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Teacher professional learning communities and children's school readiness in China: the moderating role of supportive conditions and cooperative atmosphere

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Introduction: This study examined whether teacher professional learning communities (PLCs) established through a collaborative effort between kindergarten and primary school teachers can effectively promote Chinese children's school readiness and explore the policy conditions that stimulate such a facilitative effect.

Methods: A total of 839 children and 67 teachers in kindergartens from Chongqing, China, participated in this study. Firstly, we used descriptive statistical analysis to determine the overall situation of teacher PLCs. Subsequently, a series of mean difference tests and multiple linear regression analysis were used to test the relationship between teacher PLCs and children's school readiness.

Results: The results indicated that the three dimensions of teacher PLCs, including shared vision, collaborative practice, and resource sharing, significantly and positively predicted children's school readiness. Chinese teachers scored highest in the dimension of shared vision, followed by collaborative practice, and lowest in resource sharing. The collaborative atmosphere of teacher PLCs enhanced their effects on children's school readiness, while the supportive conditions of teacher PLCs were ineffective.

Discussion: The empirical findings from this study broaden the scope of existing research on teacher PLCs and provide information from a Chinese context about improving children's early development to benefit international society.

KEYWORDS

teacher professional learning communities, transition from kindergarten to primary school, school readiness, supportive conditions, cooperative atmosphere

1 Introduction

Early childhood significantly influences children's development, establishing the groundwork for their future accomplishments. The transition from kindergarten to primary school marks a critical phase in a child's early growth (Besi and Sakellariou, 2019a; Purtell et al., 2020). To ensure a smooth transition, adequate preparation is essential before children enter primary school (Pears et al., 2013). The readiness of children during this period not only impacts their adjustment and academic progress in primary school (Xia, 2020; Besi and Sakellariou, 2019b) but also shapes their sustainable development over time (Black et al., 2017; Lohndorf et al., 2021). Research indicates that insufficient preparation for school can lead to challenges and disruptions during the first year of primary education (Xu and Liu, 2018),

potentially exposing children to health-related and social–emotional risks (Hair et al., 2006).

Research on children's transitions between school stages underscores the importance of school readiness, with significant attention given to improving children's readiness for primary school through various interventions (Jeon et al., 2020). The factors influencing children's readiness are complex, with much of the existing research focusing on the role of families (Kang et al., 2017; Slicker et al., 2021), while often overlooking the substantial influence of kindergarten and school environments, as well as teachers. In fact, early childhood educators play a crucial role in preparing children for school and ensuring a smooth transition to primary school. Teachers are a key resource in the educational process. Since children's transitions predominantly occur between kindergarten and primary school, it is essential for teachers from both stages to collaborate to facilitate this process. However, practical barriers—such as differences in teaching methods, knowledge structures, social status, and salary levels—often hinder effective collaboration between kindergarten and primary school teachers (OECD, 2017). Research has shown that establishing Professional Learning Communities (PLCs) can help address these disparities by promoting cooperation and communication among teachers (Xiu, 2024). A PLC is defined as "a group of people sharing and critically interrogating their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting way" (Stoll et al., 2006). In this study, PLCs are understood as collaborative learning communities where kindergarten and primary school teachers work together to support children's smooth transition across school stages. Within PLCs, educators uphold shared values and engage in continuous reflection and improvement of their teaching practices (Harris, 2014). Collaboration between teachers from different school stages calls for the creation of PLCs to bridge gaps and enhance support for children's transitions. While the positive impact of PLCs on academic performance is widely acknowledged, the effectiveness of cross-stage PLCs in preparing children for school readiness remains a topic warranting further exploration.

This study uses survey data from a province in western China to examine whether Professional Learning Communities (PLCs) formed by kindergarten and primary school teachers can effectively enhance children's school readiness. Additionally, it explores the policy conditions that foster and amplify this facilitative effect.

2 Literature review

2.1 Children's school readiness in China

School readiness refers to the essential characteristics and foundational conditions that preschool-aged children need to benefit from the formal schooling they are about to enter (Gredler, 2000). It is widely regarded as a multidimensional concept that includes various aspects of physical and mental development (Gai and Liu, 2008). Research has revealed imbalances in the development of school readiness among Chinese children. For instance, children tend to show weaknesses in self-care, learning skills, peer interactions, emotional regulation, and social skills (Zhang et al., 2005), while being overprepared in areas such as cognition, general knowledge, and language (Gai et al., 2008). Both excessive and insufficient preparation for school can cause irreversible harm to children's physical and mental health. Moreover, studies have noted that children who are neuro developmentally and behaviorally immature, struggle with self-regulation, or face attention difficulties often perform academically worse than their peers during the initial stages of school (Margetts, 2014).

In recent years, the transition from kindergarten to primary school has gained increasing attention from the Chinese government and education authorities, particularly regarding children's under-preparedness and maladaptation during this critical period. To address these issues, Chinese education authorities have introduced specific policies aimed at facilitating a smooth transition. In 2021, the Ministry of Education issued *the Opinions on Promoting the Transition from Kindergarten to Primary School* (hereinafter referred to as "*the Opinion*") (Ministry of Education, 2021). For the first time, this policy classified children's school readiness into four domains: physical and mental readiness, life readiness, social readiness, and academic readiness. It also provided clear and actionable educational guidance for implementing school-readiness education in kindergartens and adaptation education in primary schools. As a result, *the Opinion* serves as a vital practical guide for kindergarten educators and early childhood education practitioners in China, equipping them to support school readiness and help children transition smoothly into primary school (Li and Li, 2022). This policy document forms the foundation of our research, which empirically examines the school readiness of Chinese children in the context of growing concerns about their physical and mental health and ongoing efforts to improve the quality of early childhood education in China. Based on our findings, we will propose policy recommendations to enhance the quality of the kindergarten-to-primary-school transition and promote children's school readiness. These recommendations will focus on fostering collaborative and cooperative practices between kindergarten and primary school teachers.

2.2 Factors influencing children's school readiness and teacher PLCs in China

Given the critical role of children's school readiness in sustaining the benefits of early education and supporting their holistic development, current research has systematically examined the factors influencing school readiness. Early studies primarily highlighted the role of families, emphasizing that active parental involvement in transition practices facilitates a smoother transition to primary school. Higher levels of parental involvement have consistently been associated with better school readiness outcomes (Jeon et al., 2020; Puccioni, 2015). More recently, researchers have turned their attention to transition-related educational policies and schooling practices that support successful transitions. Drawing on the experiences of Western countries while considering the Chinese educational context, Chinese researchers have proposed targeted curriculum and teaching implementation programs for transitions. These include actionable guidelines on curriculum content, teaching methods, and evaluation systems (Xu and Hu, 2022; Ren and Zhao, 2022). Teachers play a vital role as designers, implementers, and evaluators of these policies and practices. Their quality and level of participation are directly linked to the effectiveness and completeness of the transition process. Since the transition from kindergarten to primary school spans two distinct educational stages, both kindergarten and primary school teachers hold a crucial position in facilitating this process. However, much of the existing research on transitions has disproportionately focused on kindergarten teachers, often assuming that school-readiness education is solely the responsibility of kindergartens and has little to do with primary schools. As a result, many current transition practices in China remain largely one-sided.

In China, the implementation of PLCs has gained momentum through educational reforms and policies aimed at enhancing teacher professional development and improving teaching quality. With the increasing emphasis on educational quality, especially in basic education, many schools have established PLCs—referred to in China as "teaching and research groups"—to foster collaboration and communication among teachers. Typically, PLCs are organized within schools, bringing together teachers of the same grade or subject to focus on the knowledge system, teaching methods, and learning characteristics specific to their school stage. Regular activities such as collective lesson planning, peer observations, lesson evaluations, and mentoring between senior and junior teachers are common, providing opportunities for collaboration and professional growth (Zheng et al., 2021; Zhu, 2019). In urban areas, where schools have better resources, PLCs are more systematically implemented, with dedicated funding and support from the government or schools. These PLCs often conduct regular activities, offering teachers the chance to reflect on and improve their practices. However, rural schools, which face challenges such as limited funding, time constraints, and insufficient training support, often struggle with PLC implementation. Moreover, due to the structure of China's education management system, traditional PLCs are typically confined to a single school stage, lacking the cross-stage collaboration needed to address children's development during transitions. As a result, these PLCs are less effective in supporting seamless transitions between kindergarten and primary school. Existing research highlights the potential of PLCs to not only enhance teachers' professional development (Huijboom et al., 2021; Fu and Yan, 2015) and improve classroom practices (Andrews and Lewis, 2007) but also positively impact students' academic performance (Thomas et al., 2015). By fostering collaboration among teachers, PLCs contribute to both teacher growth and student development (Andrews and Lewis, 2007; Fuligni et al., 2009). Recent empirical studies have further demonstrated a positive correlation between collaborative learning in PLCs and students' academic achievement (Zhao et al., 2013). Specifically, PLCs and ongoing post-service guidance have been found to significantly enhance children's school readiness (Son et al., 2013). Collaborative efforts between kindergarten and primary school teachers, particularly in curriculum alignment, have been identified as the most crucial factor influencing children's future academic performance. Research suggests that the more diverse and collaborative the activities between kindergarten and primary school teachers, the faster children's learning abilities develop during the transition from kindergarten to first grade (Ahtola et al., 2011). While direct research on the impact of teacher PLCs on children's school readiness is still limited, existing evidence underscores the importance of collaboration between kindergarten and primary school teachers in ensuring successful transitions. This insight forms the foundation and inspiration for our research.

2.3 Policy conditions for teacher PLCs to promote student development

With the growing emphasis on children's transition practices worldwide, fostering effective collaboration between kindergarten and primary school teachers has become a critical issue in advancing high-quality kindergarten education and supporting children's holistic development. However, numerous factors constrain the practical establishment of teacher Professional Learning Communities (PLCs). Research highlights that at the heart of a successful PLC is the cultivation of a collaborative culture characterized by openness, democracy, mutual trust, and support among teachers (Shi et al., 2007). A PLC provides not only a framework of ideological concepts but also a set of behavioral patterns that promote collaboration (Hu, 2013). The cooperative spirit of mutual benefit and sharing is an essential element of this culture (Shi, 2013). Within such a collaborative atmosphere, teachers' values and group visions can align, enabling open, trusting, and supportive communication. Teachers can candidly discuss teaching challenges, share experiences, and collaboratively explore solutions through shared inquiry (Du and Chang, 2018). On the other hand, existing research emphasizes that supportive conditions are a crucial factor in the development of PLCs (Stoll et al., 2006; Nelson, 2009). This support primarily stems from organizational structures, including a conducive community environment, shared time and space for collaboration, effective communication and learning systems, and access to necessary hardware and software resources. Additionally, support from both internal and external stakeholders is essential. Internally, mutual respect and collaboration among colleagues create a supportive atmosphere, while externally, understanding and encouragement from individuals such as family members and friends are vital for teachers' professional growth. Despite these insights, significant structural barriers hinder collaboration between kindergarten and primary school teachers during the transition from kindergarten to primary school. These barriers include a lack of dedicated time for collaboration, insufficient resources to support joint efforts, and differences in educational practices and learning environments. These challenges severely limit two-way communication and collaborative practices between teachers at these two educational stages, impeding efforts to create a seamless transition for children.

2.4 The present study

The focus of early childhood education development in China has shifted from expanding access to enhancing quality. Within this context, the quality of the transition from kindergarten to primary school—and whether children can transition smoothly—has emerged as a critical yet challenging aspect of improving early childhood education. While the role of teacher Professional Learning Communities (PLCs) in student development and education quality improvement has been widely researched and recognized globally, their impact in the field of preschool education, particularly during the transition period between kindergarten and primary school, remains insufficiently understood. Consequently, there is a lack of corresponding empirical studies in this area. Chinese education authorities have emphasized the need for better communication and collaboration between kindergarten and primary school teachers to facilitate a smoother transition for children. However, in the absence of well-established policy practices and widespread successful examples, there is limited empirical evidence on how kindergarten and primary school teachers can effectively collaborate to maximize children's school readiness. To address this gap, this study aims to examine the relationship between teacher PLCs established across these two school stages and children's school readiness. Additionally, it seeks to explore how supportive conditions and a collaborative atmosphere can be fostered to strengthen this relationship, focusing on the perspectives of kindergarten and primary school administration.

The main research question of this study is: can teacher PLCs established across school stages by kindergarten and primary school

teachers effectively promote children's school readiness? This question is composed of three sub-research questions: (a) How do kindergarten and primary school teachers in China establish teacher PLCs? (b) Which content dimension of the teacher PLCs established across school stages by kindergarten and primary school teachers has a greater impact on children's school readiness? (c) Under what conditions can teacher PLCs better support children in preparing for school entry?

3 Methodology

3.1 Context and participants

The data and samples for this study were collected from Chongqing, China. Chongqing, the fourth-largest centrally administered municipality in China, is located in the southwest region of the country. This region lags behind the more economically developed eastern provinces, such as Beijing and Shanghai, in terms of educational development. Additionally, the southwest's significant minority population and the diverse family backgrounds of its students require greater policy attention than is currently being provided. Chongqing, as the most representative province in the southwest, is home to a large population of school-age children, making it an ideal location for this study. Selecting children and teachers from Chongqing as survey respondents ensures both the quantity and quality of the sample population. For this study, five districts and counties in Chongqing were randomly selected. Stratified random sampling was then conducted based on the following characteristics: kindergarten location (urban or rural), type of kindergarten (public independent kindergarten, public primary school-affiliated kindergarten, or private inclusive kindergarten),[1] and rank ("model" kindergarten, "first-level" kindergarten, "second-level" kindergarten).[2] Based on these criteria, 17 kindergartens were selected for the study. From each senior kindergarten class, 15 children and two teachers were randomly chosen as participants. After excluding questionnaires with missing information, the final sample comprised 839 children and 67 teachers.

Table 1 summarizes the individual family backgrounds of the children and the basic characteristics of the teachers. Among the child sample, 52.8% were boys and 47.2% were girls. The vast majority were Han Chinese (97.6%), with 42.1% coming from rural areas. Most children were not the only child in their families (67.9%) and were primarily raised by their parents (85.6%). In terms of parental education, 40.2% of parents held a bachelor's degree or higher, while the majority of families had an annual income of RMB 200,000 or less (82.4%). For the teacher sample, the majority held a bachelor's degree (55.2%), and nearly all (89.6%) had teaching credentials, with only a small percentage (10.4%) holding other degrees. Most teachers were employed in urban kindergartens (61.2%) and public kindergartens (59.7%). Among the kindergartens, "First-level" kindergartens made up the largest proportion (64.2%), while "Second-level" kindergartens were the least represented (3%).

3.2 Data collection

This study gathered information on children's school readiness and teacher professional learning communities (PLCs) across school stages. Additionally, background information about children's families was collected to provide context for the children's data. During the data collection process, the researchers visited the selected kindergartens, conducted training sessions for teachers,[3] and then organized the kindergarten senior teachers to fill out the Child School Readiness Scale. Given children's limited reading and writing abilities, this study adopted a common practice in early childhood education for assessing school readiness (Xia, 2020; Hunter et al., 2018). Specifically, both head and assistant teachers observed children in their daily activities and subsequently answered questions related to school readiness. As primary educators in the preschool stage, kindergarten teachers play a key role in facilitating children's transition to school and possess a comprehensive understanding of their school readiness. Therefore, they were deemed well-suited to answer the questionnaires on behalf of the children. To address potential subjectivity and reduce measurement errors associated with proxy responses, consistency checks were conducted between the responses of head and assistant teachers. After confirming no significant differences between the two sets of responses, the study relied on the head teachers' answers to minimize potential biases in the data. Following this, kindergarten teachers were also asked to complete a questionnaire evaluating the quality of the PLCs collaboratively developed by themselves and primary school teachers. To merge the data from the children's and teachers' questionnaires into a single database, unified identification codes were pre-assigned to children and teachers, enabling accurate data matching.

1 In the Chinese educational context, kindergartens can be classified into three types according to their nature: public, public nature, and private. In this study, independent public kindergartens are established by the education administration department using state financial education funds according to the law. Public primary school-affiliated kindergartens are a type of public kindergarten characterized by their affiliated nature and subordinate to primary schools in terms of administrative relationships, including unified leadership relationships in personnel and financial systems. Finally, private inclusive kindergartens refer to nonprofit private kindergartens that accept government financial subsidies and charge government-guided prices.

2 In Chongqing, China, kindergartens are divided into "first-level" kindergartens, "second-level" kindergartens, and "third-level" kindergartens according to the level of operation, and "model" kindergartens are considered "first-level" kindergartens. The audit of the kindergarten level is organized and implemented by the county education commission in conjunction with the competent health department and the competent price department, and the kindergarten level certificate is issued by the county education commission if the conditions are met. Chongqing kindergarten rank assessment methods include the operating conditions, kindergarten management, teaching and learning, child development, school efficiency in five dimensions, and the construction of a quality assessment system, including the combination of fundamental and developmental indicators.

3 Before teachers formally completed the questionnaire, we conducted a focused training session for kindergarten teachers. The training session primarily involved emphasizing the importance of this survey, explaining the meanings of each dimension of the School Readiness Scale, and providing instructions on how to fill out the questionnaire.

TABLE 1 Descriptive statistics of the sample.

Variables	Item	*N*	%
Student Background			
Gender	Male	443	52.80%
	Female	396	47.20%
Ethnicity	Han Chinese	819	97.60%
	Ethnic Minority	20	2.40%
Hukou (household register)	Agricultural account	353	42.10%
	Nonagricultural account	295	35.20%
	Resident account	188	22.40%
	No account	3	0.40%
The only child	The only child	269	32.10%
	Not the only child	570	67.90%
Raised by grandparents	Yes	121	14.40%
	No	718	85.60%
Family background			
The highest educational level of parents	Junior high school or lower	123	14.70%
	High school	248	29.60%
	College	131	15.60%
	Bachelor's degree or higher	337	40.20%
Annual household income	Low grouping	691	82.40%
	Medium grouping	107	12.80%
	High grouping	41	4.9%
Kindergarten teachers' background			
Academic qualifications	Middle school/Junior college	1	1.50%
	University specialists	29	43.30%
	Undergraduate	37	55.20%
Teaching degree	Yes	60	89.60%
	No	7	10.40%
Location of kindergarten	Urban area	41	61.20%
	Township	26	38.80%
Types of kindergarten	Public independent kindergarten	40	59.70%
	Public primary school-affiliated kindergarten	18	26.90%
	Private inclusive kindergarten	9	13.40%
Rank of kindergarten	"Model" kindergarten	22	32.80%
	"First-level" kindergarten	43	64.20%
	"Second-level" kindergarten	2	3.00%

3.3 Measures

3.3.1 Scale for children's school readiness

When developing the school readiness scale for Chinese children in this study, we primarily referenced policy documents issued by the Chinese Ministry of Education, as well as relevant literature from both domestic and international sources. In 2021, the Chinese Ministry of Education (Ministry of Education, 2021), considering the developmental status of Chinese children, adopted *the Guidelines for Learning and Development of Children Aged 3–6* and *the Kindergarten Education Guidance Outline* as theoretical foundations. Based on these guidelines and focused on the essential qualities required for children transitioning to school, the Ministry formulated and issued *the Guidance Points on Kindergarten School Readiness Education.* This policy, which serves as a critical reference for recent transitional efforts in China, categorizes children's school readiness into four dimensions: physical and mental readiness, life readiness, social readiness, and academic readiness. Our questionnaire was designed based on these four dimensions. For specific items, we drew inspiration from school readiness scales developed by Bay (2020) and Lu et al. (2016). The final scale comprises 26 items, grouped into four main dimensions: (1) physical and mental readiness, which includes explicitly three secondary dimensions (e.g., physical and mental readiness for school, emotional readiness, and sports readiness); (2) life readiness, which includes three secondary dimensions (e.g., living habits, safety, protection, and labor participation); (3) social readiness (the secondary dimensions include interaction and cooperation, honesty and compliance); and (4) academic readiness (the secondary dimensions include curiosity, study habits, interest in learning, and learning ability). The scale uses a 5-point Likert scoring system, ranging from 1 ("not at all") to 5 ("completely"), with higher scores indicating greater levels of school readiness. In this study, the internal consistency of the scale was assessed using Cronbach's alpha. The coefficients for the overall scale and its four dimensions were 0.930, 0.756, 0.807, 0.738, and 0.920, respectively, indicating strong internal reliability. Furthermore, the correlations between the mean scores of the four dimensions and the overall scale revealed significant relationships, with R^2 values ranging from 0.676 to 0.938. This demonstrates that when the scores of the four dimensions were used to predict the overall scale score, they collectively explained more than 67.6% of the variance in the overall score. These findings indicate that the children's school readiness scale used in this study is a reliable and promising measure.

3.3.2 Scale for teacher PLCs across school stages

Drawing on the literature on teacher professional learning communities (PLCs) (Du and Chang, 2020; Peng et al., 2022), this study categorized teacher PLCs across school stages into three dimensions: shared vision, collaborative practice, and resource sharing.

Shared vision refers to kindergarten and primary school teachers having aligned understandings and shared value judgments about the transition from kindergarten to primary school. This represents the conceptual foundation of teacher collaboration across school stages. An example item for this dimension is: "I believe that collaboration with primary school teachers around children's transition between school stages promotes my professional development." Collaborative practice involves joint, collective activities between kindergarten and primary school teachers aimed at achieving transition-related goals. Example items include: "I have co-organized joint teaching and research activities with primary school teachers on the theme of transition" and "I have participated in activities with primary school teachers to experience each other's work." Resource sharing refers to the exchange of teaching experiences and materials between kindergarten and primary school teachers to support children's transition. Examples include: "I have shared examples of teaching practices around children's transition with primary school teachers" and "I have shared child development assessment tools with primary

school teachers in collaboration around children's transition." The teacher PLCs across school stages scale used in this study consists of 11 items, scored on a 5-point Likert scale ranging from 1 ("not at all") to 5 ("completely"), with higher scores indicating higher quality of teacher PLCs. The reliability of the scale was assessed using Cronbach's alpha, which yielded coefficients of 0.867 for the overall scale and 0.904, 0.946, and 0.919 for the three dimensions, respectively. These results indicate strong internal consistency. Additionally, significant correlations were found between the mean scores of the three dimensions and the overall scale, with R^2 values ranging from 0.596 to 0.938. This means that the three dimensions collectively explained more than 59.6% of the variance in the overall scale. These findings suggest that the teacher PLCs across school stages scale used in this study is a reliable and valid tool for evaluating the quality of teacher collaboration around children's transitions between kindergarten and primary school.

3.3.3 The measurement of the two moderator variables

In this study, the two moderator variables are supportive conditions and a cooperative atmosphere. Supportive conditions refer to the time and hardware resources provided by schools to facilitate teachers' collaborative learning efforts (Admiraal et al., 2021). This variable is assessed using 5 items (e.g., "The collaboration between me and primary school teachers is supported by both schools; There are channels for sharing policy documents related to children's transitions between me and primary school teachers").

The cooperative atmosphere represents an important foundation for teacher collaboration and communication, where teachers share unified values and group visions (Du and Chang, 2018). This variable is measured through 5 items (e.g., "I trust primary school teachers during our collaboration; I communicate openly and honestly with primary school teachers during our collaboration"). Both moderator variables are rated on a 5-point Likert scale, and standardized scores for each variable are obtained through factor analysis. The cronbach's alpha coefficients of the two scales are 0.916 and 0.946, respectively.

3.4 Data analysis plan

First, to understand the situation of teacher PLCs across school stages in Chongqing, China, this study conducted descriptive statistical analysis to assess the overall situation of teacher PLCs across the three dimensions: shared vision, collaborative practice, and resource sharing. Based on this analysis, paired-sample tests were performed to determine whether the mean differences among the three dimensions of teacher PLCs were statistically significant. Second, to investigate the impact of teacher PLCs on children's school readiness, the teacher sample was divided into three groups (high, medium, and low) based on the levels of teacher PLC operation. Differences in children's school readiness were then compared across these three groups to explore the relationship between the levels of teacher PLC synergy and children's school readiness. Third, a multiple regression analysis was conducted, with children's overall school readiness as the dependent variable and the three dimensions of teacher PLCs across school stages as the independent variables. The regression model controlled for several variables, including the child's gender, whether the child was raised by grandparents, annual family income, kindergarten type, and teacher-child ratio. Finally, to explore the heterogeneity in the relationship between teacher PLCs across school stages and children's school readiness and to identify potential policy factors that could strengthen this relationship, supportive school conditions and the collaborative atmosphere were introduced into the regression model as moderating variables. Interaction terms were created between these moderating variables and the dimensions of teacher PLCs. The regression coefficients for the teacher PLCs measured their direct effect on children's school readiness, while the coefficients for the interaction terms tested whether school-level policy factors moderated the relationship between teacher PLCs and children's school readiness.

4 Results

4.1 The current status of teacher PLCs across school stages

As shown in Table 2, the overall proficiency of the PLCs across school stages was found to be moderate ($M = 3.775$, SD = 0.938). Among the three dimensions assessed, the shared vision dimension scored the highest ($M = 4.524$, SD = 0.716), followed by the collaborative practice dimension ($M = 3.582$, SD = 1.201). The resource sharing dimension, however, scored the lowest ($M = 3.408$, SD = 1.322). To compare the mean scores of the three dimensions, a significance test for differences in means was conducted. Results from the paired samples T-test revealed that the shared vision dimension scores were significantly higher than those of both the collaborative practice and resource sharing dimensions ($p < 0.01$). Additionally, the scores for the collaborative practice dimension were significantly higher than those for the resource sharing dimension ($p < 0.01$).

These findings suggest that kindergarten and primary school teachers are conceptually motivated to collaborate and have begun experimenting with collective professional development activities. For instance, they have engaged in co-organizing joint teaching and research initiatives related to children's transition across school stages and learning more about each other's work. However, it is worth noting that concrete actions in resource sharing remain insufficient. This is evidenced by the low levels of sharing teaching practice examples and exchanging information about children's physical and mental development.

TABLE 2 Descriptive statistics and analysis of variance for teacher PLCs and its dimensions.

Dimensions	N	M	SD	T test
1. Shared vision	3	4.524	0.716	Shared vision>Collaborative practice*** Shared vision>Resource sharing*** Collaborative practice>Resource sharing***
2. Collaborative practice	4	3.582	1.201	
3. Resource Sharing	4	3.408	1.322	
4. Overall level of teacher PLCs	11	3.775	0.938	

N represents the number of items in each dimension. M represents the average score of each dimension. SD stands for standard error. ***p < 0.01.

To gain deeper insight into the specific challenges faced by kindergarten and primary school teachers in the lower-scoring dimensions of collaborative practice and resource sharing, this study further analyzed the individual items within these dimensions. Figure 1A illustrates the scores for individual items within the collaborative practice dimension. The slightly higher scores for items 1 and 4 suggest that the PLCs established by kindergarten and primary school teachers primarily focus on co-organizing transition-related teaching and research activities, as well as thematic activities, at a practical level. In contrast, the slightly lower scores for items 2 and 3 indicate that the practice of learning about each other's work is less developed, with the joint development of transition-related thematic activities for children being the least developed.

Figure 1B. presents the scores for individual items within the resource sharing dimension. The results show that all four items scored low, highlighting poor performance in this area. Specifically, Items 1 and 2 scored slightly higher, indicating that kindergarten and primary school teachers are relatively better at sharing resources related to children's physical and cognitive development. Conversely, the lower scores for Items 3 and 4 suggest that the sharing of teaching practice cases related to children's transition and evaluation tools for children's development is significantly underdeveloped.

4.2 Analysis of the differences in children's school readiness under different levels of teacher PLCs

Table 3 presents the results of a one-way analysis of variance conducted to test differences in children's school readiness scores across different levels of teacher PLCs (grouped by factor scores). The results indicate that teachers with higher levels of operation in their PLCs tend to have students with higher school readiness scores. This trend was consistent across all dimensions of teacher PLCs, suggesting

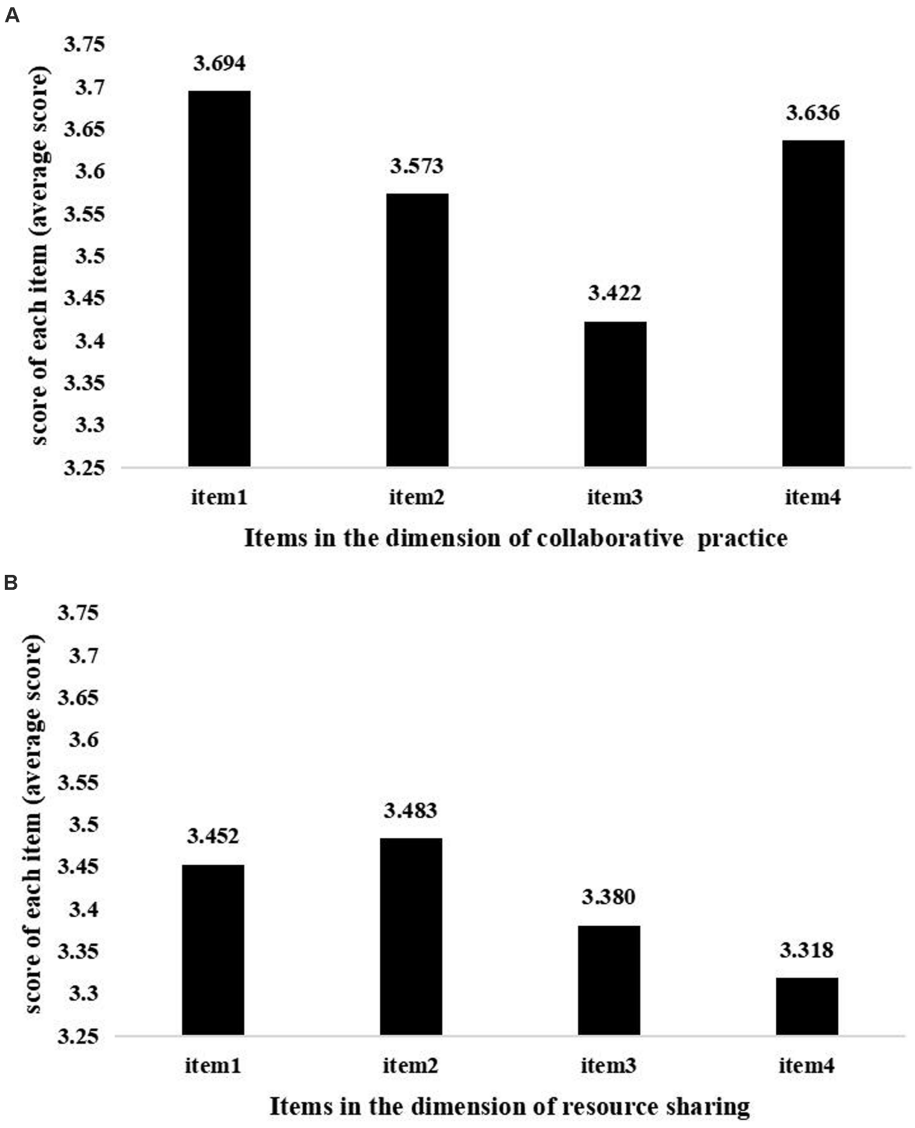

FIGURE 1
The average score of four items in the collaborative practice dimension **(A)** and the resource sharing dimension **(B)**.

TABLE 3 Analysis of differences in children's school readiness at different levels of teacher PLCs.

Teacher PLCs across school stages		Children's school readiness score	F	Two-by-two comparison
Dimension 1: Shared vision	Low	4.347	21.57***	High>Low*** Medium>Low***
	Medium	4.549		
	High	4.575		
Dimension 2: Collaborative practice	Low	4.433	3.04**	High>Low** Medium>Low**
	Medium	4.509		
	High	4.522		
Dimension 3: Resource sharing	Low	4.467	9.45***	High>Low*** High>Medium***
	Medium	4.417		
	High	4.583		

*$P < 0.1$, **$p < 0.05$, ***$P < 0.01$.

TABLE 4 Impact of the teacher PLCs across school stages on children's school readiness.

Predictor	Model 1	Model 2	Model 3	Model 4
Shared vision	0.135***[b]			0.139***
	(3.869)[c]			(4.010)
Collaborative practice		0.090***		0.092***
		(2.675)		(2.763)
Resource sharing			0.112***	0.115***
			(3.304)	(3.447)
Covariates[a]	Yes	Yes	Yes	Yes
Number of observations	839	839	839	839
R^2	0.070	0.062	0.066	0.092
Adj. R^2	0.061	0.053	0.057	0.081

[a]The covariates included the gender of the child, whether the child was raised by his or her grandparents, annual household income, type of kindergarten, and teacher–child ratio.
[b]**$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
[c]Standard errors.

that each dimension plays a significant role in influencing children's school readiness. However, it is noteworthy that in dimension 3, there was no significant difference in children's school readiness scores between classrooms of teachers operating at the middle and lower levels of the PLCs. In other words, the impact on children's school readiness becomes apparent only when teacher PLCs reach a high level of operation. These findings underscore the importance of significantly enhancing collaboration between teachers at both school stages—particularly in terms of resource sharing—to effectively promote children's school readiness skills.

4.3 Regression analysis of the impact of teacher PLCs across school stages on children's school readiness

This study employs a series of multiple regression models to analyze the specific effects of teacher PLCs across school stages on children's school readiness. Models 1 through 4 serve as baseline models, examining the effects of the three dimensions of teacher PLCs—shared vision, collaborative practice, and resource sharing—on children's school readiness after controlling for contextual factors at the student, family, and teacher levels. Models 5 through 8 explore the moderating effect of supportive conditions on the relationship between teacher PLCs across school stages and children's school readiness. Similarly, Models 9 through 12 investigate the moderating effect of a collaborative atmosphere on this relationship.

4.3.1 Baseline model results: associations between teacher PLCs across school stages and children's school readiness

Table 4 presents the results of the baseline models. Specifically, Models 1 through 3 examine the predictive effect of each dimension of teacher PLCs on children's school readiness independently. Model 4 incorporates all three dimensions into the regression equation to explore their combined predictive effects on children's school readiness. The results from Model 1 to Model 3 show that shared vision positively predicted children's school readiness ($\beta = 0.135$, $p < 0.01$), collaborative practice positively predicted children's school readiness ($\beta = 0.090$, $p < 0.01$), and resource sharing positively predicted children's school readiness ($\beta = 0.112$, $p < 0.01$). In Model 4, when all three dimensions were included simultaneously, the results indicated that each dimension of teacher PLCs continued to significantly and positively predict children's school readiness ($p < 0.01$). Furthermore, by comparing the standardized regression coefficients[4], it becomes evident that: the shared vision of teachers in the teacher PLCs across school stages had the most significant effect on children's school readiness ($\beta = 0.139$), resource sharing among teachers had the second most remarkable effect on school readiness ($\beta = 0.115$), and collaborative practice had the slightest effect ($\beta = 0.092$).

4.3.2 Results of the interaction effects model: moderating effects of supportive conditions on the relationship between teacher PLCs across school stages and children's school readiness

Model 5 incorporates the first moderating variable (supportive conditions) into Model 4, while Models 6 through 8 examine the moderating effect of supportive conditions on the relationship between the three dimensions of teacher PLCs across school stages and children's school readiness. The results indicate that the effect of supportive conditions on children's school readiness was insignificant, and supportive conditions did not moderate the relationship between teacher PLCs across school stages and children's school readiness ($p > 0.1$) (see Table 5).

4.3.3 Results of the interaction effects model: moderating effects of collaborative atmosphere on the relationship between teacher PLCs across school stages and children's school readiness

Model 9 introduces a second moderating variable (collaborative atmosphere) into Model 4, and Models 10 through

4 Since this study's three core explanatory variables were standardized before the regression analysis, the regression coefficients are the standardized regression coefficients.

TABLE 5 Moderating effects of supportive conditions on the relationship between teacher PLCs across school stages and children's school readiness.

Predictor	Model 5	Model 6	Model 7	Model 8
Shared vision	0.140***[b]	0.145***	0.140***	0.134***
	(4.029)[c]	(4.148)	(4.027)	(3.762)
Collaborative practice	0.092***	0.093***	0.092***	0.100***
	(2.766)	(2.790)	(2.714)	(2.875)
Resource sharing	0.116***	0.122***	0.115***	0.113***
	(3.450)	(3.613)	(3.275)	(3.370)
Supporting conditions	0.016	0.024	0.015	0.004
	(0.413)	(0.641)	(0.407)	(0.097)
Shared vision * Supporting conditions		0.046		
		(1.632)		
Collaborative practice * Supportive conditions			0.002	
			(0.063)	
Resource sharing * Supporting conditions				−0.028
				(−0.791)
Covariates[a]	Yes	Yes	Yes	Yes
Number of observations	839	839	839	839
R^2	0.092	0.095	0.092	0.092
Adj. R^2	0.080	0.082	0.079	0.079

[a]The covariates included the gender of the child, whether the child was raised by his or her grandparents, annual household income, type of kindergarten, and teacher–child ratio.
[b]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
[c]Standard errors.

TABLE 6 The moderating effect of the collaborative atmosphere on the relationship between teacher PLCs across school stages and children's school readiness.

Predictor	Model 9	Model 10	Model 11	Model 12
Shared vision[b]	0.128***	0.129***	0.101***	0.107***
	(3.686)[c]	(3.160)	(2.805)	(2.946)
Collaborative practice	0.090***	0.090***	0.078**	0.091***
	(2.732)	(2.679)	(2.340)	(2.745)
Resource sharing	0.110***	0.110***	0.112***	0.106***
	(3.298)	(3.218)	(3.355)	(3.152)
Cooperative atmosphere	0.088**	0.088**	0.125***	0.128***
	(2.342)	(2.332)	(3.141)	(2.982)
Shared vision * Cooperative atmosphere		0.000		
		(0.019)		
Collaborative practice * Cooperative atmosphere			0.118***	
			(2.717)	
Resource sharing * Cooperative atmosphere				0.069*
				(1.919)
Covariates[a]	Yes	Yes	Yes	Yes
Number of observations	839	839	839	839
R^2	0.098	0.098	0.106	0.102
Adj. R^2	0.086	0.084	0.093	0.088

[a]The covariates included the gender of the child, whether the child was raised by his or her grandparents, annual household income, type of kindergarten, and teacher–child ratio.
[b]*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
[c]Standard errors.

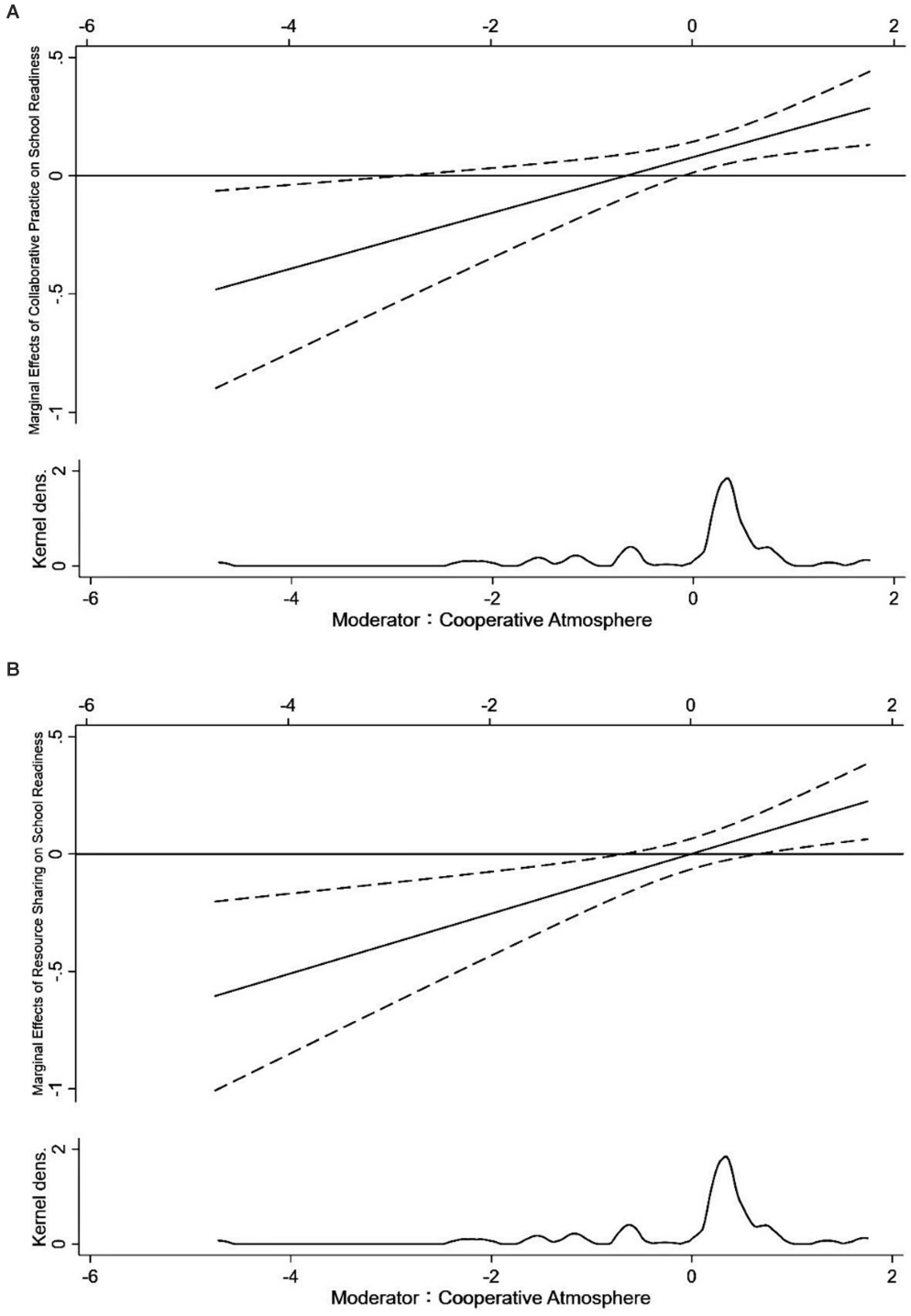

FIGURE 2
The marginal effects of the cooperative atmosphere in moderating the relationship between collaborative practice and school readiness **(A)** and the relationship between resource sharing and school readiness **(B)**.

12 explore the moderating effect of collaborative atmosphere on the relationship between the three dimensions of teacher PLCs across school stages and children's school readiness. The findings reveal that collaborative atmosphere was a positive and significant predictor of children's school readiness. Specifically, the more collaborative the atmosphere created for teacher PLCs within the school, the better the children's school readiness. Additionally, collaborative atmosphere moderated the relationship between collaborative practice and children's school readiness ($\beta = 0.118$, $p < 0.01$), as well as the relationship between resource sharing and children's school readiness ($\beta = 0.069$, $p < 0.1$). However, collaborative atmosphere had no significant moderating effect on the relationship between shared vision and children's school readiness ($p > 0.1$) (see Table 6).

To further illustrate how a collaborative atmosphere influences the relationship between teacher PLC dimensions and children's school readiness, this study plotted the marginal effects of the interaction terms, as shown in Figures 2A,B. The solid sloping line in the graphs represents how the marginal effects of collaborative practice and resource sharing on children's school readiness change as the collaborative atmosphere improves. The significance of this effect can be determined by examining the two-tailed 95% confidence interval plotted around the line; the effect is significant when both the upper and lower bounds of the confidence interval are entirely above or below the zero line (Golder, 2006). The results in Figures 2A,B show a similar pattern: as the collaborative atmosphere improves, the marginal effects of collaborative practice and resource sharing on children's school readiness shift from a non-significant negative effect to a positive and statistically significant effect. In other words, collaborative practice and resource sharing among teachers can only significantly enhance children's school readiness once the collaborative atmosphere created within kindergartens and schools reaches a certain level.

5 Discussion

This study examined the relationship between teacher Professional Learning Communities (PLCs) across school stages and children's school readiness in China, focusing on the moderating effects of supportive conditions and the collaborative atmosphere fostered by these relationships.

First, the study found that kindergarten and primary school teachers in China shared a strong vision for building PLCs, indicating their subjective recognition of the value of such communities. They expressed a desire to help children transition smoothly to primary school through collaborative efforts. While kindergarten and primary school teachers are currently engaged in some collaborative practices, the study revealed that these efforts remain limited in scope, with moderate levels of collaboration. Specifically, teachers at the two school stages collaborate mainly in traditional teaching and research activities, with minimal collaboration in curriculum development and instructional design. This finding aligns with existing research in China (Tian, 2020; Zhang and Pang, 2016). Moreover, teachers reported the lowest scores in the resource-sharing dimension, suggesting that information about children's transitions is rarely shared between kindergarten and primary school teachers. This lack of resource sharing may hinder teachers' understanding of children's physical and mental development during the transition period, making it difficult for them to support a smooth transition. Several factors contribute to these challenges. In China, kindergarten is a non-compulsory level of education, while primary school is compulsory, resulting in significant differences in funding, curriculum and teaching management systems, and staffing arrangements. These disparities often create institutional barriers to transition activities (Huang et al., 2024). As a result, the division of authority and responsibility between kindergartens and primary schools during the transition process is unclear, making cooperation and resource sharing difficult (Fu and Yan, 2015).

Second, the central focus of this study was the effect of teacher PLCs across school stages on children's school readiness. The findings indicate that teacher PLCs are a crucial factor influencing children's readiness for school. Specifically, shared vision, collaborative practices, and resource sharing among teachers from both school stages positively predicted children's school readiness. This supports existing research on the role of teacher PLCs (Fu and Yan, 2015; Andrews and Lewis, 2007) and suggests that establishing PLCs can effectively promote children's transitions to primary school in China. Notably, the study found that having a shared vision among teachers had the most significant impact on children's school readiness, followed by resource sharing, while collaborative practices had the least impact. Given that our previous research showed that collaborative practices were weakest in the resource-sharing dimension, it highlights the need to encourage and facilitate resource sharing among teachers from different school stages in China.

Third, the context in which PLCs are most effective in promoting children's school readiness is a key concern for policy and practice in China's education system. Research indicates that the successful construction of teacher PLCs requires support from various conditions (Admiraal et al., 2021), including the provision of supportive structural conditions and the creation of a collaborative atmosphere. Structural support encompasses aspects like the physical environment, time, space, systems, hardware and software resources, and institutional frameworks. Meanwhile, a supportive atmosphere, characterized by mutual trust, equality, and cooperation, provides the motivation for teachers to engage in PLCs. Our findings partially align with existing research, which suggests that creating a cooperative atmosphere—based on mutual trust, respect, openness, and communication—can enhance the positive effects of PLCs on children's school readiness. However, simply providing supportive conditions, such as open collaboration channels or supportive policies, was insufficient to stimulate the desired effects on school readiness. This suggests that fostering a collaborative atmosphere is more important than merely offering structural support in transition-related practices in China.

5.1 Implications for policy and practice

This study highlights the positive impact of teacher PLCs in promoting children's school readiness in China, emphasizing the role of collaborative cooperation between kindergarten and primary school teachers. It provides valuable insights for Chinese policymakers and educators looking to optimize support for children's transitions.

Given the significant impact of teacher PLCs across school stages, educational authorities should actively encourage the establishment of such communities. Since children's transitions and their physical and mental development depend on the participation of multiple stakeholders, future PLCs should leverage the advantages of educators from different regions, school stages, and schools. It is also crucial to involve professionals who specialize in children's physical and psychological development, encouraging their participation in transition practices to support children's healthy growth (Hou and Zhang, 2024). Beyond providing basic structural support, emphasis should also be placed on creating a collaborative

atmosphere. This requires strong backing from school leaders, both in kindergartens and primary schools, to foster engagement in PLCs and reduce hierarchical barriers (OECD, 2017). Leadership-level support provides a foundation for teachers to collaborate effectively (Yu et al., 2019). Moreover, addressing public biases against kindergarten teachers and promoting equal, respectful relationships between kindergarten and primary school teachers will help create a favorable social climate for deeper collaboration.

In particular, dimensions with a significant impact on children's school readiness—such as collaborative practice and resource sharing—should be prioritized by education authorities and school administrators. Mechanisms for localized teacher exchanges, workshops, and sharing platforms should be explored. For example, when establishing teacher PLCs, kindergarten and early childhood educators could create growth profiles for children, documenting key aspects of their physical and mental development (e.g., height, weight, cognitive skills). These profiles could then accompany the children as they transition to primary school, helping primary school teachers better understand and support the children's development. Additionally, a professional learning network (Engel et al., 2015) or peer mentoring group (Doan, 2021) could be established between kindergartens and primary schools, where teachers from both stages share experiences and resources related to children's transitions and healthy development.

Given the limitations of China's traditional education management system, achieving long-term sustainability for cross-stage teacher PLCs will require updating management practices. The Chinese government and educational authorities should work to establish an integrated management system that bridges the gap between different school stages. For example, funding support for activities related to the transition from kindergarten to primary school should be prioritized to prevent financial constraints from hindering collaboration. Additionally, district-level education authorities and teacher training schools could incorporate cross-stage teacher training into their routine work, providing ongoing guidance and opportunities for collaboration.

5.2 Limitations and future directions

This study has several limitations. First, due to the limited literacy skills of children aged 3–6 years, the assessment of children's school readiness in this study draws on the measurement approaches of existing studies and is primarily conducted through the evaluation of kindergarten teacher measurements, which may result in biased estimates of children's school readiness. Future studies could employ a variety of methods to assess school readiness to reduce potential biases. Second, the study did not establish a causal relationship between teacher PLCs and children's school readiness, only revealing a correlation. Future research should incorporate randomized controlled trials and advanced measurement techniques to explore causal links. Lastly, the study focused on 17 kindergartens in a single centrally administered municipality in western China, limiting the generalizability of the findings. Expanding the sample to include a broader range of regions could provide more comprehensive insights.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Academic Ethics Review Committee of the Early Childhood Development Academy, Chongqing Preschool Education College. The studies were conducted in accordance with the local legislation and institutional requirements. The participants, and their legal guardian/next of kin provided their written informed consent to participate in this study.

Author contributions

YH: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. YM: Data curation, Formal analysis, Funding acquisition, Investigation, Project administration, Software, Writing – original draft. YZ: Conceptualization, Data curation, Formal analysis, Methodology, Software, Writing – original draft, Writing – review & editing. JR: Data curation, Funding acquisition, Investigation, Project administration, Resources, Supervision, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2024.1400960/full#supplementary-material

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