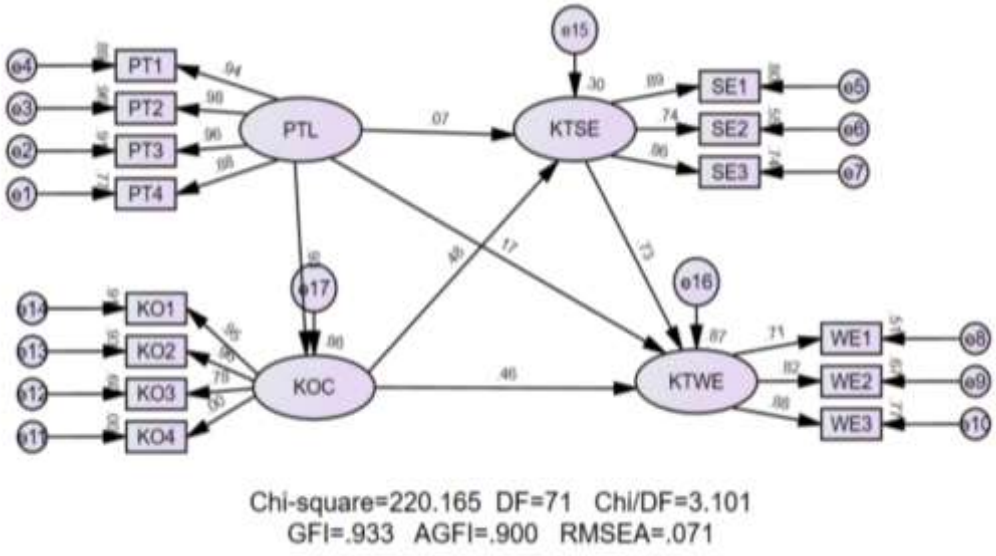

Figure 2. Initial structural equation model

Table 7. Overall fitting of initial structural equation model

Fit Index	χ^2/df	RMR	RMSEA	GFI	TLI	IFI	CFI	PGFI
Recommended Threshold	＜3	＜0.08	＜0.08	＞0.8	＞0.9	＞0.9	＞0.9	＞0.5
Model Value	3.101	0.034	0.071	0.933	0.968	0.975	0.975	0.631

4.4.2. Path analysis

According to Table 8, confirmatory factor analysis showed that the standardized factor loadings were high and significant ($p < 0.001$). For principals' transformational leadership (PTL), item loadings (PT1 to PT4) ranged from 0.945 to 0.978. For kindergarten organizational climate (KOC), loadings for KO1 to KO4 ranged from 0.651 to 0.963. For teachers' self-efficacy (KTSE), loadings for SE1–SE3 ranged from 0.742 to 0.861. For teachers' work engagement (KTWE), loadings for WE1 to WE3 ranged from 0.715 to 0.879. These results indicate good convergent validity and support proceeding to the examination of structural paths among the latent variables.

Table 8. Path Analysis Results for Structural Equation Model

Path			Unstd	S.E.	z-value	P	Std.
PT4	<---	PTL	1.000				0.875
PT3	<---	PTL	1.123	0.035	31.789	***	0.956

Path			Unstd	S.E.	z-value	P	Std.
PT2	<---	PTL	1.092	0.032	33.793	***	0.978
PT1	<---	PTL	1.112	0.036	30.810	***	0.945
SE1	<---	KTSE	1.000				0.893
SE2	<---	KTSE	0.901	0.050	18.082	***	0.742
SE3	<---	KTSE	0.918	0.040	23.005	***	0.861
WE1	<---	KTWE	1.000				0.715
WE2	<---	KTWE	0.740	0.046	15.921	***	0.820
WE3	<---	KTWE	0.775	0.046	16.717	***	0.879
KO4	<---	KOC	1.000				0.651
KO3	<---	KOC	1.096	0.065	11.090	***	0.776
KO2	<---	KOC	0.886	0.078	13.031	***	0.963
KO1	<---	KOC	0.905	0.058	10.874	***	0.955

Table 8. (*Continued*)

**** indicates a highly significant correlation at P < 0.001.*

4.4.3. Hypothesis test results

The findings of the hypothesis test are collected in Table 9, and provide insights into the relationships between the key variables. The hypotheses tested are as follows:

H1: Principals' transformational leadership is positively associated with teachers' self-efficacy.

The effect was positive and statistically significant (standardized β = .17, SE = .09, z = 2.39, p = .017), which supports H1.

H2: Kindergarten organizational climate is positively associated with teachers' self-efficacy.

A strong positive association (Std. = 0.482, S.E. = 0.083, C.R. = 5.814, p < 0.001). H2 is fully supported.

H3: Kindergarten teachers' self-efficacy is positively associated with their work engagement.

A strong and highly significant positive association (Std. = 0.734, S.E. = 0.077, C.R. = 14.043, p < 0.001). H3 is fully supported.

H4: Principals' transformational leadership is positively associated with teachers' work engagement.

A small but significant positive association (Std. = 0.072, S.E. = 0.093, C.R. = 2.505, p = .018). H4 is supported.

H5: Kindergarten organizational climate is positively associated with teachers' work engagement.

A significant association (Std. = 0.455, S.E. = 0.086, C.R. = 5.312, p < .001). H5 is fully supported.

Additionally, H6 and H7 focus on the mediation effects, which are detailed in Table 10.

Table 9. Hypothesis Testing Results for Direct Relationships

Hypothesis	Path	Std.	S.E.	C.R.	P	Hypothesis Testing Results
H1	KTSE<---PTL	0.17	0.09	2.39	0.017*	Supported
H2	KTSE<---KOC	0.482	0.083	5.814	***	Supported
H3	KTWE<---KTSE	0.734	0.077	14.043	***	Supported

Hypothesis	Path	Std.	S.E.	C.R.	P	Hypothesis Testing Results
H4	KTWE<---PTL	0.072	0.093	2.505	0.018*	Supported
H5	KTWE<---KOC	0.455	0.086	5.312	***	Supported

Table 9. (*Continued*)

*** indicates an extremely significant correlation at P < 0.01; *** indicates a highly significant correlation at P < 0.001.*

According to the mediation analysis using bias-corrected bootstrap confidence intervals (5,000 resamples), the association between transformational leadership and work engagement (H6) is significantly mediated by teachers' self-efficacy: the indirect effect β = 0.210 (95% CI [0.154, 0.278]) accounts for 47.96% of the total effect, while the direct effect β = 0.228 (95% CI [0.180, 0.276]) remains significant—indicating partial mediation.

Furthermore, the association between organizational climate and work engagement (H7) is also mediated by teacher self-efficacy, with an indirect effect β = 0.345 (95% CI [0.261, 0.442]) explaining 49.71% of the total effect; the direct effect β = 0.349 (95% CI [0.273, 0.426]) remains significant—again indicating partial mediation.

Table 10. Hypothesis Testing Results for Mediation Effects

Hypothesis	Path	P	Effect	β	LLCT	ULCT	Effect Proportion	Hypothesis Testing Results
H6	PTL --->KTSE --->KTWE	***	Total effects	0.438	0.382	0.493		Supported
			Direct effects	0.228	0.18	0.276	52.02%	
			Indirect effects	0.21	0.154	0.278	47.96%	
H7	KOC --->KTSE --->KTWE	***	Total effects	0.694	0.613	0.775		Supported
			Direct effects	0.349	0.273	0.426	50.29%	
			Indirect effects	0.345	0.261	0.442	49.71%	

*** indicates an extremely significant correlation at P < 0.01; *** indicates a highly significant correlation at P < 0.001.*

In conclusion, the SEM analysis indicates that both principals' transformational leadership and kindergarten organizational climate are positively associated with teacher work engagement, both directly and indirectly via teachers' self-efficacy. These results underscore the importance of fostering supportive organizational climates, strengthening teachers' self-efficacy, and cultivating effective leadership to promote teacher engagement.

5. Discussion

This study provides significant theoretical contributions and practical insights into the factors affecting teachers' work engagement in early childhood education, with a particular focus on China. The findings highlight the roles of kindergarten organizational climate, teachers' self-efficacy, and principals' transformational leadership, with self-efficacy serving as a key mediator.

5.1. Theoretical contributions

This study advances the application of transformational leadership theory to the understudied kindergarten context in China. It clarifies how leadership relates to teachers' work engagement through organizational climate and self-efficacy. Using the Job Demands–Resources perspective as the core lens, and drawing on transformational leadership and social cognitive theory for support, the study specifies a resource pathway in which leadership is associated with a more supportive climate and, in turn, higher self-efficacy

and engagement. Compared with K–12 evidence, this extends theory building to settings where care–education integration and close home–school ties are salient.

Additionally, by highlighting the mediating role of teachers' self-efficacy, this study clarifies how Social Cognitive Theory applies to early childhood settings. In line with that theory, higher self-efficacy is associated with higher work engagement. The mediation is partial rather than complete: the structural equation results still show significant direct associations from organizational climate and from principals' leadership to work engagement (see Tables 9–10).

The Job Demands–Resources perspective is central here. A positive organizational climate operates as a contextual resource, and self-efficacy functions as a proximal psychological resource that helps translate resources into engagement. The pattern of associations in our model is clear: links from organizational climate to self-efficacy and to work engagement, and the link from self-efficacy to work engagement, are relatively larger, whereas the direct link from principals' leadership to work engagement is smaller. Taken together, these findings provide an ECE-specific foundation for future work on how leadership, climate, and self-efficacy combine to shape teachers' engagement.

Finally, the observed gender differences (with females scoring higher on average) are consistent with cultural explanations in the Chinese context, such as gendered role expectations and relational norms in early childhood education. Future theoretical and empirical work should incorporate these socio-cultural factors as potential moderators.

5.2. Practical implications

The results suggest several actionable directions for early childhood education systems. First, leadership development for principals should be strengthened, with an emphasis on emotional intelligence, adaptability, and individualized support. Such practices are associated with a more supportive work environment and with higher teacher motivation and professional growth. Second, cultivating a collaborative organizational climate—characterized by open communication, mutual support, and sustained professional development—is essential for fostering teachers' work engagement. A favorable climate is also linked to higher self-efficacy and greater day-to-day engagement and well-being. Finally, professional development should explicitly target the enhancement of teachers' self-efficacy, which is a key correlate of work engagement and an important factor in mitigating burnout. At the system level, leadership development and climate improvement should be prioritized within reform initiatives to raise the overall quality of early childhood education.

5.3. Limitations and future research

Despite the fact that this study offers insightful information, it must be noted that it has several limitations. The use of a cross-sectional design constrains the ability to draw causal conclusions; longitudinal or experimental studies are required to explore the temporal sequence and mechanisms linking leadership, climate, self-efficacy, and engagement. The measures are based on self-reports; future research would benefit from incorporating observational or other objective indicators of engagement (e.g., classroom observations, child outcomes) to triangulate the findings. Finally, because the study focuses on the Chinese context, comparative work across provinces and cultures is warranted to assess generalizability and to examine how transformational leadership operates under different cultural norms and institutional arrangements.

6. Conclusion

This study sheds light on factors related to early childhood teachers' work engagement, with a special emphasis on kindergarten settings in China. According to the findings, teachers' self-efficacy, organizational

climate, and principals' transformational leadership all play important roles, with self-efficacy acting as a key mediating factor. The main findings are outlined below:

6.1. Impact of transformational leadership on teacher engagement

The findings indicate that principals who enact transformational practices—such as individualized support and encouragement of critical thinking—are associated with higher teacher engagement. Such leadership behaviors are linked to greater enthusiasm and commitment among teachers, which may be reflected in better performance at both individual and institutional levels. This pattern underscores the role of leadership in shaping conditions that foster teacher motivation and engagement, particularly in early childhood settings.

6.2. The role of organizational climate in teacher engagement

A supportive organizational climate in kindergarten settings, characterized by open communication, accessible support from principals and colleagues, fair procedures, and sustained professional development, is associated with higher teacher engagement. When early childhood educators encounter these positive everyday conditions, they are more likely to feel confident, energized, and deeply invested in their teaching and caregiving roles. This underscores the importance of cultivating a collaborative and affirming environment where staff feel both supported and empowered. To promote such engagement, kindergartens can adopt targeted strategies such as protected planning time, transparent workload guidelines, and consistent pedagogical coaching. These practices are vital for sustaining long-term teacher motivation and fostering professional growth in early childhood education.

6.3. Self-efficacy as a mediator in teacher engagement

The findings further reveal that teachers' self-efficacy partially mediates the relationship linking transformational leadership to work engagement, and also the link between organizational climate and work engagement. Within the JD–R framework, self-efficacy is conceptualized as a key personal resource that facilitates motivational processes. Effective leadership and a positive organizational climate are associated with higher teachers' self-efficacy, which in turn relates to more energy and commitment in their work. In kindergarten settings, where teaching and care are integrated and home–school communication is frequent, strengthening self-efficacy appears especially consequential. These findings underscore the central role of self-efficacy in leadership practices and organizational interventions aimed at promoting teacher engagement.

6.4. Practical implications for policy and practice

The findings of this study offer several practical implications for improving early childhood education. First, principals should receive training that strengthens transformational leadership behaviors, particularly emotional intelligence, adaptability, and the provision of individualized support. At the organizational level, kindergartens should foster a climate that promotes collaboration, continuous professional development, and mutual support among teachers. Such an environment not only enhances teachers' self-efficacy but is also associated with reduced burnout and higher job satisfaction. Finally, professional development initiatives should explicitly target the enhancement of teachers' self-efficacy, given its consistent links with work engagement and performance.

In summary, this research contributes to the theoretical understanding of leadership and work engagement in preschool education, particularly within the context of China, by specifying a JD–R–consistent personal-resource pathway centered on self-efficacy. These findings offer actionable insights for policymakers and educational leaders, providing a clear framework to foster supportive and engaging environments that enhance teacher engagement and improve early childhood education quality. This study

has wide implications for both the Chinese context and the broader international educational landscape. It also points to future research using longitudinal or multi-source designs, testing cross-level effects such as center-level climate, and examining group differences such as gender or tenure to refine boundary conditions.

Author contributions

Conceptualization and methodology, Jing Li. and Chonlavit Sutunyarak.; formal analysis and investigation, Jing Li.; supervision and project administration, Chonlavit Sutunyarak. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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