

Running head: CAN TEACHERS FOSTER CHILDREN'S ToM?

Translating child development research into practice:

Can teachers foster children's theory of mind in primary school?

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Abstract

Background

Translating research findings into practice should be one of the objectives of developmental psychology. Recently, research demonstrated the existence of individual differences in theory of mind (ToM) during middle childhood that are crucial for children's academic and social adjustment.

Aims

The present study aims to transfer the results of recent experimental studies on ToM interventions into primary-school teachers' practices. It examines whether a ToM training program, based on conversations about mental states, can be effective under real-school-world conditions and if it can be translated in such a way that it becomes suitable for primary school teachers.

Sample

Seventy-two 8- to 9-year-old children took part in the study. A total of 4 classes were recruited and randomly assigned to the experimental (34 children, 18 boys) or to the control condition (38 children, 18 boys).

Methods

The ToM group and the control group were matched at pre-test for age, ToM, socio-economic background, verbal ability, working memory and planning. Teachers were trained in 4 four teacher-training sessions; the classroom-training program was delivered by teachers in 4 sessions (each 50 mins long). Children were assessed before the intervention, after the end of the program, and two months later.

Results

The ToM group improved ToM skills significantly more than the control group both in the short and in the long term.

Conclusions

Teachers can successfully promote their pupils' ToM development during their regular teaching hours. Results are discussed in light of the importance of ToM promotion for children's school adjustment.

Translating Child Development Research Into Practice: Can Teachers Foster Theory of Mind
in Primary School?

Translating research findings into practice in order to allow children to develop their full potential should be one of the main objectives of developmental psychology. In recent years, great emphasis has been placed on the need for knowledge transfer (Shonkoff & Bales, 2011) and evidence based practices (Flay et al., 2005) amongst the academic community.

The present study follows up on these recommendations. It focuses on theory of mind (ToM) defined as the ability to acknowledge the existence of mental states and to use this knowledge to predict, explain, and guide manifest behavior (Premack & Woodruff, 1978; Wimmer & Perner, 1983). The main aim was to transfer the results of recent experimental studies conducted on a ToM training program (Bianco, Lecce, & Banerjee, 2015; Lecce Bianco, Devine, & Hughes, 2014) into primary-school teachers' practices. More precisely, this study aimed to test the efficacy of Lecce's ToM training program when delivered by primary school teachers. We focused on school experience because it is crucial for children's life and wellbeing (Ray & Elliott, 2006; Zins, Weissberg, Wang, & Walberg, 2004) both in the short (Jang, Kim, & Reeve, 2012) and long (Parker & Asher, 1987) term.

During primary school children become increasingly sophisticated at using their ToM skills to comprehend people's behavior (Banerjee, Watling, & Caputi, 2011). Research showed that 8/9-year-old children are still only beginning to effectively understand faux pas (Banerjee et al., 2011) and ironic sentences (Filippova & Astington, 2008). Specifically, during this period, children improve their competence in attributing context-sensitive appropriate mental states (Bianco et al., 2015), in detecting relevant information within complex and ambiguous social exchanges (Apperly, 2011; Devine & Hughes, 2013), and in aligning emotions, beliefs and decision (Lagattuta, Elrod, & Kramer, 2016). Moreover, children become sophisticated in the recognition of interpersonal goals underpinning social

behavior (Lovett & Pillow, 2010) and increase the frequency of mental-state terms when describing people's behavior (Meins, Fernyhough, Johnson, & Lidstone, 2006). Given these considerations, we focused on 8- to 9-year-old children because this age represents a key developmental period during which children move beyond false belief understanding and become able to infer mental states in complex social scenarios.

ToM Training for Primary School Children

The origins of school-based ToM training programs can be found in studies involving clinical groups, typically autistic children (i.e., Beaumont, Rotolone, & Sofronoff, 2015). In a shift from this research tradition, in the present study we focused on typically developing children. This because existing studies show strong individual differences in ToM during middle childhood (Devine & Hughes, 2013) that affect children's social and academic life at school in a number of ways. Indeed, ToM supports children in building positive relationships with friends (Fink, Begeer, Hunt, & De Rosnay, 2014) and peers (Banerjee et al., 2011; Caputi, Lecce, Pagnin, & Banerjee, 2012), and in achieving better scholastic results (Lecce, Caputi, & Hughes, 2011). On a more general note, then, ToM training programs for typically developing children can be considered not only as a way to improve ToM, but as a tool to support an adaptive daily life functioning.

Given the importance of ToM for children's school adjustment, to date only three studies have investigated the possibility of helping primary school aged children in developing ToM skills (Bianco et al., 2015; Ornaghi, Brockmeier, and Grazzani, 2014; Lecce, Bianco, et al., 2014). The study by Ornaghi and colleagues (2014) involved 6- to 7-year-old children who participated in a 2-months ToM training (two 1-h sessions per week) program based on reading illustrated scenarios and conversations on emotional aspects of the stories. Results showed that children in the ToM training condition improved their understanding of emotions and cognitions more than children attending the control training

condition (in which experimenters asked children to make a drawing about the scenario instead of taking part in mental-state conversations). The effect of the intervention remained stable over 6 months. The second study of Lecce and collaborators (2014) focused on 9- to 10-year-old children that were assigned to either an experimental-ToM or a control-physical condition. In both conditions, experimenters asked children to, first, work individually on written narratives by answering pre-developed questions, and then to take part in guided group discussions on the narratives. In the ToM condition, narratives had a mental focus (i.e., misunderstanding) and participants took part in guided conversations about mental states and mental-state verbs involved in complex social situations. In the control training condition, narratives had a physical focus and participants took part in conversations that focused on physical rather than mental inferences. Results showed that the ToM training group improved ToM skills significantly more than the control group. This effect was stable over two months and was not moderated by socio-economic background, verbal ability, reading comprehension, and executive functions. More recently Bianco and colleagues (Bianco et al., 2015) extended these last results, showing that conversations about the mind during the training help children in the transition towards a more accurate usage of (rather than simply a propensity to use) ToM.

These studies (Bianco et al., 2015; Lecce, Bianco, et al., 2014; Ornaghi et al., 2014) are innovative and interesting for at least three reasons. Firstly, they clearly show that ToM can be enhanced in school-aged children with relatively short training programs. Secondly, the positive effects of the ToM training seems to be independent of individual differences on pre-test measures. Thirdly, they demonstrated that group-based conversations about mental states are an efficient strategy to strengthen ToM in middle childhood.

Although practically useful and theoretically compelling, the studies cited above are limited in that they place little attention on the application of ToM to real-life contexts. In all

cases, the ToM training was delivered by an external researcher that was new to the children and the activities were run in small groups. Thus, these training sessions were not strictly embedded in the classroom context. This is an important limitation, given that the power of an intervention strongly depends on being effective under real-life conditions (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011).

Translating Research on ToM Trainings into Primary-School Teachers Practice

The current study aims to address the existing gap between research on ToM training programs and children's real life by examining if a ToM training program can be incorporated into teachers' educational practice. More precisely, we tested the efficacy of a conversation-based ToM training program administered by regular classroom teachers during their lecture-time. We decided to focus on mental-states conversations because they prompt the coordination of different perspectives on the same event and the reflection upon social experiences (Carpendale & Lewis, 2004; de Rosnay, Fink, Begeer, Slaughter, & Peterson, 2014; Harris, 1999; Symons, 2004). In doing that, we adopted the training program developed by Lecce and colleagues (2014) as it fits easily into the teaching schedule. Specifically, this conversation-based program has three facets that make it suitable to schools' daily activities. Firstly, it predominantly uses written narratives which represent typical school activities for both teachers and pupils. Secondly, Lecce's ToM training program is centered around feedback in order to confirm and expand children's answers. Again, teachers are very familiar with giving feedback to enhance children's tasks performance and the role of feedback in children's learning is very well known (for a review see Hattie & Timperley, 2007). Thirdly, in Lecce's program each training trial follows a predictable sequence in which children: work individually and, subsequently, take part in group discussions guided by the adult. This sequence (individual work followed by group discussion) is very common for classroom-based activities and is known to foster reflective

thinking, conceptual change, and social construction of knowledge (Bigozzi, Vezzani, Tarchi, & Fiorentini, 2011; Mason, 2001; Rivard & Straw, 2000).

The Present Study

The present study had two main aims. The first goal was to test the efficacy of a conversation-based ToM intervention when implemented by teachers and, thus, to provide experimental evidence for the possibility that ToM can be enhanced in a real-life scholastic environment. The second was to test the stability of the training effect by re-assessing children's ToM two months after the end of the training program. Ours is the very first study that addresses the issue of school-based ToM training for typically developing children in primary school; it, thus, should be considered as a preliminary test of the role of teachers in ToM development. In addressing these issues, we controlled for individual differences on a number of potential confounding factors that are known to be related to ToM and that can affect our results: socio-economic background (Cutting & Dunn, 1999), verbal ability (Milligan, Astington, & Dack, 2007), reading comprehension (Lecce, Zocchi, Pagnin, Palladino, & Taumoepeau, 2010), and executive function skills (Devine & Hughes, 2014).

Method

Participants

Seventy-two children, aged between 8 and 9 years, took part to this study (M age = 104.13; SD = 4.3 months). All children were fluent Italian speakers; no participant was clinically referred for developmental disorders or learning difficulties. A total of 4 classes took part in the study. Classes were recruited in 4 different schools located in the same town. The main teacher of each classroom administered the training program. Table 1 provides details about the gender and the teaching experience of the participating teachers. Classes were randomly assigned to the experimental (34 children, 18 boys) or to the control condition (38 children, 18 boys).

Materials

Socio-economic background (pre-test). We used the Family Affluence Scale (Currie et al., 2008). This is a short questionnaire on family wealth made up of four questions about: family car ownership (range 0-2), having their own unshared room (range 0-1), the number of computers at home (range 0-3), and the number of holidays in the past year (range 0-3). We aggregated children's answers to each question into an overall index of family socio-economic background (range 0-9).

Verbal Ability (pre-test). We measured verbal ability through the Italian version of the vocabulary subtest of the Primary Mental Abilities (PMA; Thurstone & Thurstone, 1962; Rubini & Rossi, 1982). This test requires participants to select the right synonym of a target word by choosing one out of 4 alternatives. The test presented 30 target words and had to be completed within 7 minutes (range 0-30).

Executive functions (pre-test). We tested children's planning and working memory. We indexed planning via a modified version of the Tower of London (Shallice, 1982), used previously by Lecce and colleagues (Lecce, Bianco, et al., 2014). We gave children a series of cards with the starting and the final configuration of three balls of different colors on three pegs of different height. We told children that the big peg could carry all three balls, the middle peg could carry two balls, and the little peg could carry just one ball. Moreover, they were told that they could move only one ball at a time. We required participants to write down the minimum number of moves needed to solve the problem. For each item, we credited children with success (1 point) if they wrote the correct number of moves (range 0-7). We measured working memory through the Backwards Digit Span test from the Italian version of WISC-R (Orsini, 1997). We presented participants with 7 sequences of 2 to 8 digits and asked them to repeat the sequences in reverse order. For each sequence, we

credited children with success only if they recalled all the numbers in the right order (range 0-7).

Reading Comprehension (pre-test). We evaluated reading comprehension through the memory and transfer standardized reading comprehension battery (Cornoldi & Colpo, 1998). This standardized task requires the participant to answer 12 multiple-choice questions, after having read a text. In order to provide the correct answer, inferential processes are needed as the questions do not probe literal information. No time limit was set (range 0-12).

Theory of mind (at each time point). We tested theory of mind via the Strange Stories Task (Happé, 1994; White, Hill, & Happé, 2009). The Strange Stories task is an advanced test of ToM that evaluates the ability to attribute mental states to characters in complex and ambiguous social scenarios. It requires to perform mental-states inferences by interpreting non-literal statements. We gave children 6 short stories depicting: double bluff, persuasion, and misunderstanding situations. According to the scoring procedure (White et al., 2009) we scored participants' answers to each story as a 2 for full and explicit answers consisting of a mental state explanation, 1 for partially correct answers, and 0 for incorrect/irrelevant answers (range 0-12). An item example (with scoring criteria) is given in the Appendix A. Two raters independently coded 25% of the responses at each time point. The degree of accord was established with Cohen's Kappa ($k = .80$ at pre-test, $k = .80$ at post-test; and $k = .77$ at follow-up).

Procedure

We obtained parental written consent at the beginning of the study. We pre-tested children at school for the focus and the control variables. After the pre-test, children took part in a classroom-training program that consisted of four sessions lasting 50 mins each. At the end of the classroom-training program, all children were post-tested twice: one week after

the end of the training program and 2 months after the end of the training program.

Experimenters conducting pre- and post-testing were blind to group membership.

The content of the classroom-training program and the materials used in the intervention were very similar to those developed by Lecce and colleagues (2014). As in Lecce and colleagues (2014), the structure of the ToM and control classroom-training programs consisted of four sessions, each involving group conversations about two stories and two language exercises. Stories and language exercises were presented in a written form and we required children to write down their answers to the questions individually and then to take part in a group conversation. During this conversation, a frequent use of positive and corrective feedback was made in order to maximize the effects of the training (Clements, Rustin e McCallum, 2000). In the experimental condition the stories and language exercises were about mental states. Stories for the ToM group were based on the mental state stories of the revised Strange Stories task (White et al., 2009). Specifically, the first session was about misunderstanding, the second about sarcasm, the third about faux-pas, and the last one about double-bluff. Questions for each story concerned: a) the main character's mental state, b) one character's belief about the other characters' mental states, c) the relationship between one character's mental state and his/her social behavior. The last question of each story asked children what the main character could do or say in order to change the other character's point of view. In the control condition, stories and language exercise were about physical states. Stories for the control group were similar to those used in the control vignettes of the Strange Stories task (White et al., 2009). Appendix B contains a description of one complete trial for each condition. More details on the training program can be found in the study by Lecce and colleagues (2014).

The training program of the present study differs from that of Lecce and colleagues in two features: the introduction of the "reminder card" and the agent that conveyed the

program. Following a procedure previously used by Fisher & Happé (2005), at the end of each training session teachers gave pupils a ‘‘reminder card’ containing a short sentence about the focus of the session. Each session began with reading the sentence on the card and shortly discussing what had been learnt the previous session. This was done in order to maximise children’s learning and help them in connecting the various sessions of the program.

The program was conveyed by teachers who were not informed about the hypotheses of the work. Given that regular class teachers have not a specific background in psychology, we scheduled a series of teacher-training sessions to increase the chances that the program was carried out faithfully. More specifically, an expert researcher (who had already administered the training in classrooms) trained teachers in four teacher-training sessions. We scheduled the first two teacher-training sessions the week before the beginning of the classroom-training program. The last two teacher-training sessions were run during the implementation phase. This was crucial and helped us to monitor the fulfillment of the program. Specifically, we scheduled the third –teacher-training session between the first and the second classroom-training sessions and the fourth teacher-training session between the third and the fourth classroom-training session. During the first teacher-training session, the researcher explained teachers the structure of the program, the modality of delivering it, and teachers started to familiarize with the materials. In the second teacher-training session, the researchers instructed teachers how to realize the first classroom-training session. In the third teacher-training session, teachers were given instructions on the second and the third classroom-training sessions. In the fourth teacher-training session, the content of the final classroom-training session was explained to teachers. During these meetings, teachers were free to ask as many questions as they needed and they were encouraged to discuss any doubts about the content of the training and its delivering strategies. In order to guarantee a correct

and homogeneous implementation of the training program, the researcher provided teachers with written guidelines (Flay et al., 2005; Kratochwill & Steele Shernoff, 2004) containing instructions and scripts about group discussions. Specifically, these guidelines contained information about: i) the content of each training session, ii) the strategies to implement the activities of the training program, iii) the input that teachers were supposed to give to students during group discussions, and iiiii) how much time they were supposed to allocate to each activity of the intervention (individual work, group discussions and language exercises).

Results

Descriptive statistics for control and focus variables in the two groups are shown in Table 2. Preliminary analyses showed that at pre-test the two groups did not show significant differences on age, $t(70) = 1.73, p = .088$; ToM, $t(70) = 0.84, p = .404$; socio-economic background, $t(70) = 0.84, p = .404$; verbal ability, $t(70) = 0.42, p = .678$; working memory, $t(70) = 1.29, p = .202$; and planning, $t(70) = 1.44, p = .16$. Results also showed there was a marginally significant difference in reading comprehension, with the control group outperforming the experimental one, $t(70) = 1.96, p = .054, d = 0.46, 95\% \text{ CI} [-1.89, 0.02]$. For this reason, in subsequent analyses, we controlled for reading comprehension scores.

In order to investigate the efficacy of the training, we conducted a mixed ANCOVA on the Strange Stories scores with time (pre-test score, post-test score and follow-up score) as the within-subjects factor, training group (ToM and control) as the between-subjects factor, and reading comprehension as the covariate. Results showed a significant main effect of training group, $F(1, 69) = 7.58, p = .008, \text{ partial } \eta^2 = .10$. There was also a significant time by group interaction, $F(2, 139) = 5.58, p = .005, \text{ partial } \eta^2 = .08$. Pairwise contrasts (applying a Bonferroni correction for multiple comparisons) revealed significant improvements in both the experimental, $p < .001, d = 1.38, 95\% \text{ CI} [2.10, 3.60]$, and the control condition, $p < .001, d = 0.58, 95\% \text{ CI} [0.56, 1.98]$, between pre- and post-test. Improvements between pre-test

and follow-up were significant for both the experimental condition, $p < .001$, $d = 1.28$, 95% CI [1.75, 3.59], and the control condition, $p < .001$, $d = 0.90$, 95% CI [1.06, 2.80]. No significant differences were found between post-test and follow-up scores in either group, $p \geq .124$. As shown in Figure 1, despite at pre-test groups did not significantly differ, $p = .345$, the ToM group outperformed the control one at post-test, $p < .001$, $d = 0.79$, 95% CI [0.96, 3.16], and at follow-up, $p = .028$, $d = 0.42$, 95% CI [0.14, 2.28].

These results are not due to a small number of outliers. When the 6 children in the experimental group, who had the highest gain scores from pre-test to post-test, were excluded (removing the top 18% of the group), we still found a significant greater gain from pre-test to post-test in the ToM group than in the control group, $t(64) = 2.22$, $p = .030$, $d = 0.58$, 95% CI [0.09, 1.79].

We were also interested in investigating the amount of variance in ToM at post-test and at follow-up explained by the training condition, over and above children's performances on the pre-test and on the control variables. Therefore, we ran two hierarchical regression analyses. At Step 1 we entered performance at pre-test on the key variable and on the control variables. At Step 2 we entered the type of training as a dummy variable. Results showed that training condition explained, respectively, 9.7% and 4.3% of the variance at post-test and at follow-up, $\Delta F(1, 64) = 15.21$, $p < .001$, $\Delta F(1, 64) = 4.36$, $p = .041$.

Note that there were no significant differences in the amount of gains (i.e., post-test minus pre-test) between the two classrooms that got the ToM training program, $t(32) = 0.27$, $p = .786$, and between the two classes that got the control training program, $t(36) = 0.35$, $p = .730$, suggesting that the effect of the training (both of the ToM and of the control one) did not depend on the teacher delivering it.

Discussion

Following recent interest in ToM during the middle childhood (e.g., Devine & Hughes, 2015; Hughes, in press; Im-Bolter, Agostino, & Owens-Jaffray, 2016), the present study examined ToM in children attending primary school. It examined whether a ToM training program, based on conversations about mental states, can be effective under real-school-world conditions and, more specifically, if it can be translated in such a way that it becomes suitable for primary school teachers. We focused on teachers as they are a fundamental part of children's school-life, able to scaffold and support the socio-cognitive development of their pupils (Birch & Ladd, 1998; Hamre & Pianta, 2001). Our results indicate that children in the experimental group performed significantly better than those in the control group on the ToM task at both post-test and follow-up. This pattern of results is independent from children's performance at pre-test on ToM and control variables.

In addition of being experimentally relevant, these results are also interesting from a more theoretical point of view. Indeed, effective training program are a stringent way to test specific causal relations between children's experience during training and a later outcome measure. Accordingly, ToM training studies could shed light on the nature of the relations between ToM and language, executive function and social competence.

The Role of Teachers in Fostering Children's ToM

Results of the present study demonstrate that teachers can successfully promote their 8- to 9-year-old pupils' ToM development during their regular teaching hours. This result fits nicely with the theoretical models that posit the development of human understanding of mental phenomena in the interpersonal context (Carpendale & Lewis, 2004) and with data from experimental research showing that conversations about mental states at school predict children's ToM (Bianco et al., 2015; Lecce, Bianco, et al., 2014; Ornaghi et al., 2014). This is the first study that shows not only that conversations about the mind during primary-school lectures are meaningful for ToM understanding, but also that teachers can have a role in ToM

development. This result aligns with the Vygotskian perspective on socio-cognitive development (Fernyhough, 2008) and, more specifically, on the scaffolding role that the expert adult plays on pupil's ToM. Teachers can guide, through daily school interactions, his/her alumni towards a full management of complex social situations by packaging the alternative perspectives on reality, explicitly linking mental states to overt behavior, and drawing child's attention to mental states (Slaughter & Peterson, 2012).

Here it is also important to note that future research should investigate both the mechanisms underlying this positive effect and the variables able to moderate this effect. One interesting possibility is that a teaching style focused on making extensive use of mental-state reasoning and of mental-states conversations plays an important role for children's ToM development. Such a teaching style has already been showed to produce an increment in metacognition (Boekaerts, 1999) and significant links between ToM and metacognition have been found (Lecce et al., 2010). Another important issue regards teachers' ability to capitalize on the experience of our training program. As mentioned earlier on, in the present study, teachers were given pre-designed material, already structured and equipped with a (mental) script to follow. Whether teachers that took part to our experimental group will be able to take advantage of the mentalizing-teaching style learned during the program and to extend it to the materials they regularly use is still an open question.

Generally speaking, our pattern of results fits with the "pedagogical experience" hypothesis according to which ToM benefits from narrow socially organized activities such as schooling (Ratner, 1999; Wang, Devine, Wong, & Hughes, 2016) that is able to offer a series of learning activities focused on interpreting mental states.

ToM Enhancement as a Resource for Children's School Life

The strength of our findings is empowered by their applicative implications. School is an extremely challenging environment for children: it requires children to positively

engage in classroom activities, to build and maintain satisfying relationships with peers and teachers, and to meet academic requests (Ladd & Coleman, 1997; Perry & Weinstein, 1998). Failure in coping with these demands seems to increase the risk for psychological, interpersonal, and emotional problems (e.g., Roeser & Eccles, 1998; Parker & Asher, 1987), while being successful supports children's well-being and academic achievement (Ray & Elliott, 2006).

It is therefore important to note that the empowerment of ToM competence might provide teachers a platform to help their alumni to successfully deal with social and academic challenges of the school-context. Mature ToM skills, indeed, help children to better understand the teachers' criticism and this, in turn, promotes academic performance both in the short term (Lecce, et al., 2011) and in the long term (Lecce, Caputi, & Pagnin, 2014). Moreover, ToM seems to make children more aware of how the mind works during a cognitive task (Lecce et al., 2010; Lecce, Caputi, & Pagnin, 2015) and to be more socially competent (Slaughter, Imuta, Peterson, & Henry, 2015).

A core advantage of our ToM program is that the activities can be easily conveyed to the whole class body. Moreover, the ToM intervention we used seemed to have a similar effect across children. This is crucial, given that one of teacher's challenges is giving lectures that are effective and motivating to the whole class that is, by definition, not homogeneous (Kerry, 1984).

For all the reasons outlined in the previous paragraphs, the current study can be read as the first step of a new (hopefully) line of research aimed at translating ToM research into school life practices. Future studies should also investigate if, through the enhancement of ToM, teachers can affect children's more general level of social adjustment and academic results.

Caveats

Caution is warranted as our study has some limits. Firstly of all, we should mention that the semi randomization of the sample cannot guarantee for the exclusion of “class” confounding variables. However, as previous studies on the same training program have used a stringent randomized allocation of participants, this effect seems unlikely. Secondly, only four classes were involved in the present study, so that the recruitment of a larger sample is needed. Thirdly, it should be noted that, at a closer inspection, we found that the effects in this study were slightly smaller than the ones reported in a previous study where the ToM training program was delivered by researchers (Lecce, Bianco, et al., 2014)¹. This difference in the power of effects needs some attention and could be due to the differences in the age of participants. Whereas children involved in the present study attended Year 3 of primary school, children that took part in previous studies were a year older. Therefore it is possible that this ToM training program is more effective with slightly older children. It is also possible that a range of potential moderators are responsible for this heterogeneity in effects (Plewis, 2002). Between all, the actual level of implementation, and the commitment of the personnel delivering the program are likely to have had a role in moderating the outcomes of the program described here (Salmivalli, Kaukiainen, & Voeten, 2005). Indeed, although we paid specific attention to train teachers to the use of the training program, we did not include any measures of protocol fidelity and therefore future research should encompass rigorous control measures for how the training program is actually conveyed.

To conclude, findings from the current work extend research on the role that teachers play in promoting socio-emotional growth of their alumni (for a review see Greenberg et al.,

¹ In the study by Lecce and colleagues (2014), training condition accounts for 23% of variance in ToM performance (post-test), while in the present study training condition accounts for 9.7% .

2003). The present work should also be considered as one of the first answers to the following crucial question recently posed by Claire Hughes in a high-acclaimed book on socio-cognitive understanding: “how might schooling help children progress towards a mature understanding of mind?” (Hughes, 2011).

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CAN TEACHERS FOSTER CHILDREN'S ToM?

Table 1

Gender and Teaching Experience of the Participating Teachers

Condition	Teacher	Gender	Weekly hours of lecturing (target class)	Years of teaching experience (in total)	Years of teaching experience (with the target class)
ToM condition	Teacher n° 1	Female	18	33	3
	Teacher n° 2	Female	8	33	2
Control condition	Teacher n° 3	Female	18	32	3
	Teacher n° 4	Female	16	31	3

Table 2

Descriptive Statistics on All Study Measures

	ToM group (N = 34)	Control group (N = 38)
Pre-test age in months	103.21 (4.8)	104.95 (3.7)
Socio-economic background (0-9)	5.88 (1.7)	6.24 (1.9)
Verbal ability (0-64)	24.44 (6.0)	24.97 (5.0)
Reading comprehension (0-10)	8.62 (2.3)	9.55 (2.7)
Planning (0-7)	2.79 (2.3)	3.55 (2.2)
Working memory (0-7)	2.09 (0.9)	2.37 (1.0)
Pre-test ToM - Strange Stories (0-12)	6.09 (1.9)	5.68 (2.1)
Post-test ToM – Strange Stories (0-12)	8.85 (2.1)	7.03 (2.5)
Follow-up ToM – Strange Stories (0-12)	8.65 (2.1)	7.71 (2.4)
Gains in ToM from pre-test to post-test	2.76 (1.5)	1.34 (2.0)
Gains in ToM from pre-test to follow-up	2.56 (2.1)	2.03 (2.2)

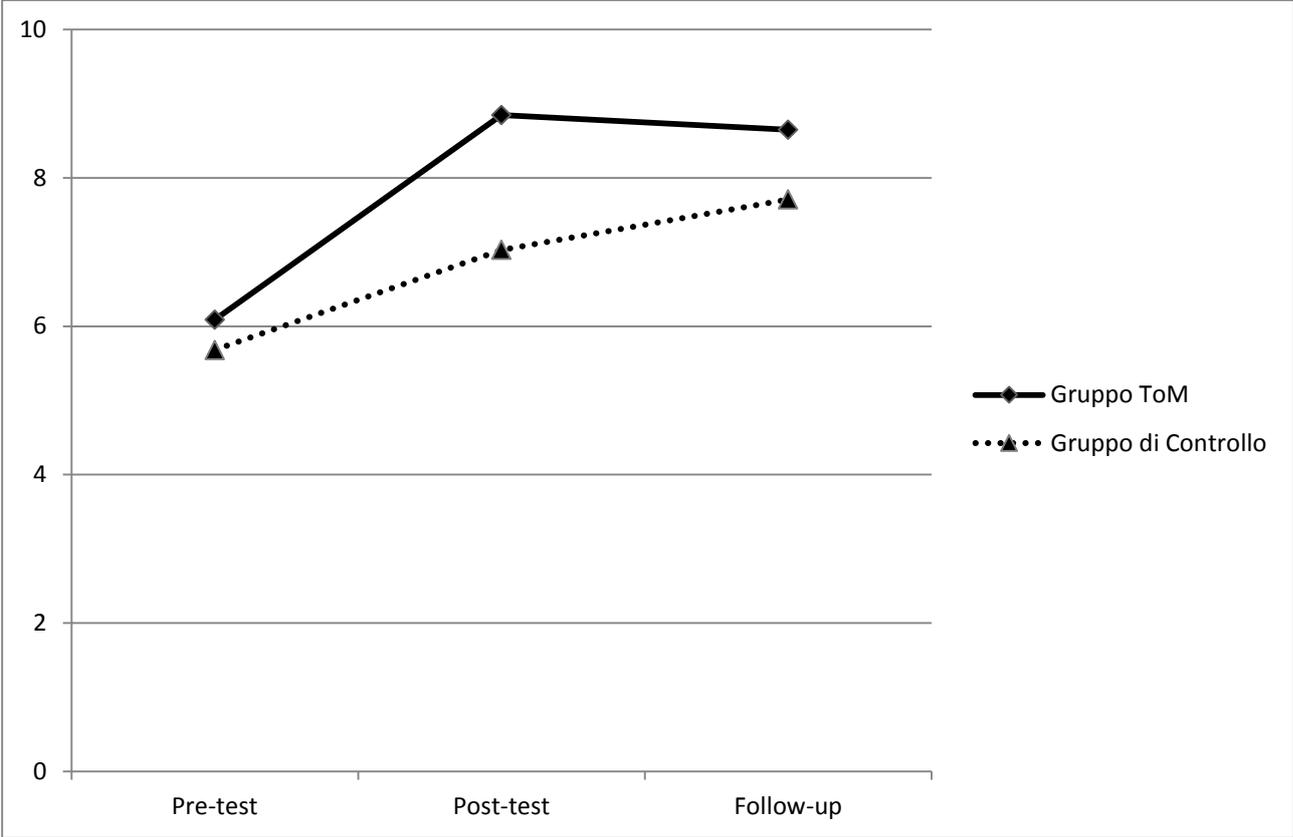
CAN TEACHERS FOSTER CHILDREN'S ToM?

Figure captions

Figure 1. *Strange Stories Performance Across Time in Each Group*

CAN TEACHERS FOSTER CHILDREN'S ToM?

Figure 1.



Appendix A

Example item from the Strange Stories Task (White et al., 2009)

Double Bluff Story: During the war, the Red army captures a member of the Blue army. They want him to tell them where his army's tanks are; they know they are either by the sea or in the mountains. They know that the prisoner will not want to tell them, he will want to save his army, and so he will certainly lie to them. The prisoner is very brave and very clever, he will not let them find his tanks. The tanks are really in the mountains. Now when the other side asks him where his tanks are, he says, "They are in the mountains."

Question: "Why did the prisoner say that?"

2 points: reference to fact that other army will not believe and hence look in other place, reference to prisoner's realization that that's what they'll do, or reference to double bluff

1 point: reference to outcome (e.g., to save his army's tanks) or to mislead them

0 points: reference to motivation that misses the point of double bluff (e.g., he was scared)

Note. From "Revisiting the Strange Stories: Revealing Mentalizing Impairments in Autism", by

White et al. (2009), *Child Development*, 80, p.110.

Appendix B

Script of Training Procedures for Each Condition

ToM condition: example of misunderstanding. Researchers' comments are given in Italics

<i>Story</i>	<i>Questions</i>	<i>Feedback examples for each question</i>	<i>Conversation onset provided by experimenter</i>	<i>Language Exercise</i>
<p><i>It is evening time, and Robin is taking a bag of rubbish outside to put in the bin. Suddenly he sees his neighbor's cat running away. He thinks to run after it in order to return it to his old neighbor. Luckily he manages to catch the cat. At that moment, his neighbor opens the door and glimpses her cat struggling in the arms of a boy. She has left her glasses in the dining room, so she can't see well. She starts to shout: " Help me! Stop the cat thief!"</i></p>	<p><i>- What was Robin intending to do?</i></p>	<p><i>-Right!/ No, actually Robin didn't want to steal the cat. He wanted to do a good deed. He wanted to return it to the neighbor.</i></p>	<p><i>Right! If Robin did what you said, the woman would stop shouting. She would recognize Robin and understand his good intentions about returning her cat. So she would change her point of view. Indeed people's beliefs can change, for example, when people understand that their ideas are wrong or that they have not got enough information in order to understand well. People can act or say things in order to change other people's wrong beliefs. In this way they can solve misunderstandings, just as Robin would do if he made his neighbour recognize him and he explained to her that he wanted to return the cat.</i></p> <p><i>Imagine a misunderstanding episode similar to Robin's story. Describe it, explaining</i></p>	<p><i>What is in your opinion the meaning of this sentence in the story? "...he <u>thinks</u> to run after it...":</i></p>
	<p><i>- Why does the neighbour start to shout "Help me! Stop the thief!"?</i></p>	<p><i>-Well done!/ No, actually she shouts because she thinks he wants to steal her cat. She has misunderstood the situation. She has not understood Robin's good intentions.</i></p>		<p><i>-he <u>imagines</u> to run after it</i></p>
	<p><i>- What does Robin think about the neighbour's behavior?</i></p>	<p><i>-Right!/ No, actually Robin imagines that the old woman didn't understand what had happened because she forgot her glasses.</i></p>		<p><i>-he <u>decides</u> to run after it*</i></p>
	<p><i>- Can Robin say or do something in order to stop his neighbour's shouts? What? If he does this, why would the old woman stop shouting?</i></p>	<p><i>-You're right! / No, actually he could make his neighbor recognize him and explain that the cat was escaping and that he thought to run after it in order to return it. By doing this, the elderly woman would modify her point of view. She would realize her misunderstanding and she</i></p>	<p><i>-he <u>believes</u> to run after it</i></p> <p><i>- he <u>understands</u> to run after it</i></p>	

		would understand what really happened.	what would you do in that situation in order to solve it.	
<i>Control condition. Researchers' comments are given in Italics</i>				
Story	Questions	Feedback examples for each question	Conversation onset provided by experimenter	Language Exercise
<p><i>Today is Friday. Teachers are giving some homework to their students for the weekend. Sarah always writes all her homework in her diary. During English class the teacher gives homework to the children and Sarah writes it in her diary. Then, students go to the Art room. There, the teacher says: "Write down that you must draw a picture of your family with crayons by next Monday". After Art class they go to the gym and then to Computer Lab. When the computer class teacher gives homework, Sarah can't write it down because she can't find her diary. So she tells the teacher. The teacher looks for the diary in the Art room and in the gym, but not in the English classroom.</i></p>	<p><i>- What does Sarah do when teachers give homework?</i></p>	<p><i>-Ok/No, actually she writes the homework down in her diary.</i></p>	<p><i>Sometimes people are very busy and they can accidentally leave an object somewhere. Later, when they need that object, they can't find it. So they can look for it starting in the last place in which they used it.</i></p> <p><i>Have you ever lost an object? How did you go about finding it? Tell your classmates about it.</i></p>	<p><i>What is in your opinion the meaning of this sentence in the story? "teachers <u>give</u> homework":</i></p>
	<p><i>- Are Sarah and her classmates always in the same place? If no, where do they go? (List the places in the right order)</i></p>	<p><i>-Right answer!/No actually, they went to different places. They were in the English classroom first, then they went to the Art room, then to the gym and finally to the Computer Lab.</i></p>		<p><i>- teachers <u>do</u> homework</i></p> <p><i>- teachers <u>set</u> homework *</i></p>
	<p><i>- In which places did Sarah use the diary?</i></p>	<p><i>-Well done! No actually Sarah used the diary in the English classroom and in the Art room.</i></p>		<p><i>- teachers <u>check</u> homework</i></p> <p><i>- teachers <u>have</u> homework</i></p>
	<p><i>- Why does the teacher look for the diary in Art room and in the gym, but not in the English classroom?</i></p>	<p><i>-You're right! The teacher doesn't look for the diary in the English classroom because Sarah didn't leave her diary there. She used it in the next place she went, that is the Art room. She left her diary in the Art room or in the gym.</i></p>		

Note. From "Promoting theory of mind in middle childhood: A training program", by Lecce et al. (2014), Journal of Experimental Child Psychology, 126, p. 63.