

Enhancing Intelligent Education Literacy among Teachers in Urban Public Kindergartens: An Empirical Study of Kindergarten Y in Yibin, Sichuan Province

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Abstract: This study surveyed 86 kindergarten teachers at Kindergarten Y in Yibin, Sichuan Province, to examine intelligent education literacy across four dimensions: awareness, knowledge, skills, and ethics. The overall mean score was 3.76 on a five-point scale. Ethics (3.99) and awareness (3.95) scored higher than knowledge (3.57) and skills (3.65), revealing a structural contradiction of “high willingness but limited capability.” Within the skills dimension, basic operational skills (3.69) exceeded data use and assessment skills (3.61), indicating a gap between operating technical tools and using educational data effectively. Although 69.77% of respondents had participated in relevant training, the training content was insufficiently connected to practical preschool care and education scenarios and did not effectively narrow this gap. Based on these findings, the study proposes four targeted strategies: low-cost family-kindergarten collaboration, tiered knowledge and skills development, kindergarten-based teaching and research, and institutional safeguards for ethical practice. These measures are intended to support a progression from willingness to use intelligent technologies, to the ability to use them, and ultimately to effective application.

Keywords: urban public kindergartens; kindergarten teachers; intelligent education literacy

1. Introduction

Kindergarten teachers' intelligent education literacy refers to the comprehensive ability of teachers to effectively integrate artificial intelligence technologies into teaching, apply intelligent knowledge to solve practical problems, shape intelligent ethics and values, and promote self-development and lifelong learning^[1]. Zheng et al. decomposed teachers' intelligent education literacy into four core dimensions: awareness, knowledge, skills, and ethics^[2]. Qiao and Zhou emphasized that kindergarten teachers ought to enhance their professional capabilities in intelligent instruction, educational research and kindergarten management, highlighting that technological application must satisfy the requirements of safety, appropriateness, and operability^[3]. Drawing on the above theoretical frameworks and incorporating the inherent traits of preschool education, this study specifies awareness, knowledge, skills, and ethics as the operational dimensions of kindergarten teachers' intelligent education literacy. Prior academic findings have uncovered typical developmental characteristics of such literacy among kindergarten teachers. Liu et al. noted that kindergarten teachers widely display the superficial application feature summarized as “can use but do not understand, can operate but are not proficient”^[1]. The cross-provincial survey conducted by Sun and Liu across six Chinese provinces further verified the prominent drawbacks in the digital application dimension^[4]. However, empirical evidence is still lacking regarding whether such superficiality presents heterogeneous forms among different urban hierarchies, especially whether it evolves into a more prominent contradiction of high willingness but limited capability among teachers in third- and fourth-tier cities. Zheng et al.'s research targeting primary and secondary school educators detected analogous structural contradictions^[2], which indicates that this dilemma exists across various educational phases, albeit with differentiated manifestations within preschool educational scenarios. Nevertheless, the majority of existing studies center on first- and second-tier cities or economically developed areas, while in-depth explorations of teachers serving urban public kindergartens in third- and fourth-tier cities are far from adequate. Confronted with stricter resource restrictions and inadequate training support, this cohort still accounts for a major component

of preschool educators nationwide. Accordingly, this paper selects teachers from an urban public kindergarten (hereinafter referred to as Kindergarten Y) in Yibin City, Sichuan Province, as research participants. It systematically analyzes the overall status and structural traits of their intelligent education literacy, pinpoints core developmental weaknesses, and puts forward targeted improvement routes adaptable to the resource-limited practical conditions of third- and fourth-tier cities.

2. Research Design

2.1 Research Participants

The study targeted Kindergarten Y, an urban full-time public kindergarten in Yibin City, Sichuan Province, which operates four campuses with 42 classes and approximately 1,470 children. A total of 86 questionnaires were distributed, with a 100% effective return rate. All teachers were female. Teaching experience was concentrated in the 1–5 years (41.86%) and 6–10 years (38.37%) ranges. The majority held a bachelor's degree (75.58%), while teachers with senior professional titles were few (associate senior and above accounted for 4.65%). Compared with public kindergartens in first- and second-tier cities, Kindergarten Y had certain gaps in high-end training resources and expert guidance (see Table 1).

Table 1. Participant characteristics

Variable	Category	N	Percentage (%)
Gender	Female	86	100
Teaching experience	Less than 1 year	3	3.49
	1–5 years	36	41.86
	6–10 years	33	38.37
	15 years and above	14	16.28
Educational background	Bachelor's Degree	65	75.58
	Junior College Diploma	21	24.42
Professional title	Primary-grade teacher	67	77.91
	Intermediate-grade teacher	15	17.44
	Associate-senior teacher	3	3.49
	Senior teacher	1	1.16

Note: No respondent reported 11–14 years of teaching experience.

2.2 Research Instrument

The questionnaire was developed on the basis of the AI-TPACK literacy framework for kindergarten teachers put forward by Liu et al.^[1] and the intelligent education literacy framework constructed by Zheng et al.^[2]. It was revised to adapt to the core characteristics of integrated preschool care-education and contextualized teaching practice. The formal research instrument was divided into four components: (1) respondents' demographic information; (2) the Intelligent Education Literacy Scale, which includes 20 questionnaire items covering four core dimensions: awareness dimension, knowledge dimension, skills dimension and ethics dimension; (3) measurement items regarding training activities and kindergarten institutional support, where the 69.77% training participation rate cited throughout this study originates; (4) an open-ended inquiry arranged in the final part: "To better enhance teachers' intelligent education literacy, what training methods, resource supports, or practical approaches do you find effective and feasible? Please provide suggestions based on your experience." Altogether 79 valid textual responses were obtained from this question. Reliability test results demonstrated that the overall Cronbach's α coefficient of the questionnaire reached 0.96, and the alpha coefficients of each subdimension fluctuated between 0.87 and 0.97, which verifies favorable internal consistency of the entire scale and its separate dimensions. SPSS 26.0 software was adopted for data entry and statistical analysis procedures.

3. Results and Analysis

To comprehensively demonstrate the overall status and internal variations of intelligent education literacy of teachers in Kindergarten Y, descriptive statistics covering mean values and standard deviations were firstly calculated for each dimension. Subsequently, disparities in literacy across

teachers with diverse demographic backgrounds were analyzed: one-way ANOVA was adopted with teaching experience serving as the independent variable (three cohorts: "5 years and below," "6–10 years," and "15 years and above"), while an independent-samples t-test was conducted with educational attainment as the grouping factor (the bachelor's degree group versus the junior-college diploma group). The statistical significance threshold was set at $\alpha = 0.05$.

3.1 Overall Level of Teachers' Intelligent Education Literacy

Overall, the total mean score was 3.76 (out of 5), indicating a moderately high level. The scores of the four dimensions, in descending order, were: ethics ($M = 3.99$, $SD = 0.61$), awareness ($M = 3.95$, $SD = 0.55$), skills ($M = 3.65$, $SD = 0.68$), and knowledge ($M = 3.57$, $SD = 0.67$). Ethics and awareness were higher, while knowledge and skills lagged behind, revealing a core contradiction of "high willingness but limited capability." The gap between the highest and lowest dimensions was 0.42 points. The minimum score for both awareness and ethics was 3.00, indicating that teachers generally endorsed the concept of intelligent education, whereas knowledge and skills had lower-scoring individuals, suggesting greater variability in practical competencies. Teachers showed sufficient willingness but insufficient practical ability—they were willing to use intelligent education but lacked the operational knowledge and skills to do so. This distribution is highly consistent with the superficial characteristic of "can use but do not understand, can operate but are not proficient" identified by Liu et al.^[1] (see Table 2).

Table 2. Descriptive statistics for the four dimensions of intelligent education literacy

Dimension	N	Minimum	Maximum	M	SD
Awareness	86	3.00	5.00	3.95	0.55
Knowledge	86	1.50	5.00	3.57	0.67
Skills	86	1.00	5.00	3.65	0.68
Ethics	86	3.00	5.00	3.99	0.61

Note: The mean score of the skills dimension is the average of teaching operation (3.69) and assessment ability (3.61). The teaching operation dimension corresponds to Part 3 of the questionnaire (4 items), and the assessment ability dimension corresponds to Part 4 of the questionnaire (4 items).

3.2 High Awareness but Insufficient Transformation into Action

The awareness dimension obtained a mean score of 3.95, ranking second across all dimensions. Teachers attained generally high scores on questionnaire items such as "I recognize the positive role of intelligent tools in young children's development", which indicates broad recognition of the value of intelligent education and may also reflect continued policy attention to this area. Nevertheless, the striking contrast between the high scores of the awareness dimension and the lower scores of the knowledge and skills dimensions demonstrates that positive subjective willingness has not been effectively converted into practical actions for knowledge acquisition and competency enhancement, which urgently calls for the construction of operable supporting mechanisms to provide targeted guidance.

3.3 Weak Knowledge and Lack of Systematic Training

The knowledge dimension obtained the lowest mean score ($M = 3.57$), constituting the most prominent weakness across the four dimensions. This result may be associated with limitations in pre-service preparation. Although 75.58% of teachers in Kindergarten Y held bachelor's degrees, digital courses in preschool teacher education are often offered as electives and may not be deeply integrated with core courses such as child developmental psychology and preschool pedagogy. Teachers may therefore be able to operate interactive whiteboards without understanding the underlying logic of data interaction, or use child-management software without clearly understanding the ethical boundaries of data collection. This pattern is consistent with the superficial application characteristics of kindergarten teachers summarized by Liu et al. ^[1] within the AI-TPACK framework. Survey data showed that 69.77% of respondents had attended relevant training; however, the content focused mainly on general operational skills, was insufficiently connected to preschool care and education scenarios, and did not effectively address the knowledge gap.

3.4 Low Skills, Particularly in Data Use and Assessment

The skills dimension attained a composite mean score of 3.65 and ranked third across all dimensions, presenting the developmental characteristic of “competent in basic operational skills yet deficient in in-depth application capacity.” The subdimension of basic operational skills obtained a mean score of 3.69, which demonstrates that teachers can proficiently complete routine operational tasks, including the manipulation of interactive whiteboards and basic courseware development. By comparison, the data use and assessment subdimension reached 3.61, a lower value. Insufficient assessment competency places teachers in dual predicaments: for one thing, teachers may lack sufficient data-analysis skills to process young children’s behavioral records; in addition, an inherent tension exists between the qualitative orientation of preschool education assessment and digital quantification requirements. Young children’s development is marked by generativity, interactivity, and emotionality, and their learning behaviors cannot be fully measured via quantitative indicators. This finding aligns with the developmental trait of “competent basic operation yet insufficient data use capacity” discovered by Zheng et al. [2] within the cohort of primary and secondary school educators.

3.5 Good Ethical Awareness but Obstacles to Ethical Action

The ethics dimension obtained the highest mean score ($M = 3.99$). Scores for its four items ranged from 3.97 to 4.02, showing highly even item-level responses. Teachers had developed relatively stable awareness of privacy protection, teacher leadership, legal compliance, and equitable treatment of children. This pattern is closely related to the professional characteristics of preschool education: kindergarten teachers routinely handle children’s physical information, behavioral records, and image or video materials, which may heighten their sensitivity to privacy protection^[5]. Nevertheless, a high ethics score does not necessarily indicate fully developed ethical decision-making competence. Teachers’ awareness may remain at the level of intuitive vigilance, or “ethical sensitivity”^[6], rather than systematic ethical decision-making^[7]. Ethical sensitivity means sensing that a practice may be inappropriate, whereas ethical decision-making requires identifying the risk, explaining why it is problematic, and selecting a defensible response. When facing questions such as whether children’s behavioral videos may be shown in teaching and research activities or how children’s artwork data may be used in public communication, teachers may rely primarily on personal experience. Two factors may contribute: the absence of operational data-ethics guidelines at the kindergarten level and limited pre-service or in-service training in ethical decision-making. Previous research has also shown that kindergarten teachers encounter professional ethical dilemmas in classroom management and family–kindergarten communication^[8]. The gap between ethical awareness and ethical action therefore remains an important constraint on professional practice.

3.6 Differences by Demographic Variables

To examine differences in intelligent education literacy across demographic groups, this study tested teaching experience and educational attainment. Professional title was excluded because its distribution was highly skewed: 77.91% of teachers held primary-grade titles, whereas only 4.65% held associate-senior titles or above. Gender was also excluded because all participants were female. For teaching experience, participants were grouped into “5 years or less” ($N = 39$), “6–10 years” ($N = 33$), and “15 years or more” ($N = 14$). One-way ANOVA showed no significant differences in awareness ($F = 1.72$, $p = 0.18$), knowledge ($F = 1.83$, $p = 0.15$), or ethics ($F = 0.85$, $p = 0.43$). The difference in skills approached but did not reach statistical significance ($F = 2.94$, $p = 0.058$). Teachers with 15 years or more of experience ($M = 3.41$) scored lower in skills than those with 5 years or less ($M = 3.78$) and those with 6–10 years ($M = 3.72$). This pattern suggests that greater teaching experience does not necessarily produce stronger skills and that improvement may depend on systematic training rather than the accumulation of years alone. Independent-samples *t*-tests also showed no significant differences between teachers with bachelor’s degrees and junior-college diplomas in awareness ($t = 1.39$, $p = 0.17$), knowledge ($t = 0.61$, $p = 0.54$), skills ($t = 1.09$, $p = 0.28$), or ethics ($t = 0.73$, $p = 0.47$). Thus, neither teaching experience nor educational attainment was a significant differentiating variable in this sample. Improvement strategies should therefore prioritize diagnosis of teachers’ capability levels rather than demographic grouping.

4. Enhancement Strategies

Based on the preceding analysis and the practical constraints of third- and fourth-tier cities, including limited staffing and relatively scarce high-level training resources, four targeted strategies are proposed to support the transformation from awareness into practical capability.

4.1 Build Low-Cost Family–Kindergarten Collaboration Mechanisms

Research has indicated that parental recognition and cooperation constitute a core component of social expectations for teachers, effectively strengthening teachers' self-efficacy and sustained implementation confidence^[9]. Given the high costs and technical thresholds of high-end digital platforms in third- and fourth-tier cities, low-cost innovative practices can be advanced from two aspects. First, teachers can adopt WeChat class groups as carriers for reflective practice. Teachers conduct monthly graphic-text sharing in class groups to show parents examples of intelligent education activities (e.g., “Today we used the interactive whiteboard for a classification game”). Teachers accomplish reflective practice by narrating “what we did—why we did it—the developmental value for children.” Second, the kindergarten can hold an “Intelligent Education Open Day” once per semester, inviting parents to enter the classroom and personally experience intelligent education activities. Positive feedback in authentic scenarios reinforces teachers' implementation confidence and reduces avoidance behaviors stemming from fear of errors or public questioning. Through the two-way interaction of external driving force from family–kindergarten collaboration and internal reflective thinking, teachers can gradually shift their mindset from “knowing what should be done” to “being willing to sustain the practice.”

4.2 Implement Tiered Knowledge Development and Skills Progression

The knowledge dimension obtained the lowest mean score among all dimensions ($M = 3.57$), and the skills dimension presented superficial developmental characteristics: satisfactory foundational operational skills (3.69) yet insufficient data use capacity (3.61). The open-ended questionnaire items repeatedly reflected demands for systematic theoretical guidance and hands-on demonstrative teaching (approximately 30 responses), and many teachers explicitly put forward a need for advanced-tier training. Therefore, the measures should be coordinated across two dimensions. For knowledge development, the teaching and research group can compile one issue of the Quick Reference Manual for Intelligent Education each month, and display data specification standards and tool operating principles via concise graphic-text materials. The teaching and research group can arrange 10-minute centralized learning sessions prior to every teaching and research meeting, and adopt situational judgment tests to examine knowledge retention rates at the end of each semester. The training should also embed explanations of “the circulation logic of data” and “the scope of ethical boundaries” into operational skill training, enabling teachers to grasp both phenomena and underlying mechanisms.^[10] For skills development, the kindergarten can construct a three-tier competency system in light of teachers' current competency levels and job requirements, including the foundational skill mastery tier, data use enhancement tier, and integrated innovation cultivation tier. Tier 1 refers to universal mastery assessment, with at least 30% of teachers sampled for assessment each academic year; Tier 2 denotes data use enhancement, with two professional workshops held each semester to tackle the developmental bottleneck of “capable of data recording yet incompetent at data interpretation” based on authentic early childhood activity cases; Tier 3 stands for integrated innovation cultivation, with three replicable demonstration cases selected annually for wider use. A dynamic adjustment mechanism is set between tiers, and teachers' corresponding tiers will be reconfirmed each semester according to assessment outcomes to avoid permanently fixed classifications. Through the parallel development of knowledge and skills, teachers can gradually shift their mindset from “being willing to implement” to “possessing competent implementation capacity.”

4.3 Establish Kindergarten-Based Teaching and Research Mechanisms for Practice Transformation

A tiered training system addresses the issue of “what training progression pathway to adopt,” yet if training content remains divorced from practical preschool care and education scenarios, the progressive competency system will become a mere formality. Current kindergarten teaching and research activities may lack a sufficiently evidence-based process for selecting themes; the introduction of data-enabled targeted teaching and research constitutes an effective solution to this dilemma^[11]. Specifically, the kindergarten can organize monthly joint seminars combining teaching cases and data,

adopts authentic research materials including children's behavioral records and activity observation data to carry out collective analysis and judgment on the implications reflected by data and corresponding adjustment of teaching strategies, so as to embed the improvement of data use capacity into daily teaching and research routines. It should be noted that preschool education assessment has a strong qualitative tradition. The Guidelines for the Quality Assessment of Kindergarten Care and Education (Ministry of Education, 2022) explicitly call for a focus on "process-oriented, developmental assessment," aiming to effectively reverse the tendency to "emphasize results over processes." Given that young children's development is characterized by generativity, interactivity, and emotionality, their learning behaviors cannot be fully captured by quantitative data alone^[12]. Therefore, data interpretation shall strike a balance between quantitative indicators and qualitative narratives, and refrain from substituting teachers' professional observation and judgment with simple data collection. In addition, the kindergarten can hold a micro-innovation review every semester, encourages teachers to put forward targeted optimization schemes based on class-specific practical conditions (e.g., "utilizing voice recorders to assist documentation of language activities", "adopting class electronic albums to track children's social behaviors"), so as to stimulate the internal driving force of practical optimization. In response to demands put forward in open-ended questionnaire items such as "procurement of institutional accounts" and "school-level accounts for paid apps", the kindergarten establishes a shared kindergarten account mechanism, incorporates frequently applied high-quality digital tools into centralized procurement, and lowers institutional barriers restricting individual independent exploration. Through the linkage between tiered training and kindergarten-based teaching and research, teachers can gradually shift from "competent in basic operation" to "able to apply technology effectively".

4.4 Promote Synergistic Development of Ethical Norms and Decision-Making Capacity

The ethics dimension obtained the highest mean score among all dimensions ($M = 3.99$), yet teachers' ethical awareness mostly stays at the stage of intuitive vigilance and fails to form systematic ethical decision-making competency. Ethical decision-making refers to the capacity to identify ethical dilemmas in ethical scenarios, envision alternative action plans, and select ethically defensible solutions^[7]. Comments in the open-ended responses such as "avoid reversing the primary and secondary relationship by making teachers serve artificial intelligence" illustrate the gap between cognition and practice. Accordingly, improvement measures should address two dimensions: institutional norms and decision-making competency. At the institutional level, the kindergarten can formulate Norms for the Collection and Use of Young Children's Data, clarify the scope of data collection, data storage procedures, parental informed consent procedures and other core matters, so that teachers can follow clear grounds when confronting ethical dilemmas including "whether to display young children's behavioral videos during teaching and research activities" or "how to apply young children's artwork data for public exchange." For ethical decision-making, the kindergarten can hold ethics scenario workshops every semester, select authentic ethical dilemmas such as "how to respond when parents apply to check the records of other young children." Through case-analysis discussions and role-playing activities, these workshops can help transform teachers' ethical sensitivity into systematic ethical decision-making competency, empowering them to identify ethical dilemmas, weigh multiple alternative action plans and make judgments consistent with professional ethical standards^{[6][7]}. Through the parallel development of institutional norms and scenario-based decision-making training, teachers can gradually shift from intuitive ethical perception to ethical practical conduct in daily practice.

5. Conclusion

This study identifies the structural contradiction characterized by "high willingness but limited capability" in intelligent education literacy of teachers serving public kindergartens in urban areas of third-tier cities. The main weakness is that limitations in knowledge and skills constrain the translation of awareness and ethical understanding into practice, among which limited data use and assessment skills are particularly prominent. To tackle this problem, this study proposes improvement strategies covering four dimensions: awareness transformation, knowledge supplementation, skill advancement and ethical deepening. The empirical basis for strategy formulation rests on the finding that neither teaching experience nor educational attainment was a significant differentiating variable; accordingly, capability-based grouping is more appropriate than demographic grouping, and the improvement of professional competency relies on targeted training rather than the accumulation of teaching years. This study adopts a single-kindergarten case design with an all-female research sample, which restricts the

generalization of research conclusions and calls for prudent extrapolation. Furthermore, the cross-sectional research design fails to reflect the change over time of intelligent education literacy. Future research should expand the research sample size, carry out longitudinal follow-up research and adopt multi-case comparative analysis, so as to further deepen the research on developmental mechanisms of teachers' intelligent education literacy in analogous regions.

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References

- [1] Liu, X., Peng, H. Q., & Zhang, Y. G. (2025). Realistic challenges and countermeasures for enhancing preschool teachers' intelligent education literacy from the perspective of AI-TPACK theory. *Journal of Xinyang Normal University (Philosophy and Social Sciences Edition)*, 45(1), 94–102.
- [2] Zheng, Z. Y., Xiao, L., & Song, N. Q. (2023). Status analysis and enhancement paths of intelligent education literacy among primary and secondary school teachers: An empirical survey of 11,703 teachers. *Educational Development Research*, 43(04), 30–39.
- [3] Qiao, Y. Y., & Zhou, Y. (2021). Connotation and cultivation of kindergarten teachers' information literacy in the age of artificial intelligence. *Studies in Early Childhood Education*, (11), 58–61.
- [4] Sun, L. H., & Liu, J. C. (2025). Development level of digital literacy among preschool teachers: An empirical survey based on the Ministry of Education's Teacher Digital Literacy standard. *Journal of Shaanxi Preschool Normal University*, 41(03), 72–80.
- [5] Li, Y. Y., & Yan, C. Y. (2023). Professional ethical dilemmas of kindergarten teachers in institutional contexts: A sociological neo-institutionalist perspective. *Studies in Early Childhood Education*, (7), 64–77.
- [6] Bu, S. M., & Li, Y. Y. (2017). Ethical sensitivity: A core competency for kindergarten teachers' professional development. *Early Childhood Education (Educational Sciences)*, (1), 60–63, 68.
- [7] Cheng, L., & Zhai, J. M. (2021). Ethics-oriented teacher morality education: Why and how. *Educational Development Research*, 41(24), 16–23.
- [8] Duan, L. T., & Gan, J. M. (2020). A study on professional ethical dilemmas of kindergarten teachers. *Early Childhood Education*, (9), 30–32.
- [9] Liu, S. Y., & Zhou, L. Z. (2021). Investigation of kindergarten teachers' self-efficacy in inclusive education. *Teacher Education Research*, 33(04), 63–70.
- [10] Wang, J. (2016). The essence, conditions, and strategies for the transformation of teacher training effects. *Primary and Secondary School Teacher Training*, (3), 9–12.
- [11] Sun, Y., & Xiong, Z. (2024). Smart empowerment: Building precision teaching research based on preschool education data analysis. *Education Science Forum*, (8), 42–46.
- [12] Ministry of Education. (2022). *Guidelines for the Quality Assessment of Kindergarten Care and Education* (No. Jiaoji [2022] 1) [Report]. Ministry of Education.