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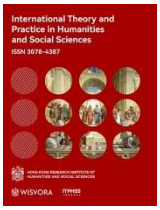

Building Sustainable Schools: The Reciprocal Relationship Between Distributed Leadership and Teacher Professional Commitment Across Time

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Abstract

Sustainable school development requires leadership approaches that strengthen organizational capacity and sustain teachers' long-term professional engagement. Although previous research has established a positive association between distributed leadership and teacher professional commitment, limited attention has been given to their reciprocal relationship across time. This study examined the longitudinal relationship between distributed leadership and teacher professional commitment using a three-wave panel design. Data were collected from 1,384 primary and secondary school teachers in China and analyzed using an autoregressive cross-lagged panel model. The results demonstrated that distributed leadership significantly predicted subsequent teacher professional commitment, while teacher professional commitment also positively influenced later distributed leadership. The reciprocal model showed superior fit compared with alternative directional models, indicating that leadership practices and teacher commitment mutually reinforce each other over time. This study contributes to sustainable educational management by extending distributed leadership theory from a leader-centered perspective toward a relational and dynamic framework. The findings highlight the importance of developing participatory leadership structures and cultivating teacher agency to promote sustainable school development.

1. Introduction

1.1 Sustainable school development and teacher professional commitment

In the context of increasing educational complexity, schools are increasingly viewed as sustainable organizations that require continuous improvement, organizational resilience, and effective human resource development. Sustainable school development emphasizes not only short-term performance improvement but also the long-term capacity of schools to maintain educational quality through effective leadership and teacher development (Hargreaves & Fink, 2006). As teachers represent the core human resources of schools, maintaining teachers' professional commitment has become essential for achieving sustainable educational outcomes

(Day & Gu, 2010).

Teacher professional commitment refers to teachers' psychological attachment and willingness to invest effort in their profession and organizations (Meyer et al., 1993). Highly committed teachers are more likely to demonstrate professional engagement, participate in school improvement activities, and remain in the teaching profession (Somech & Bogler, 2002). Therefore, understanding how schools cultivate teacher professional commitment is a critical issue in sustainable educational management.

Previous studies have demonstrated that organizational factors, particularly leadership practices, play an important role in shaping teachers' professional attitudes. However, less attention has been given to how leadership processes and teacher commitment may influence each other dynamically over time.

1.2 Distributed leadership and sustainable school management

Distributed leadership has emerged as an important approach for sustainable school development because it emphasizes shared responsibility, collaborative decision-making, and teacher participation in organizational governance (Spillane, 2006). Unlike traditional leadership models that focus primarily on principals, distributed leadership views leadership as a collective process involving multiple members within the school community (Harris, 2008).

From a sustainability perspective, distributed leadership contributes to organizational continuity by developing internal leadership capacity and empowering teachers to participate actively in school improvement processes (Hargreaves & Fink, 2006). When teachers perceive greater autonomy, trust, and participation opportunities, they are more likely to develop stronger professional commitment toward their schools (Bogler & Somech, 2004).

Therefore, previous research has mainly assumed a directional relationship: Distributed Leadership → Teacher Professional Commitment. However, this assumption may overlook teachers' active role in shaping school leadership practices.

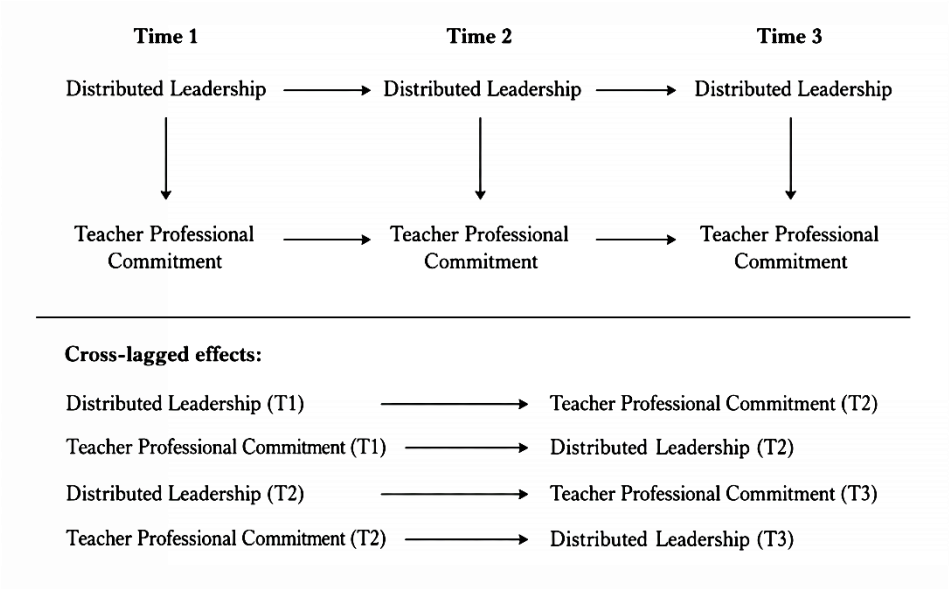
1.3 Reciprocal relationship between distributed leadership and teacher professional commitment

Schools are complex social systems where leadership practices and teacher behaviors continuously interact. Teachers with strong professional commitment may not only respond positively to distributed leadership but also actively contribute to leadership processes through collaboration, decision-making, and informal leadership behaviors (York-Barr & Duke, 2004).

Based on social exchange theory (Blau, 1964), organizational relationships are developed through reciprocal interactions. When schools provide teachers with trust and participation opportunities, teachers may respond with stronger commitment. Conversely, committed teachers may reinforce distributed leadership by actively engaging in school governance.

Therefore, distributed leadership and teacher professional commitment may represent a reciprocal relationship rather than a simple one-way causal process.

Figure 1. Conceptual Framework of the Reciprocal Relationship Between Distributed Leadership and Teacher Professional Commitment



1.4 Current study

Although previous studies have identified the positive association between distributed leadership and teacher commitment, most research has relied on cross-sectional designs, making it difficult to determine the temporal direction of their relationship. Therefore, this study adopts a three-wave longitudinal design and applies an autoregressive cross-lagged panel model to examine whether distributed leadership predicts teacher professional commitment, whether teacher professional commitment predicts distributed leadership, or whether both processes occur simultaneously.

This study addresses three research objectives: (1) To examine the stability of distributed leadership and teacher professional commitment across time. (2) To investigate the longitudinal effects of distributed leadership on teacher professional commitment. (3) To explore whether teacher professional commitment reciprocally influences distributed leadership.

By revealing the dynamic relationship between leadership practices and teacher commitment, this study contributes to sustainable educational management by explaining how schools develop internal capacities for long-term organizational sustainability.

2. Literature Review and Hypothesis Development

2.1 Distributed leadership and teacher professional commitment: A sustainable leadership perspective

Sustainable school development requires leadership approaches that can continuously build organizational capacity, support teacher development, and maintain long-term educational improvement. Sustainable leadership theory emphasizes that effective leadership should not rely solely on individual leaders but should cultivate shared responsibility, collective capacity, and organizational learning (Hargreaves & Fink, 2006). Within this perspective, distributed leadership has become an important mechanism for achieving sustainable school management because it enables schools to develop leadership capacity among multiple organizational members.

Distributed leadership conceptualizes leadership as a collective practice that emerges through the interaction between leaders, teachers, and organizational contexts rather than as an individual behavior of school principals (Spillane, 2006). It emphasizes three essential characteristics: shared decision-making, collaborative professional practice, and teacher empowerment (Harris,

2008). By involving teachers in school governance and providing opportunities for professional participation, distributed leadership can enhance teachers' sense of autonomy, competence, and organizational belonging.

From the perspective of sustainable leadership, teacher autonomy and professional participation are critical resources for maintaining organizational sustainability. When teachers perceive that their knowledge and expertise are valued, they are more likely to develop stronger professional identity and commitment toward their schools (Bogler & Somech, 2004). Previous studies have shown that empowering teachers through participative decision-making and collaborative leadership structures can increase organizational commitment and professional commitment (Somech, 2005). Similarly, distributed leadership has been found to promote teacher engagement by creating supportive professional environments where teachers actively contribute to school improvement (Wahlstrom & Louis, 2008).

However, most previous studies examining the relationship between distributed leadership and teacher commitment have relied on cross-sectional designs. Although these studies demonstrate significant associations between leadership practices and teacher outcomes, they cannot determine whether distributed leadership produces changes in teacher commitment over time. Sustainable management requires understanding not only whether leadership matters but also how leadership influences organizational members through temporal processes. Therefore, this study proposes that distributed leadership represents an antecedent factor that contributes to the development of teacher professional commitment.

Accordingly, the first hypothesis is proposed:

H1: Distributed leadership at an earlier time point positively predicts subsequent teacher professional commitment.

2.2 Teacher professional commitment and distributed leadership: A social exchange perspective

Although distributed leadership is often considered a determinant of teacher commitment, teachers should not be viewed as passive recipients of leadership practices. Contemporary organizational theories emphasize that employees actively shape organizational processes through their attitudes, behaviors, and participation (Bandura, 2001). In schools, teachers with strong professional commitment are more likely to engage in collaborative activities, contribute to decision-making, and undertake informal leadership responsibilities (York-Barr & Duke, 2004). Therefore, teacher professional commitment may also influence the emergence and strengthening of distributed leadership practices.

Teacher professional commitment refers to teachers' psychological attachment to their profession and their willingness to devote effort toward professional responsibilities and organizational goals (Meyer et al., 1993). Highly committed teachers demonstrate stronger motivation to participate in school improvement, support colleagues, and contribute beyond formal job requirements (Somech & Bogler, 2002). These behaviors are closely aligned with the principles of distributed leadership, where leadership is created through collective participation and shared responsibility.

Social exchange theory provides a theoretical explanation for this reciprocal process (Blau, 1964). According to this theory, organizational relationships are developed through reciprocal exchanges between individuals and institutions. When teachers experience supportive organizational conditions, they tend to respond with positive attitudes and behaviors toward the organization. Conversely, teachers with strong professional commitment may actively invest personal resources into school development, thereby reinforcing collaborative leadership practices.

From this perspective, committed teachers may contribute to distributed leadership in several ways. First, they are more willing to participate in collective decision-making processes. Second, they are more likely to assume informal leadership roles among colleagues. Third, they contribute to professional communities that facilitate knowledge sharing and collaborative problem-solving (York-Barr & Duke, 2004). These behaviors can strengthen the practical implementation of distributed leadership within schools.

Despite this theoretical possibility, limited empirical research has examined whether teacher professional commitment can predict subsequent distributed leadership. Most previous studies have focused on leadership as an external influence on teacher attitudes, neglecting the possibility that teachers' professional orientations may actively shape organizational leadership processes. Addressing this limitation is important for sustainable educational management because sustainable organizations depend not only on effective leadership structures but also on the active participation of organizational members.

Therefore, this study proposes:

H2: Teacher professional commitment at an earlier time point positively predicts subsequent distributed leadership.

2.3 Reciprocal relationship between distributed leadership and teacher professional commitment

The relationship between distributed leadership and teacher professional commitment may therefore be better understood as a dynamic reciprocal process rather than a simple linear relationship. Sustainable organizations are characterized by continuous interactions between organizational structures and individual agency, where institutional practices influence employees while employees simultaneously contribute to organizational development (Hargreaves & Fink, 2006).

In the school context, distributed leadership may initially enhance teacher professional commitment by increasing autonomy, participation, and professional recognition. Over time, teachers with stronger professional commitment may further strengthen distributed leadership by actively engaging in collaborative decision-making and assuming leadership responsibilities. This reciprocal mechanism creates a reinforcing cycle in which leadership practices and teacher commitment continuously support each other.

The reciprocal perspective is also consistent with social cognitive theory, which suggests that human behavior results from the interaction between individuals and their social environments (Bandura, 2001). Teachers are not merely influenced by school structures; they actively interpret, respond to, and modify their organizational environments. Therefore, teacher commitment and leadership practices should be examined as mutually dependent processes.

Methodologically, longitudinal designs are necessary to identify these reciprocal relationships. Cross-sectional studies cannot determine whether leadership precedes teacher commitment or whether committed teachers contribute to leadership development. Autoregressive cross-lagged panel models provide an appropriate approach because they examine stability effects and cross-temporal predictive relationships simultaneously (Kearney, 2017). By applying this approach, the present study aims to provide stronger evidence regarding the dynamic relationship between distributed leadership and teacher professional commitment.

Therefore, the following hypothesis is proposed:

H3: Distributed leadership and teacher professional commitment demonstrate reciprocal longitudinal relationships across time.

3. Methodology

3.1 Research design

This study employed a three-wave longitudinal panel design to investigate the reciprocal relationship between distributed leadership and teacher professional commitment over time. Unlike cross-sectional studies that examine relationships between variables at a single point, longitudinal research enables researchers to explore temporal stability and directional relationships among constructs (Little, 2013). This approach is particularly appropriate for sustainable educational management research because organizational development is a dynamic process in which leadership practices and teacher attitudes continuously influence each other.

The study adopted an autoregressive cross-lagged panel model (ACLM) to examine whether distributed leadership predicts subsequent changes in teacher professional commitment and whether teacher professional commitment subsequently influences perceptions of distributed leadership. Cross-lagged models allow researchers to simultaneously estimate autoregressive effects, representing the stability of constructs over time, and cross-lagged effects, representing predictive relationships between different constructs across measurement occasions (Hamaker et al., 2015).

Data were collected at three time points with approximately six-month intervals between each wave. The first measurement was conducted at the beginning of the academic year, followed by two follow-up assessments. The longitudinal research design and data collection procedure are presented in Table 1.

Table 1 Research Design and Data Collection Schedule

Measurement wave	Data collection period	Research purpose
Time 1 (T1)	Sep-24	Initial assessment of distributed leadership and teacher professional commitment
Time 2 (T2)	Mar-25	Examination of short-term longitudinal changes
Time 3 (T3)	Sep-25	Examination of long-term reciprocal effects

The three-wave design provides an appropriate temporal framework for examining reciprocal relationships because it allows each construct measured at an earlier time point to predict changes in the other construct at later time points while controlling for previous levels of the same construct.

3.2 Participants and procedure

The participants were primary and secondary school teachers recruited from public schools located in eastern, central, and western regions of China. A stratified sampling approach was employed to improve sample representativeness by considering geographical distribution and school level differences. The target population included full-time teachers with different levels of teaching experience and professional backgrounds.

At Time 1, approximately 2,000 questionnaires were distributed through cooperating schools. After excluding incomplete responses, 1,742 valid questionnaires were obtained, resulting in an effective response rate of 87.1%. Participants were invited to participate in subsequent surveys after six-month intervals. At Time 2, 1,526 teachers completed the second questionnaire, and 1,384 teachers completed all three waves of data collection. Therefore, the final longitudinal sample consisted of 1,384 teachers.

The demographic characteristics of the final sample are summarized in Table 2. The sample included teachers with diverse demographic backgrounds, including gender, teaching experience, school level, and geographical location, which enhanced the generalizability of the findings.

Table 2 Demographic Characteristics of Participants (N = 1,384)

Characteristics	Category	n	%
Gender	Male	462	43.4
	Female	922	66.6
Teaching experience	Less than 5 years	284	20.5
	5–15 years	613	44.3
	More than 15 years	487	35.2
School level	Primary school	721	52.1
	Secondary school	663	47.9
Region	Eastern China	538	38.9
	Central China	451	32.6
	Western China	395	28.5

3.3 Measures

3.3.1 Distributed leadership

Distributed leadership was measured using a scale adapted from previous research on distributed leadership theory (Harris, 2008; Spillane, 2006). The scale consisted of 12 items measuring three core dimensions: shared decision-making, collaborative professional practice, and teacher empowerment. Participants responded to each item using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Representative items included statements such as “Teachers participate actively in important school decisions” and “School members collaborate to solve educational problems.” Higher scores indicated stronger perceptions of distributed leadership within the school environment. Previous research has demonstrated that distributed leadership measures show strong reliability and validity in educational organizational contexts (Wahlstrom & Louis, 2008).

3.3.2 Teacher professional commitment

Teacher professional commitment was assessed using a nine-item scale adapted from Meyer et al. (1993) and Somech and Bogler (2002). The measure evaluated teachers’ psychological attachment to their profession and schools, including professional identity, career commitment, and organizational commitment.

Participants rated each statement on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Example items included “I feel strongly attached to the teaching profession” and “I intend to continue developing my teaching career.” Higher scores represented stronger professional commitment.

The measurement characteristics of both constructs, including item numbers and internal consistency coefficients, are presented in Table 3.

Table 3 Measurement Characteristics of Study Variables

Construct	Dimensions	Number of items	Cronbach’s α

Distributed leadership	Shared decision-making; Collaborative practice; Teacher empowerment	12	0.93
Teacher professional commitment	Professional identity; Career commitment; Organizational commitment	9	0.91

3.4 Data analysis

Data analysis was conducted using Mplus 8.8. The analytical procedure followed several sequential steps to evaluate both measurement quality and longitudinal relationships among variables.

First, descriptive statistics and Pearson correlation analyses were conducted to examine the distributions and preliminary associations among distributed leadership and teacher professional commitment across three measurement occasions. The means, standard deviations, and correlation coefficients are presented in Table 4.

Table 4 Descriptive Statistics and Correlations Among Study Variables

Variable	M	SD	1	2	3	4
Distributed leadership T1	3.71	0.56	—			
Teacher commitment T1	3.84	0.52	.54**	—		
Distributed leadership T2	3.76	0.55	.72**	.49**	—	
Teacher commitment T2	3.88	0.51	.47**	.73**	.55**	—

*p < .05, **p < .01, ***p* < *.001*

Second, confirmatory factor analysis (CFA) was conducted to evaluate whether distributed leadership and teacher professional commitment represented empirically distinct constructs. Model fit was assessed using the comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Following Hu and Bentler (1999), CFI and TLI values above .90 and RMSEA and SRMR values below .08 indicate acceptable model fit.

The CFA results comparing alternative measurement models are shown in Table 5.

Table 5 Confirmatory Factor Analysis Results for Measurement Models

Model	χ^2	df	CFI	TLI	RMSEA	SRMR
One-factor model	1842.56	189	0.821	0.786	0.086	0.074
Two-factor model	612.34	188	0.952	0.941	0.045	0.038
Correlated two-factor model	574.21	187	0.959	0.949	0.042	0.034

The correlated two-factor model demonstrated the best fit, supporting the discriminant validity of distributed leadership and teacher professional commitment.

Third, measurement invariance testing was conducted across the three measurement occasions before estimating longitudinal structural models. Establishing measurement invariance ensures that the constructs maintain the same meaning across time and that observed changes reflect true developmental changes rather than measurement differences (Vandenberg & Lance, 2000).

Configural, metric, and scalar invariance models were sequentially tested, and changes in CFI and RMSEA were evaluated according to recommended criteria (Chen, 2007).

The measurement invariance results are presented in Table 6.

Table 6 Measurement Invariance Testing Across Three Measurement Occasions

Model	CFI	ΔCFI	RMSEA	ΔRMSEA
Configural invariance	0.958	—	0.043	—
Metric invariance	0.956	0.002	0.043	0
Scalar invariance	0.951	0.005	0.044	0.001

Finally, after establishing measurement invariance, cross-lagged panel models were estimated to examine reciprocal longitudinal relationships. Four competing models were compared: the stability model, the distributed leadership-to-commitment model, the commitment-to-distributed leadership model, and the reciprocal model. Model comparisons were conducted using fit indices and information criteria, including CFI, RMSEA, and Akaike information criterion (AIC). The model comparison results are reported in Table 7.

Table 7 Comparison of Competing Cross-Lagged Panel Models

Model	Description	CFI	RMSEA	AIC
Model 1	Stability model	0.921	0.061	54218
Model 2	Distributed leadership → commitment	0.938	0.052	53142
Model 3	Commitment → distributed leadership	0.935	0.053	53287
Model 4	Reciprocal model	0.957	0.041	52136

4. Results

4.1 Preliminary analysis

Before testing the longitudinal structural relationships, preliminary analyses were conducted to examine the descriptive characteristics and bivariate associations among distributed leadership and teacher professional commitment across the three measurement occasions.

As presented in Table 4, both distributed leadership and teacher professional commitment demonstrated relatively high mean scores across all three waves. Distributed leadership increased slightly from Time 1 (M = 3.71, SD = 0.56) to Time 3 (M = 3.82, SD = 0.54), while teacher professional commitment showed a similar increasing pattern from Time 1 (M = 3.84, SD = 0.52) to Time 3 (M = 3.91, SD = 0.50).

Pearson correlation analyses indicated that distributed leadership was significantly and positively associated with teacher professional commitment at each measurement occasion. The correlations between distributed leadership and teacher professional commitment ranged from r = .47 to r = .56 ($p < .001$), suggesting a consistent positive relationship between the two constructs. Moreover, autoregressive correlations across time points were relatively strong, indicating substantial temporal stability of both distributed leadership and teacher professional commitment.

These findings provided preliminary support for further longitudinal analyses using the cross-lagged panel model.

4.2 Measurement invariance across time

Before examining the longitudinal reciprocal relationships, measurement invariance tests were conducted to determine whether distributed leadership and teacher professional commitment maintained equivalent measurement properties across the three time points.

As shown in Table 6, the configural invariance model demonstrated acceptable fit (CFI = .958, RMSEA = .043), indicating that the basic factor structure remained consistent across Time 1, Time 2, and Time 3. The metric invariance model, in which factor loadings were constrained to be equal across time, resulted in only a minimal reduction in model fit (ΔCFI = .002, ΔRMSEA = .000). Similarly, the scalar invariance model showed acceptable fit changes compared with the metric model (ΔCFI = .005, ΔRMSEA = .001).

According to the recommended criteria that changes in CFI should not exceed .01 and changes in RMSEA should not exceed .015 (Chen, 2007), both metric and scalar invariance were supported. Therefore, the constructs of distributed leadership and teacher professional commitment were considered comparable across the three measurement occasions, allowing subsequent longitudinal structural analyses.

4.3 Cross-lagged panel model comparison

To examine the temporal directionality between distributed leadership and teacher professional commitment, four competing structural models were estimated. These models included a stability model, a distributed leadership-to-commitment model, a commitment-to-distributed leadership model, and a reciprocal model.

The model comparison results are presented in Table 7. The stability model demonstrated acceptable but relatively weaker fit (CFI = .921, RMSEA = .061, AIC = 54218). Adding cross-lagged paths from distributed leadership to teacher professional commitment improved model fit (CFI = .938, RMSEA = .052, AIC = 53142). Similarly, adding paths from teacher professional commitment to distributed leadership also improved model fit compared with the stability model (CFI = .935, RMSEA = .053, AIC = 53287).

However, the reciprocal model, which simultaneously estimated cross-lagged effects in both directions, demonstrated the best overall fit among all competing models (CFI = .957, RMSEA = .041, AIC = 52136). Therefore, the reciprocal model was retained as the final model for interpreting longitudinal relationships between distributed leadership and teacher professional commitment.

The results indicate that the relationship between distributed leadership and teacher professional commitment cannot be adequately explained by a single directional pathway. Instead, both constructs appear to influence each other over time.

Table 7 Comparison of Competing Cross-Lagged Panel Models

Model	Description	CFI	RMSEA	AIC
Model 1	Stability model	0.921	0.061	54218
Model 2	Distributed leadership → Teacher professional commitment	0.938	0.052	53142
Model 3	Teacher professional commitment → Distributed leadership	0.935	0.053	53287
Model 4	Reciprocal model	0.957	0.041	52136

4.4 Cross-lagged effects

After selecting the reciprocal model as the best-fitting model, autoregressive and cross-lagged coefficients were examined. The standardized path coefficients are presented in Table 8.

The autoregressive effects showed that both distributed leadership and teacher professional commitment were highly stable across time. Distributed leadership at Time 1 significantly predicted distributed leadership at Time 2 ($\beta = .71$, SE = .04, $p < .001$), and distributed leadership at Time 2 significantly predicted distributed leadership at Time 3 ($\beta = .74$, SE = .04, $p < .001$). Similarly, teacher professional commitment showed significant stability across measurement occasions, with Time 1 commitment predicting Time 2 commitment ($\beta = .76$, SE = .03, $p < .001$) and Time 2 commitment predicting Time 3 commitment ($\beta = .78$, SE = .03, $p < .001$).

Regarding the cross-lagged effects, distributed leadership significantly predicted subsequent teacher professional commitment. Specifically, distributed leadership at Time 1 positively predicted teacher professional commitment at Time 2 ($\beta = .18$, SE = .05, $p < .001$), and distributed leadership at Time 2 predicted teacher professional commitment at Time 3 ($\beta = .15$, SE = .05, $p < .01$). These findings supported the assumption that distributed leadership contributes to the development of teacher professional commitment over time.

Importantly, teacher professional commitment also demonstrated significant reciprocal effects on distributed leadership. Teacher professional commitment at Time 1 positively predicted distributed leadership at Time 2 ($\beta = .13$, SE = .04, $p < .01$), while teacher professional commitment at Time 2 predicted distributed leadership at Time 3 ($\beta = .16$, SE = .04, $p < .001$). These findings indicated that teachers' professional commitment was not merely an outcome of leadership practices but also contributed to the subsequent development of distributed leadership.

Overall, the cross-lagged results supported the reciprocal relationship between distributed leadership and teacher professional commitment.

Table 8 Cross-Lagged Path Estimates of the Reciprocal Model

Path	β	SE	p
Distributed leadership T1 → Distributed leadership T2	0.71	0.04	< .001
Distributed leadership T2 → Distributed leadership T3	0.74	0.04	< .001
Teacher professional commitment T1 → Teacher professional commitment T2	0.76	0.03	< .001
Teacher professional commitment T2 → Teacher professional commitment T3	0.78	0.03	< .001
Distributed leadership T1 → Teacher professional commitment T2	0.18	0.05	< .001
Distributed leadership T2 → Teacher professional commitment T3	0.15	0.05	0.003
Teacher professional commitment T1 → Distributed leadership T2	0.13	0.04	0.002
Teacher professional commitment T2 → Distributed leadership T3	0.16	0.04	< .001

4.5 Summary of hypothesis testing

The hypothesis testing results are summarized in Table 9. The findings provided support for all proposed hypotheses. Distributed leadership demonstrated significant positive effects on subsequent teacher professional commitment, supporting H1. Teacher professional commitment

also significantly predicted future distributed leadership, supporting H2. Finally, the significant reciprocal cross-lagged paths confirmed H3, indicating that distributed leadership and teacher professional commitment form a mutually reinforcing longitudinal relationship.

Table 9 Summary of Hypothesis Testing Results

Hypothesis	Relationship	Result
H1	Distributed leadership → Teacher professional commitment	Supported
H2	Teacher professional commitment → Distributed leadership	Supported
H3	Reciprocal relationship between distributed leadership and teacher professional commitment	Supported

5. Discussion

5.1 The reciprocal mechanism between distributed leadership and teacher professional commitment

This study aimed to extend understanding of sustainable school development by examining the longitudinal relationship between distributed leadership and teacher professional commitment. Using a three-wave longitudinal design and an autoregressive cross-lagged panel model, the findings demonstrated that distributed leadership and teacher professional commitment were not only positively associated but also reciprocally influenced each other over time. Specifically, distributed leadership significantly predicted subsequent teacher professional commitment, while teacher professional commitment also contributed to later perceptions of distributed leadership.

The finding that distributed leadership promotes teacher professional commitment is consistent with previous research suggesting that participative and empowering leadership practices enhance teachers' sense of autonomy, professional identity, and organizational belonging (Bogler & Somech, 2004; Harris, 2008). When teachers are involved in decision-making processes and perceive that their professional expertise is recognized, they are more likely to develop stronger psychological attachment to their profession and schools. From the perspective of sustainable leadership, this result highlights that leadership practices supporting teacher empowerment are important mechanisms for maintaining organizational capacity and long-term school improvement (Hargreaves & Fink, 2006).

However, the present study further advances previous research by demonstrating that the relationship is not unidirectional. While earlier studies have primarily conceptualized leadership as an antecedent of teacher attitudes, the current findings reveal that teacher professional commitment also predicts subsequent distributed leadership. This suggests that committed teachers are not passive recipients of leadership practices but active contributors to the development of leadership processes within schools.

This reciprocal pattern reflects the interactive nature of sustainable educational organizations. Schools do not develop sustainability solely through formal leadership structures; rather, sustainability emerges through continuous interactions between organizational conditions and individual agency. Teachers with strong professional commitment may actively participate in collaborative decision-making, support colleagues, and undertake informal leadership responsibilities, thereby reinforcing distributed leadership practices (York-Barr & Duke, 2004). Therefore, sustainable school leadership should be understood as a dynamic process in which

leadership capacity and teacher commitment continuously strengthen each other.

5.2 Theoretical contributions

The findings of this study provide several theoretical contributions to sustainable educational management and leadership research.

First, this study extends distributed leadership theory by challenging the traditional assumption that leadership practices primarily influence teacher outcomes through a one-directional pathway. Previous research has largely examined distributed leadership as an organizational antecedent that shapes teacher motivation, commitment, and engagement (Spillane, 2006; Wahlstrom & Louis, 2008). Although this perspective has generated important insights, it may underestimate teachers' active role in shaping organizational leadership processes. By identifying a significant path from teacher professional commitment to distributed leadership, this study demonstrates that leadership is also socially constructed through teachers' participation, willingness, and professional agency.

This finding is consistent with social cognitive theory, which emphasizes reciprocal interactions between individuals and their social environments (Bandura, 2001). Teachers influence their organizational contexts through their behaviors, beliefs, and participation. Therefore, distributed leadership should not only be viewed as something provided by school administrators but also as something developed through collective engagement among organizational members.

Second, this study contributes to sustainable management theory by highlighting the importance of relational and human-centered processes in achieving organizational sustainability. Sustainable management research has increasingly emphasized that long-term organizational success depends on developing internal capabilities, maintaining employee engagement, and creating adaptive organizational cultures (Avery & Bergsteiner, 2011). In educational contexts, teacher professional commitment represents a critical form of human resource sustainability because committed teachers contribute to organizational continuity, innovation, and institutional resilience.

The reciprocal relationship identified in this study suggests that sustainable schools are not created merely through administrative strategies or leadership interventions. Instead, sustainability emerges when leadership practices and employee commitment form a reinforcing cycle. Distributed leadership creates conditions that support teacher commitment, while committed teachers contribute to stronger leadership capacity. This finding expands sustainable management perspectives from resource allocation and structural management toward relational sustainability.

Third, this study provides methodological advancement by applying a longitudinal cross-lagged approach to examine leadership processes. Previous studies on distributed leadership and teacher commitment have frequently relied on cross-sectional data, limiting conclusions regarding causal direction. Cross-sectional correlations cannot determine whether leadership influences commitment or whether committed teachers perceive and contribute to leadership differently. By using three-wave longitudinal data, this study provides stronger evidence regarding the temporal ordering and reciprocal nature of these constructs.

5.3 Practical implications for sustainable school management

The findings provide several practical implications for educational leaders and policymakers seeking to develop sustainable schools.

First, school leaders should move beyond traditional hierarchical leadership approaches and actively create conditions that enable distributed leadership. Rather than concentrating decision-making authority among principals, schools should establish mechanisms that encourage teacher participation, collaborative problem-solving, and shared responsibility. Providing teachers

with meaningful opportunities to participate in school governance may strengthen their professional commitment and contribute to long-term organizational stability.

Second, educational managers should recognize that teacher commitment is not merely an outcome of leadership but also an organizational resource that can enhance leadership capacity. Teachers with strong professional commitment represent potential sources of informal leadership within schools. Therefore, professional development programs should not only focus on improving teachers' instructional skills but also cultivate leadership capabilities, collaboration skills, and participation in organizational decision-making.

Third, sustainable school management should focus on building reciprocal relationships between leaders and teachers. Leadership development programs often emphasize improving principals' leadership competencies; however, the current findings suggest that sustainable leadership requires developing a broader leadership culture involving all members of the school community. Schools should therefore promote professional learning communities, collaborative networks, and shared decision-making structures that allow leadership capacity to emerge collectively.

5.4 Limitations and future research directions

Although this study provides important insights into the dynamic relationship between distributed leadership and teacher professional commitment, several limitations should be acknowledged.

First, the study relied primarily on teachers' self-reported perceptions of distributed leadership and professional commitment. Although self-report measures are appropriate for assessing individuals' psychological perceptions, they may introduce common method bias and social desirability effects (Podsakoff et al., 2003). Future studies could adopt multi-source research designs by incorporating principal evaluations, peer assessments, classroom observations, or objective indicators of school functioning to provide a more comprehensive understanding of leadership processes.

Second, the sample was collected from public schools in China, which may limit the generalizability of the findings to other educational contexts. Leadership practices and teacher commitment may vary across different cultural, institutional, and educational systems. Future research should examine whether the reciprocal relationship between distributed leadership and teacher professional commitment remains consistent across countries and educational contexts through cross-cultural comparative studies.

Third, although the three-wave longitudinal design provides stronger evidence regarding temporal relationships than cross-sectional research, it does not establish definitive causality. Future research could incorporate longer follow-up periods, experimental interventions, or quasi-experimental designs to further examine how changes in leadership practices influence teacher commitment development.

Finally, future research could expand the current model by including additional organizational and psychological mechanisms. For example, variables such as organizational trust, teacher well-being, professional learning communities, and school climate may help explain why distributed leadership and teacher commitment reinforce each other over time. Examining these mediating and moderating mechanisms would further enhance understanding of sustainable educational management processes.

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