

Key Factors in Early Childhood Teachers' Professional Development in Shandong Province: A Multivariate Analysis

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ABSTRACT:

The strategic shift in China's preschool education from scale expansion to quality improvement has made teachers' professional competence a major barrier to advancing high-quality education. This study employed multivariate difference analysis to methodically investigate the ways in which four important factors, teacher qualifications, the frequency of quarterly training, the size of the kindergarten, and the leadership style of the director, differentially affect the professional knowledge, teaching behavior, and teaching innovation capabilities of preschool teachers. 500 in-service preschool teachers were surveyed using a questionnaire, and the study used stratified random sampling with Linyi, Weifang, and Jinan as the empirical field in Shandong Province, China. The data were processed using multivariate analysis of variance (MANOVA). The findings demonstrate that the most powerful and all-encompassing factor influencing teachers' professional development is the frequency of quarterly training; the leadership style of a transformational director is considerably superior to that of transactional and servant leadership in terms of encouraging teachers' knowledge depth, optimising interactive behaviour, and stimulating innovation willingness; teachers' educational background significantly predicts knowledge reserves and innovation potential but has no direct significant impact on daily teaching behaviour; and kindergarten size has no statistically significant impact on teachers' professional development. This study demonstrates that soft power development, exemplified by leadership and training programs, is significantly more beneficial than merely making large-scale investments.

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1. Introduction

In the context of worldwide educational reform, the quality of Early Childhood Education (ECE)

is recognized as the foundation of national human capital development and the first step toward achieving social fairness. Recent

innovations in neuroscience and developmental psychology have led the global community to a growing agreement: the expertise of early childhood educators is a fundamental factor influencing childcare quality and fostering comprehensive child development (OECD, 2019; Zhang & Ng, 2022).

In light of this context, evaluating the underlying factors of teacher professional development from a managerial viewpoint has emerged as a forefront issue in international educational studies. In China, early childhood education is experiencing a significant historical shift from mere quantitative growth to a focus on high-quality, intrinsic advancement (OECD, 2019). The Chinese government has explicitly expressed its aim to cultivate a high-caliber, professional early childhood educator workforce through the enactment of the three-child policy (Wang & Li, 2023).

As a densely populated region and a center for education in eastern China, Shandong has notable and exemplary progress in preschool education. Despite ongoing macro-policy support, teacher professional development continues to face substantial structural obstacles in localized practices (Cao et al., 2020). For instance, in Shandong Province, there exist pronounced disparities in economic advancement, educational resource distribution, and management ethos among Weifang, Linyi, and Jining. This geographical diversity offers a domain for investigating varied approaches to teacher professional advancement in distinct settings. Nevertheless, an examination of the current literature indicates that, despite many studies on teacher professional development, considerable research deficiencies persist in several critical areas:

Current studies frequently concentrate on isolated aspects, such as evaluating the influence of training on competencies or the significance of academic credentials in expertise. Shulman's (1987) seminal PCK theory posits that teacher professionalism includes a blend of knowledge, conduct, and creativity. Nevertheless, little research has developed comprehensive models to

investigate how external management factors (such as directors' leadership styles and training frequency) variably influence these three unique but interrelated internal characteristics (Chen & Zheng, 2023). In the realm of educational administration, leaders frequently emphasize tangible metrics (such as increasing kindergarten capacity or elevating academic standards) while overlooking the significance of the intangible environment (including the director's leadership approach and the organizational climate). In the distinctive setting of China's administrative management, is the allocation of material resources (size) more significant, or is the transformation of management culture (leadership) more vital? At present, there is an absence of quantitative empirical evidence derived from extensive sample data (Yang, 2021).

Current studies on Chinese preschool educators predominantly utilize qualitative descriptions or basic correlation analysis, failing to establish robust causal inferences. The intricate dynamics involving various independent variables (such as teacher credentials, training, scale, and leadership) and numerous dependent variables (including knowledge, behavior, and innovation) are especially troubling. Limited research employs multivariate analysis of variance (MANOVA) to mitigate errors and effectively discern the individual impacts of each variable. This complicates the assessment of whether the subpar teacher quality in a certain area stems from inadequate educational credentials or lack of training.

In light of the aforementioned context and identified research deficiencies, this investigation uses Shandong Province, China, as the empirical setting and selects a sample of 500 kindergarten educators from Linyi, Weifang, and Jining. The objective is to develop an all-encompassing analytical framework that incorporates personal attributes (educator qualifications), institutional traits (size of the kindergarten), management strategies (frequency of quarterly training sessions), and leadership context (style of the director). The aims of the research are:

- To examine the extent of teacher expertise, pedagogical conduct, and instructional

innovation among early childhood educators in Shandong Province.

To analyze and assess the multivariate disparities of critical elements in early childhood educator professional development, specifically the teacher's highest academic credential, frequency of quarterly training, size of the kindergarten, and the leadership approach of the director.

2. Literature Review and Hypothesis Development

2.1 Pedagogical Advancement Theory

The notion of teacher development serves as the foundational concept for the dependent variable in this research. Shulman's (1987) foundational theory of pedagogical content knowledge (PCK) posits that a teacher's professionalism is rooted in both subject mastery and the capacity to convey that knowledge in an accessible manner to students (Blömeke & Gustafsson, 2023). This theory serves as the fundamental framework for delineating teacher knowledge in this research, specifically as a holistic cognitive system that integrates subject expertise, pedagogical strategies, and educational psychology. Nevertheless, knowledge does not constitute the culmination of professional growth. Day (1999) asserts that teacher development is an evolving process that encompasses both intellect (knowledge) and affect (emotions/behaviors), highlighting the significance of teachers' immediate reactions and engagements within the classroom environment (Fatima et al., 2023), especially in addressing the varied social-emotional and developmental requirements of children (Schleicher, 2020; Yang, 2025).

2.2 Theory of Resources-Based Perspective

The Resource-Based Value (RBV) theory asserts that an organization's distinctive, limited, and non-replicable resources are the foundation of its performance disparities. In preschool education, teachers' academic credentials and professional development are seen as essential human capital assets (Bao & Miao, 2021). Darling-Hammond (2017) posits that educators' academic qualifications (degrees) signify their foundational knowledge and influence their capacity to

assimilate new information and participate in advanced cognitive processes. Simultaneously, ongoing professional development is regarded as a reinvestment in human resources, averting the devaluation of human capital by regular knowledge enhancements (Sims & Fletcher-Wood, 2021).

2.3 Theory of Leadership

This research presents Bass's comprehensive leadership framework, specifically his theories on transformational, transactional, and servant leadership, to elucidate the influence of the organizational context on educators (Gumus et al., 2020). Fullan (2016) emphasizes in his investigation of educational transformation that leaders can profoundly modify teachers' motivation and conduct by formulating a vision, fostering intellectual stimulation (transformational), or creating a nurturing atmosphere (servant) (Strehmel et al., 2022). This analysis delineates Bass's integrative leadership model, notably his transformational, transactional, and servant leadership concepts, to clarify the effect of the organizational milieu on instructors (Gumus et al., 2020). Fullan (2016) asserts in his study regarding educational reform that leaders can markedly influence teachers' motivation and behaviors by establishing a vision, encouraging intellectual engagement (transformational), or offering a supportive setting (servant) (Strehmel et al., 2022).

2.4 Hypothesis Formulation

2.4.1 Teacher Qualifications

The academic qualifications of teachers are commonly viewed as the cognitive basis for their career advancement. As stated by Shulman (1987), having a solid grasp of subject knowledge is vital for successful instruction. Instructors with elevated academic qualifications (including undergraduate and master's degrees) usually have more structured training in child development psychology, educational philosophy, and curriculum theory during their initial preparation. Thus, instructors with higher educational qualifications should demonstrate a marked advantage in the extent and intricacy of their

teaching knowledge relative to their counterparts with associate degrees (H1).

While educational qualities mainly shape intellectual capacity, their potential influence on instructional creativity must not be disregarded. The pursuit of innovation typically demands the disruption of established mental frameworks and the incorporation of cross-disciplinary insights. Research by Darling-Hammond et al. (2017) reveals that instructors with higher academic qualifications are more likely to use innovative teaching methodologies such as inquiry-based learning and demonstrate superior curriculum design and optimization skills (H3) (Duocui, 2025). Nevertheless, existing investigations into the effect of educational qualifications on routine teacher behavior (such as interactions with children and classroom management) are contradictory. In alignment with human capital theory, we continue to foresee that advanced academic qualifications can bolster standardized and professional pedagogical behaviors (H2).

H1: A considerable variation in the knowledge of early childhood teachers is evident among different educational levels.

H2: A substantial variation is observed in the behaviors of early childhood teachers depending on their educational qualifications.

H3: A considerable variation is observed in the instructional innovations of early childhood teachers at differing educational levels.

2.4.2 Training Frequency

In-service training is a primary means of knowledge updating and skill iteration in a teacher's career. Guskey's (2016) teacher professional development assessment model emphasizes that effective training can trigger a chain reaction in teachers' knowledge, beliefs, and practices. This study focuses specifically on training frequency, i.e., the number of training sessions per quarter, viewing it as a dosage effect. Frequent training (e.g., more than twice per quarter) ensures teachers receive timely access to the latest educational philosophies and policy directions, significantly expanding their knowledge base (H4). Changes in teaching

behavior often require continuous reinforcement and feedback. Pianta et al. (2016), in their research on teacher-child interaction, pointed out that through continuous guidance and practice, teachers can internalize theory into concrete, high-quality emotional support and teaching organization behaviors (H5). Training is often a source of inspiration for innovation. By exposing teachers to diverse teaching cases and cutting-edge methods, frequent training can break down their path dependence, reduce their fear of change, and thus stimulate their willingness and practice of teaching innovation (H6).

H4: There is a significant difference in teacher knowledge of early childhood teachers with different number of quarterly trainings.

H5: There is a significant difference in teacher behavior of early childhood teachers with different number of quarterly trainings.

H6: There is a significant difference in teaching innovations of early childhood teachers with different number of quarterly trainings.

2.4.3 Kindergarten Size

Kindergarten size, as an important organizational structure variable, has two diametrically opposed theoretical explanations for its impact on teacher development. On the one hand, based on resource dependence theory, large kindergartens typically have more abundant funding, more advanced teaching and research equipment, and more diverse expert resources, providing a material foundation for teachers' knowledge acquisition and innovative practices. On the other hand, Hargreaves & Fullan's (2021) professional capital theory reminds us that excessively large organizational sizes may lead to bureaucratic rigidity, hindering in-depth collaboration and informal communication among teachers; while small and medium-sized kindergartens may have closer social networks and more flexible decision-making mechanisms, which are conducive to the dissemination of tacit knowledge and rapid adjustment of teaching behaviors.

This study hypothesizes that organizational ecosystems of different sizes

(small/medium/large) will form different balance points between resource supply and interaction efficiency, thus having a differentiated impact on teachers' professional development output.

H7: There is a significant difference in teacher knowledge of early childhood teachers of different kindergarten sizes.

H8: There is a significant difference in teacher behavior of early childhood teachers of different kindergarten sizes.

H9: There is a significant difference in teaching innovation among early childhood teachers of different kindergarten sizes.

2.4.4 Director's Leadership Style

As the chief education officer of a kindergarten, the director's leadership style directly determines the organization's psychological atmosphere and behavioral norms (Al Marshoudi et al., 2023). Transformational leadership aims to enhance subordinates' intrinsic motivation through building a shared vision, intellectual stimulation, and personalized care. Fullan (2016) argues that this style best encourages teachers to challenge the status quo, thereby significantly promoting pedagogical innovation and deep knowledge construction. Transactional leadership, based on

contracts and exchanges, regulates employee behavior through clear reward and punishment mechanisms. This style may be very effective in ensuring teachers adhere to routines and meet basic behavioral standards, but it may have limitations in stimulating higher-order innovation. Servant leadership emphasizes meeting subordinates' needs through service and empowerment. This style helps create a safe and supportive psychological environment and may have a positive impact on teachers' emotional behavior and knowledge sharing.

In summary, this study anticipates that different director's leadership style will have a significant differentiated impact on the three dimensions of teacher professional development by shaping differentiated organizational learning cultures.

H10: There is a significant difference in teacher knowledge of early childhood teachers with different director's leadership styles of directors.

H11: There is a significant difference in teacher behavior of early childhood teachers with different director's leadership styles of directors.

H12: There is a significant difference in teaching innovation among early childhood teachers with different director's leadership styles of directors.

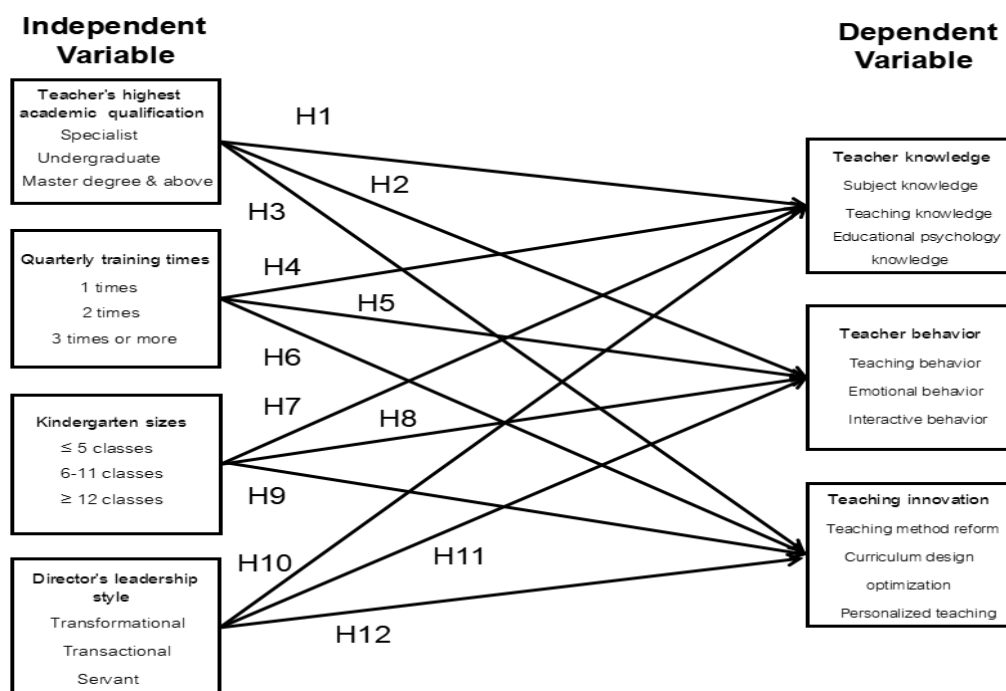


Figure 1 Conceptual framework

3. Methodology

3.1 Research Subjects and Sampling

This study was conducted in Shandong Province, a representative education center in eastern China. To ensure the representativeness of the sample, a stratified random sampling method was used, selecting Weifang, Linyi, and Jining as the research subjects. These three cities were chosen to represent different stages of preschool education development and socioeconomic background within Shandong Province. The target population consisted of in-service preschool teachers in both public and private kindergartens. The sampling process consisted of two stages: first, 50 kindergartens were randomly selected from the three cities based on the teacher-to-population ratio; second, teachers from these kindergartens were invited to participate in a questionnaire survey. After removing incomplete questionnaires, 500 valid questionnaires were retained for analysis. The sample size ($N=500$) met the requirements for multivariate statistical power, ensuring the robustness of the subsequent multivariate analysis of variance (MANOVA).

3.2 Measuring Tools

The structured questionnaire used in this study consisted of two parts, developed based on a systematic literature review and validated through expert review and pre-testing. This part collected data on four categorical independent variables (IVs): education level (divided into associate's, bachelor's, and master's degrees or above); training frequency (measured by the number of professional training sessions attended per quarter (1, 2, or ≥ 3)); kindergarten size (categorized by the number of classes: small (≤ 5 classes); medium (6-11 classes); large (≥ 12 classes)); and director's leadership style (determined based on teachers' perceptions of their principal's primary director's leadership style: transformational leadership, transactional leadership, or servant leadership).

The dependent variable was measured using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), which measures three core dimensions of teacher professional development. These scales were adapted from existing research tools (e.g., Shulman, 1987; Pianta et al., 2016; Fullan, 2016) to suit the realities of preschool education in China: Teacher Knowledge (36 items), assessing subject knowledge, pedagogical knowledge, and educational psychology knowledge; Teacher Behavior (33 items), assessing teaching behavior, emotional behavior, and interactive behavior; and Teaching Innovation (39 items), assessing teaching method reform, curriculum design optimization, and personalized teaching.

The Cronbach's α coefficients for the three main scales were 0.826 (knowledge), 0.827 (behavior), and 0.826 (innovation), with the total scale reaching 0.822, all exceeding the recommended threshold of 0.70 (Hair et al., 2010). The KMO values for all constructs were greater than 0.85, and the Bartlett test results were significant ($p < .001$), indicating excellent construct validity.

3.3 Data Analysis Strategy

Multivariate analysis of variance (MANOVA) was selected as the primary statistical method, and the analysis followed a two-step procedure: testing for multiple main effects (Wilks' Lambda) to determine whether the independent variables had a significant effect on the pooled dependent variable; and performing univariate tests and Tukey's HSD post-hoc comparisons to identify specific between-group differences.

4. Results and Analysis

4.1 Descriptive Statistics

4.1.1 Demographic Characteristics of Respondents

This survey collected 500 valid questionnaires from Shandong Province. The demographic characteristics of the sample are shown in Table 1. The sample is predominantly female (97.8%), consistent with the gender distribution in China's early childhood education industry. Regarding

age, most respondents are in the early to mid-stages of their careers, with 33.6% aged 20-29 and 61.6% aged 30-39, indicating a relatively young workforce in this industry. In terms of educational background, the majority of

respondents hold a bachelor's degree (66.6%), followed by an associate's degree (27.2%), while the proportion of respondents with a master's degree or higher is relatively small (6.2%). See Tables 1 and 2 for details.

Table 1 Distribution of basic information of cities

Item	Category	Weifang		Linyi		Jining		Overall	
		Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)
Gender	Female	146	97.30	196	98.00	147	98.00	489	97.80
	Male	4	2.70	4	2.00	3	2.00	11	2.20
Overall		150	100.00	200	100.00	150	100.00	500	100.00
Age	20-29	33	22.00	59	29.50	76	50.70	168	33.60
	30-39	108	72.00	130	65.00	70	46.70	308	61.60
	40-49	9	6.00	11	5.50	4	2.60	24	4.80
Overall		150	30.00	200	40.00	150	30.00	500	100.00

Table 1 Distribution of independent variables among sample teachers

Independent Variables	Category	Weifang		Linyi		Jining		Overall	
		Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)
Highest educational attainment of teachers	Specialist	30	20.00	50	25.00	56	37.30	136	27.20
	Bachelor's	104	69.30	139	69.50	90	60.00	333	66.60
	Master's and above	16	10.70	11	5.50	4	2.70	31	6.20
	Overall	150	100.00	200	100.00	150	100.00	500	100.00
Number of quarterly training sessions	1	45	30.00	69	34.50	74	49.30	188	37.60
	2	30	20.00	95	47.50	56	37.30	181	36.20
	3 times and above	75	50.00	36	18.00	20	13.30	131	26.20

Kindergarten school's Size	Overall	150	100.00	200	100.00	150	100.00	500	100.00
	Small	36	24.00	44	22.00	43	28.70	123	24.60
	Medium	39	26.00	54	27.00	47	31.30	140	28.00
	Large	75	50.00	102	51.00	60	40.00	237	47.40
	Overall	150	100.00	200	100.00	150	100.00	500	100.00
Director's Leadership Style	Transforma tional	80	53.30	41	20.50	29	19.30	150	30.00
	Transaction al	16	10.70	105	52.50	45	30.00	166	33.20
	Servant	54	36.00	54	27.00	76	50.7 0	184	36.80
	Overall	150	100.00	200	100.00	150	100.00	500	100.00

4.1.2 Descriptive Analysis of Key Variables

Table 3 summarizes the descriptive statistics of key dependent variables in the three cities and the overall sample. The overall means for teacher knowledge (mean = 3.32, standard deviation = 0.60), teacher behavior (mean = 3.31, standard deviation = 0.62), and teaching innovation (mean = 3.33, standard deviation = 0.61) are all in the middle range (approximately 3.3 out of 5). This indicates that while preschool teachers in Shandong Province possess a certain level of professional competence, there is still significant

room for improvement in elevating them to an excellent level.

It is worth noting that there are significant regional differences. Teachers in Weifang City scored the highest across all dimensions (average approximately 3.95), indicating a high level of professional development. In contrast, teachers in Jining City scored the lowest (average approximately 2.58), reflecting a need for targeted support, while those in Linyi City scored in the middle (average approximately 3.42).

Table 3 Descriptive statistics of dependent variables

N	Variable	Minimum	Maximum	Mean	Standard deviation	Variance	Skewness	Kurtosis
150	Teacher knowledge	3.47	4.31	3.94	0.17	0.03	- 0.30	- 0.18
	Teacher Behavior	3.47	4.31	3.96	0.16	0.03	- 0.30	- 0.13
	Teaching Innovation	3.44	4.50	3.96	0.18	0.03	- 0.25	0.59
200	Teacher Knowledge	2.67	4.06	3.42	0.32	0.10	-0.62	- 0.77
	Teacher Behavior	2.64	4.00	3.41	0.34	0.12	-0.74	- 0.64

	Teaching Innovation	2.58	4.00	3.42	0.34	0.12	-0.79	- 0.52
	Teaching Knowledge	2.08	3.25	2.59	0.30	0.09	0.55	- 0.84
150	Teaching Behavior	2.08	3.39	2.56	0.32	0.10	0.74	- 0.60
	Teaching Innovation	2.08	3.36	2.60	0.32	0.10	0.74	- 0.66

4.2 Preliminary Hypothesis Testing for MANOVA

Before conducting the multivariate analysis of variance (MANOVA), we rigorously tested the fundamental assumptions of homogeneity of variances and homogeneity of covariance matrices. Homogeneity of variance test (Levene test): The Levene test was performed to assess the equality of error variances across groups of dependent variables. The results showed that the test statistics were not significant for all dependent variables (education level, training, size, and leadership) ($p > .05$). Homogeneity of covariance matrix (Box's M test): The Box's M test was used to test the homogeneity of covariance matrices across groups. The results showed that the test statistics for all independent variables were not significant; therefore, the null hypothesis of covariance matrix equality could not be rejected. The data met all the necessary preconditions, validating the effectiveness of using multivariate analysis of variance (MANOVA) for subsequent hypothesis testing.

4.3 Hypothesis Testing Results

4.3.1 The impact of education level (H1-H3)

The multivariate main effect of education level was statistically significant (Wilks' $\lambda = .910$, $F(6, 990) = 8.093$, $p < .001$, $\eta^2 = .047$), indicating that teachers' educational background has a significant impact on their overall professional development.

Teacher Knowledge (H1): Educational background had a significant impact ($F = 14.899$, $p < .001$), supporting hypothesis H1. Post-hoc comparisons (Tukey's HSD) showed a clear hierarchical structure: teachers with master's degrees scored significantly higher than those with bachelor's degrees, and those with bachelor's degrees scored significantly higher than those with associate's degrees. Instructional Innovation (H3): Innovative ability also had a significant impact ($F = 4.632$, $p = .010$), supporting hypothesis H3. Higher education was associated with stronger curriculum design and methodological reform capabilities. Teacher Behavior (H2): However, no significant differences were found in teacher behavior ($F = 2.508$, $p = .083$). This led to the rejection of hypothesis H2, indicating that higher education does not automatically translate into better daily teaching practices in the absence of mediating factors.

Table 4 Results of between-subjects effects tests on the influence of teachers' educational attainment on each dependent variable

Source	Dependent Variable	III-type sum of squares	df	Mean Square	F	p-value	Partial Eta-squared (Partial η^2)
Adjusted model	Teacher knowledge	11.099	2	5.550	14.899	0.001	0.057
	Teacher Behavior	1.838	2	0.919	2.508	0.083	0.010
	Teaching Innovation	3.232	2	1.616	4.632	0.010	0.018
Intercept	Teacher Knowledge	7119.987	1	7119.987	19120.354	0.001	0.975
	Teacher Behavior	6982.982	1	6982.982	19045.242	0.001	0.975
	Teaching Innovation	6828.611	1	6828.611	19,576.456	0.001	0.975
Educational Attainment	Teacher Knowledge	11.099	2	5.550	14.899	0.001	0.057
	Teacher Behavior	1.838	2	0.919	2.508	0.083	0.010
	Teaching Innovation	3.232	2	1.616	4.632	0.010	0.018
Error	Teacher knowledge	185.127	497	0.372			
	Teacher Behavior	182.203	497	0.367			
	Teaching Innovation	173.398	497	0.349			
Overall	Teacher Knowledge	7,317	500				
	Teacher Behavior	7,167	500				
	Teaching Innovation	7005	500				
Overall Corrections	Teacher Knowledge	196.226	499				
	Teacher Behavior	184.041	499				
	Teaching Innovation	176.63	499				

4.3.2 Impact of Quarterly Training Frequency (H4-H6)

Analysis shows that training frequency has the greatest impact among all independent variables (Wilks' $\lambda = .820$, $F(6, 990) = 17.887$, $p < .001$, $\eta^2 = .098$), confirming that on-the-job training frequency is an important driver of professional development.

Univariate analysis (Table 5) showed significant differences across the three dimensions of knowledge ($F=34.686$), behavior ($F=16.920$), and

innovation ($F=22.846$), with all p-values less than .001. Post-hoc tests revealed a consistent dose-response relationship: teachers attending ≥ 3 training sessions per quarter significantly outperformed those attending 2, and those attending 2 sessions outperformed those attending only 1. Unlike academic qualifications, training frequency significantly improved teacher behavior ($\eta^2 = .064$), indicating that continuous practical training is crucial for shaping daily classroom interactions. Therefore, hypotheses H4, H5, and H6 are strongly supported.

Table 5 Results of between-subjects effects tests on the influence of quarterly training frequency on each dependent variable

Source	Dependent Variable	III Sum of squares	Df	Mean square	F	p-value	Partial Eta-squared (Partial η^2)
Number of quarterly training sessions	Teacher knowledge	23.361	2	11.681	34.686	0.001	0.122
	Teacher behavior	11.789	2	5.895	16.920	0.001	0.064
	Teaching innovation	15.150	2	7.575	22.846	0.001	0.084

4.3.3 Impact of Kindergarten Size (H7-H9)

The multivariate test for kindergarten size was not significant (Wilks' $\lambda = .993$, $F(6, 990) = 0.598$, $p = .732$, $\eta^2 = .004$), indicating that kindergarten size (small, medium, or large) has no significant impact on teachers' professional development. Since the main multivariate effect was not significant, no further analysis of the univariate test results was conducted. Therefore, hypotheses H7, H8, and H9 were rejected. This insignificant result has important theoretical implications because it suggests that, in the context of preschool education in China, soft factors (such as training and leadership) may be more influential than hard structural factors (such as size).

4.3.4 The Influence of the Director's Leadership Style (H10-H12)

The multivariate main effect of director's leadership style was statistically significant (Wilks' $\lambda = .963$, $F(6, 990) = 3.141$, $p = .005$, $\eta^2 = .019$), which confirms that the director's leadership style

has a significant impact on students' academic performance.

Transformational leadership plays a crucial role in teacher development. Univariate tests (Table 6) show that transformational leadership has a significant impact on all three dimensions: knowledge ($p=.033$), behavior ($p=.007$), and innovation ($p=.006$). Post-hoc comparisons consistently indicate that transformational leadership is the most effective director's leadership style. Teachers under transformational leadership scored significantly higher than those under transactional or servant leadership across all dimensions. Interestingly, while transactional leadership (focusing on rewards and punishments) and servant leadership (focusing on support) also showed some positive effects, they were significantly less effective than transformational leadership in promoting innovation and high-quality behavior. Therefore, hypotheses H10, H11, and H12 are supported, highlighting the superiority of transformational leadership in education.

Table 6 Results of between-subjects effect tests on the influence of directors' leadership styles on each dependent variable

Source	Dependent Variable	III-type sum of squares	df	Mean Square	F	p-value	Partial Eta-squared (Partial η^2)
Director's Leadership Style	Teacher Knowledge	2.620	2	1.311	3.444	0.033	0.014

Teacher behavior	3.670	2	1.835	5.087	0.007	0.02 0
Teaching Innovation	3.585	2	1.793	5.115	0.006	0.02 0

5. Discussion and Conclusion

Quantitative analysis showed that training frequency was the strongest predictor among the three dimensions of professional development ($\eta^2 = 0.098$). This finding strongly supports Guskey's (2016) model, which posits that continuous professional learning is crucial for changing teachers' practices and beliefs. Teachers who participated in more than three training sessions per quarter significantly outperformed other teachers, a finding strongly supported by qualitative interviews in which teachers described high-frequency training not only as a source of information but also as a preservative to prevent knowledge from becoming obsolete and a corrector of behavioral habits.

Research confirms that director's leadership style is a key environmental factor, with transformational leadership outperforming transactional and servant leadership in all aspects. This aligns with Fullan's (2016) view that leaders are drivers of change and shape a learning culture. Qualitative data explains why this director's leadership style is superior. While transactional leadership (common in Linyi) ensures basic obedience through rewards and punishments, this often leads to utilitarian innovation and a fear of failure. In contrast, transformational leadership (prevalent in Weifang) fosters a culture of tolerance for failure and a visionary appeal.

A rigorous finding of this study is the selective effect of educational qualifications. While higher qualifications significantly predict teachers' knowledge and innovation, they do not have a significant main effect on teacher behavior itself. However, high-quality behavior is a skill acquired through in-service practice and mentorship, independent of initial degrees. Hargreaves & Fullan, (2021) argue that professional capital relies more on social collaboration than on material assets. Qualitative evidence supports this de-scaling view, with teachers from small but high-performing kindergartens emphasizing that a cohesive team culture and a positive learning environment are far more important than hardware facilities.

This study provides reliable empirical evidence from Shandong, China, the key factors for the professional development of preschool teachers were identified. Professional development comprises high-frequency training and transformational leadership; training ensures continuous updating of knowledge and behavior, while transformational leadership creates psychological safety and motivation for innovation. To shift from quantity to quality, education stakeholders must shift their focus from building larger schools and demanding higher qualifications to establishing high-frequency training systems and cultivating transformational leaders.

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