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Teachers' Theory-of-mind Coaching and Children's Executive Function Predict the Training Effect of Sociodramatic Play on Children's Theory of Mind

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Abstract

*Theory of mind (ToM), the ability to interpret one's own and others' mental states, is essential for social interaction; thus, it is important to promote the early development of ToM. The current study investigated (1) whether sociodramatic play (SDP) promotes the development of ToM in kindergarten children; (2) whether teachers' ToM coaching, as well as children's individual differences in language and executive function (EF), may influence how children benefit from SDP; and (3) whether SDP improves children's development in language and EF. Seventy-one kindergarteners (*M *age = 60.2 months,* SD *= 5.7) divided into 12 groups were randomly assigned to three conditions: free play, SDP, or SDP + ToM coaching. Each condition included four weekly sessions, 45 min per session. Before and after the training, children's ToM, language and EF were measured. The results showed that after children's individual differences in ToM were considered, (1) SDP positively predicted children's post-test ToM; (2) teachers' ToM-related guidance during SDP and children's pretest EF positively predicted the training effect of SDP on children's ToM; (3) teachers' ToM-related guidance during SDP, but not SDP alone, predicted children's post-test language; and (4) neither SDP nor teachers' ToM-related guidance during SDP predicted children's post-test EF.*

Keywords: theory of mind; play; teachers; executive function

Introduction

Theory of mind (ToM) refers to an individual's ability to ascribe mental states such as beliefs, knowledge, and intentions to oneself and others, so as to understand and predict the behavior of oneself and others (e.g., Premack & Woodruff, 1978). It is essential for social interaction (see review in Hughes & Leekam, 2004). Numerous studies, both cross-sectional and longitudinal, have shown that the early development of ToM is associated with children's social competence (e.g., Cassidy, Werner, Rourke, Zubernis, & Balaraman, 2003; Razza & Blair, 2009). It can reduce the risks of engaging in disruptive and aggressive behaviors (Renouf et al., 2010) and the chance

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of becoming bullying victims (Shakoor et al., 2012). Therefore, it is important to promote the early development of ToM. Sociodramatic play (SDP), a form of pretend play involving 'voluntary social role-taking with others' (Levy, Wolfgang, & Koorland, 1992), is a widely used classroom activity in kindergartens (Smith, 2010). SDP has been proposed to promote children's development of ToM (e.g., Harris, 1995), though experimental evidence is still lacking (see review in Lillard et al., 2013). The current study aimed to examine (1) whether a group training program incorporating SDP would promote the development of ToM in kindergarten children; (2) what key factors may influence how children benefit from this program; and (3) whether this ToM group training program would improve children's development in other areas.

Development of Theory of Mind During Early Childhood

The early development of ToM can be scaled to different stages, including diverse desires, diverse beliefs, knowledge access, false belief, and belief emotion (Wellman, Fang, & Peterson, 2012). The term 'diverse desires' means that people can have different desires about the same object. The term 'diverse beliefs' means that people can have different beliefs about the same event. 'Knowledge access' is the understanding that without witnessing an event, people may not have knowledge about it. The term 'false belief' is the understanding that people's beliefs can be wrong. 'Belief emotion' is the understanding that people's feelings regarding a particular situation depend on their expectations. Two-year-olds can understand diverse desires but may not understand diverse beliefs until they reach three years of age. Between four and six, children progressively develop their understanding of knowledge access, false belief, and belief emotion.

Sociodramatic Play: A Potential Method to Improve ToM

SDP may improve children's ToM via several mechanisms. According to the re-description theory (e.g., Perner, 1998; Perner, Strummer, Sprung, & Doherty, 2002), in order to understand mental states, children need to understand that the same event can be represented and viewed differently. Therefore, researchers can improve children's ToM by promoting children's representation. For instance, Iao, Leekam, Perner, and McConachie (2011) have successfully improved children's false belief understanding by guiding children to use different names to describe the same objects. During SDP, the real world is substituted to an imaginary world (e.g., Doyle & Connolly, 1989; Smith, 2010), in which daily objects are given alternative names, meanings, properties, or functions. In this sense, SDP should improve children's ToM via improving children's representation. Furthermore, SDP may improve ToM by providing children the opportunity to pretend to be other people and imagine what they would think, believe, feel, and behave in a situation. According to Leslie (1987), pretense is 'an early manifestation' of ToM. Likewise, according to Harris's (1995) simulation theory, to interpret and predict other people's behaviors, we can engage in simulation—putting ourselves into other people's shoes. Indeed, previous work has shown that SDP increases children's ability to interpret and predict other people's mental states and behaviors (Dockett, 1998; Flavell, 1988; Harris, 2000). Moreover, unlike solitary dramatic play, during SDP, two or more children are involved (Smilansky, 1968). Children need to negotiate the theme of their play and what role each of them should take. Astington and Jenkins (1995) have shown that such social

interaction during SDP facilitated children's ToM. Taken together, SDP should promote the development of ToM. Indeed, via a correlational study, Youngblade and Dunn (1995) showed that children who often engage in SDP tend to have advanced ToM. Similarly, Goldstein and Winner (2012) found that compared to children who enrolled in visual arts or music classes, after one year of training, children who enrolled in acting classes improved their ToM. However, in this study, the participants were not randomly assigned to the training conditions; hence, the findings are not conclusive.

Factors Influencing the Training Effect of SDP on ToM

To systematically investigate the training effect of SDP on ToM, it is critical to consider adults' involvement and individual differences in language and executive function (EF).

Adults' Involvement. One environmental factor that is often confounded in research on SDP is adults' involvement. According to Levy et al. (1992), how much guidance adults provide during children's SDP can determine how much children benefit from SDP. During children's SDP, an adult can be involved in three ways: (1) as a safety monitor who provides various toys and materials for children to play with and is only involved when children get into trouble, (2) as a stage manager who determines the theme of children's play and provides relevant materials, or (3) as a coach who directs, prompts, and guides children to engage in the play. Particularly as a ToM coach, an adult can lead children to reflect on why characters think and behave in certain manners, and provide feedback and explanations accordingly. Adults' ToM-related explanations are critical for children's ToM development. For instance, in Ornaghi, Brockmeier, and Gavazzi's (2011) study, after reading a group of about six children stories involving mental state words, an adult either guided the children to use the mental state words in a language game or let children play by themselves. Consequently, only the children who were guided to practice the mental state words showed improvement in ToM. Likewise, researchers who only provided children with feedback on whether their ToM understanding was correct or incorrect without providing any explanations failed to improve children's performance on ToM tasks (Clements, Rustin, & McCallum, 2000). Thus, when examining how SDP may improve children's development of ToM, it is necessary to consider whether teachers provide ToM-related guidance during children's SDP.

Individual Differences in Language and Executive Function. Language has been shown to play an essential role in the development of ToM (see meta-analysis of Milligan, Astington, & Dack, 2007). Children's verbal ability not only correlates with children's ToM significantly (e.g., Cutting & Dunn, 1999) but also predicts children's ToM longitudinally (e.g., Astington & Jenkins, 1999).

From a functional perspective, EF is the process required for the goal-directed regulation and conscious control of thought, emotion, and action (e.g., Zelazo, Qu, & Müller, 2005). The general assumption is that our cognitive resources such as attention and working memory are limited; there is competition in terms of cognitive resources for performing various activities (Norman & Bobrow, 1975). Thus, to achieve the particular goal of a task, EF is needed to allocate cognitive resources strategically. From a component perspective, Miyake and Friedman (2012) have proposed a unity/

diversity framework of EF, which states that EF is composed of a common component, inhibition, and two specific subcomponents—updating and shifting. Inhibition is the ability to keep relevant information and responses activated while keeping irrelevant information and responses suppressed. Information updating involves keeping information online, whereas mental set shifting consists of switching between different mental sets and response sets flexibly. Developmental studies have indicated that in three to six-year-olds, these three components are not separable (e.g., Wiebe et al., 2011). A large number of correlational and cross-sectional studies have linked EF to ToM (see a meta-analysis in Devine & Hughes, 2014). It has been found that EF at age 2 predicted ToM at age 3 (Carlson, Mandell, & Williams, 2004), EF at age 3 predicted ToM at age 4 (Blankson et al., 2013), and EF at age 4 predicted ToM at age 5 (Hughes, 1998). According to the emergence account, children should have a certain level of cognitive control to understand mental states (e.g., Hughes & Russell, 1993). In particular, children need to keep track of what they know and what other people know, suppress their own thinking, and switch to other people's perspectives accordingly.

Language and EF are essential for ToM at both micro- and macro-levels. At the micro-level, when processing ToM, children need their language to understand the task and to provide appropriate answers. Likewise, children need their EF to maintain, update, and activate relevant information as well as suppress irrelevant information. At the macro-level, both language and EF are needed for children to learn ToM-related knowledge. A child who is advanced in language and EF would have more opportunities to engage in social conversations and to learn ToM (e.g., Astington & Jenkins, 1999; Benson, Sabbagh, Carlson, & Zelazo, 2013; Hughes, 1998). Thus, when investigating how SDP influences the development of ToM, researchers should control these individual differences.

SDP may Improve Language and EF

It is still under debate whether the training effects of SDP on ToM can transfer to other domains such as language and EF (see a meta-analysis in Lillard et al., 2013). Previous research has shown that a three-month language-oriented SDP program improved children's performance on the Peabody Picture Vocabulary Test (PPVT) (e.g., Levy, Schaefer, & Phelps, 1986). Likewise, Ornaghi et al. (2011) have found that when teachers guided children using mental state words during a language game, children's ToM as well as language improved. These results suggest that during SDP, teachers' explanations of vocabulary and mental state verbs can improve children's language. Nevertheless, these two studies did not include a condition to examine the impact of the SDP/language game, so it is unclear whether SDP alone can facilitate children's language.

SDP may improve children's EF as well. During SDP, children need to remember what roles they should adopt, how to use particular objects, and what actions should be conducted. Practice of rule enactment is supposed to benefit children's EF (e.g., Zelazo, Carter, Reznick, & Frye, 1997). However, the results are controversial. For instance, Elias and Berk (2002) found that in classrooms, the amount of SDP children engaged in initially positively predicted children's self-regulation behaviors during clean-up but not during 'circle time' half a year later. The researchers explained that, unlike their behaviors during clean-up, children's self-regulation behaviors during

circle time were not a sensitive measurement of EF. Therefore, multiple comprehensive and valid measures of EF are needed to further explore this issue.

Theoretically, whether training in ToM can improve EF is debated. According to the meta-representation account (e.g., Perner & Lang, 1999), ToM understanding underlies the growth of EF skills in preschoolers; hence, an intervention, though targeted at ToM, may also improve EF. Indeed, Kloo and Perner (2003) found that the experimenter's explanations of false belief improved children's performances on both false belief and EF tasks. Nevertheless, according to the emergence account (e.g., Hughes & Russell, 1993), it is the improvement in EF that leads to the improvement in ToM though a ToM training program may not necessarily improve EF. Supporting this statement, Benson et al. (2013) did not replicate Kloo and Perner's (2003) finding. Some methodological flaws of these two studies (e.g., both training and testing were conducted by the same experimenter) made it difficult to draw a conclusion; hence, systematically well-controlled experimental studies are needed to further investigate this issue.

Current Study

The current study aimed to investigate (1) whether SDP would facilitate the development of ToM in kindergarten children, (2) whether teachers' ToM coaching and children's individual differences in language and EF may influence how children benefit from SDP, and (3) whether SDP and teachers' ToM coaching would improve children's development in language and EF. To examine these research questions, we recruited five to six-year-old kindergarten children in Singapore. The whole study, including pretest, training, and post-test, lasted less than two months and was conducted at the children's own kindergartens. Like Ornaghi et al. (2011), we assigned children into groups with an average of six children per group. These groups were then randomly assigned to three conditions: (1) free play, (2) SDP, and (3) SDP + ToM coaching. Regardless of the training condition, these groups went through four training sessions. Each training session, lasting 45 min, was conducted weekly. Before and after the training, experimenters who were unaware of children's training conditions assessed children's ToM, language, and EF individually.

Based on previous literature, we formed the following hypotheses:

H1: After children's pretest ToM was controlled, SDP should predict children's post-test ToM.

H2: After children's pretest ToM and SDP experience were considered, teachers' ToM-related coaching, individuals' differences in language and EF, as well as the interaction between teachers' coaching and individual differences should determine the facilitation effect of SDP on ToM, in particular, after children's pretest ToM and SDP experience were controlled,

H2.1: Teachers' ToM-related explanations during children's SDP should predict children's post-test ToM.

H2.2: At the micro-level, children's pretest language should predict children's post-test ToM.

H2.3: At the micro-level, children's pretest EF should predict children's post-test ToM.

H2.4: At the macro-level, the interaction between children's pretest language and teachers' ToM-related explanations during children's SDP should predict children's post-test ToM.

H2.5: Likewise, at the macro-level, the interaction between children's pretest EF and teachers' ToM-related explanations during children's SDP should predict children's post-test ToM.

H3: After children's pretest language was controlled, SDP and teachers' ToM-related coaching during SDP should predict children's post-test language.

H4: After children's pretest EF was controlled, SDP and teachers' ToM-related coaching during SDP should predict children's post-test EF.

Method

Participants

Seventy-five healthy Singaporean kindergarten children of different ethnicities were recruited from seven local kindergartens (N = 5, 6, 7, 8, 9, 12, and 24, respectively). Participants who missed training sessions (N = 2) and participants who were unavailable for post-test (N = 2) were excluded in the following analysis. The final sample consisted of 71 kindergarteners (*M* age at pretest: 60.2 months, *SD* = 5.7, *range* = 50–74 months; 34 girls). In Singapore, children younger than 7 years of age generally study in childcare centers and kindergartens before entering primary schools.

Materials

The test materials, training materials, and procedure were approved by the Institute Review Board of Nanyang Technological University.

Test Materials. Eight tasks, including four ToM tasks, one language task, and three EF tasks, were conducted by research assistants. Two sets of test materials were used—one for pretest and one for post-test. Counterbalancing was employed such that half of the children received the first set during pretest, whereas the other half received the same set during post-test.

ToM tasks. The four ToM tasks assessed children's understanding of knowledge access, contents false belief, location false belief, and belief emotion, respectively. The reproducibility and consistency of this four-item ToM scale were .97 and .61, respectively (Wellman et al., 2012). These tasks were constructed with similar linguistic and procedural demands as well as formats and scoring methods. For each task, dolls acted as characters in the story, and props were used to help enact the situation. Target questions regarding characters' mental states, and control questions aimed at checking for children's memory about the story plots were asked. One point was awarded if the participant correctly answered both questions.

To assess knowledge access, an experimenter opened a box and exposed the content to the child. After closing the box, the experimenter told the child that Jack had never seen what was inside the box. She then asked the child 'Does Jack know what is inside the box?' and 'Did Jack look inside the box?'

To assess contents false belief, the experimenter showed the child a Mentos box and asked the child what he thought the box contained. The experimenter then showed the child the unexpected content (e.g., marbles) inside the box. The child was told that Polly had never looked inside the box, and was asked 'What does Polly think is inside the box? Mentos or marbles?' and 'Did Polly look inside the box?'

To assess location false belief, the experimenter showed the child that Big Bird hid a toy in one place, and then when Big Bird was absent, Grover moved the toy to the other hidden place. The experimenter asked the child 'now Big Bird comes back. Where do you think Big Bird will look for his toy?' and 'Where is Big Bird's toy?'

To assess belief emotion, the experimenter told the child that Honey Stars were Kelly's favorite snack. While Kelly was absent, the experimenter showed the child that tissue was inside of the Honey Stars box. After closing the box, the experimenter asked the child 'How do you think Kelly will feel when she sees the box of Honey Stars? Happy or sad?' and 'How do you think Kelly will feel after she looks inside the box?'

Language task. PPVT-IV (Dunn & Dunn, 2007) was used to test children's receptive vocabulary. This task was reported to be highly reliable (r = .93; Dunn & Dunn, 2007). It correlated with other language measures significantly (rs; .67–.72), suggesting a good validity (Dunn & Dunn, 2007). For each trial, after showing the child four pictures, the experimenter said a target word and asked the child to point at the picture that depicted the word appropriately. Every 12 trials were classified as a set. When the child made eight or more errors in a set, the test stopped. The final score was the total number of correct responses a child had made. Both raw and standard scores were recorded.

EF tasks. Three tasks were used: The forward digit (Lezak, 1995) measured information updating. In this task, the child was told sequences of digits paced at one-second apart and was asked to repeat these digits in the original order. When the child reported a sequence correctly, the experimenter told the child a new sequence, one digit longer than the previous sequence. Otherwise, the experimenter gave the child another opportunity by telling the child a new sequence of the same length. If the child failed again, the task ended. There were two practice trials. The length of the longest list that the child was able to recall correctly was used as the final score.

The backward digit (Lezak, 1995) measured information manipulation. The format of the backward digit span was similar to the forward digit span, except that participants were asked to repeat the sets of numbers in a reversed order.

The Flexible Item Selection Task (FIST; Jacques & Zelazo, 2001) measured the ability to inhibit previous responses and flexibly switch to new responses. In the FIST, the child was shown sets of stimuli made up of four pictorial items. Each trial was derived from a combination of three dimensions (i.e., shape, color, or size). During each trial, the child was first asked to select one pair of pictures that matched on a dimension, and then asked to select a different pair of pictures that matched on a different dimension. To score one point on a particular trial, the two selection criteria (i.e., dimensions) needed to be different from each other. There were two practice and nine test trials. The total number of trials that the child correctly responded was the final score.

The test–retest reliabilities of these tasks were .66, .64, and .84, respectively (Müller, Kerns, & Konkin, 2012; Willoughby, Blair, Wirth, & Greenberg, 2010). These three tasks have been shown to correlate with other EF measures significantly (rs: .44–.51; Müller et al., 2012; Qu, Finestone, Loh, & Leong, 2013). Pre- and post-EF scores were calculated by averaging the standardized scores of these three tasks during pre- and post-test, respectively.

Materials for ToM training. For the free play condition, age-appropriate popular storybooks, common props and dress-up materials, popular toys such as dolls, cars,

and building blocks, and coloring pencils and colorful papers were used. In the other two conditions, four picture books involving ToM stories were specially designed by the research team. The stories were about the daily activities of a family of eight (a girl, a boy, mother, father, grandmother, grandfather, uncle, and aunt), including preparing breakfast, preparing for a family trip, packing books and water bottles before going to the library, and making gifts for grandmother. For example, in the library story, the girl and the boy put books in a blue bag, but other characters moved the books to a yellow bag and put water bottles in the blue bag. As a result, the girl and the boy could not find their books. Cartoon pictures were used with simple sentences describing the actions and conversations of the characters. Explicit mental state verbs such as 'think' and 'believe' were stated in these storybooks. Each story was less than 20 pages long. Props and dress-up materials were provided to help children to act out the stories.

Design

This was a 3 (condition: free play, SDP, vs. SDP + ToM coaching) X 2 (test time: pre- vs. post-training) mixed design. Predictors were SDP, teacher's ToM-related coaching, children's pretest ToM, language, and EF. Outcome measures were children's post-test ToM, language, and EF. Control variables were children's gender, test material version, and task order. In terms of task order, during pre- and post-test, the eight tasks were arranged in a semi-random order: the FIST, one of the two false belief tasks, forward and backward digit span, knowledge access, belief emotion, a short break, the other false belief task, and finally the PPVT before children received tokens for participation. The test material version (i.e., using the first set of test materials during pretest vs. during post-test) and false belief task orders (i.e., giving the location false belief task first vs. the contents false belief task first) were fully counterbalanced between participants. Children were assigned to groups according to their kindergartens and then the groups were randomly assigned to the three training conditions.

Procedure

All tests and training were conducted in a quiet room at children's own kindergartens. Because English was the main language used in the kindergartens, English was used during testing and training. The experimenters who conducted pre- and post-tests were not aware of children's conditions, and the teachers and assistants who conducted the training did not know children's performances on various tasks.

Pre- and Post-intervention Tests. Each child was tested individually. The whole procedure lasted less than 50 min. Pretest was conducted about one week before the training was conducted, whereas the post-test was conducted at least three days after the last training session.

Training. We organized children into different groups based on their kindergartens. For the kindergartens that had fewer than nine children, we did not further split the children into groups. For the kindergartens that had nine or more children, we matched children's pre-ToM scores and then randomly assigned them to groups of four to six children. Eventually, 12 groups were formed, with six children per group on average. Cluster analysis with pretest ToM scores as the dependent variable revealed that these 12 groups could be categorized to two clusters, high (N = 6) and low

(N = 6). Then within each cluster, the groups were randomly assigned to the three training conditions. Correspondingly, there were four groups in each training condition. Once a week, each group went through a 45-min training session conducted by a teacher and an assistant. There were four sessions in total.

To ensure that the teachers who conducted the ToM training at kindergartens followed our procedure, we conducted two one-hour orientation sessions before the study. During the orientation, we introduced the teachers to the three conditions. To help the teachers understand the concepts and learn the procedure, we also provided these teachers hands-on practice with researchers. The teachers conducted the training in their own kindergartens only after they had finished the orientation.

Free Play Condition. In this condition, the teacher and the assistant provided children books to read, various toys to play with, and coloring tools to use, but they sat to one side doing their own paper work. They would only respond and interact with children if supervision was needed.

SDP Condition. Each session was divided into two parts. The first part was about 15 min, during which the teacher read children one of our newly created ToM training stories, but did not ask children any questions or provide any explanations pertaining to the characters' mental states. After the teacher finished reading the story, the children were given the book to read by themselves and asked to decide which characters they were going to act as. The second part was the SDP time when each child pretended to be a character from the particular story. Children were provided with props and dress-up materials. While children were engaging in SDP, the assistant narrated the situation and the teacher did not ask about or discuss mental states of the characters with children. If children happened to ask questions about the mental states of the story characters, the teacher provided answers with limited explanation.

SDP + ToM Coaching Condition. This condition was similar to the SDP condition, as it included both storytelling and SDP. During the storytelling, the teacher asked questions pertaining to the characters' mental states including knowledge access, false belief, and belief emotion. For instance, the teacher asked whether the girl saw that the grandmother took the books from the bag, and whether the girl knew that the books were not in the bag anymore. The teacher provided feedback on children's answers. The teacher then provided detailed explanations. Mental state verbs such as 'think' and 'know' were used during the explanations. During the SDP, the teacher reinforced children's understanding of the mental words discussed previously by repeating the questions and providing feedback and explanations when necessary, and reminded children of their respective character's perspectives. The teacher and the assistant also monitored the group dynamics and ensured that each participant had a fair opportunity to express their opinions and answers.

Results

Preliminary Analysis and Data Analysis Plan

Separate one-way analyses of variance revealed no significant performance differences in terms of gender, test material version, or task order, so the data were combined along these variables. Independent sample *t* tests showed that the three conditions were equivalent in terms of children's age and baseline performance (see Table 1). Pearson

Table 1. Children's Age and Performance by Condition and Test Time

	Free play				SDP				SDP + ToM coaching			
	Pretest		Post-test		Pretest		Post-test		Pretest		Post-test	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age (month)	59.45	5.40	60.65	5.90	60.60	5.59	62.36	6.09	60.19	6.09	61.81	6.05
Theory of Mind												
KA	.25	.44	.40	.50	.36	.49	.68	.48	.42	.50	.73	.45
CFB	.20	.41	.25	.44	.32	.48	.40	.50	.23	.43	.73	.45
LFB	.30	.47	.25	.44	.20	.41	.32	.48	.15	.37	.65	.49
BE	.35	.49	.45	.51	.32	.48	.40	.50	.27	.45	.58	.50
Total	1.10	1.12	1.35	1.39	1.20	1.29	1.80	1.15	1.10	1.32	2.69	1.16
Language: Peabody Picture Vocabulary Test												
Raw	62.35	25.81	61.15	26.97	65.36	18.31	59.32	20.76	55.93	17.32	62.01	15.21
Standard	86.95	18.15	85.50	17.46	85.16	10.89	82.28	13.10	81.65	11.78	84.62	11.00
Executive function												
FDS	4.25	.91	4.30	.80	4.68	.92	4.56	1.05	4.37	1.03	4.67	.81
BDS	1.65	.75	1.85	.88	1.42	.57	1.70	.76	1.62	.75	1.92	.69
FIST	1.50	2.42	1.45	2.44	.68	1.22	2.16	3.02	.88	1.80	2.19	2.93

Note: SDP = sociodramatic play; ToM = theory of mind; KA = knowledge access; LFB = location false belief; CFB = contents false belief; BE = belief emotion; FDS = forward digit span; BDS = backward digit span; FIST = Flexible Item Selection Test.

Table 2. Correlations (Partial Correlations After Controlling Children's Pretest Age) between Theory of Mind (ToM), Language, and Executive Function (EF) by Test Time

		Pre		Post		
		Language	EF	ToM	Language	EF
Pre	ToM	.35* (.46**)	.29* (.29*)	.42** (.27)	.13 (.24)	.56*** (.51***)
	Language		.32* (.33*)	.14 (.23)	.57*** (.55**)	.41** (.48***)
	EF			.49** (.52**)	.70** (.73***)	.50*** (.50***)
Post	ToM				.21 (.34*)	.54** (.48***)
	Language					.34* (.42**)

* $p < .05$; ** $p < .01$; *** $p < .001$.

correlations were conducted and revealed that only pretest EF significantly correlated with post-test ToM, even after age was partialled out (see Table 2).

To examine what factors influenced post-test ToM, hierarchical multiple regressions were conducted. Pretest ToM and EF as well as post-test ToM scores were mean centered. The product of teachers' ToM coaching and children's pre-EF was calculated as the interaction of these two variables. The manipulation of SDP and ToM coaching were dummy coded, respectively with the free play, coded as 0, serving as the reference. In the hierarchical multiple regressions, to control individual differences in pretest ToM, pretest ToM scores were entered as the first block, SDP then was entered as the second block, teachers' ToM coaching and pretest EF were entered as the third block, and the interaction between the teachers' coaching and pretest EF were entered as the fourth block. Likewise, to examine whether SDP and teachers' ToM coaching during SDP influenced children's post-test language and EF, respectively, children's pretest scores were entered as the first block, SDP was entered as the second block, and teachers' ToM coaching was entered as the third block.

Factors that Influenced Post-test ToM

Results of hierarchical multiple regressions with post-test ToM as the dependent variable (see Table 3) showed that after children's pretest ToM was taken into consideration, children's SDP significantly and positively predicted children's post-test ToM, suggesting that after controlling children's pretest ToM, the children who engaged in the four sessions of SDP outperformed their counterparts who did not engage in the four sessions of SDP. When both children's pretest ToM and children's SDP experience were considered, teacher's ToM coaching and children's pretest EF positively predicted children's post-test ToM performance, but not the interaction between teacher's ToM coaching and children's pretest EF. These results indicate that among the children

Table 3. Results of Hierarchical Multiple Regressions Predicting Theory of Mind (ToM)

Predictor	β	*SE*	*b*	*t*	p_t	*F*	p_F	ΔR^2	F_{Change}	$p_{Fchange}$
1 PreToM	.54	.11	.50	4.82	<.001	23.19	<.001	.24	23.19	<.001
2 PreToM	.53	.11	.50	5.06	<.001	17.69	<.001	.32	9.38	<.003
SDP	.89	.30	.30	3.06	.003					
3 PreToM	.43	.10	.41	4.37	<.001	17.12	<.001	.48	11.23	<.001
SDP	.41	.29	.14	1.41	.16					
Coaching	.82	.27	.30	3.01	.004					
PreEF	.25	.08	.29	3.12	.003					
4 PreToM	.43	.10	.41	4.37	<.001	13.92	<.001	.48	1.05	.31
SDP	.41	.29	.14	1.41	.16					
Coaching	.77	.28	.28	2.78	.007					
PreEF	.21	.09	.24	2.27	.027					
Coaching × PreEF	.18	.17	.11	1.02	.31					

Note: SDP = sociodramatic play; PreToM = pretest ToM; × PreEF = pretest executive function.

Table 4. Results of Hierarchical Multiple Regressions Predicting Language

Predictor	β	*SE*	*b*	*t*	p_t	*F*	p_F	ΔR^2	F_{Change}	$p_{Fchange}$
1 Pretest	.75	.08	.74	9.18	<.001	84.28	<.001	.54	84.28	<.001
2 Pretest	.75	.08	.74	9.08	<.001	41.61	<.001	.54	.07	.79
SDP	.65	2.47	.02	.26	.79					
3 Pretest	.77	.08	.76	9.43	<.001	30.16	<.001	.56	3.83	.055
SDP	−1.85	2.74	−.06	−.68	.50					
Coaching	5.02	2.57	.18	1.96	.055					

Note: SDP = sociodramatic play.

who engaged in the four sessions of SDP, the more ToM-related guidance teachers provided during children's SDP and the more advanced children's pretest EF were, the better children performed on the ToM tasks during post-test.

Factors that Influenced Post-test Language

The results were the same regardless of whether the raw scores or the standard scores of the PPVT were used in data analysis. Here, we report the results using the standard scores of the PPVT. Results of hierarchical multiple regressions with post-test PPVT as the dependent variable (see Table 4) showed that after children's pretest PPVT scores were controlled, children's SDP did not predict children's post-test PPVT significantly. Nevertheless, when both children's pretest PPVT and children's SDP experience were considered, teacher's ToM coaching positively predicted children's

Table 5. Results of Hierarchical Multiple Regressions Predicting Executive Function

Predictor	β	*SE*	*b*	*t*	p_t	*F*	p_F	ΔR^2	F_{Change}	$p_{Fchange}$
1 Pretest	.72	.15	.50	4.74	<.001	22.48	<.001	.24	22.48	<.001
2 Pretest	.71	.15	.49	4.66	<.001	11.49	<.001	.23	.63	.43
SDP	.42	.52	.08	.79	.43					
3 Pretest	.71	.16	.49	4.56	<.001	7.56	<.001	.22	.03	.88
SDP	.37	.60	.08	.62	.54					
Coaching	.09	.56	.02	.16	.88					

Note: SDP = sociodramatic play.

post-test ToM performance at a trend level ($p = .055$). These results indicate that to a certain degree, among the children who engaged in the four sessions of SDP, the more ToM-related guidance teachers provided during children's SDP, the better children performed on the PPVT during post-test.

Factors that Influenced Post-test EF

Results of hierarchical multiple regressions with post-test EF as the dependent variable (see Table 5) showed that only children's pretest EF positively predicted children's post-test EF. Neither SDP nor teachers' ToM coaching were significant predictors.

Discussion

The results have revealed that after children's individual differences in ToM were controlled, SDP, teachers' ToM-related guidance during SDP, and children's pretest EF all influenced children's post-test ToM. Furthermore, to a certain degree, teachers' ToM-related guidance also seemed to improve children's language ability, albeit at a trend level.

Training Effect of SDP on ToM

Supporting our hypothesis, the results showed that after children's individual differences in ToM were taken into consideration, SDP positively predicted children's post-test ToM performance. These results are consistent with previous findings (e.g., Astington & Jenkins, 1995) in addition to the redescription theory (Perner, 1998) and the simulation theory (Harris, 1995). During SDP, children may improve their skills in representing the same objects differently, taking on other people's perspectives via simulation, and negotiating with other children on how to conduct the play collaboratively. All these skills may potentially increase children's ToM.

Factors Predicting the Training Effect of SDP on ToM

Partly supporting our hypotheses, the results showed that after children's pretest ToM was considered, among the children who had SDP training, teachers' ToM coaching

and children's pre-EF positively predicted children's post-test ToM. These findings are broadly consistent with Levy et al.'s (1992) conclusion that teachers' involvement during children's SDP determines the quality of SDP. Furthermore, our results are consistent with the finding that adults' ToM-related explanations can promote children's ToM (e.g., Ornaghi et al., 2011). Moreover, our study has extended previous findings by showing that in a group setting, teachers can improve children's ToM via providing ToM-related scaffolding during children's SDP.

Additionally, the results showed that the more advanced children's pretest EF were, the more developed children's post-test ToM were. These findings are consistent with the EF-ToM emergence account (e.g., Hughes & Russell, 1993). To understand other people's ToM, at the micro level, children need to keep track of their own and other people's intentions, selectively attend to relevant information in the environment, inhibit their own perspectives when they are irrelevant, and adopt other people's perspectives accordingly.

Based on previous findings that at the macro level, EF is vital for children to engage in effective ToM learning (Hughes, 1998), we had expected that EF might moderate how children benefit from teachers' guidance. Nevertheless, this hypothesis was not supported. It is possible that unlike in daily life, in the SDP + ToM coaching condition, the teachers and assistants carefully monitored children's progress and ensured that all children had a relatively equal amount of time to participate in the activities. This finding suggests that although children may differ from each other in terms of how good they are at regulating their behaviors during ToM learning, teachers still can facilitate children's development in ToM if they provide all children with sufficient guidance.

Although our results have shown that children's pretest linguistic ability was significantly correlated with post-test ToM even after age was partialled out, pretest linguistic ability was not a significant predictor of children's post-test ToM. This hypothesis may have been supported if we had measured children's use of mental state-related lexicon and syntax. Thus, future studies should include those particular linguistic tasks to further examine this question.

Teachers' ToM Coaching During SDP but Not SDP Alone Improved Children's Language

Partially supporting our hypotheses, we have found that the more ToM-related guidance teachers provided during SDP, the higher children scored on the PPVT during post-test. Such findings are consistent with Lillard et al.'s (2013) meta-analysis that the facilitation effect of SDP on language is mainly dependent on adults' guidance during children's SDP (Levy et al., 1986; Ornaghi et al., 2011). However, our results only showed the trend. It is possible that the results may become significant if we had included more participants, more comprehensive measures of language ability, or more sessions. Future studies can further examine these possibilities.

Neither SDP nor Teachers' ToM Coaching During SDP Improved Children's EF

Contrary to our hypotheses, we did not find that SDP or teacher's ToM coaching improved children's EF. Compared to Elias and Berk's (2002) correlational study, our experiment was better controlled and used three well-established measures of EF. However, we only used four training sessions, whereas in Elias and Berk's (2002)

study, children were followed up for six months. Future studies can examine whether SDP may improve EF if more SDP sessions are provided.

Our results were consistent with Benson et al.'s (2013) finding and did not replicate Kloo and Perner's (2003) finding in that the training effect on ToM did not transfer to EF. Unlike previous EF training programs (e.g., Klingberg et al., 2005), in our training program, although children had four sessions of training on how to represent, explain, and infer other people's mental states, they did not receive special guidance on how to improve their EF. Thus, the sessions did not improve children's EF. Additionally, in terms of the relationship between ToM and EF, our results have revealed that EF was essential for the development of ToM, whereas improvement on ToM did not improve EF. These findings were in line with the emergence account (e.g., Hughes & Russell, 1993) and were inconsistent with the meta-representation account (Perner & Lang, 1999).

Implication, Limitation, and Future Direction

To our knowledge, this study is the first experiment demonstrating that (1) in kindergartens, children's SDP can improve their ToM, though not language or EF; (2) during children's SDP, via providing ToM-related guidance, teachers can improve children's ToM as well as language, though not EF; and (3) individual differences in EF predicted children's ToM after four sessions of SDP training. These findings are theoretically important. These results have brought some insights into the debates on whether SDP can improve children's ToM (Lillard et al., 2013), whether the development of ToM relies on the development of EF (Devine & Hughes, 2014), and whether training on ToM can be generalized to other domains such as language and EF (Kloo & Perner, 2003; Ornaghi et al., 2011). Furthermore, in terms of methodology, our study was carefully conducted. Participants were first screened and matched, then were randomly assigned to the intervention and control conditions. Research assistants who conducted pre- and post-test assessments were unaware of participants' training conditions and the trainers who provided the intervention had no knowledge about participants' performance on various assessments. Practically, our findings have demonstrated that it is possible for kindergarten teachers to teach ToM in kindergartens.

However, our study also has limitations. Because only 30 percent of parents returned their demographic information form, we could not fully match children based on their socioeconomic backgrounds though we carefully matched children based on their pretest ToM. Furthermore, we designed the training based on the redescription theory (Perner, 1998) that emphasizes the role of children's representation in the development of ToM; however, similar to previous studies (Iao et al., 2011; Kloo & Perner, 2003), we were unable to measure children's representation directly. Thus, future studies are needed to explore how to measure representation. Additionally, we must acknowledge that SDP and the teachers' ToM-related guidance may improve children's learning of ToM via increasing children's motivation and mood (Siegler & Lin, 2009; Smith, 2010). Measurement of children's motivation and mood should be included in future studies. Lastly, future longitudinal studies are needed to examine the long-term effects of this training program on social competence.

Conclusion

Taken together, we have found that after children's individual differences in ToM were considered, (1) SDP positively predicted children's post-test ToM; (2) teachers'

ToM-related guidance during SDP and children's pretest EF positively predicted the training effect of SDP on children's ToM; (3) teachers' ToM-related guidance during SDP but not SDP alone predicted children's post-test language; and (4) neither SDP nor teachers' ToM-related guidance during SDP predicted children's post-test EF. Theoretically and practically, our study has made some important contributions to the field.

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