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ORIGINAL ARTICLE

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Mind what teacher says: Teachers' propensity for mental-state language and children's theory of mind in middle childhood

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Abstract

This study examined the link between theory of mind (ToM) in middle childhood and teachers' propensity for mental-state language and self-reported conversational-instruction strategies. Multilevel analyses on 430 Italian children (221 girls, M_{age} = 9.34 years, SD = .63, Range: 7.95–11.43 years) from 27 primary-school classrooms and their teachers showed that: (i) there were striking between-classroom differences in children's ToM; (ii) teachers' propensity for mental-state language ($\beta = .14$) and self-reported conversational-instruction strategies ($\beta = .16$) were uniquely associated with pupils' ToM even when child-related (i.e., age, verbal ability, number of siblings and SES) and teacher-related variables (i.e., ToM, verbal ability and years of experience) were controlled; and (iii) the association between self-reported conversational-instruction strategies and ToM was significant in older children and smaller classrooms. These findings extend socio-cultural accounts of ToM by showing a developmental continuity of environmental effects on children's ToM.

KEYWORDS
instructions strategies, mental-state conversations, middle childhood, teachers' classroom interactions, theory of mind

1 | INTRODUCTION

The ability to tune into others' thoughts, desires and emotions, called 'theory of mind' (ToM), has intrigued developmental scientists for more than four decades. Over the past decade, researchers have demonstrated continued age-related growth (e.g., Devine & Hughes, 2013; Lecce et al., 2017; Osterhaus et al., 2016) and marked individual differences in ToM in middle childhood (e.g., Devine et al., 2016; Lecce et al., 2010). There is therefore a need to understand the factors that influence developmental and individual differences in ToM in middle childhood (6–12 years of age). Socio-cultural accounts of ToM posit that social interactions are necessary for understanding of others' minds (Heyes & Frith, 2014). The over-arching aim of the current study was to extend socio-cultural accounts of ToM by examining the link between children's classroom context and individual differences in ToM in middle childhood. We investigated the role that classroom teachers, rather than parents, play in shaping children's ToM beyond the preschool years by examining the relations between teachers' self-reported classroom interactions, teachers' mental-state language, conversational-instruction strategies and children's ToM.

Interactions rich in mental-state language and discourse that prompts consideration of others' perspectives represent important mechanisms linking social experience and individual differences in ToM. Research testing socio-cultural accounts of ToM has focused largely on family context such that it is not clear whether social interactions outside the family and beyond early childhood are related to children's ToM (e.g., Devine & Hughes, 2018). Extending the developmental focus of ToM research provides an opportunity to examine: a) whether social experiences continue to impact on children's ToM after its initial emergence and b) the extent to which social experiences outside the family influence children's ToM. It also provides practitioners with potential tools to support children's ToM in the school settings.

1.1 | Teachers' mental-state language and children's theory of mind

Observational studies, based largely on data from preschool settings, show that teachers vary in mental-state language and references to different perspectives during conversations with their pupils (e.g., Andrews et al., 2020). This variability predicts gains in preschool children's positive engagement with teachers (Alamos & Williford, 2020) and is associated with classroom quality, including positive climate and teachers' sensitivity (King & LeParo, 2015). Emerging evidence indicates that teachers' use of mental-state language may be linked with children's ToM. Andrews et al. (2020) compared teachers' and mothers' use of mental-state language during separate dyadic conversations about the past and about the future with 2- to 5-year-old children. Although teachers used more mental-state language than mothers, pre-schoolers' mental-state language was more strongly related to mothers' mental-state language than to teachers' one. Mata Lopez et al. (2020) examined the association between children's ToM and both parents' and teachers' mental-state language in the context of separate shared storybook reading sessions with preschool children. Children's ToM was positively associated with both parents' and teachers' use of mental-state language. However, teachers' mental-state language was associated with children's ToM only among children whose parents frequently used mental-state language. These studies indicate that teachers' mental-state language is linked to preschoolers' emerging ToM. It remains unclear whether teachers' mental-state language continues to shape children's ToM in school years.

Our first aim was to examine the association between teachers' mental-state language and primary school children's ToM. Building on previous research (Peterson & Slaughter, 2003; Ruffman et al., 1999), we asked teachers to respond to short vignettes to assess their spontaneous use of mental-state language. Offline measures of parental mental state language based on short vignettes are strongly correlated with online parental use of mental-state language during picture book interactions (Slaughter & Peterson, 2012) suggesting that offline measures provide insight into the actual use of mental-state language. Furthermore, a recent meta-analysis indicated that associations between parents' mental state language and children's ToM do not differ depending on whether mental-state language was assessed using online observational measures or offline measures (Tompkins et al., 2018).

1.2 | Teachers' conversational-instruction strategies and theory of mind

The present study also focused on teachers' self-reported conversational-instruction strategies as a possible means through which teachers affect their pupils' ToM. Asking open-ended questions prompts children to explain their own thinking, promotes sharing ideas (i.e., dialogic teaching), and fosters knowledge and understanding (e.g., Muhonen et al., 2016). Through dialogue, teachers scaffold students' peer group interactions to create opportunities for conceptual development (Littleton & Mercer, 2010). Conversation has been identified as a crucible for ToM development (Nelson, 2007). According to socio-cultural accounts, teachers' conversational-instruction strategies constitute a rich context for helping children to reflect on the differences between others' and their own states of mind, helping them to develop a mature understanding of others' minds.

Emerging evidence points to a link between participation in conversations and ToM in middle childhood. Training studies demonstrate that conversation-based interventions improve children's ToM (e.g., Bianco & Lecce, 2016; Lecce et al., 2014). Teachers can promote pupils' metacognition through group conversation (Lai, 2011) and metacognition is associated with ToM (Lecce et al., 2015). Our second aim was therefore to examine whether teachers' use of strategies to foster classroom conversation was associated with pupils' ToM. We used an offline self-report measure of conversational-instruction strategies. Self-report measures are a cost effective and flexible procedure for monitoring classroom instruction and much less time consuming than direct observations. Previous research indicates that there are significant associations between teachers' self-reported behaviours and observed classroom behaviours suggesting that focused teacher self-reports yield reliable data on instructional practices (Koziol & Burns, 1986; Newfield, 1980).

1.3 | Correlates and moderators of the association between teachers' classroom interactions and pupils' theory of mind

Associations between teachers' classroom interactions and pupils' ToM might be explained by child-related characteristics associated with individual differences in ToM. Individual differences in ToM performance in middle childhood are positively and moderately correlated with age (e.g., Devine & Hughes, 2016), receptive vocabulary (see Lecce et al., 2021 for a review), and positively and modestly correlated with socio-economic status (SES) and number of siblings (see Foley & Hughes, 2021 for a review). We included measures of these covariates to examine the unique associations between teachers' reported classroom interactions and pupils' ToM. Observed associations between teachers' mental-state language, conversational-instruction strategies, and pupils' ToM may also be due to more general teacher-related characteristics (e.g., years of experience, teachers' verbal ability, teachers' ToM). Teachers' own ToM may be a foundational aspect of teaching (Strauss & Ziv, 2012). Therefore, any association between teachers' classroom interactions and pupils' ToM may reflect teachers' own ToM capacity or teachers' verbal ability. However, recent work showed that although parents' mental-state language was not associated with parents' ToM performance, parental mental-state language (and not ToM) predicted preschool children's ToM (Devine & Hughes, 2019). With regard to teaching experience, variation in teachers' professional qualifications and years of practice have been linked with teachers' use of mental-state language (Andrews et al., 2020) and conversational-instruction strategies (Cabel et al., 2015). If teachers' mental-state language and conversational-instruction strategies both support children's ToM, then differences between teachers in these two aspects of classroom interactions will show unique associations with children's ToM.

Several factors may moderate detected links between teachers' classroom interactions and children's ToM. We focused on class size, contact hours per week and children's age. Within smaller primary-school classrooms students receive more individualized attention than within larger classrooms (Hunn-Sannito et al., 2001). Moreover, classroom size is negatively associated with frequency of teachers' conversational-instruction strategies (e.g., asking activity-relevant questions) (Frampton et al., 2009). Children may therefore have more opportunities to participate

in conversations in smaller classrooms. Alternatively, children may have more opportunities to access others' mental states and multiple perspectives in larger classrooms. It is also possible that the duration of exposure to a particular teacher might moderate the association between teachers' classroom interactions and children's ToM. If so, then associations between teacher measures and children's ToM will be stronger when teachers have more hours of contact per week with pupils and stronger among older children, as children in Italian schools keep the same teacher over the five years of primary school. Our third aim was to examine the uniqueness and potential moderators of associations between teachers' propensity for mental-state language, self-reported preference for conversational-instruction strategies, and children's ToM.

1.4 | Summary of aims

Our overall aim was to examine the associations between children's ToM and teachers' (1) propensity for mental-state language, and (2) self-reported preference for conversational-instruction strategies. On the basis of existing research, we expected to find associations between individual differences in teachers' classroom interactions (both propensity for mental-state language and self-reported preference for conversational-instruction strategies) and children's ToM. We also examined the uniqueness of these relations, as well as potential moderators. To test uniqueness, we controlled for a number of pupil-related variables (i.e., age, verbal ability, number of siblings and SES) and teacher-related variables (i.e., ToM, verbal ability and years of experience). We tested moderating effect of structural indicators of the classroom context (i.e., teaching hours per week and class-size) and children's age.

Given the hierarchical structure of our data (i.e., pupils nested within classrooms) we used Multilevel Linear Modelling (MLM). This approach partitions the variance of the outcome variable (i.e., children's ToM) into within- and between-classroom components and models these simultaneously. Within-classroom variance in ToM reflects variation in ToM scores across children. Between-classroom variance in ToM reflects variation in ToM mean scores across classrooms. By partitioning the variance in children's ToM into these two components, MLM allowed us to evaluate the proportion of between-classroom variance explained by specific features of the shared classroom context (i.e., teachers' propensity for mental-state language and self-reported preference for conversational-instruction strategies), over and above individual differences across pupils (i.e., within-classroom variance).

2 | METHOD

2.1 | Participants

Thirty-three primary school classes (633 children) in Northern Italy were initially recruited. Of these 33 classes, six (85 children in total) were excluded from the final sample because: (i) pupils' participation rate was poor (i.e., < 50%) (one class), or (ii) the main teacher was not available to participate in the study (five classes). The remaining 27 classes were attended by 549 children in total. Classroom size ranged from 5 to 28 pupils ($M = 20.33$, $SD = 5.11$). Of these 549 children, 119 (21.2% per class on average) did not meet the inclusion criteria: fluent Italian speaker with no history of developmental disorder. The final sample, therefore, consisted of 430 Italian children (209 boys and 221 girls, $M_{age} = 9.34$, $SD = .63$, range = 7.95–11.43 years) from 27 primary school classrooms and their main classroom teachers. One hundred twenty-five children (i.e., 7 classes) were in Year 3 (age range = 7.95–9.33), 255 children (i.e., 16 classes) were in Year 4 (age range = 8.67–10.45) and 50 children (i.e., 4 classes) were in Year 5 (age range = 9.93–11.43) of the Italian school system. The majority of children (77%) were categorized as 'high affluence', 22% as 'middle affluence' and 1% as 'low affluence' (Currie et al., 2008). One quarter (24%) of the children were singletons, 55% had one sibling, 16% had two siblings, and 5% had three or more siblings. Some data were missing for children's verbal

ability (N = 2, .5%) and socioeconomic status (N = 3, .7%) measures. A full information maximum likelihood (FIML) estimation approach was adopted in our analyses.

The 27 classrooms belonged to six different primary schools. All teachers were the main classroom teacher and their teaching subject was *Literacy*. Teachers were all female; they reported their ages as being between 36 and 66 years (M_{age} = 52.27, SD = 7.70) and their teaching experience as being between 11 and 53 years (M_{exp} = 28.37, SD = 9.63). One teacher (the one who reported 53 years of teaching experience) did not report her age. There were no missing data on any of the other teacher variables. All the teachers had an Advanced level education, with 11% having also a degree level education. Except for one teacher, who met her pupils 2 years before the beginning of the data collection, all the teachers knew their pupils because their 1st year of primary school. Teachers spent 17.37 hr per week working with the participating classroom (SD = 3.94, range = 10–22 hr).

2.2 | Procedure

Written parental informed consent together with the child's own verbal assent to participate in the study were obtained. Children's ToM, verbal ability and SES were collected using the same tasks and procedure across all participants. Children belonging to three Year-4 classrooms completed a slightly different version of the verbal ability task (see the measures section for more details). Tasks were administered collectively in a whole-class testing session, with children completing their response booklets independently. One researcher introduced the tasks. A second researcher was present to ensure that all participants understood the instructions.

Teachers were tested in small-groups (i.e., 2–4 participants) after their teaching hours in a room located in the school building. They completed: two advanced ToM tasks, a vocabulary test, two questionnaires to gather information about teachers' propensity for mental-state language with pupils and their preference for conversational-instruction strategies, respectively, and a demographic questionnaire to obtain information about their age, level of education, number of years because they met their pupils, and time spent teaching in the participating classroom per week.

2.3 | Measures

2.3.1 | Children's socioeconomic status

The Family Affluence Scale (Currie et al., 2008) consists of four questions about material possessions at home and so provides a child-friendly index of material deprivation. Responses to the four items were summed and scores ranged from 0 to 9 (for scoring procedure, see Currie et al., 2008).

2.3.2 | Children's verbal ability

Children completed the Italian version of the vocabulary subtest of the Primary Mental Abilities (PMA) test (Rubini & Rossi, 1982; Thurstone & Thurstone, 1962). Participants selected the synonym of 30 target words by choosing one out of 4 alternatives (range 0–30). Three classes completed the Intermediate Form of the PMA vocabulary test (Thurstone & Thurstone, 1962). Children had to find the synonym of 50 target words, choosing among five alternatives (Range 0–50). In order to compensate for the difference in the number of items and in the degree of difficulty between the two versions of the PMA task used, we standardized children's scores within each year group. Reliability coefficients, measured using the Kuder-Richardson Formula 20 (Kuder & Richardson, 1937), were .93 for the 30 items version and .80 for the 50 items version of the task.

2.3.3 | Children's theory of mind

Children completed four stories (one double bluff, two misunderstandings and one persuasion) from the Strange Stories task (White et al., 2009). Each story was followed by an open question requiring participants to explain the reasons behind the main character's behaviour. Written responses were coded using a 3-point scale indicating full (2), partial (1) or failed (0) understanding of the mental state underlying the main character's behaviour (see the Appendix for an example). Interrater agreement (based on double-coding of 25% of the responses) was good (Cohen's K = .90). Total scores ranged from 0 to 8. Confirmatory Factor Analysis (CFA) using a mean- and variance-adjusted weighted least square (WLSMV) estimator, in which the four items were permitted to load onto a single latent factor provided a good fit to the data, $\chi^2(2) = 4.19$, $p = .12$, CFI = .98, TLI = .94, RMSEA = .051. All the items loaded significantly onto the latent factor with standardized loadings ≥ .51, $ps \leq .001$. The scale reliability score was .60.

2.3.4 | Teachers' verbal ability and theory of mind

Teachers completed the vocabulary subtest of the Primary Mental Abilities–Intermediate Form (PMA; Thurstone & Thurstone, 1962) as an index of verbal ability. They identified a synonym for 50 target words, choosing among five alternatives (Range 0–50).

Teachers completed the Triangles task (Castelli et al., 2000) and the Silent Film task (Devine & Hughes, 2013, 2016) to capture ToM skills. In the Triangles task, teachers described what happened in three short clips animations involving two cartoon triangles depicting instances of encouraging, teasing and surprising. Responses were coded for intentionality on a scale ranging from 0 to 5 (i.e., the degree to which teachers described the behaviour exhibited by the triangles as deliberate; Castelli et al., 2000). Interrater agreement (based on double-coding all the responses) was good (Cohen's K = .85). Total scores could range between 0 and 15 (actual range 5–15). The Triangle task scores were normally distributed, with only one teacher reaching the maximum score (i.e., 15/15). In the Silent Film task (Devine & Hughes, 2013, 2016), teachers answered six questions about a character's behaviour in five short clips from a classic silent film depicting instances of mistaken belief, deception and mistaken identity. Participants' responses received a score of 0 (incorrect), 1 (partial credit) or 2 (fully correct; Devine & Hughes, 2013). Interrater agreement (based on double-coding all the responses) was good (Cohen's K = .95). Total scores could range between 0 and 12 (actual range 2–12). Scores were negatively skewed ($S = -1.51$, $SE = -.45$) with a median of 10 and IQR of 2.5 (i.e., 8.5–11). Only one teacher reached the maximum score (i.e., 12/12). Teachers' scores on the Triangle and the Silent Films tasks were highly intercorrelated, $r = .62$, $p \leq .001$. We constructed an aggregate measure of teacher's ToM by summing the standardized scores of each task (Devine & Hughes, 2019).

2.3.5 | Teachers' propensity to use mental-state language

Teachers recorded what they would do or say to their pupils in five disciplinary situations (i.e., lying, teasing, stealing, shouting and damaging) using an offline measure developed by Ruffman et al. (1999) to capture individual differences in propensity to use mental-state language. Responses were coded using a 3-point scale reflecting the degree to which teachers used mental-state language to deal with a specific disciplinary situation. Two points were given to those answers in which the teacher made explicit reference to the child's, victim's or classmate's mental states (e.g., I would discuss the situation with the whole class in order to highlight classmates' positive and negative thoughts). One point was given to those responses that showed interest in the child's point of view (or mental state) but that were ambiguous as to whether they reflected explicit conversations about mental states (e.g., I tried to understand the child motives). Zero points were given if the teacher simply reprimanded the child without discussing the situation (e.g., I

told the child to give the object back or to apologise) or engaged pupils in general discussion about the situation referring to rules instead of mental states (e.g., I would talk about the importance of respecting others' belongings). Total scores could range from 0 to 10. Descriptive analyses conducted on data from the 27 teachers in the current study combined with data from a pilot study including 46 primary school teachers (total N = 73) showed that, over the five disciplinary situations the percentage of teachers producing an explicit mental-state response (i.e., 2-points) ranged from 15% (i.e., damaging) to 44% (i.e., teasing) and the percentage of teachers who reprimanded the child or used general discussion about rules (i.e., 0-points) ranged from 36% (i.e., teasing) to 65% (i.e., damaging). Internal consistency among the five disciplinary situations, measured using Ordinal α, was .63.

2.3.6 | Teachers' self-reported preference for conversational instruction strategies

Teachers rated (on a 0-to-10-point scale) the importance they placed on (1) classroom debates comparing pupils' points of view, and (2) pupils listening to peers' answers before listening to the correct answer provided by the teacher. Teachers reported on how often they used teamworking activities and group conversations on a 5-point scale (i.e., *Never*, *Once*, *Every 15 days*, *Once a week*, *More than once a week*). Teachers' scores on the two sets of questions were significantly correlated, $r = .48$. We constructed an overall index reflecting teachers' preference for conversational-instruction strategies by summing the standardized scores for each question. Internal consistency was good (Cronbach's $\alpha = .71$).

2.4 | Analyses plan

We used MLM to investigate whether features of the shared classroom context (i.e., teachers' propensity for mental-state language and self-reported preference for conversational-instruction strategies) explained unique variation in children's ToM. We specified a two-level hierarchical structure for our regression equation in which children represented the lower level of analysis (level 1) and classrooms represented the upper-level clustering variable (level 2). In the first step, we ran a Random Intercepts Only model in which we only included the outcome variable (i.e., children's ToM) and allowed the intercept (i.e., ToM mean) to vary across classrooms. This model permits to partition the variance of the outcome variable into within- and between-classroom components and to estimate the percentage of total variance in children's ToM scores that was attributable to the belonging to a particular classroom (i.e., Intraclass Correlation Coefficient–ICC). This first model indicated whether there was significant variation in mean-level ToM scores across classrooms.

In the second step, we tested a Random Intercept Within-classroom model, in which we included child-level variables (i.e., children's age, verbal ability, number of siblings and SES) as predictors of ToM. At this second step, children were the units of analysis and within-classroom variation in ToM was modelled. At this step, associations among individual differences in children's ToM and those in age, verbal ability, number of siblings and SES were tested.

In the third and final step, we tested whether the between-classroom variance in children's ToM was associated with features of the shared classroom context using a Random Intercept Between-classroom model in which we included teacher-level variables as predictors in our model (i.e., teachers' ToM, propensity for mental-state language and self-reported preference for conversational-instruction strategies). Teachers' verbal ability, years of experience, number of teaching hours per week and class-size were also included at this step as control variables. At this third step, the effect of teachers' characteristics on pupils' ToM was tested.

We adopted a nested model comparison approach based on the *deviance* (Hox, 2010). Models with a lower *deviance* fit better than models with a higher deviance. The difference between deviances for two nested models can be tested using a chi-square test, with degrees of freedom equal to the difference in the number of parameters estimated in

TABLE 1 Descriptive statistics and zero-order correlations for children-related variables

	M (SD)	Min - Max	2	3	4	5
1. C_Age	9.34 (.63)	7.95–11.43	−.04	.06	.16**	.03
2. C_SES	6.59 (1.57)	1–9	–	.17**	.07	−.18**
3. C_VA	.02 (1.00)	−6.57–2.20		–	.28**	−.08*
4. C_ToM	4.20 (1.79)	0–8			–	−.05
5. C_Sib	1.03 (.86)	0–6				–

Note. C_Age, Children's age; C_SES, Children's socioeconomic status; C_VA, Children's verbal ability; C_ToM, Children's ToM; C_Sib, Number of children's siblings.
*$p \leq .10$.
**$p \leq .001$.

the two models (Hox, 2010). Where there are non-significant differences between two models, the simpler model is preferred.

Finally, we examined potential moderators. We examined whether the strength of the associations between teachers' propensity for mental-state language and/or self-reported preference for conversational-instruction strategies and children's ToM were equal at varying levels of structural indicators (i.e., teaching hours per week, class-size). We tested two Random Intercept Interaction models in which interaction terms between teacher-related variables and class-size (first model) or teaching hours per week (second model) were included as further predictors in the Random Intercept Between-Classroom model. These models were compared with the Random Intercept Between-Classroom model. We examined whether expected associations between teachers' propensity for mental-state language and/or self-reported conversational-instruction strategies and children's ToM were moderated by children's age. We tested a Random Slope Interaction model with a cross-level interaction between children's age and both teachers' propensity for mental-state language and self-reported conversational-instruction strategies. We permitted the coefficient of the association between children's age and children's ToM to vary across classroom (i.e., random slope). The Random Slope Interaction model was compared with the Random Intercept Between-Classroom model.

Multilevel models can be estimated using FML (Full Maximum Likelihood) or REML (Restricted Maximum Likelihood) estimators. REML does not permit model comparison (Field, 2009) but is preferable when the number of clusters (i.e., classrooms) is fewer than 30. When FML is used, as few as 15 clusters are sufficient to get unbiased fixed-effects point estimates for both level-1 and level-2 predictors (including cross-level interactions) but at least 30 clusters are required to obtain unbiased estimates of level-2 variance component and standard errors (McNeish & Stapleton, 2016). We used FML instead of REML to derive model parameters and compare models. We confirmed our results by estimating level-2 standard errors and variances using REML as a further analysis.

3 | RESULTS

3.1 | Descriptive statistics and correlations

Tables 1 and 2 show descriptive statistics and zero-order correlations for children and teachers variables, respectively.

3.2 | Multilevel analyses

Unstandardized parameter estimates, deviance statistics and intraclass correlation coefficients are presented in Table 3. Results of the Random Intercepts Only model (step 1) showed significant variation in random intercepts,

TABLE 2 Descriptive statistics and zero-order correlations for teachers-related variables

	M (SD)	Min - Max	2	3	4	5	6	7
1. Class-Size	20.33 (5.11)	5–28	.52**	−.05	−.14	.41*	−.05	.25
2. T_Hours	17.37 (3.94)	10–22	–	−.44*	−.01	.04	−.08	−.02
3. T_VA	45.48 (3.12)	38–50		–	.15	.05	.17	.05
4. T_Exp	28.37 (9.63)	11–53			–	−.40*	.10	−.31
5. T_ToM	–	−4.83–2.95				–	.15	.58**
6. T_MSL	3.15 (2.07)	0–8					–	.05
7. T_Conv	–	−4.57–1.92						–

Note. Class-Size, Number of pupils; T_Hours, Teaching hours per week; T_VA, Teacher's verbal ability; T_Exp, Teaching experience in years; T_ToM, Teacher's ToM; T_MSL, Teacher's propensity for mental-state language; T_Conv, Teacher's self-reported conversational-instruction strategies.

*$p \leq .05$.

**$p \leq .01$.

var(u0) = .31, $\chi^2(1) = 2.28$, $p < .05$, indicating that mean-level ToM scores varied across classrooms. Belonging to a particular class accounted for 9.7% of variation in children's ToM performance. These results were identical when estimated using REML instead of FML. Before testing the effect of teacher-related contextual variables, we estimated the Random Intercepts Within-classroom model (step 2). This model allowed us to account for the role of individual child characteristics known to be related with variation in ToM and likely to affect the classroom ToM mean. The deviance statistic decreased moving from the Random Intercepts Only (step 1) to the Random Intercepts Within-classroom (step 2) model, $\Delta\chi^2(4) = 57.5$, $p < .001$.

Children's ToM was associated with variation in age and verbal ability (but not SES and number of siblings). Marginal R^2 (variance explained by only fixed effects - Nakagawa & Schielzeth, 2013) indicated that child-related variables accounted for 9.1% of variation in their ToM. Mean-level ToM scores varied across classrooms after intercepts (i.e., classrooms' ToM means) were adjusted for variation in children's age, verbal ability, number of siblings and SES. After controlling for children's characteristics, belonging to a particular class still accounted for 8.3% (8.8% with the REML estimator) of the variance in children's ToM.

We next used a Random Intercepts Between-classroom model (step 3) to test whether between-classroom variance in ToM was explained by teacher-related contextual variables. The deviance statistic decreased moving from the Within-classroom (step 2) to the Between-classroom (step 3) model, $\Delta\chi^2(7) = 17$, $p < .05$. Teachers' propensity for mental-state language and self-reported preference for conversational-instruction strategies, but not teachers' ToM, uniquely accounted for significant between-classroom variation in children's ToM. These effects held when children's age, verbal ability, number of siblings and SES, as well as teachers' verbal ability, years of experience, teaching hours per week and class-size were considered. Teachers' propensity for mental-state language, $\beta = .14$, $p < .05$, and self-reported preference for conversational-instruction strategies, $\beta = .16$, $p < .05$, uniquely explained 3.8% (3.4 % with the REML estimator) of between-classroom variation in children's ToM. Conditional R^2 indicated that the Random Intercepts Between-classroom model accounted for 17.4% of variation in children's ToM. When the Random Intercepts Between-classroom model was tested using the REML instead of the FML estimator, the pattern of results did not change.

The deviance statistic decreased moving from the Random Intercepts Between-classroom model to the first Random Intercept Interaction model, which included interaction terms between class-size and both teacher propensity for mental-state language and self-reported preference for conversational-instruction strategies, $\Delta\chi^2(2) = 6.6$, $p < .05$. The number of pupils in the classroom moderated the association between teachers' preference for conversational-instruction strategies and children's ToM and, $\beta = -.11$, $p < .05$. The strength of association between teachers' self-reported preference for conversational-instruction strategies and children's ToM was stronger in smaller

TABLE 3 Intercept-only and nested models with explanatory variables

Model	M1: Intercept-only	M2: Within-classroom	M3: Between-classroom
Fixed part	Coefficient (s.e.)	Coefficient (s.e.)	Coefficient (s.e.)
Intercept	4.18 (.14)	.71 (1.7)	−4.11 (2.24)
Child-level variables			
C_Age		.36 (.17)*	.40 (.16)*
C_SES		.03 (.05)	.03 (.05)
C_VA		.46 (.08)***	.45 (.08)***
C_Sib		−.07 (.10)	−.08 (.09)
Classroom-level variables			
Class-Size			−.01 (.03)
T_Hours			.07 (.03)*
T_VA			.06 (.04)+
T_Exp			.01 (.01)
T_ToM			−.12 (.07)+
T_MSL			.12 (.05)*
T_Conv			.17 (.07)*
Random Part			
σ^2_e	2.88 (.20)	2.66 (.19)	2.65 (.19)
σ^2_{u0}	.31 (.14)	.24 (.12)	.05 (.06)
Model statistics			
Deviance	1701.7	1644.2	1627.2
ICC	.097	.083	.019
Marginal R^2	.000	.091	.158
Conditional R^2	.097	.167	.174

Note. C_Age, Children's age; C_SES, Children's socioeconomic status; C_VA, Children's verbal ability; C_Sib, Number of children's siblings; Class-Size, Number of pupils; T_Hours, Teaching hours per week; T_VA, Teacher's verbal ability; T_Exp, Teaching experience in years; T_ToM, Teacher's ToM; T_MSL, Teacher's propensity for mental-state language; T_Conv, Teacher's self-reported preference for conversational-instruction strategies. $^{+}p \leq .10$; $^{*}p \leq .05$; $^{**}p \leq .01$; $^{***}p \leq .001$.

classrooms. Simple slope analyses showed that teachers' self-reported preference for conversational-instruction strategies was associated with children's ToM in classrooms with fewer than 20 pupils (see Figure 1). When the number of pupils was 15 (1SD below the mean) the association was significant, $\beta = .27$, $p < .001$. The deviance statistic significantly decreased moving from the Random Intercepts Between-classroom model to the second Random Intercept Interaction model, which included teaching hours per week as a moderator of teacher effects, $\Delta\chi^2(2) = 6.7$, $p < .05$. Results of this model showed a negative interaction between teachers' use of mental-state language and number of hours spent with pupils in a week, $\beta = -.11$, $p < .05$. However, this interaction effect was not significant when the model was tested using the REML, $\beta = -.11$, $p = .14$.

The deviance statistic decreased moving from the Random Intercepts Between-classroom model to the Random Slope Interaction model examining the moderating role of age, $\Delta\chi^2(3) = 11.8$, $p < .01$. There was a significant cross-level interaction between children's age and teachers' self-reported preference for conversational-instruction strategies, $\beta = .17$, $p \leq .001$, indicating that the association between teachers' self-reported preference for

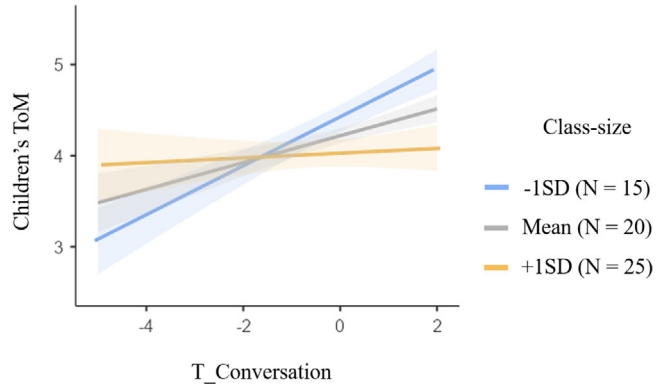

FIGURE 1 Association *between teachers' self-reported conversational-instruction strategies and children's ToM by level of class-size. Note.* Simple slopes of teachers' self-reported conversational-instruction strategies and children's ToM for children belonging to classroom of different sizes (i.e., number of pupils). Specifically, one standard deviation below the mean (i.e., 15 pupils), the mean (i.e., 20 pupils) and one standard deviation above the mean (i.e., 25 pupils). Shaped borders around regression lines represent standard errors

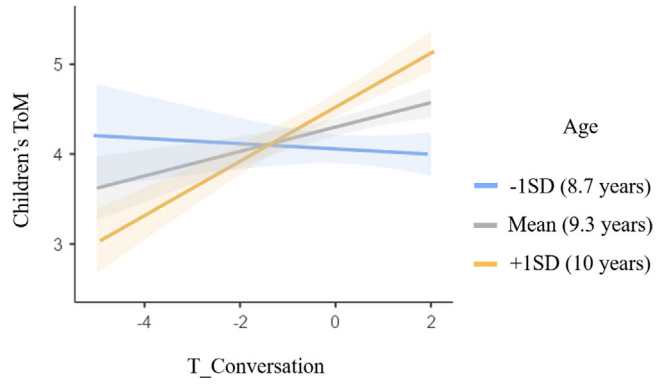

FIGURE 2 Association *between teachers' self-reported conversational-instruction strategies and children's ToM by level of children's age. Note.* Simple slopes of teachers' self-reported conversational-instruction strategies and children's ToM for children aged one standard deviation below the mean (i.e., corresponding to 8.7 years), at the mean (i.e., corresponding to 9.3 years) and one standard deviation above the mean (i.e., corresponding to 10 years). Shaped borders around regression lines represent standard errors

conversational-instruction strategies and children's ToM increases with age. This association was marginally significant for children aged 9.3 years, $\beta = .14$, $p = .07$ and significant for children aged 10, $\beta = .28$, $p < .001$ (see Figure 2).

4 | DISCUSSION

Multi-level models revealed three key results. First, even when differences in children's age, verbal ability and SES were considered, there were striking between-classroom differences in children's ToM. Second, both teachers' tendency to use mental-state language with pupils and teachers' preference for conversational-instruction strategies were associated with variation in pupils' ToM even when child- (i.e., age, verbal ability, number of siblings and SES) and teacher-related variables (i.e., ToM, verbal ability and years of experience) were controlled. Third, the association between teachers' self-reported preference for conversational-instruction strategies and ToM was stronger in older children and smaller classrooms.

The presence of between-classroom differences points to contextual influences on children's ToM. We showed that social experiences shape ToM beyond the initial emergence of false belief understanding in the preschool years. Our results are consistent with findings from teacher-led conversational interventions suggesting that enhancing teachers' use of mental-state conversations improves 9- and 10-year-old children's ToM (Bianco & Lecce, 2016). Through mental-state language and conversational-instruction strategies teachers have the opportunity to enhance dialogue (Muhonen et al., 2016), build on each other's ideas (Littleton & Mercer, 2010), and acquire a more flexible understanding of others' minds.

We found that teachers using mental-state language in response to offline vignettes were not necessarily inclined to report a preference for group conversation in their teaching. Offline measures may have masked any potential association between mental-state language and conversational-instruction strategies. Alternatively, mental-state language and conversational-instruction strategies may reflect two distinct aspects of teachers' classroom interactions and two distinct mechanisms through which teachers shape children's ToM. Indeed, it is possible to highlight differences between two pupils' responses to a question without using any mental-state language. Recognizing discrepancies in how others' view the same problem (without using mental-state language) might still provide the necessary experience for children to refine their understanding of others' minds or motivate children to consider others' perspectives. Different aspects of teachers' classroom interactions can be distinguished using both observational and questionnaire measures (e.g., Mashburn et al., 2008). Future intervention studies examining the impact of manipulating teachers' use of mental-state language vs. conversational-instruction strategies on children's ToM will provide insight about the unique contribution of these aspects of teachers' classroom interactions.

Associations between teachers' propensity to use mental-state language or self-reported preference for conversational-instruction strategies and children' ToM were unique. They were not explained by teachers' characteristics (i.e., teachers' teaching experience and verbal ability) or their pupils' characteristics (i.e., age, verbal ability or SES). Associations between teachers' interaction style and pupils' ToM were not explained by teachers' own ToM capacity. In other words, what mattered most for pupils' ToM was not teachers' own ToM but, rather, teachers' propensity to use mental-state language and self-reported conversational-instruction strategies. Whereas individual differences in teachers' ToM were related to self-reported preference for conversational-instruction strategies, teachers' propensity for mental-state language was not associated with teachers' ToM. These results echo research showing that parents' use of mental-state language was unrelated to parents' ToM (Devine & Hughes, 2019). Conversely, teachers' self-reported preference for conversational-instruction strategies may reflect teachers' ToM skills. This result fits with the view that ToM is a skill associated with teaching activities (Strauss & Ziv, 2012) and that taking the learner's mind into account is a prerequisite for explicit acts of teaching (Wellman & Lagattuta, 2004). Teachers with superior understanding of others' minds may use conversational-instruction strategies or, alternatively, are better equipped to manage instructional strategies based on group dialogue.

The positive association between children's ToM and teachers' self-reported preference for conversational-instruction strategies (but not teacher's mental-state language) was moderated by class size and children's age. Vezzani (2019) showed that small groups facilitated children's active participation and use of complex utterances in classroom conversations. Our results suggest that active participation in group conversations can provide a training ground for children's ongoing ToM development in middle childhood. We also found that the association between self-reported preference for conversational-instruction strategies and children's ToM was stronger for older children. This might indicate an exposure effect given that, in Italy, primary school teachers remain with same class across all five primary school years. Alternatively, older children may have higher levels of executive function that make them more receptive than younger children to learning experiences. Accordingly, children with better working memory showed greater gains in ToM during a conversation-based intervention than children with poorer working memory (Lecce & Bianco, 2018). Future work including measures of children's executive function will illuminate how differences between children moderate the association between teachers' classroom interactions and children's ToM.

We used offline measures of teachers' use of mental-state language and conversational-instruction strategies. Although existing studies have shown associations between offline and online observation measures of teachers' interactions (Koziol & Burns, 1986; Newfield, 1980), future work using direct observations is needed to confirm our findings. Previous research points to the importance of elaborative interactions (Peterson & Slaughter, 2003) and connected conversations (Ensor & Hughes, 2008) in the emergence of ToM. Online observational measures will enable researchers to consider the type, quality and content of communicative interactions between teachers and pupils.

Our study adds to a growing body of work pointing to the presence of marked individual differences in children's ToM in middle childhood (e.g., Devine, 2021). Consistent with previous research, we have shown that there are individual differences in ToM that are not explained by age or verbal ability. Furthermore, these individual differences appear

to be related to children's social experiences at school. Evidence from longitudinal studies (e.g., Devine & Hughes, 2016; Lecce et al., 2017) indicate that individual differences in ToM are genuine in that they exhibit rank-order stability over time and are not entirely explained by verbal ability or executive function (Devine et al., 2016). By standard accounts children should possess a basic grasp of mental concepts (e.g., beliefs, desires, knowledge) and the cognitive capacities to pass traditional false belief tasks by age 5 (e.g., Apperly, 2012). Our results therefore add weight to the view that individual differences in ToM reflect differences in children's fluency in reasoning about others' minds (e.g., mastery over a repertoire of mental states and how these relate to various social contexts) or children's propensity to do so (e.g., sensitivity to others' minds or motivation to reason about others' minds) or some combination of these. Recent research showed only modest correlations between different measures of ToM in middle childhood (e.g., Rice et al., 2019). Future studies should incorporate a wider range of ToM measures using diverse stimuli (e.g., short film clips and animations) to rule out the possibility that the observed associations are driven in part by the choice to ToM measure.

5 | CONCLUSIONS

Three limitations deserve note. First, the cross-sectional design precludes any firm conclusion about the direction of the associations reported here. Longitudinal data will illuminate the direction of associations over time and whether teachers' use of mental-state language mediates links between conversational-instruction strategies and children's ToM. Second, we did not measure children's executive functions, which have been linked to both children's ToM (e.g., Devine & Hughes, 2014) and teacher-child interactions (e.g., Vandenbroucke et al., 2018). Links between teachers' instructional strategies and ToM might therefore be mediated via contextual effects on children's executive function. Third, children in the present study were affluent and future research should test the generalizability of our findings to a more diverse sample of children. This is relevant considering that the association between ToM and SES seems to be modest in middle childhood (Foley & Hughes, 2021).

Notwithstanding these limitations, to our knowledge, our study marks the first attempt to examine associations between teachers' classroom interactions and children's ToM in middle childhood. Our study, which controls for a number of possible confounds and adopts a stringent analytic approach, provides compelling support for the view that teachers are in an ideal position to foster their pupils' understanding of others' minds through using mental-state language and classroom conversations. These results have implications for both socio-cultural theoretical accounts of ToM development and classroom practice.

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CONFLICT OF INTEREST

We have no known conflict of interest to disclose. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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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