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ARTICLE

New insights and approaches to early learning

Picture book reading improves children's learning understanding

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Abstract

Mental state reasoning is an integral part of children's teaching and learning understanding. This study investigated whether a picture book reading approach focusing on mental state discourse and contrasting perspectives in a preschool classroom setting would improve children's teaching and learning understanding and school readiness. In total, 104 children from four classrooms aged between 46 and 64 months (53 girls, M = 54.03 months, SD = 3.68) participated in the study. Half of the classrooms were randomly assigned to an experimental group where teachers read picture books rich in mental state discourse and engaged in intensive discussions with children for eight weeks. Children's false belief understanding and teaching and learning understanding were measured before and after the eight-week period. The result revealed that picture book reading improved children's learning understanding with a medium effect size, controlling for demographic variables, children's verbal ability, inhibition, and initial false belief understanding. The experimental group children further demonstrated more advanced school readiness 18 months after the intervention ended in a follow-up study using a teacher questionnaire.

KEYWORDS

picture book reading, teaching and learning understanding, theory of mind, training, young children

Statement of contribution

What is already known on this subject?

- Young children's understanding of the teaching and learning concepts is associated with their theory of mind ability;
- Training focusing on mental state talk is highly effective in facilitating children's theory of mind development.

What the present study adds?

- Picture book reading focusing on mental state talk in a classroom context significantly improved children's learning understanding;
- The training effect was still present more than a year later in school readiness measures.

BACKGROUND

Teaching and learning understanding from a theory of mind perspective

Theory of mind (ToM) is the ability to attribute mental states, including intent, belief, desire, and emotion, to others (Wellman, 2014). It emerges early during infancy (Baillargeon et al., 2010; Southgate et al., 2007) and matures throughout childhood and adolescence (Dumontheil et al., 2010; Wang et al., 2016). ToM has a profound impact on children's social functioning (Imuta et al., 2016; Lee & Imuta, 2021; Sai et al., 2021; Slaughter et al., 2015). Equally important but often overlooked is how mental state reasoning is associated with children's cognitive development (Lockl et al., 2017). Mental state reasoning, such as knowledge inference (Jeong & Frye, 2020; Ziv & Frye, 2004) and intention attribution (Frye & Ziv, 2005; Sobel et al., 2007; Wang & Frye, 2021), is an integral part of children's teaching and learning understanding. While the concept of teaching implies an intentional effort to change the learner's knowledge state, the concept of learning does not necessarily involve a learning intention but rather focuses on the learner's knowledge change (Wang & Frye, 2021).

Young children tend to think of learning as action-based. Sobel and Letourneau (2018) found that although 3-year-old children could correctly report learning from exploration, they underestimated learning from direct instruction given by others. Instead, they attributed both types of learning to actions. Five-year-old children were more likely to differentiate the two types of learning and correctly identify the source of their knowledge. Young children's action-oriented learning concept indicated that they were yet to develop a metacognitive understanding of how learning occurred. Similarly, Jeong and Frye (2020) asked 3- to 6-year-old children to judge whether they or someone else had learned something new after comparing the knowledge state difference before and after the learning event. They found that young children's understanding of learning as a knowledge-based concept developed during early childhood between 3 and 6 years of age.

Building on several studies probing children's concepts of teaching and learning (Frye & Ziv, 2005; Wang, 2010; Ziv & Frye, 2004), Wang et al. (2017) developed a Preschool Teaching and Learning Comprehension Index (PTLCI) with sufficient construct validity and measurement and structural equivalence across cultures. The PTLCI is comprised of 16 teaching and learning stories for 3- to 6-year-old children. The stories involve intention, knowledge differences, and false beliefs in teaching and learning scenarios. For example, the coincidence learning story describes two characters who both drew a circle. One of the characters acquired genuine knowledge change when being told it is actually how the letter O looks like, while the other character was simply told that he did a good job drawing a circle. To judge which character actually learned how to write the letter O, children need to understand

that learning involves genuine knowledge change, and drawing a circle without the knowledge change is not learning.

Wang and Frye (2021) examined the association between young children's ToM and their understanding of coincidence versus incidental learning. They found that younger children could not differentiate accidental coincidence from incidental learning with genuine knowledge change. Young children also over-attributed learning intention to incidental or implicit learning. Furthermore, children's false belief understanding (FBU) was associated with their knowledge-based learning judgement and learning intention attribution. However, the correlations were no longer statistically significant when child age was taken into consideration. Using the 16 stories from the PTLCI, Wang et al. (2017) reported a medium effect-sized association between children's ToM and teaching and learning understanding even after controlling for child age and verbal abilities.

What is unclear though is the direction of the association between teaching and learning understanding and children's developing ToM. On the one hand, children who passed the FBU tasks demonstrated more mature mental state attribution in the context of teaching understanding (Frye & Ziv, 2005; Ziv & Frye, 2004). On the other hand, Wang et al. (2016) found that Hong Kong children attending the traditional practice-and-drill type of schools, but not those attending inquiry-based schools, were delayed in their ToM development compared to their UK counterparts. It was reasoned that inquiry-based pedagogy with discourses addressing the mental states and processes in learning benefits children's ToM development. Adopting a reversed causality analysis approach, Wang et al. (2017) demonstrated that the model fit was better when teaching and learning understanding was regressed onto ToM than the other way around. Furthermore, Bass et al. (2019) found that children who passed the FBU tasks were more likely to select pedagogical evidence to correct others' false beliefs in their teaching. They also found that training children's pedagogical evidence selection improved their ToM, indicating a reciprocal relation between ToM and teaching and learning experiences. It is premature to assert a direction of causation in the association between children's ToM development and their teaching and learning understanding based on current evidence. It is plausible that reflection on one's learning processes facilitates the understanding of other minds. It is also viable to assume that the association is bidirectional and reciprocal. An even bolder assumption is that both constructs tap into the same core capacities of mental state reasoning, with ToM measures focusing on children's FBU while teaching and learning understanding addressing the mental processes in more specific contexts.

Not only does mental state reasoning matter in children's teaching and learning understanding, but it also affects children's learning outcomes and teaching strategies. Jeong and Frye (2018a) found that children's understanding of teaching intention significantly contributed to their learning outcome, but only when the teacher made the intention explicit. Children also demonstrated better learning performance when the informant was knowledgeable instead of ignorant (Jeong & Frye, 2018b). Another study (Baer & Friedman, 2018) showed that 4- to 6-year-old children were less likely to mention specific details of an object to a listener who was ignorant of the topic. Older children were more likely to mention general facts to a knowledgeable listener than an ignorant one. Ye et al. (2021) found that 4- to 6-year-old young children's mental state inferences in a teaching context and their ToM were both associated with their effective teaching strategies, controlling for age and language ability. Bass et al. (2019) demonstrated that 6- to 8-year-old children were sensitive to the teacher's beliefs about their abilities. They could also use that information to adjust their learning from that teacher in the future. These findings show that children become very sophisticated in their teaching and learning understanding by the time they start formal schooling and could benefit from such in their own learning. Hence, teaching and learning understanding should be considered an essential aspect of school readiness (Frye & Wang, 2008).

Theory of mind training through mental state talk

Individual differences in ToM development have been attributed to the quality and quantity of social interaction input (Hughes & Devine, 2015). Among the family correlates, mental state talk has a

significant and long-lasting impact on children's ToM (Devine & Hughes, 2018). Parents' appropriate and explanatory mental state talk during shared book reading, especially cognitive talk, strongly predicted children's FBU (Tompkins, 2015; Tompkins et al., 2018). A meta-analysis of the training studies aimed to improve children's performance on ToM measures focusing on enriched mental state talk revealed a very encouraging large effect size of .75 (Hofmann et al., 2016). While most of the training studies were conducted on an individual basis with one-on-one sessions using some format of storytelling facilitated with videos, picture books, or role-play, training in a classroom setting was also effective in promoting children's FBU (Qu et al., 2015).

Research has identified various elements that play a role in driving the training effect. For example, Sellabona et al. (2013) showed that the mere existence of mental state terms and sentential complement syntax per se without contrasting perspectives failed to improve ToM performance. In a longitudinal study, Tompkins (2015) showed that although reading storybooks rich in mental content alone without discussing them could enhance children's FBU scores and social skill ratings, the storybook plus conversation condition achieved the largest gains. Another study (Qu et al., 2015) established the training effect through explicit discussion of mental states and dramatic play, which enabled children to take on the protagonist's perspective first-hand. Lecce et al. (2014) concluded that the conversational approach is the most effective training method, highlighting the importance of conversations rich in mental state references, corrective feedback to children, elaborations on children's comments, and explanations of contrasting views and perspectives.

The question of interest here is whether the mental state talk training effect could enhance children's teaching and learning understanding as well as school readiness. Meta-analysis by Hofmann et al. (2016) highlighted several areas that need future research in training research, one of which is that none of the training studies in the meta-analysis included a transfer of knowledge to relevant skills in everyday life. Current evidence indicates that the ToM training effect can transfer to children's social communication skills such as lie-telling (Ding et al., 2015). Given the strong association between children's ToM development and their teaching and learning understanding (Wang et al., 2017), it is reasonable to expect that mental state talk training should improve teaching and learning understanding. Furthermore, since teaching and learning understanding leads to children's better learning outcomes and teaching strategies (Baer & Friedman, 2018; Bass et al., 2019; Jeong & Frye, 2018a, 2018b; Ye et al., 2021), it is expected that mental state talk training should also enhance children's school readiness. The studies in the meta-analysis did not consider the confounding effects of language development and other cognitive abilities such as executive function. It is well established that ToM development is associated with children's language ability and executive function (Milligan et al., 2007; Wade et al., 2018). There is further evidence that executive function could predict to what extent children benefit from ToM training (Benson et al., 2013). Hence it is crucial to control these confounding variables in the training study. Fidelity of implementation in intervention studies refers to the degree to which the intervention is delivered as intended (Carroll et al., 2007), which affects the credibility and utility of the programme. To ensure fidelity of implementation, the current study also examined the extent to which the trained teachers adhered to the instructional procedures with designated dosage in the training sessions.

The current study

The aim of the current study is threefold. The first aim was to replicate the training effect of ToM. It was hypothesized that picture book reading would improve children's FBU after controlling for demographic variables and children's inhibition and verbal ability. The second aim was to examine whether picture book reading in a classroom would improve children's teaching and learning understanding. It was hypothesized that picture book reading would improve children's teaching and learning understanding after controlling for demographic variables and children's inhibition, verbal ability, and pre-training FBU. Last but not least, the study aimed to examine the long-term effect of picture book reading in early childhood classrooms on children's school readiness. It was

hypothesized that children in the experimental group would outperform those in the control group on school readiness measures when they graduate from kindergarten. Theoretically, the study would provide further evidence on the nature of the association between children's teaching and learning understanding and their ToM development, and highlight the significance of mental state reasoning in children's academic readiness during early years. In practice, the study would test the feasibility and effectiveness of an intervention programme using picture book reading in preschool classrooms in preparing children for school entry.

METHOD

Setting and participants

The study took place in the city of Zhuji, China. The research team approached an early childhood education provider who owns and operates several kindergartens in the region to initiate collaboration. Once the director consented to participate and helped identify four classrooms for the study, all children and families from the identified classrooms were invited to participate. In a group intervention, two classrooms were randomly assigned as the experimental group, while the other two were assigned as a business-as-usual control group. One hundred and five children and their primary caregivers gave consent to participate. Children were predominately Chinese in ethnicity and fluent in Mandarin. One child was excluded from the study due to a diagnosed developmental delay. Data from two additional children were excluded from the analysis due to the incompletion of the post-test. The final data set included 102 normally developing children aged between 46 and 64 months (53 girls, M = 54.03 months, SD = 3.68), 60.8% ($n = 62$) of whom had siblings. There were 51 children between 46 and 61 months (26 girls, M = 54.02 months, SD = 3.97) in the experimental group, and 53 children between 49 and 64 months (28 girls, M = 53.98 months, SD = 3.35) in the control group. The primary caregivers reported both parents' educational levels (*1 = primary school; 2 = secondary school; 3 = college; 4 = master degree; and 5 = doctoral degree or above*) and the household monthly income (*1 = below RMB5000; 2 = RMB5001–10,000; 3 = RMB10,001–RMB15,000; and 4 = RMB15,001 and above*) on ordinal scales. Both the median and mean statistics of the family's monthly income ranged from RMB10,001 to RMB15,000, and 81.4% of mothers and 80.4% of fathers had post-secondary education. A composite score of socioeconomic status (SES) was created with the sum of the father's and mother's educational levels and the family income level on ordinal scales, with a mean score of 9.37 (SD = 1.95, range = 5–15). Figure 1 provides a recruitment and randomization flow diagram.

Procedures

All procedures were reviewed and approved by a university's human research ethics committee.

Intervention

Book choice. The intervention was conducted in the 2020–2021 school year. Eight books from the *Elephant and Piggie* series by Mo Willems were identified for training purposes (see Appendix A for a list of book titles and content summaries). The Chinese translations of these books are well received with positive reviews and high ratings on a book review website, douban.com. These books feature narratives rich in mental state discourses and surprising endings, all of which involve some format of false belief, ignorance, and contrast between imagination and reality. In addition, these books also tap into scenarios that involve social understanding such as white lies, practical jokes, and misunderstanding, as well as social emotions such as embarrassment, pride, and jealousy. For example, *I will surprise my friend*

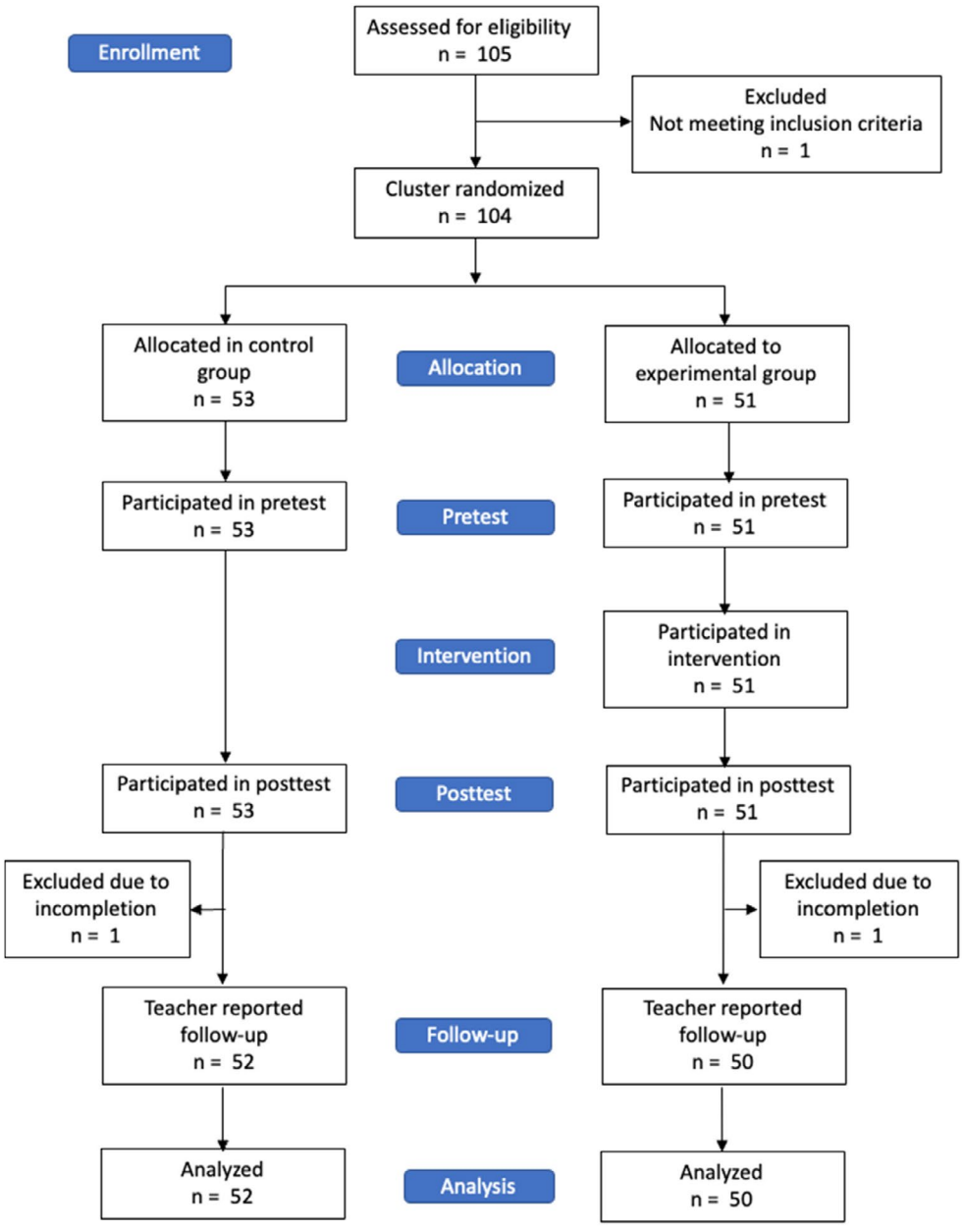

FIGURE 1 Participants recruitment and randomization flow diagram.

is a story about playing a practical joke on others, which is associated with young children's developing ToM (Wang & Wang, 2021).

Teacher qualifications and professional development. All four teachers involved in the study were qualified early childhood educators with bachelor's degrees. The two teachers in the experimental group had one and four years of teaching experience, respectively, while those in the control group had two and 16 years of experience, respectively. The research team worked closely with the teachers in the experimental group to develop lesson plans for the picture book reading sessions. A professional development session was convened with teachers to enhance their mental state conversation skills. Teachers were instructed to highlight the false beliefs and misunderstandings of the characters and

use open-ended questioning to contrast and compare different perspectives and elaborate the story plots. Teachers then independently developed lesson plans focusing on the story characters' mental activities and processes, especially cognitive mental processes and social emotions. The research team gave detailed written feedback on the lesson plans. Teachers piloted and video-recorded the intervention sessions with two books from the same book series but not from the eight chosen training books with children. The research team watched the recordings and convened with the teachers again to give feedback.

Training sessions. Shared picture book reading led by teachers was a part of the standard curriculum in the participating kindergartens. Training sessions for the experimental group children occupied the normal picture book reading time within the class schedule, while the control group children continued their regular picture book reading activities. The training sessions were led by classroom teachers in a group setting with around 28–30 children. Teachers introduced one new book each week in eight consecutive weeks. The book was read two to three times within the week, with each session lasting for around 25–30 min. Teachers started the sessions by reading through the book, then moved on to probing children's understanding and explaining the plot page by page. A typical line of inquiry started with the teacher asking children how a character felt and why he or she felt this way, which was usually associated with some sort of false belief or misunderstanding. The teacher then highlighted the reality that was in contrast with the character's belief and capitalized on the children's surprise reactions to the unexpected plot by asking the children to reflect on their own belief change.

Two translated excerpts from the training transcripts are presented in Appendix B. In the first example, the teacher started with a reflection on the children's current beliefs and made a connection with that of the characters', "So you all think they will draw their new best friends, right? That is exactly what Gerald thinks". She then presented the contrasting reality from the story plot, and asked children to reflect on their previous false belief, "Is that the same as you thought?". She concluded the discussion by summarizing the differences between the children's beliefs and reality, "We guessed Piggie would draw Brian Bat, and Brain Bat would draw Piggie…. In fact, they still drew their old best friends". In this example, the teacher used the epistemic term *think* to highlight the mental states of both the children themselves and the character before the children learned about the surprising twist. She then switched to a less certain epistemic term *guess* after the reveal. Children were also provided with an opportunity to reflect on their own false beliefs. To highlight the unexpected plot twist, the teacher used the term *in fact* as a marker to indicate contrast. The second example further illustrated how teachers unpacked the contrast between beliefs and reality: "Why did we guess that they would learn from Piggie? We all thought only Piggie knew how to dance, right? That's why we guessed the squirrels are here to learn from Piggie. But what they really want is to learn to dance like Gerald". Here the teacher summarized the readers' reasoning process based on their (false) beliefs and highlighted its gap with reality. Again, the teacher used *think* to label a quite certain belief at an earlier stage of the story and a rather uncertain *guess* when the readers reflected on their previous false belief after finding out the truth.

Pre-test, post-test, and follow-up survey. The pre-test and post-test were administrated individually in a quiet room in children's kindergartens by trained graduate assistants. The pre-test took place in September 2020, followed by an eight-week training period for the experimental group and a business-as-usual teaching period for the control group. The post-test was conducted in January 2021. Each session lasted for 30 to 45 min. Children completed a battery of tasks that measured their teaching and learning understanding, FBU, inhibitory control, and verbal ability in the pre-test, and another battery of teaching and learning understanding and FBU in the post-test. The order of tasks was counterbalanced at both time points.

A follow-up study with individual children was not feasible due to COVID-related regulations. As an alternative, classroom teachers filled in a questionnaire on individual children's school readiness 18 months after the intervention in June of 2022 before the children graduated from kindergarten. As per the practice of the kindergartens recruited, all children had been with the same teachers from 2020 to 2022. The teachers who completed the questionnaire were the same classroom teachers during the intervention period.

Measurement and materials

Pre-test correlates

Children's verbal ability. A Mandarin version of the Bus Story Test (Renfrew, 1997) was administered at the pre-test. As a narrative speech test, the Bus Story Test requires children to retell a story told by the experimenter with pictorial stimuli as prompts. It measures both expressive and receptive language abilities, given that children must comprehend the narrative to retell it. The Bus Story score is strongly correlated with other measures of receptive vocabulary (Hughes et al., 2018). Children's narratives were digitally recorded and transcribed verbatim for coding. Two independent raters coded the number of information elements in the narratives based on 20% of the transcripts, and the intraclass correlation coefficient (ICC) was high at .95. Five children either did not respond to the instructions or their responses were not recorded. Their data on this task were treated as missing.

Conflict inhibition. The Simon Says task was adopted in this study to assess children's inhibitory control (Carlson & Wang, 2007; Kloo & Sodian, 2017) at the pre-test. This task required children to perform the instructed actions (e.g., *Touch your nose*) only when they heard *Simon says* before the instruction. Children had to inhibit a prepotent response and remain still when the instructor did not say *Simon says* in the beginning. This task correlates with other inhibitory control measures with moderate to strong effect sizes in preschool children (Kloo & Sodian, 2017). The task began with two practice trials with feedback. The formal test contained 40 trials (20 with *Simon says*) in a fixed interspersed order without feedback. Each trial was rated as no movement, partial movement or self-correction, or full movement. The scoring followed methods developed by Carlson and Wang (2007) and ranged from 0 to 2 by trial type. The total score ranged from 0 to 80, with higher scores indicating advanced levels of conflict inhibition. A trained research assistant rated children's performance in real-time during the assessment. One child did not finish the Simon Says task and was treated as missing data.

Pre-test and post-test main variables

Teaching and learning understanding. A short version of the PTLCI (Wang et al., 2017) was administered at pre-test and post-test to measure children's understanding of teaching and learning. Eight out of the 16 stories in the original PTLCI were chosen to form a short version for measurement brevity based on their higher difficulty levels. The short version included four learning stories (i.e., coincidence, learner's overestimation of own knowledge, incidental learning, and implicit learning) and four teaching stories (i.e., teacher's overestimation of own knowledge, teacher's overestimation of learner's knowledge, imitation, and teaching embedded in games). These stories assess children's attribution of knowledge states or teaching or learning intentions, which involve some sort of conflict by design. For example, the coincidence story is about two characters drawing a circle that perfectly resembles the letter O. One of the characters was told by the teacher that it was the letter O, while the other was told that she did a good job drawing a circle (Wang & Frye, 2021). To judge which one of the two characters learned how to write the letter O in the story, children need to understand that although the second character could draw a circle that looks like the letter O, she did not gain new knowledge and hence did not learn. Data from the current sample showed that the short version was sufficient in demonstrating individual differences in children's teaching and learning understanding. The post-test version was equivalent to the pre-test version in structure and format but differed in the learning contents (e.g., replacing the *Birthday Song* with the *Two Mice Song*) to minimize repeated testing effects. The experimenter told the eight stories in random order with illustrations and demonstrations as prompts. Each story had several memory control questions to ensure the participants understood the plots. The experimenter repeated the story if children answered a memory control question incorrectly. The story ended with a forced-choice test question probing children's understanding of the protagonist's knowledge state or teaching/learning

intention. Children were credited 1 point for correctly answering each test question, making the maximum score for this task 8.

False belief understanding (FBU). The location false belief task (Wimmer & Perner, 1983) and the content false belief task (Gopnik & Astington, 1988) were administered at both the pre-test and the post-test. While the story formats remained the same, there were slight variations in the characters' names, container contents, and object locations to minimize the repeated measure effects. The total score for the FBU tasks ranged from 0 to 4.

Location false belief tasks (Wimmer & Perner, 1983). Children were told a story about two characters. While one of the characters put an object in location A and left the scene, the other one retrieved the object and put it away in location B before exiting. Children were asked where the first character would look for the object upon return, in location A or B; and why. To pass the task, children needed to correctly recall the object's original location in response to a control question, and indicate that the first character would look for the object in its original location in response to the test question. If the child failed to answer the control question correctly, the experimenter re-read the first part of the story and asked the question again. For the explanation question, children had to mention that the first character did not know or see the location change. Children scored 1 point for an accurate response to each test question, making the maximum score for this task 2.

Content false belief tasks (Gopnik & Astington, 1988). Children were shown a case of a commercial product with clear labels and pictures (e.g., Band-Aid plasters or Colgate toothpaste). Children were first asked to guess what was inside the case. Most children replied that the case should contain something consistent with the label, either Band-Aids or toothpaste. The unsure few were prompted, for example, "Do Band-Aid cases usually contain Band-Aids?". Children were then shown that the case contained crayons or pencils instead. The case was sealed again with the content inside. Children were asked three forced-choice questions in a fixed order: (1) the representational change question ("Before you looked inside, what did you think was inside the case?"), (2) the reality control question ("What is inside the case really?"), and (3) the other's false belief question ("This girl has not seen what is inside this case. If she sees it all closed up like this, what will she think is inside the case?"). Children who failed the reality control question were not given any points. Those who passed the control question received one point for correctly answering the representational change question, and another one for correctly answering the false belief question, making the total possible score 2 for this task.

Follow-up teacher questionnaires

Approaches to learning. Classroom teachers rated children's approaches to learning using a 28-item Preschool Children's Approaches to Learning Assessment Questionnaire (Li & Zhang, 2020) 18 months after the intervention. The questionnaire was developed in Chinese based on Hyson's (2008) approaches to learning in early childhood classrooms, and showed good internal consistency and construct validity (Li & Zhang, 2020). It includes five subscales: Creativity (e.g., uses materials or toys in new and innovative ways), Persistence (e.g., sustains attention for a long time in tasks or activities), Initiative (e.g., makes autonomous decisions in choosing toys, play corners, or activities), Cooperation (e.g., understands others' thoughts, intentions, and motives), and Independence (e.g., can finish tasks independently without adult's assistance). The questionnaire was presented on a 5-point Likert scale (from 1 never to 5 always). Higher scores indicate higher levels of approaches to learning. The internal consistencies of the subscales in the current sample ranged from .89 to .93. Correlations among the five subscales were high between .808 and .907. The sum of the five subscales was used as an indicator of approaches to learning.

Academic competence. Teachers also rated individual children's academic competence using a purposefully designed 5-item survey developed by the research team addressing overall academic competence, literacy and numeracy competency compared to other children, and literacy and numeracy level referenced to the government's kindergarten learning and development guideline (e.g., Compared to other children in the cohort, this child's overall academic competency is _). Teachers rated the children on

a 5-point scale (from 1 lowest to 5 highest) for each item. The internal consistency of the five items was .97. The sum score was used as an index of children's academic competence. A higher score indicates higher academic competence.

RESULTS

Fidelity of implementation

All video recordings of the book reading sessions were transcribed verbatim. Two trained research assistants independently coded the number of teachers' mental state utterances using a coding scheme adapted from Chan et al.'s (2020). We coded teachers' mentions of cognition, emotion, and desire of the children and the story characters. In addition, we coded the number of contrasts between mental states or between reality and beliefs in teachers' utterances and teachers' open-ended questions addressing children's mental states. The ICCs ranged between 0.958 and 1.00. The average values of the two coders were taken as the final counts. Table 1 presents the descriptive statistics of teachers' mental state utterances across the two classrooms and eight books. The average number of mental state terms plus contrasts and elaborations for each book was 169.75 for Classroom A and 209.13 for Classroom B. The results indicated high fidelity of implementation. Although the two teachers in the experimental group did not differ in their total number of mental state utterances, the teacher in Classroom B made significantly more references to children's emotions, $t(14) = -2.953$, $p = .010$ and proposed more elaborative questions, $t(14) = -3.058$, $p = .009$ than the other teacher.

Descriptive statistics and correlations

Table 2 shows the descriptive statistics of all variables at both time points. The experimental group and the control group did not differ on age, family SES, gender composition, sibling status, or inhibitory control ability, all ps > .05. Neither did the two groups differ on their pre-test FBU, or teaching and learning understanding, all ps > .05. However, children in the control group (M = 22.80, SD = 9.34) scored higher than those in the experimental group (M = 18.91, SD = 9.09) on verbal ability, $t(97) = -2.103$, $p = .038$.

Table 3 shows the zero-order correlations among the measured variables in the upper right and the partial correlations controlling for age on the bottom left. Children's FBU at pre-test was significantly correlated with their verbal ability ($r = .224$, $p = .027$, $df = 95$) and inhibition ($r = .201$, $p = .049$, $df = 95$). These correlations were no longer significant after controlling for age. However, the partial correlation between pre-test FBU and teaching and learning understanding was still significant ($r = .214$, $p = .026$, $df = 94$), particularly with pre-test learning understanding ($r = .224$, $p = .028$, $df = 94$). Pre-test FBU was also significantly associated with post-test FBU after controlling for age, $r = .323$, $p = .001$, $df = 94$. The concurrent association between FBU and teaching and learning understanding at the post-test was significant after controlling for age ($r = .203$, $p = .047$, $df = 94$).

Training effects

We adopted a repeated measure approach treating time (pre- and post-) as a within-participant variable. Given the well-established individual differences associated with child gender, age, sibling status, family SES, and cognitive abilities including inhibitory control and verbal ability, these variables were included in the subsequent analyses as covariates. Repeated measure ANCOVA was conducted to examine the training effect on children's FBU, controlling for demographic variables including age, gender, family SES, sibling status, and cognitive covariates including verbal ability and inhibition. Gender and sibling status (only child vs. with siblings) were coded as binary dummy variables, while all other covariates were continuous

TABLE 1 Frequency of teachers' mental state terms and elaborations across eight books and two classrooms.

	Mental state term						Elaboration		
	Cognition		Emotion		Desire				
	Character	Child	Character	Child	Character	Child	Contrast	Elaborative question	Total
1. Listen To My Trumpet!									
Class A	58.5	27.5	6.5	1	13	1.5	6	24	138
Class B	66	39	6.5	1.5	19.5	1.5	5	46.5	185.5
2. Elephants Cannot Dance!									
Class A	158.5	56	9	2.5	20	0	5	65	316
Class B	86.5	30	58	17	12	0	5	57	265.5
3. My Friend is Sad									
Class A	51	5	55	5	20.5	1	6	30.5	174
Class B	33	38	57.5	14.5	15.5	1	7	49.5	216
4. I Will Surprise My Friend!									
Class A	68.5	20	39.5	6	8	0	9.5	39	190.5
Class B	86	53	58	18	31	0	10.5	92.5	349
5. Pigs Make Me Sneeze!									
Class A	29.5	15	8	0	6	0	11.5	47	117
Class B	14.5	21	1.5	0	7	0.5	5	50.5	100
6. Happy Pig Day!									
Class A	26	15	9.5	0	2.5	0	6	29.5	88.5
Class B	13	35.5	27	7.5	10.5	4.5	6	59	163
7. I Love My New Toy!									
Class A	19.5	10.5	31.5	2	16	1	13	37.5	131
Class B	15	23.5	39.5	8.5	21	12.5	10	64	194
8. My New Friend Is So Fun!									
Class A	78.5	12	44.5	0.5	16	1.5	8	42	203
Class B	26	31	45.5	9	14	0	12	62.5	200

TABLE 1 (Continued)

	Mental state term						Elaboration		
	Cognition		Emotion		Desire				
	Character	Child	Character	Child	Character	Child	Contrast	Elaborative question	Total
Minimum									
Class A	19.5	5	6.5	0	2.5	0	5	24	88.5
Class B	13	21	1.5	0	7	0	5	46.5	100
Maximum									
Class A	158.5	56	55	6	20.5	1.5	13	65	316
Class B	86.5	53	58	18	31	12.5	12	92.5	349
Mean									
Class A	61.25	20.13	23.33	2.13	12.75	0.63	8.13	39.31	169.75
Class B	42.5	33.88	35.3	9.5	16.31	2.5	7.56	60.19	209.13
Standard deviation									
Class A	48.14	15.95	19.49	2.28	6.62	0.69	2.94	12.75	70.55
Class B	31.97	10.06	22.90	6.69	7.49	4.31	2.85	14.50	73.38

TABLE 2 Descriptive statistics.

	Pre-test						Post-test					
	Experimental group ($n=51$)		Control group ($n=53$)		Total ($n=104$)		Experimental group ($n=50$)		Control group ($n=52$)		Total ($n=102$)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Age (month)	54.02	3.97	53.98	3.35	54.00	3.65	58.06	4.00	58.00	3.38	58.03	3.68
Gender (girl)	50.98%		52.83%		51.92%		50%		53.8%		52.00%	
Sibling (yes)	62.75%		58.49%		60.58%		62%		59.62%		60.80%	
SES	9.24	2.10	9.47	1.80	9.36	1.95	–	–	–	–	–	–
Verbal ($n=99$)	18.91	9.09	22.80	9.34	20.91	9.38	–	–	–	–	–	–
Inhibition ($n=103$)	45.16	9.68	44.98	8.97	45.07	9.27	–	–	–	–	–	–
FBU	2.45	1.42	2.53	1.50	2.49	1.45	3.50	0.95	3.31	1.13	3.40	1.05
Teaching	2.71	1.07	2.90	0.83	2.81	0.95	3.31	0.95	3.33	0.86	3.32	0.90
Learning	2.71	1.07	3.04	0.96	2.88	1.02	3.56	0.65	3.21	0.90	3.38	0.80
T&L	5.37	1.73	5.91	1.52	5.64	1.64	6.98	1.17	6.63	1.38	6.82	1.23

Abbreviations: FBU, False Belief Understanding; Learning, Learning Understanding; SES, Socioeconomic Status; T&L, Combined Teaching and Learning Understanding; Teaching, Teaching Understanding.

TABLE 3 Bivariate correlations among variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SES	–	.205*	−.005	.020	−.022	.120	.063	−.011	−.011	−.103	−.065	.101	−.003
2. Verbal	.212*	–	−.082	.224*	.042	.133	.109	.190	.090	−.070	.019	.073	−.028
3. Inhibition	−.005	−.106	–	.201*	.100	.172	.167	.121	.050	−.005	.030	.254**	.188
4. FBU pre	.022	.197	.188	–	.137	.229*	.225*	.335**	.000	−.043	−.024	.141	−.012
5. Teach pre	−.022	.021	.090	.123	–	.348***	.804***	.105	−.001	.029	.016	.065	−.052
6. Learn Pre	.120	.125	.167	.224*	.354**	–	.837***	.122	−.064	−.148	−.124	.176	−.004
7. T&L pre	.064	.091	.159	.214*	.802***	.837***	–	.139	−.041	−.077	−.070	.150	−.033
8. FBU post	−.010	.171	.111	.323**	.094	.117	.129	–	.177	.120	.182	.266**	.070
9. Teach post	−.012	.126	.067	.024	.015	−.056	−.027	.197	–	.359***	.851***	−.041	.037
10. Learn Post	−.104	−.051	.004	−.028	.039	−.143	−.068	.132	.350***	–	.796***	.034	.106
11. T&L post	−.067	.052	.046	.000	.032	−.118	−.056	.203*	.847***	.794***	–	−.007	.083
12. Approaches	.101	.060	.249**	.131	.058	.173	.144	.260**	−.031	.041	.003	–	.423***
13. Competence	−.002	−.053	.179	−.031	−.064	−.010	−.044	.058	.055	.117	.101	.419***	–

Note: The upper right of the table presents the zero-order correlations, and the bottom left presents the age-partialled correlations. *$p < .05$; **$p < .005$; ***$p < .001$.

Abbreviations: Approaches, Approaches to Learning; Competence, Academic Competence; FBU, False Belief Understanding; Learn, Learning Understanding; post, Post-Test; pre, Pre-Test; SES, Socioeconomic Status; T&L, Combined Teaching and Learning Understanding; Teach, Teaching Understanding.

variables. There was no significant between-participant effect, $F(1, 89) = 0.547$, $p = .461$, $\eta^2 = .006$, nor within-participant time effect, $F(1, 89) = 1.29$, $p = .259$, $\eta^2 = .014$. Although the time-by-group interaction effect was not significant, $F(1, 89) = 0.973$, $p = .327$, $\eta^2 = .011$, there was a trend difference in the FBU gains between the experimental group and the control group, with a small effect size of .21 (Cohen's *d*, Cohen, 1988), favouring the experimental group.

Another repeated measure ANCOVA was conducted to examine the training effect on children's teaching and learning understanding, controlling for demographic variables including age, gender, SES, sibling status, and cognitive covariates including verbal ability, inhibition, and FBU at pre-test. There was no significant between-participant effect, $F(1, 88) = 0.077$, $p = .782$, $\eta^2 = .001$. The within-participant time effect was significant, $F(1, 88) = 5.032$, $p = .027$, $\eta^2 = .054$, so was the time-by-group interaction effect, $F(1, 88) = 4.093$, $p = .046$, $\eta^2 = .044$. Figure 2 shows that the experimental group gained more in teaching and learning understanding than the control group over the training period, with a Cohen's *d* of .60, representing a medium effect size (Cohen, 1988).

Additional repeated measure ANCOVAs were conducted to examine the training effect on children's learning understanding and teaching understanding separately, controlling for demographic variables including age, gender, SES, sibling status, and cognitive covariates including verbal ability, inhibition, and pre-test FBU. There was no significant between-participant effect in children's learning understanding, $F(1, 91) = 0.111$, $p = .704$, $\eta^2 = .002$. The within-participant time effect was not significant either, $F(1, 91) = 2.575$, $p = .090$, $\eta^2 = .031$. However, the time-by-group interaction effect was significant, $F(1, 91) = 5.174$, $p = .017$, $\eta^2 = .061$, with a Cohen's *d* of .75, representing a medium effect size (Cohen, 1988). In contrast, there was no significant between-participant effect in teaching understanding, $F(1, 91) = 0.171$, $p = .670$, $\eta^2 = .002$. The within-participant time effect in teaching understanding was not significant either, $F(1, 91) = 2.792$, $p = .062$, $\eta^2 = .038$, nor was the time-by-group interaction effect, $F(1, 91) = 0.533$, $p = .402$, $\eta^2 = .008$.

Given the differences in the two experimental group teachers' delivery of the intervention, it was necessary to examine whether children's outcomes varied with the intervention dosage, that is, the amount of exposure to the treatment condition (Charlebois et al., 2004). Children in the two classrooms did not differ significantly in their post-test FBU or teaching and learning understanding. However, they did differ significantly in their learning understanding gain score (post-test score minus pre-test score), $t(49) = -3.145$, $p = .003$ (Class A: M = 0.32, SD = 1.09; Class B: M = 1.34, SD = 1.20), favouring Classroom B.

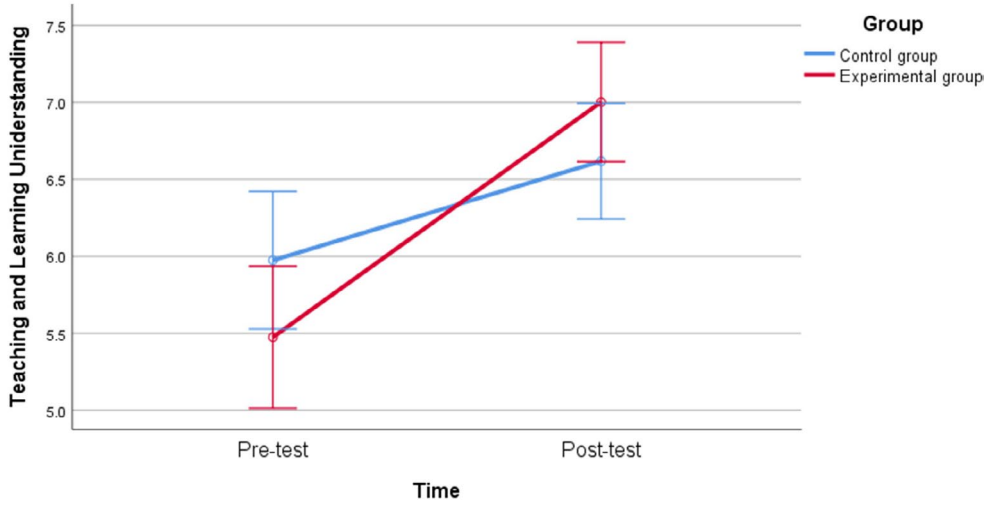

FIGURE 2 Training effect on children's teaching and learning understanding with 95% CI, controlling for child age, gender, sibling status, family socioeconomic status, verbal ability, inhibition, and false belief understanding at pre-test.

Long-term effects

The experimental group and the control group differed significantly in the teacher's rating of approaches to learning 18 months later, $t(101) = 8.98$, $p < .001$, with the experimental group (M = 120.61, SD = 7.50) outperforming the control group (M = 93.54, SD = 20.20). The experimental group (M = 21.76, SD = 3.79) also scored higher than the control group (M = 17.73, SD = 5.71) on the academic competence rating, $t(101) = 4.22$, $p < .001$. Hierarchical regressions showed that controlling for demographic variables (child age, gender, sibling status, and family SES), cognitive variables (inhibition and verbal ability), and pre-test FBU and teaching and learning understanding, group membership (experimental group vs. control group) significantly predicted children's approaches to learning (standardized $\beta = .75$, $\Delta R^2 = .522$) and academic competence (standardized $\beta = .39$, $\Delta R^2 = .143$) (Table 4).

DISCUSSION

Building on the association between children's ToM ability and their teaching and learning understanding, this training study was aimed to test whether a mental state talk training approach using picture book reading in a classroom setting could improve young children's FBU and teaching and learning understanding, as well as school readiness. The findings showed that although the training effect on FBU performance was not statistically significant, a picture book reading approach could significantly improve young children's learning (but not teaching) understanding. Moreover, a follow-up teacher survey further indicated that the training effect persisted 18 months later at the children's kindergarten graduation. Those who participated in the training were rated significantly higher than their control group counterparts on approaches to learning and academic competence. Through randomization in the group intervention, the current study design minimized systematic biases associated with maturation and everyday teaching and learning activities. The control group children had regular exposure to shared picture book reading as part of their standard curriculum. According to our knowledge, this is the first rigorous training study that provided robust evidence showing that mental state talk training improved children's learning understanding as well as school readiness. The current finding highlighted the importance of mental state discourse in shared picture book reading, but not shared reading itself, in fostering young children's epistemic understanding.

After controlling for demographic variables and child cognitive correlates, the training effect of picture book reading on children's FBU was insignificant, although the experimental group showed a trending advantage in their FBU gain compared to the control group with a small effect size. This result was not consistent with the meta-analysis of Hofmann et al. (2016) that showed mental state talk training improved children's performance on ToM measures with a large effect size. A closer examination of the data suggested a close-to-ceiling FBU performance in the post-test when children were almost 5 years of age. Future training studies should consider adopting more age-appropriate ToM measures.

Although the picture book reading training did not significantly improve children's FBU performance, it did advance children's comprehension of learning (but not teaching) with a medium effect size. This finding was substantial considering the array of control variables, including child age, gender, sibling status, family SES, child inhibition, verbal ability, and even the pre-test FBU. ToM research has been primarily focused on young children's FBU (Wellman et al., 2001). However, recent interest has shifted to how children understand other epistemic processes, such as knowing, remembering, and understanding (Louca, 2019). We accumulate knowledge, skills, and wisdom through social transmission, which makes human intelligence distinctive from animals (Moll & Tomasello, 2007). The knowledge differences and intentional processes embedded in teaching and learning mean that a certain level of mental state reasoning is necessary for children to have a metacognitive understanding of these concepts.

The study shed light on the theoretical construal of the association between ToM and children's teaching and learning understanding. It is worth noting that the training effect was most salient in children's learning understanding but non-significant in teaching understanding, indicating a metacognitive first-person

TABLE 4 Hierarchical regression analysis predicting approaches to learning and academic competence.

	Approaches to learning						Academic competence					
					95% CI						95% CI	
Predictor	*B*	SE *B*	*β*	ΔR^2	LL	UL	*B*	SE *B*	*β*	ΔR^2	LL	UL
Step 1												
Age	0.372	0.558	.067	.048	−0.736	1.480	0.164	0.142	.116	.053	−0.118	0.445
Gender	7.652	4.062	.193		−0.415	15.719	1.859	1.029	.184		−0.185	3.903
Sibling	−0.148	4.167	−.004		−8.424	8.127	−0.508	1.051	−.049		−2.596	1.579
SES	0.928	1.053	.090		−1.163	3.018	0.054	0.267	.020		−0.476	0.583
Step 2												
Age	0.148	0.568	.027	.055	−0.736	1.480	0.142	0.146	.100	.034	−0.148	0.431
Gender	8.176	3.993	.206*		−0.415	15.719	1.969	1.024	.195		−0.064	4.002
Sibling	1.710	4.176	.042		−8.424	8.127	−0.228	1.065	−.022		−2.342	1.886
SES	0.831	1.058	.081		−1.163	3.018	0.071	0.271	.027		−0.468	0.610
Inhibition	0.501	0.215	.238*		−0.736	1.480	0.099	0.055	.184		−0.010	0.209
Verbal	0.138	0.224	.065		−0.415	15.719	−0.010	0.058	−.019		−0.125	0.104
Step 3												
Age	0.075	0.569	.014	.022	−1.056	1.207	0.146	0.148	.103	.001	−0.148	0.440
Gender	7.989	3.989	.201*		0.063	15.915	1.977	1.035	.195		−0.078	4.033
Sibling	0.504	4.259	.012		−7.958	8.966	−0.147	1.101	−.014		−2.334	2.041
SES	0.789	1.059	.077		−1.315	2.893	0.075	0.275	.028		−0.471	0.620
Inhibition	0.414	0.223	.197		−0.028	0.856	0.105	0.058	.194		−0.010	0.220
Verbal	0.052	0.233	.025		−0.410	0.515	−0.005	0.060	−.010		−0.125	0.115
FBU_pre	1.140	1.462	.084		−1.765	4.044	−0.066	0.379	−.019		−0.818	0.687
T&L pre	1.450	1.292	.119		−1.116	4.017	−0.093	0.335	−.030		−0.760	0.573

TABLE 4 (Continued)

	Approaches to learning						Academic competence					
					95% CI						95% CI	
Predictor	***B***	**SE *B***	***β***	**ΔR^2**	**LL**	**UL**	***B***	**SE *B***	***β***	**ΔR^2**	**LL**	**UL**
Step 4												
Age	−0.078	0.364	−.014	.522***	−0.801	0.646	0.129	0.137	.091	.143***	−0.143	0.400
Gender	7.374	2.549	.186**		2.308	12.439	1.928	0.955	.191*		0.029	3.826
Sibling	0.222	2.721	.005		−5.185	5.630	−0.234	1.017	−.023		−2.255	1.787
SES	0.511	0.677	.050		−0.834	1.856	0.029	0.254	.011		−0.475	0.533
Inhibition	0.408	0.142	.193**		0.125	0.690	0.103	0.053	.191		−0.003	0.209
Verbal	0.386	0.151	.183*		0.085	0.687	0.040	0.057	.073		−0.073	0.153
FBU_pre	0.820	0.934	.061		−1.037	2.677	−0.122	0.350	−.035		−0.818	0.574
T&L pre	2.918	0.835	.239***		1.258	4.578	0.094	0.313	.030		−0.528	0.717
Group	29.715	2.606	.749***		24.536	34.893	3.958	0.973	.391***		2.024	5.893

Note: *$p < .05$; **$p < .005$; ***$p < .001$.

Abbreviations: FBU, False Belief Understanding; Group, Experimental group versus control group; pre, Pre-Test; SES, Socioeconomic Status; T&L, Combined Teaching and Learning Understanding.

advantage. This is consistent with the simulation theory of ToM development (Harris, 1995), which argues that our privileged access to our own mental states sets the stage for understanding others'. The training sessions, as evidenced in the examples in Appendix B, focused heavily on children's own belief changes and surprises. Children's developing appreciation of their own learning processes should lay the foundation for understanding other people's mental states. Nevertheless, the current study could not directly address the question regarding the direction of causation between ToM and teaching and learning understanding. While epistemic discourses and teaching and learning experiences might facilitate ToM development (Bass et al., 2019; Wang et al., 2016), evidence is needed to assert whether the teaching and learning understanding, in addition to the experiences, leads to enhanced ToM. Furthermore, the current study could not rule out the possibility of a bidirectional and reciprocal relation or that the two constructs are just two sides of the same coin addressing mental state reasoning in different contexts.

Implementation fidelity in training studies affects the intervention outcome (Rojas-Andrade & Bahamondes, 2019). Children from the two classrooms in the experimental group were exposed to somewhat different intervention dosages, with the Classroom B teacher addressing children's emotions and proposing elaborative questions more often. The results showed that although children from the two classrooms did not differ significantly in their post-test FBU or teaching and learning understanding, those from the classroom with a higher level of implementation fidelity did exhibit some advantage in their learning understanding gain score, indicating a dosage effect.

The follow-up study 18 months after the training ended showed that the picture book reading intervention had medium to large positive effects on children's approaches to learning and academic competence according to teacher ratings. This finding should be interpreted with caution since the same teachers who conducted the intervention study rated children's approaches to learning and academic competence. On the one hand, these teachers had been with the same group of children for at least two years. They were most familiar with individual children's developmental levels. On the other hand, the teachers were likely biased due to their participation in the intervention stage of the study and awareness of the research hypotheses. Nevertheless, the differences between the experimental group and the control group children long after the intervention ended are encouraging. It suggests that the training effect on children's learning understanding might be able to transfer to other abilities that prepare them for school entry. Children with more advanced ToM and better learning understanding could appreciate the goals of teaching and learning episodes. They likely had enhanced metacognitive skills to regulate their own learning as well. In the long-term, these advantages transferred to better school readiness, that is, the mental state understanding training might have resulted in a far-transfer effect in improvements in untrained abilities (Gunzenhauser & Nückles, 2021). In addition, it could also indicate a ripple effect (García et al., 2023). It is likely that the professional training sessions and the intervention experience boosted the experimental group teachers' awareness of children's epistemic mental states and skills of scaffolding children's understanding, which enhanced the quality of their interaction with children even after the intervention ended.

The research findings bear crucial practical implications from an educational perspective by providing a blueprint for designing classroom-based interventions in early childhood education settings to improve children's epistemic understanding and school readiness. With a few exceptions (Qu et al., 2015), the majority of the current training studies were conducted on an individual basis. Compared to individual-based interventions that are individualized but time-consuming, classroom-based training encourages peer learning and would be much more cost and time-efficient if proven effective. The current study demonstrated that with a careful selection of children's books, well-designed lesson plans, and sufficient intensity or dosage, teachers with proper training could deliver the intervention in classrooms effectively.

Limitations and future directions

Previous training studies failed to control children's language ability and executive functions (Hofmann et al., 2016). The current study included children's inhibition and verbal ability in the pre-test as covariates. The training effect on teaching and learning understanding remained significant

after demographic variables and cognitive correlates were controlled, indicating a more robust finding. However, executive function is a multifaceted construct (Wade et al., 2018), and it may interact with mental state training to influence the effect (Benson et al., 2013). Future research should consider measuring a full range of cognitive abilities such as IQ, working memory, cognitive flexibility, and inhibition both before and after training to examine the moderating effects of cognitive abilities.

Through randomization, the study design minimizes systematic bias in the findings. However, it is still a challenge to balance participant characteristics. It is essential to replicate the results with large samples in the future. In addition, due to the COVID-related school closure, the current study could not conduct a follow-up assessment to determine the long-term effect or examine the participants' school readiness at the end of their kindergarten to demonstrate the real-life long-term consequences of training. We opted to ask the same teachers from the intervention stage of the study to complete a questionnaire for individual children to understand the long-term effect. As discussed earlier, teachers might be biased due to the exposure to the research hypotheses and the intervention procedures. Future training studies with rigorously controlled follow-up assessments are warranted.

AUTHOR CONTRIBUTIONS

Zhenlin Wang: Conceptualization; formal analysis; funding acquisition; methodology; supervision; writing – original draft; writing – review and editing. **Yihan Shao:** Data curation; project administration.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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APPENDIX A

Book titles from the *Elephant & Piggie* series (by Mo Willems) used in the training and content summary

1. *My Friend is Sad* (Mar 2007): Gerald the Elephant is sad. Piggie dresses up as a cowboy, a clown, and a robot to cheer Gerald up. Yet Gerald is still sad. It turns out he is sad because he thinks his best friend Piggie is not there to share the joy with him. The story ends with Piggie commenting that Gerald needs new glasses. This book addresses Gerald's *lack of knowledge*: he did not know that Piggie was there with him all this time behind the cowboy, clown, and robot costume.
2. *I Love My New Toy!* (Jun 2008): Piggie has a new toy. Gerald breaks it! Piggie blames Gerald, and Gerald is embarrassed and sorry…until Squirrel shows both of them that it is, in fact, a break-and-snap toy. Now it is Piggie's turn to feel embarrassed. This book addresses a social emotion, *embarrassment*, and *false belief*. Both Piggie and Gerald thought the toy was broken, while the reality is the toy was supposed to be that way.
3. *I Will Surprise My Friend!* (Jun 2008): Playing practical jokes with your friends seems like a lot of fun. Unfortunately, Gerald gets carried away when he cannot find Piggie while playing *Surprise My Friend*: Piggie might fall off a cliff, be snapped by a giant bird, or be eaten by a monster! The reality is both of them are hiding at the opposite end of the same rock. They end up surprising each other anyway when they jump out of their hiding places at the same time. This book addresses the emotion of *surprise* in *practical joking* and the *difference between imagination and reality*. The clever use of thought bubbles helps illustrate Gerald's inner speech.
4. *Elephants Cannot Dance!* (Jun 2009): Piggie is trying to instil a growth mindset in Gerald by teaching him how to dance. Gerald just cannot dance the way Piggies does. When other friends show up to learn dancing, Piggie thinks they want to learn from her. Surprisingly, their friends are here to learn about the Elephant dance. The story ends with Gerald proudly teaching everyone the Elephant dance. This book again addresses the social emotion of *pride* and *false belief about intention*: Piggie thought their friends were here to learn how to dance from her, while in reality, they wanted to learn from Gerald.
5. *Pigs Make Me Sneeze!* (Oct 2009): Gerald cannot stop sneezing when playing with Piggie. He thinks he is now allergic to pigs. Gerald is upset since that will mean he cannot play with his best friend anymore. Dr. Cat tells him he is not allergic, he just has a cold. Gerald is so happy that he rushes to tell Piggie, only to find out Piggie is now sick too. Gerald's *false belief* that he was allergic to pigs was the key in this book.
6. *Happy Pig Day!* (Oct 2011): Piggie is so happy because today is *Happy Pig Day*! All her "pig" friends are here to celebrate. Gerald is sad because he is not a pig, hence he thinks he cannot celebrate with Piggie. It turns out that none of the friends here are pigs, they are simply wearing pink pig suits. This book highlights the *contrast between the friends' appearances and their real identities*, which prompted Gerald's *false belief* that all of them were pigs.
7. *Listen To My Trumpet!* (Feb 2012): Piggie insists on playing the trumpet for Gerald. It is not very pleasant music! Gerald tries to be polite and not hurt Piggie's feelings by giving an awkward review. Piggie says light-heartedly: *You think I am making music? I'm trying to speak Elephant*. This book uses the *mental state verb think* to highlight Gerald's *false belief* about Piggie's *intention*, and involves the concept of *white lie*.
8. *My New Friend Is So Fun!* (June 2014): Gerald is worried that Piggie is having too much fun with a new friend, Brian Bat. He does not want to lose his best friend. To make things worse, Piggie and Brian Bat even made a drawing of their best friends. It turned out that Piggie drew Gerald as her best friend, not Brian Bat as Gerald feared. Gerald has nothing to worry about but to wish Piggie to have fun with her new friend. This book addresses the emotion of *jealousy* and the *contrast between imagination and reality*.

APPENDIX B

Excerpts from intervention transcripts

My New Friend is So Fun!

Teacher (T): I have a question. Piggie and Brian Bat drew their best friends. Who do you think they drew?

Child (C): I think Piggie drew Brian Bat, and Brian Bat drew Piggie, because they are best friends now.

T: So you all think they will draw their new best friends, right? That is exactly what Gerald thinks. (Gerald thinks that) when they drew their best friends, Piggie would draw Brian Bat, and Brian Bat would draw Piggie.

(Reading from the book) "It is worse than we feared", Gerald said to Snake, "We are doomed", said Snake. "Do you want to see our drawings? Ta-da!"

Is this the same as you thought?

C: No.

T: Right. We guessed Piggie would draw Brian Bat, and Brain Bat would draw Piggies, because they are now best friends. But who did they draw really? Who did Piggie draw?

C: Gerald.

T: Who did Brian Bat draw?

C: Snake.

T: Snake. In fact, they still drew their old best friends, Gerald and Snake. Even though they now have new best friends, they still remember their old best friends. So … how do Gerald and Snake feel now?

C: Happy.

T: They are happy.

(Reading from the book) "They drew us!" "Of course, you are our best friends!"

So even with new friends, we should not forget our old friends.

Elephant Cannot Dance

T: Who do the squirrels want to learn dancing from really?

C: Gerald.

T: Let's see Piggie and Gerald's expressions, how do they feel?

C: Happy.

T: And? They are surprised, aren't they? Why? Who did we guess just now?

C: Piggie.

T: But the squirrels wanted to learn dancing from Gerald instead. Why did we guess that they would learn from Piggie? We all thought only Piggie knew how to dance, right?

That's

why we guessed the squirrels are here to learn from Piggie. But what they really want is to learn to dance like Gerald. They said: Gerald's dancing is cool, we want to learn to dance like Gerald.

In the beginning, did Gerald think he could dance or not? No, but the squirrels came here to learn from Gerald. They think Gerald is a good dancer. They said, please teach us. Then Piggie said, teach me too. Why does Piggie want to learn from Gerald?

C: Because she never learned dancing like Gerald.

T: Because she never learned. And?

C: She never learned, she doesn't know how to dance like Gerald.

T: She never learned, and she wants to try. And because Gerald learned from Piggie, now Piggies wants to learn from Gerald too, right? So at the beginning, most of us guessed that the squirrels wanted to learn from Piggie. But in reality, they came to learn from Gerald instead, because everyone can dance. Gerald thought only Piggie could dance, but not him. Now the squirrels changed his mind, now he thinks he can dance too.