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# Children in ethnically diverse classrooms and those with cross-ethnic friendships excel at understanding others' minds

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## Abstract

This study examined the link between classroom ethnic diversity, cross-ethnic friendships, and children's theory of mind. In total, 730 children in the United Kingdom (54.7% girls, 51.5% White) aged 8 to 13 years completed measures of theory of mind in 2019/2020. Controlling for verbal ability, executive function, peer social preference, and teacher-reported demographic characteristics, greater classroom ethnic diversity provided opportunities for cross-ethnic friendships, and children with cross-ethnic friendships performed better than peers without cross-ethnic friendships on theory of mind. These results extend accounts of intergroup contact by using direct assessments of children's theory of mind and advance social accounts of theory of mind by demonstrating how experiences outside the family are linked with theory of mind.

Demographic changes over the past half-century in Western Europe and North America mean that children increasingly participate in ethnically<sup>1</sup> diverse classrooms, widening children's social horizons and presenting opportunities for interacting with others whose cultural backgrounds and perspectives may differ from their own (Coleman, 2013; Galinsky et al., 2015). Yet, little is known about how exposure to classroom diversity shapes children's social skills, and more specifically, children's ability to tune in to what other people think and feel (called “theory of mind” or “mind reading”). Understanding how classroom experiences influence theory of mind is important because children who excel on tests of theory of mind are more likely than their peers to be accepted by others (Slaughter et al., 2015), be viewed as socially skilled by teachers (Devine & Apperly, 2022), and are less likely to discriminate against other social groups (Gönültaş & Mulvey, 2021). The over-arching aim of the current study was to investigate, for the first time, whether classroom ethnic diversity and cross-ethnic friendships are linked with children's theory of mind.

## Classroom ethnic diversity

To date, studies investigating social experiences and theory of mind have focused largely on early childhood and on experiences in the family (Devine & Hughes, 2018). The expansion of theory of mind research into middle childhood and adolescence over the past decade provides new opportunities to investigate how wider social experiences in school contribute to the ongoing development of theory of mind beyond early childhood (Devine & Lecce, 2021; Weimer et al., 2021). There are compelling grounds for investigating associations between classroom ethnic diversity and children's theory of mind. Long-standing social psychological accounts of intergroup prejudice propose that contact with members of different social groups (or “outgroups”) reduces negative attitudes toward members of that social group (Allport, 1958). In addition to these “primary transfer effects” (i.e., positive attitudes generalize to all members of the outgroup), intergroup contact can also lead to more favorable attitudes toward other outgroups

<sup>1</sup> In this paper, we use the word ‘ethnicity’ and recognize that it is a socially constructed term capturing diverse aspects of ancestry, culture, identity, beliefs, language, and appearance, rather than an inherent characteristic (UK Government Statistical Services, 2011).

**Abbreviation:** ICC, intraclass correlation coefficient

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called “secondary transfer effects” (Pettigrew, 2009). Intergroup contact comes in many forms and its most basic form is when participants have equal status, cooperate with one another, and have support from authority figures (Pettigrew, 1998). Classrooms typically meet these criteria, leading to the view that the basic intergroup contact afforded by classroom diversity (as distinct from the close reciprocal bonds of cross-ethnic friendship) can alter attitudes toward outgroups (Hodson et al., 2018).

Theorists claim that intergroup contact reduces prejudice by encouraging deliberate perspective-taking (Pettigrew, 1998). In other words, the effects of intergroup contact extend beyond individual interactions with a specific outgroup member and instead have the power to shape attitudes more broadly and even alter how people think (Crisp & Turner, 2011). Supporting this account, a meta-analysis found that self-reported empathy and perspective-taking were positively associated with intergroup contact (Pettigrew & Tropp, 2008). We sought to advance work on intergroup contact by drawing on direct (rather than self-report) assessments of theory of mind from developmental research. If membership in ethnically diverse classrooms exposes children to others whose perspectives and experiences differ from their own, then classroom diversity may benefit children's theory of mind.

Researchers have yet to test whether classroom ethnic diversity is associated with children's theory of mind and existing work points to mixed findings. When adults were primed to think about differences between people or multiculturalism, they more readily adopted the perspectives of others (Todd et al., 2011; Todd & Galinsky, 2012). Among 13-year-old children, self-reported experiences of diversity (between Protestant and Catholic communities in Northern Ireland) were positively associated with children's self-reported empathy (Turner et al., 2013). Crucially, 6- to 9-year-old children in inclusive classrooms (i.e., including children with disabilities) outperformed children in segregated classrooms (i.e., excluding children with disabilities) on direct measures of theory of mind (Smogorzewska et al., 2020). However, two studies of primary school-aged children in the USA incorporating broad measures of social competence rated by classroom teachers have shown no association with classroom ethnic diversity (Rasheed et al., 2020; Rucinski et al., 2021). Our first aim was to examine whether greater classroom ethnic diversity was associated with superior performance on direct tests of theory of mind.

## Cross-ethnic friendships

Developmental research indicates that social relationships between children are linked with theory of mind. Meta-analysis shows moderate associations between peer

social preference (i.e., the degree to which one is liked or admired by classmates) and superior theory of mind performance in 2- to 10-year-old children (Slaughter et al., 2015). Beyond peer social preference, friendships are defined by reciprocated liking, meaning that these relationships require greater shared understanding (Fink, 2021). Developmental theorists argue that theory of mind is needed to forge and maintain friendships and that close friendships may in turn provide a context to hone mind reading skills (Fink et al., 2015). Supporting this view, research involving 3- to 7-year-old children has shown that theory of mind performance is positively associated with having reciprocated friendships, even when potential confounding factors (such as peer social preference, language ability, and executive function) are considered (Fink et al., 2015; Peterson & Siegal, 2002). Underscoring the need for further work in older children, recent research involving 8- to 12-year-old children found that theory of mind was only related to reciprocated friendship among girls (Gazelle et al., 2023). To date, research on theory of mind has not considered the ethnic composition of friendships.

Beyond the opportunities for basic intergroup contact afforded by classroom diversity, the reciprocal bonds of cross-ethnic friendships may be particularly important contexts for intergroup contact (Hodson et al., 2018). Reflecting this, the past two decades have witnessed a growth of interest in the social correlates of cross-ethnic friendships. Although structural factors, like classroom ethnic diversity, provide children with greater opportunities for cross-ethnic friendships (referred to as the principle of “propinquity”), basic intergroup contact arising from classroom diversity does not guarantee the emergence of cross-ethnic friendships (Bagci et al., 2014; Graham et al., 2014; Hodson et al., 2018; Killen et al., 2022). Consistent with the principle of homophily, data from North America and Europe suggest that cross-ethnic friendships are less common than same-ethnic friendships as children tend to form friendships with same-ethnic peers (Killen et al., 2022). Cross-ethnic friendships are hypothesized to provide unique social and cognitive benefits over same-ethnic friendships through a process of “cognitive liberalization” (Hodson et al., 2018; Killen et al., 2022; Liu et al., 2020). Supporting this view, cross-ethnic friendships in children are associated with increased teacher-rated social competence (Kawabata & Crick, 2008) and peer social support (Kawabata & Crick, 2011), as well as decreased loneliness and peer victimization (Serdiouk et al., 2022), better mental health (Kawabata & Crick, 2015), and higher levels of academic engagement (Serdiouk et al., 2022). Researchers have yet to test whether cross-ethnic friendships are related to theory of mind.

There are strong theoretical grounds for investigating the link between cross-ethnic friendships and children's theory of mind. First, developmental accounts of theory of mind claim that discourse with diverse

others and engagement with differing perspectives are vital for the development of theory of mind (Heyes & Frith, 2014; Nelson et al., 2003). Compared with children with cross-ethnic friendships, children with same-ethnic friendships may be less exposed to different perspectives, relying instead on shared habits or norms than on reasoning about others' mental states in social interactions (Galinsky et al., 2015). Indirect support for this hypothesis comes from evidence showing that children with a sibling of a different age perform better on theory of mind tasks than children with a twin sibling only (Cassidy et al., 2005).

Second, contact theory proposes that, over-and-above sharing the same space, friendship, which is characterized by intimacy and repeated contact, is the optimal form of intergroup contact (Pettigrew, 1998). Supporting this view, intergroup friendships are associated with positive intergroup attitudes (Davies et al., 2011). Beyond shaping attitudes, cross-group friendships might fundamentally alter cognitive processes (Crisp & Turner, 2011; Meleady et al., 2019). Such "tertiary transfer effects" of intergroup contact are hypothesized to occur because cross-group friendships provide recurring chances to learn about the inner lives of outgroup members (Hodson et al., 2018; Meleady et al., 2019). Such experiences stimulate greater cognitive flexibility through repeated opportunities to override categorical thinking and heuristics and instead engage in more deliberate reasoning (Crisp & Turner, 2011; Hodson et al., 2018). The second aim of the current study was therefore to investigate the relations between cross-ethnic friendship and children's theory of mind.

## Contact in context

The "contact-in-context" framework (Yip et al., 2019) emphasizes the interplay between structural-level diversity (i.e., classroom ethnic diversity) and interpersonal diversity (i.e., cross-ethnic friendships). Classroom ethnic diversity might exert an indirect effect on children's theory of mind through opportunities for cross-ethnic friendships. With multi-level data (i.e., children embedded in classrooms), it is possible to disentangle between-classroom effects (i.e., the effect of classroom ethnic diversity on between-classroom differences in overall levels of theory of mind performance via the availability of cross-ethnic friendships) from individual-level links between having a cross-ethnic friendship and theory of mind (Graham et al., 2014). We investigated the relative influence of classroom ethnic diversity and cross-ethnic friendships on children's theory of mind.

The contact-in-context framework also holds that any effects of structural and interpersonal diversity might vary by participant characteristics such as age, ethnicity, and gender (Yip et al., 2019). Studies examining the effect of cross-ethnic friendship on intergroup attitudes

indicate that effects are consistent from childhood through to adulthood (Davies et al., 2011). In contrast, links between classroom ethnic diversity or cross-ethnic friendship and theory of mind may be moderated by ethnicity because the effect of intergroup contact may be weakest for minority ethnic groups (Tropp & Pettigrew, 2005).

Research has yet to examine whether links between classroom diversity, cross-ethnic friendships, and theory of mind vary according to participant characteristics. Reflecting the changing importance of family and school environments on theory of mind (Ronald et al., 2006), associations between classroom diversity, cross-ethnic friendships, and theory of mind may be stronger among older children than younger children. For example, the effect of social interaction (e.g., parental mental-state talk) on children's theory of mind appears stronger in early childhood than in adolescence (Carr et al., 2018). The link between classroom diversity, cross-ethnic friendships, and theory of mind might also vary by gender. For example, interventions designed to improve theory of mind are more effective for girls than for boys (Hofmann et al., 2016). Furthermore, prior work suggests that gender moderates the relations between theory of mind and reciprocated friendship (Gazelle et al., 2023). So, skilled mind reading might be correlated with forging cross-ethnic friendships in girls, but not in boys, for example. We therefore explored whether links between cross-ethnic friendship and theory of mind were moderated by children's age, ethnicity, and gender.

We also sought to examine the uniqueness of associations between classroom ethnic diversity, cross-ethnic friendship, and theory of mind by considering potential confounding variables in our analysis. Verbal ability and executive function (i.e., the ability to exert flexibility and control over thoughts and actions) exhibit moderate associations with theory of mind performance (Devine & Hughes, 2014; Milligan et al., 2007) and are also linked with children's social competence (Wang & Zhou, 2019). Furthermore, if intergroup contact leads to general benefits for cognitive flexibility (i.e., "tertiary transfer effects") (Meleady et al., 2019), then it is important to establish whether classroom ethnic diversity and cross-ethnic friendships are uniquely associated with theory of mind. By including measures of verbal ability and executive function, we sought to establish whether relations between classroom diversity, cross-ethnic friendships, and theory of mind reflected specific associations with social-cognitive outcomes rather than associations with more general cognitive abilities.

## Summary of aims and hypotheses

The current study had three over-arching aims. The first aim was to examine the relations between classroom ethnic diversity and children's theory of mind.



If basic intergroup contact stimulates deliberate perspective-taking (Crisp & Turner, 2011), then children in more ethnically diverse classrooms will exhibit better mind reading skills than those in less diverse classrooms. The second aim was to investigate the relations between cross-ethnic friendships and children's theory of mind. Developmental accounts and extensions of contact theory predict that cross-ethnic friendships (but not same-ethnic interactions) will be positively associated with theory of mind, even when potentially confounding variables (e.g., verbal ability, executive function, peer social preference) are considered. Drawing on the contact-in-context framework, the third aim was to investigate the interplay between classroom ethnic diversity, cross-ethnic friendships, and theory of mind and test the consistency of any associations across age, ethnicity, and gender. Across each aim, we sought to isolate unique associations with theory of mind by adjusting for individual differences in verbal ability, executive function, and child demographic characteristics.

## METHOD

### Participants

We recruited 1100 English-speaking children between the ages of 8 and 13 years from 37 classrooms in state-funded primary and secondary schools across the East and West Midlands in the UK as part of a larger cross-sectional study of children's theory of mind, mental health, and social competence in 2019/2020 : <https://osf.io/rxyfh>. Of 1100 children, 80 were excluded because their caregivers did not provide consent for their participation and/or the children were unable to participate in the study unaided by a classroom assistant. Due to the COVID-19 pandemic, data collection was interrupted before all teacher questionnaires were returned, meaning that information about ethnicity from teacher questionnaires was only available for 730 children in 29 classrooms. Following guidelines on missing data (Woods et al., 2021), we did not impute ethnicity, focusing our analyses on data from 730 children. In the 29 classrooms involved in the current study, on average 96.67% of children enrolled in a class participated in the testing sessions (range: 60%–100%). Excluding those without teacher questionnaires, data were available for an average of 90% of children per class (range: 29%–100%).

Children (54.7% girls) were aged between 8.27 and 13.27 years ( $M_{\text{age}} = 10.29$  years,  $SD = 1.22$ ). There were 344 eight- to nine-year-old children ( $M_{\text{age}} = 9.29$  years,  $SD = 0.47$ ), 293 ten- to eleven-year-old children ( $M_{\text{age}} = 10.70$  years,  $SD = 0.44$ ), and 93 twelve- to thirteen-year-old children ( $M_{\text{age}} = 12.73$  years,  $SD = 0.34$ ). Participants varied in socio-economic background:

23.4% (of 721) were eligible for Free School Meals (based on their parents receiving state income support) and 28% (of 722) spoke another language in addition to English at home. One fifth (17.9% of 720) had a statement of special educational needs.

We collected data about ethnicity using the “ethnic group” categories based on those in the UK census (ONS, 2015). These five broad aggregated categories do not represent inherent characteristics or capture how all people in the UK identify but are familiar to teachers and used in national surveys (GSS, 2011; ONS, 2015). Across the sample, 31.5% of children were “Asian or Asian British” (e.g., Indian, Pakistani, Bangladeshi, Chinese), 51.5% of children were “White” (e.g., White British, White Irish, White European), 8.1% of children were “Black, Black British, Caribbean or African” (e.g., Black British, African, Caribbean), 6% of children were “Mixed or Multiple Ethnic” (e.g., White and Black Caribbean, White and Black African, White and Asian), and 2.9% of children were categorized as “Other Ethnic Group” (e.g., Arab, Any Other Group).

### Procedure

Caregivers were notified about the study through mail-outs from teachers. An opt-out consent procedure was used whereby caregivers were given at least 2 weeks to contact the classroom teacher or study team to withdraw consent for their child to participate. Children provided written assent to participate in the study by endorsing an assent form. Children participated in two whole-class sessions, approximately 1 week apart. Each session, led by two research assistants, lasted between 60 and 90 min and included a fixed-order battery of tasks paced by the researcher. Children faced a large screen and completed all tasks individually on a computer through the online data collection platform PsyToolkit (Stoet, 2017). Teachers completed a questionnaire about each child. The study was approved by the University of Birmingham STEM Research Ethics Committee.

### Measures

#### Theory of mind

Children completed the Silent Film Task (Devine & Hughes, 2013), Strange Stories Task (Happé, 1994), and Triangles Task (Castelli et al., 2000). Whole-class testing procedures for measuring theory of mind have been used in numerous studies (Osterhaus et al., 2016). The Strange Stories and Silent Film tasks are sensitive to age-related and individual differences in theory of mind in 8- to 14-year-old children and show excellent

test–retest reliability in whole-class testing (Devine & Hughes, 2016). Whole-class testing on the Silent Film task yields similar results to individual testing (Devine & Apperly, 2022). The validity of the Strange Stories, Silent Film, and Triangles tasks are supported by longitudinal data showing that performance on standard false belief tasks at the start of primary school predicts later performance on each task at the end of primary school (Devine et al., 2016).

In the *Silent Film Task* (Devine & Hughes, 2013) children watched five short film clips on a large screen from a classic silent comedy depicting instances of deception, misunderstanding, and false belief. Children responded to a single question about each clip (read aloud by the research assistant), which required an explanation of a character's behavior. The next clip was not played until all children had recorded an answer. Children received 2 points for accurate mentalizing given the context, 1 point for partially correct responses, and 0 points for inaccurate or irrelevant responses (Devine & Hughes, 2016).

In the *Strange Stories Task* (Happé, 1994), the researcher read aloud five short vignettes, involving deception, misunderstanding, and double bluff. The stories were displayed on a large screen for the children to see. Children answered an open-ended question about the characters' behavior. The researcher showed the next story when all children had recorded their response. Accurate mentalizing received 2 points, partially correct responses received 1 point, and inaccurate responses received 0 points.

In the *Triangles Task* (Castelli et al., 2000), children watched three short silent animations, each involving interaction between two cartoon triangles involving instances of “sneaking,” “pretending,” and “tricking.” The next clip was not played until all children had recorded an answer. After each clip, the children were asked to describe what had happened in the animation. Answers were coded on two dimensions by trained coders: intentionality (i.e., a score from 0 to 5 indicating the degree to which the child attributed intentions and mental states to the triangles) and appropriateness (i.e., a score from 0 to 2 indicating the degree to which the child's description captured the key events of the clip). Intentionality and appropriateness scores were summed together for each response giving a score of 0 to 7 points for each clip.

Following training by an experienced coder, two research assistants scored an unseen reliability set comprised of data from 30 participants for each item of the Strange Stories, the Silent Film, and Triangles tasks. Inter-rater reliability (Krippendorff's  $\alpha$ ) for coding each item ranged from .85 to .1.00 for the Strange Stories items and .87 to 1.00 for the Silent Film task items. Intra-class correlations for Triangles task Intentionality ratings ranged from .82 to .99 and from .74 to .76 for Appropriateness ratings. Having established inter-rater reliability, each response was scored by one research

assistant only. Coders maintained reliability in weekly coding meetings with the lead author, where ratings were compared and discussed.

## Classroom ethnic diversity

Teachers reported on children's ethnicity and responses were coded into five aggregated categories based on a classification used in the UK census (ONS, 2015). We used teacher-reported ethnicity because these data are collected routinely by schools as part of the annual School Census in England (DFE, 2019). Furthermore, children's self-reported ethnicity does not exhibit stability in early adolescence (Nishina et al., 2010). We used the diversity index (Simpson, 1949) to measure classroom ethnic diversity based on the data from participating children. The index captures the probability that any two randomly selected children from the same class are from two different ethnic groups (see Rasheed et al., 2020 for a detailed description and formula). Simpson's index ranges from 0 to 1 with a score of 0 representing a homogeneous classroom (i.e., consisting of children from the same ethnicity) and a score of 1 indicating a class with equal representation of all ethnic groups considered in the study (i.e., fully heterogeneous classroom). Simpson's index is widely used in research on classroom ethnic diversity (Graham et al., 2014; Serdiouk et al., 2022).

## Cross-ethnic friendships and peer social preference

### *Friendships*

We measured friendship using a peer nomination procedure. Children nominated up to three children of any gender in their class who they “most like” to spend time with (Cillessen & Marks, 2017). While this question is typically used to measure the degree to which a person is liked by their peers by tallying the number of “most like” nominations received, asking children to identify who they like yields highly similar results as asking children who their friends are in middle childhood with between 92% and 94% agreement (Guimond et al., 2022). When two children nominated each other (e.g., Child A nominated Child B and vice versa) we counted this reciprocated liking as friendship. The total possible number of reciprocated friendships ranged from 0 to 3. Friendships were classified as cross-ethnic friendships if the two children were from two different ethnic groups or same-ethnic friendships if children were from the same ethnic group. We tallied the total number of cross- and same-ethnic friendships for each child.

### *Peer social preference*

Social preference is a dimensional measure of how much a child is liked by their peers (Newcomb et al., 1993).



Children nominated three peers in their class that they “most like” and three that they “least like” (Coie et al., 1982). The total number of nominations received by each participating child was standardized within the classroom to account for differences in classroom size. Children could nominate anyone on the classroom roll but only nominations received from participating children or given to participating children were counted. Social Preference was calculated by subtracting classroom-standardized “least like” nominations from standardized “most like” nominations (van den Berg et al., 2020). This measure captured the degree to which a child was liked by peers, regardless of whether this liking was reciprocated.

## Executive function

Children completed three tasks to measure individual differences in executive function based on a protocol developed by Obradović et al. (2018). In the *Digit Span Backwards Task* (Obradović et al., 2018), children viewed a sequence of between 2 and 5 numbers displayed one at a time (for 1000 ms) on a computer screen and then had to type the sequence in reverse order. Following practice trials, children completed 8 test trials of increasing length. Accuracy was measured by summing the number of correctly recalled sequences. In the *Hearts and Flowers Task* (Davidson et al., 2006), children completed two blocks of 12 test trials following a series of practice trials with feedback. In the Hearts (control) condition, children pressed a key on the same side as a heart appearing on their screen. In the Flowers (inhibition) condition, children instead pressed the key on the opposite side to a flower appearing on their screen. Each trial was preceded by a 750 ms fixation and remained on the screen until the participant responded (for a maximum of 750 ms). Trials were administered in a fixed pseudo-random order. In the *Fish Flanker Task* (Rueda et al., 2004) children were required to “feed the fish” in the middle ignoring fish on either side. In the congruent (control) trials all fish faced in the same direction. In the incongruent (inhibition) trials children had to ignore the surrounding fish because the fish in the middle faced in the opposite direction to the other fish. Children completed 6 practice trials with feedback followed by 34 test trials. Each trial was preceded by a 500 ms fixation stimulus and remained on the screen until the participant responded (for a maximum of 1500 ms). Twelve incongruent and 22 congruent trials were administered in a fixed pseudo-random order.

In the Hearts and Flowers Task and Fish Flanker Task anticipatory responses (i.e., with Reaction Times <250 ms) were coded as missing, and trials with no response were coded as failed. We calculated the rate correct score for each condition of both tasks by summing the total number of correct trials in each condition and

dividing this by the total time (i.e., the sum of all reaction times). This yielded a total correct trials/second for each condition.

## Verbal ability

Children completed the multiple-choice section of the *Mill Hill Vocabulary Scale* (Rust, 2008) to capture individual differences in receptive vocabulary. Children selected a synonym for 20 target words from six possible response options each and received 1 point for each correctly identified word. Total scores were age-standardized such that verbal ability scores represented a child's deviation from the average score of children of the same age.

## RESULTS

### Preliminary analyses

Based on previous publications, we reduced the number of variables in our analyses by using latent factors for theory of mind and executive function (e.g., Devine et al., 2016). We used confirmatory factor analysis to estimate latent factor scores for both constructs (see [Supporting Information](#)). [Table 1](#) shows the descriptive statistics (and extent of missing data) for all measured variables. Correlations between study variables are shown in [Table 2](#). Under the assumption that data were missing at random (see [Supporting Information](#)), we imputed 50 datasets using a Markov Chain Monte Carlo approach and a mean- and variance-weighted least squares estimator in *Mplus* Version 8 (Muthén & Muthén, 2017). Imputation included all variables that appeared in the subsequent models as well as auxiliary variables (e.g., proportion of children in receipt of free school meals). Imputed datasets were used for all subsequent analyses.

Classroom diversity ranged from 0 (homogenous) to 0.91 (diverse) with a median of 0.54. The largest ethnic group was White for 16 classrooms (with the majority ranging from 40% to 100% of children) and Asian for 13 classrooms (with the majority ranging from 33% to 82% of children). While 77.8% of children had at least one reciprocated friendship, only 33.1% of the sample had at least one cross-ethnic friendship. Most reciprocated friendships were between children of the same gender (92.6%) and almost all cross-ethnic reciprocated friendships were between children of the same gender (97.4%). There was significant between-classroom variation in cross-ethnic friendships, intraclass correlation coefficient (ICC) = .223. Multi-level structural equation models adjusted for age, gender, ethnicity, free school meal status, and peer social preference, revealed that cross-ethnic friendships were more common in

TABLE 1 Descriptive statistics.

Variable	<i>M</i> / <i>%</i>	<i>SD</i>	Range	% Missing
Child level				
Age (years)	10.29	1.22	8.27–13.27	0
Free school meals	23.7%	-	-	1.2
Gender (boys)	45.3%	-	-	0
Verbal ability	12.43	3.91	0–20	10.8
Silent film	6.06	2.63	0–12	3.8
Strange stories	5.61	1.96	0–10	3.2
Triangles task	12.27	3.68	0–20	11.6
Backward span	4.82	1.84	0–8	6.8
Fish flanker: congruent	1.39	0.47	0–2.67	5.8
Fish flanker: incongruent	1.34	0.47	0–2.46	5.8
Hearts and flowers: no conflict	2.11	0.67	0–3.73	9.5
Hearts and flowers: conflict	1.59	0.68	0–3.59	9.5
Friendship nominations				
Total	1.38	0.99	0–3	4.5
Cross-ethnic friendships	0.48	0.76	0–3	4.5
Same-ethnic friendships	0.90	0.94	0–3	4.5
Social preference				
“Most like” nominations	2.59	1.88	0–11	0
“Least like” nominations	2.43	2.81	0–21	0
Classroom level				
Ethnic diversity index	0.49	0.27	0–0.91	0
% Free school meals at school	0.16	0.09	0.04–0.34	0

diverse classrooms,  $Est. = .928$ ,  $SE = .187$ ,  $p < .001$  (see Table S1). Ethnic minority status was associated with cross-ethnic friendships,  $Est. = .204$ ,  $SE = .099$ ,  $p = .039$  (Table S1).

Given the distribution of the friendship variables and previous literature showing that the benefits of friendship tend to be based on whether a child has at least one reciprocated friend (Fink et al., 2015), we recoded cross-ethnic and same-ethnic friendships into two binary variables (i.e., 0=no reciprocated friends and 1=at least 1 reciprocated friend).

### Classroom diversity, cross-ethnic friendships, and theory of mind

The primary analysis reported here was not pre-registered, and given the novelty of the topic, it was an exploratory study. That said, while little direct empirical evidence was available for pre-registration, we tested hypotheses based on existing theory. We fit random intercepts multi-level structural equation models to the 50 imputed datasets in *Mplus Version 8* (Muthén & Muthén, 2017) using a robust maximum likelihood estimator (Finch & Bolin, 2017). We group-mean centered the level 1 independent variable and grand-mean centered the level 2 independent variable (Heck & Thomas, 2020)

(Table 3). There was marked between-cluster variance in children's theory of mind,  $ICC = .169$ , (Model 0) justifying the use of multi-level modeling. Next, we added classroom ethnic diversity as a level 2 predictor of children's theory of mind (Model 1). Greater classroom ethnic diversity was positively associated with between-class differences in theory of mind. Next, we added cross-ethnic friendship to the model as a level 1 predictor of theory of mind (Model 2). Having at least 1 cross-ethnic friendship was positively associated with theory of mind.

Given that theory of mind, classroom diversity, and cross-ethnic friendships were correlated with a range of other variables (Table 2; Table S1), we adjusted the model by regressing theory of mind onto age, gender (0=girl, 1=boy), ethnicity (0=numerical majority ethnicity, 1=numerical minority ethnicity), free school meal status (0=not eligible, 1=eligible), verbal ability, executive function, and same-ethnic friendships (Model 3). Even when models were adjusted, there were unique associations between classroom diversity and theory of mind, and between cross-ethnic friendships and theory of mind (Table 3).

Next, we included peer social preference in the model. The unique associations between theory of mind and classroom diversity and between theory of mind and cross-ethnic friendships persisted, demonstrating that reciprocated cross-ethnic friendships were distinct from social preference (Table S2, Model 1).





**TABLE 2** Correlations between study variables.

	1	2	3	4	5	6	7	8	9	10	11
1 Theory of mind											
2 Total friendships	.20										
3 Cross-ethnic friendships	.16	.39									
4 Same-ethnic friendships	.07	.53	-.25								
5 Peer social preference	.20	.58	.24	.28							
6 Gender (boy)	-.25	-.11	-.10	0	-.05						
7 Age	.36	.06	.10	-.01	.003	-.25					
8 Ethnic minority	-.01	-.09	.30	-.30	-.03	-.09	.08				
9 Free school meal	-.09	-.12	.09	-.15	-.06	-.08	.03	.24			
10 Executive function	.31	.10	.04	.01	.17	0	.003	-.09	-.06		
11 Verbal ability	.42	.21	.002	.17	.22	-.03	.09	-.11	-.11	.42	

## Contact in context

We added multiplicative interaction terms to investigate the moderating effects of age, ethnicity, and gender on the relation between cross-ethnic friendship and theory of mind. We did not find any moderating effect of age in years (Table S2, Model 2), whether children belonged to the numerical ethnic majority (i.e., the White ethnic group) or numerical ethnic minority groups (i.e., all other ethnic groups combined) (Table S2, Model 3), or gender (Table S2, Model 4) on the relation between cross-ethnic friendships and theory of mind.

We tested whether cross-ethnic friendships mediated the relation between classroom diversity and children's theory of mind using multi-level modeling (Preacher et al., 2010). We regressed within-classroom theory of mind scores onto the covariates used in Model 3 and between-classroom differences in theory of mind onto both between-classroom differences in cross-ethnic friendships and classroom-ethnic diversity (Figure 1). At the between-classroom level, greater classroom ethnic diversity was positively associated with higher levels of cross-ethnic friendship. Classroom ethnic diversity was not associated with between-classroom differences in theory of mind, once between-classroom differences in cross-ethnic friendships were considered. Likewise, between-classroom differences in cross-ethnic friendships were not associated with between-classroom differences in theory of mind. There was no indirect effect of classroom ethnic diversity on between-classroom differences in theory of mind, Est. =  $-.258$ , SE =  $.70$ ,  $p = .713$ , 95% CI [ $-1.64$ ,  $1.12$ ]. However, at the within-classroom level, children with cross-ethnic friendships outperformed their peers on theory of mind. Greater ethnic diversity provided opportunities for cross-ethnic friendships (i.e., a between-classroom effect) and when children participated in cross-ethnic friendships, they performed better than their peers on theory of mind (i.e., a within-classroom effect).

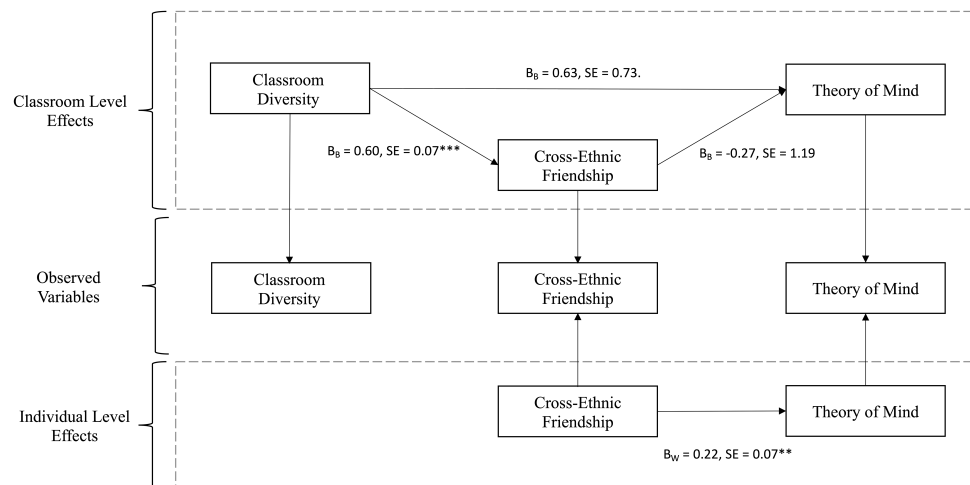
## DISCUSSION

The over-arching aim of the current study was to investigate for the first time whether classroom ethnic diversity and cross-ethnic friendships were associated with children's performance on direct assessments of theory of mind. Structural diversity was linked with children's mind reading ability, such that greater classroom ethnic diversity was associated with better performance on direct measures of theory of mind (over-and-above verbal ability and executive function). Interpersonal diversity also mattered for children's theory of mind. Children with cross-ethnic friendships outperformed their peers on theory of mind. The link between cross-ethnic friendships and theory of mind was consistent across ethnicity, age, and gender. Multi-level analysis

**TABLE 3** Multi-level Linear Model Robust Maximum Likelihood Estimates for Correlates of Theory of Mind.

	Model 0	Model 1	Model 2	Model 3
Intercept	Effect (SE)	Effect (SE)	Effect (SE)	Effect (SE)
	-0.001 (0.065)	0.001 (0.061)	0.001 (0.061)	0.183 (0.059)**
Child Level				
Age				0.325 (0.103)**
Gender (Boy)				-0.290(0.042)**
Free School Meals				-0.126 (0.060)*
Ethnic Minority				-0.043 (0.070)
Verbal Ability				0.209 (0.026)**
Executive Function				0.387 (0.086)**
Same-Ethnic Friendships				0.048 (0.052)
Cross-ethnic Friendships			0.206(0.079)**	0.177 (0.057)**
Classroom Level				
Classroom Ethnic Diversity		0.478 (0.200)*	0.479 (0.200)*	0.449 (0.187)*
Variance Components				
L1 Residual	0.509 (0.026)**	0.509 (0.026)**	0.502 (0.026)**	0.385 (0.022)**
L2 Intercept Variance	0.100 (0.026)**	0.084 (0.021)**	0.084 (0.021)**	0.070 (0.016)**
Model Fit				
AIC	1635.964	1633.665	1625.392	1447.559
BIC (Sample Size Adjusted)	1640.217	1639.336	1632.480	1464.571

Note: \*\* $p < .01$ ; \* $p < .05$ .



**FIGURE 1** Simplified model depicting between- and within-classroom effects on children's theory of mind. For ease of presentation the model does not show covariates. \*\*\* $p < .001$ . \*\* $p < .01$ .

integrating structural and interpersonal levels shed light on potential mechanisms. While classroom ethnic diversity was associated with between-classroom differences in levels of cross-ethnic friendship, it did not explain between-classroom differences in levels of theory of mind. Instead, having cross-ethnic friendships was directly associated with theory of mind. We now consider the implications of these findings for existing theory and future research.

## Classroom diversity and theory of mind

Social psychological accounts propose that contact between people from different ethnic groups reduces negative attitudes toward outgroups because interactions between members of different ethnic groups provide opportunities to consider others' perspectives, rather than relying on shared habits or norms (Allport, 1958; Pettigrew & Tropp, 2008). Drawing on methods from cognitive

developmental research, we advanced intergroup contact theory by showing that exposure to greater classroom ethnic diversity was positively associated with direct (rather than self-report) assessments of theory of mind and that these associations were not explained by other abilities such as verbal skills and executive function. This is an important advance because a meta-analysis of 85 studies has shown that self-report “cognitive empathy” measures share only a very small proportion of variance (1%) with direct behavioral measures of mind reading (Murphy & Lilienfeld, 2019).

Our results are consistent with a previous study showing how being a member of an inclusive classroom (involving children with and without disabilities) was positively associated with theory of mind (Smogorzewska et al., 2020). Consistent with work from contact theory (Crisp & Turner, 2011), our results suggest that any form of classroom social diversity (not just ethnic diversity) might confer benefits for children's theory of mind. In other words, when it comes to classroom diversity, all is grist for the mill. Future work examining children's experiences in classrooms that vary in socio-economic status, gender identity, or neurodiversity, for example, will shed light on whether all social experiences with diverse others benefit children's ability to reason about others' minds. Natural experiments capitalizing on tracking children's theory of mind across school transitions (e.g., comparing children who move from homogenous primary schools to diverse secondary schools with those who remain in diverse schools) could be leveraged to shed light on whether classroom diversity changes children's theory of mind.

## Friendship and theory of mind

Our study extends social accounts of theory of mind development beyond early childhood (Lecce et al., 2021). Supporting existing developmental findings (Fink et al., 2015; Peterson & Siegal, 2002), we found unique associations between reciprocated friendships and theory of mind (even when potential confounds such as verbal ability, executive function, and peer social preference were taken into account). Our results widen the age range of previous work and advance existing research by considering the ethnic composition of reciprocated friendships.

Integrating research on cross-ethnic friendships with research on theory of mind, raises new possibilities for understanding the relations between friendship and theory of mind, on the one hand, and for understanding the benefits associated with cross-ethnic friendships on the other. With regard to the former, if friendships act as a context for children to hone their mind reading skills (Fink, 2021), then, cross-ethnic friendships (where children may have different cultural, linguistic, or religious perspectives, for example) should provide a particularly fertile ground for children to recognize that others have

diverse perspectives on the same reality. Regarding the latter, previous work has shown that cross-ethnic friendships are positively associated with mental health, academic achievement, and teacher-rated social competence (e.g., Kawabata & Crick, 2015; Serdiouk et al., 2022). This work has led theorists to suggest that cross-ethnic friendships (more so than basic contact) can shape human cognition (and not just attitudes) (Hodson et al., 2018). Our results contribute to this work on the tertiary transfer effects of intergroup contact (Meleady et al., 2019) by showing that cross-ethnic friendships exhibited unique associations with children's theory of mind over-and-above cognitive flexibility (i.e., executive function) and verbal ability. In doing so, our work helps to refine claims about the cognitive processes impacted by intergroup contact. Given that theory of mind is correlated with mental health (Sharp & Hernandez, 2021), academic achievement (Osterhaus & Koerber, 2023), and teacher-rated social competence (Devine & Apperly, 2022), gains in theory of mind associated with cross-ethnic friendship might explain the wider benefits of cross-ethnic friendships.

We examined the interplay between structural diversity (i.e., classroom ethnic diversity) and interpersonal diversity (i.e., cross-ethnic friendships) using a multi-level model. This model showed that greater classroom ethnic diversity provided opportunities for cross-ethnic friendships (i.e., a between-classroom effect) and when individual students participated in cross-ethnic friendships, they performed better than their peers on theory of mind (i.e., a within-classroom effect). It is important to acknowledge that, although the sample size was large by traditional standards in theory of mind research and provided sufficient power to detect small-to-medium within-classroom effects, the availability of 29 classrooms meant it was only possible to detect medium-to-large between-classroom effects (Arend & Schäfer, 2019). The non-significant effect of classroom diversity on between-classroom differences in theory of mind should therefore be interpreted with some caution. That said, our findings indicated that structural diversity mattered for theory of mind insofar as it provided opportunities for cross-ethnic friendship, which in turn had a unique association with theory of mind. Consistent with work on contact theory (Hodson et al., 2018), social interactions in the context of reciprocated friendship, rather than the mere presence of diverse others, mattered most for children's theory of mind.

The cross-sectional design used in the current study makes it difficult to understand the nature of the association between cross-ethnic friendships and theory of mind. That said, it is difficult to explain how structural factors (i.e., classroom diversity) can be influenced by cross-ethnic friendship or children's theory of mind, making classroom diversity a potential social resource for enhancing children's theory of mind. Social accounts of theory of mind development (e.g., Heyes & Frith, 2014) and longitudinal research (Fink et al., 2015)

make it tempting to assume that cross-ethnic friendships provide children with opportunities to refine their mind reading skills. However, compared with their peers, skilled mindreaders may be more likely to form cross-ethnic friendships for two reasons. First, mind reading about outgroup members is more challenging than mind reading about in-group members (Gönültaş et al., 2020) meaning that children who excel at theory of mind may be better equipped to develop cross-ethnic friendships than their peers. Second, skilled mindreaders' ability to tune into the minds of others may make them less likely than others to endorse racist stereotypes and more likely to interact with cross-ethnic peers (Gönültaş & Mulvey, 2021). Such children may already exhibit the kind of cognitive flexibility that is hypothesized to arise from cross-ethnic friendships (e.g., Hodson et al., 2018). Friendship interventions (Echols & Ivanich, 2021) could be used to examine the effects of building cross-ethnic friendships on children's theory of mind.

To date, there has been a considerable emphasis on the presence or absence of friendship and children's theory of mind (e.g., Fink, 2021). Moving beyond whether children have cross-ethnic friendships, future work is needed to identify the qualities of cross-ethnic friendships that might shape or be shaped by children's theory of mind (e.g., Fink, 2021). Despite the benefits associated with cross-ethnic friendship, studies comparing same-ethnic friendships and cross-ethnic friendships in terms of stability, intimacy, support, conflict, and cooperation have produced mixed findings (Aboud et al., 2003; McGill et al., 2012), such that it is unclear what features of cross-ethnic friendships benefit children's wider outcomes and theory of mind in particular. Developmental research on theory of mind suggests that direct observations of conversations between different social partners (e.g., same- and cross-ethnic friends) might shed light on why cross-ethnic friendships are associated with better theory of mind performance. For example, studies using transcripts of children's conversations have shown that children's use of mental-state language varies according to whether they are interacting with siblings or friends (Hughes et al., 2007). Intervention studies suggest that conversations where children compare and discuss their differing perspectives can benefit children's theory of mind (Lecce, 2021). Exploring the quality and content of children's conversations with same- and cross-ethnic friends might yield insights into the relations between theory of mind and cross-ethnic friendships.

## Limitations

Four potential limitations deserve note. First, one limitation of the current study is that, while we adopted a measure of ethnicity used in the UK census and therefore familiar to teachers (ONS, 2015), broad-brush measures of ethnicity obscure the mechanisms by which classroom

diversity might influence children's theory of mind. Children can differ from one another on multiple dimensions, some of which may be more or less important for prompting consideration of others' minds. For example, the "Asian" category is very broad and two children in this category could be labeled as "same-ethnic friends" when they differ in language or religious beliefs. Rather than relying on broad ethnic group categories, future studies could adopt more nuanced measures to examine whether effects are more pronounced when children are in classrooms with others who, for example, have lived in a different country, or speak different languages at home, or have diverse religious beliefs. Conceivably, interactions between children who differ on these characteristics might provide opportunities for children to recognize that mental states are subjective and that people can have differing perspectives on the same reality (Lecce & Devine, 2021).

Second, friendship was assessed using reciprocated liking nominations, consistent with previous sociometric work on children's friendships (Salmivalli & Isaacs, 2005), and the view that friendships are defined by mutual affection (Guimond et al., 2022). Some theorists argue that friendship should only be assessed with direct questions about being friends rather than "liking" (Parker & Asher, 1993). Mirroring broader trends in research on children's friendships, research on cross-ethnic friendship has yet to converge on a specific approach to measuring friendship, with some studies using reciprocated liking nominations (Graham et al., 2014), others using reciprocated friend nominations (Kawabata & Crick, 2008), and still others using tallies of total friendship nominations regardless of whether these are reciprocated (Benner & Wang, 2017). That said, recent work suggests that "like most" and "best friend" nominations yield overlapping results in middle childhood (Guimond et al., 2022). Moreover, our analyses showed that having cross-ethnic friendships was correlated with, but distinct from, peer social preference in that cross-ethnic friendships were uniquely associated with children's theory of mind. Research is needed to compare the effect of using reciprocated liking and friendship nominations when studying cross-ethnic friendships.

Third, consistent with previous work (Cillessen & Marks, 2017), we restricted the total number of nominations and focused on the classroom context. Research comparing restricted and unrestricted approaches to nomination is sparse but a study involving 8- to 12-year-old children indicated that the restricted approach may underestimate the number of positive nominations children receive (Gommans & Cillessen, 2015). Restricting nominations may therefore underestimate the number of cross-ethnic friendships. That said, our analyses focused on the effect of having at least one cross-ethnic friendship on theory of mind, suggesting that unrestricted nominations may not alter the overall pattern of associations. Research is needed to examine

the impact of adopting unrestricted approaches to nomination and modifying the context for nominations (e.g., classroom vs. whole school).

Fourth, although the demographic characteristics of the sample in the current study reflected the diverse population of the region and provided sufficient power to examine cross-ethnic friendships and classroom diversity, the ethnic diversity of the sample does not mirror that of the United Kingdom as a whole. For example, in the 2021 Census, 81.7% of the population of England and Wales identified as White, 9.3% as Asian, 4% as Black, 2.9% as Mixed ethnicity, and 2.1% as a member of an Other ethnic group (ONS, 2022). While our study provides insights about the correlates of classroom diversity and cross-ethnic friendships, the proportion of children with cross-ethnic friendships reported here is unlikely to reflect the proportion of cross-ethnic friendships among British children. Together, these factors may affect the generalizability of the results reported here.

## SUMMARY AND CONCLUSIONS

To our knowledge, this is the first study to examine how classroom ethnic diversity and cross-ethnic friendship shape children's theory of mind. Key strengths of the current study include the use of a large, ethnically diverse sample, multiple-direct measures of theory of mind, multiple informants, and the adjustment of models for potential confounds including children's verbal ability and executive function. The results extend long-standing social psychological accounts about intergroup contact and advance developmental accounts about socio-cultural influences on children's theory of mind. Classroom ethnic diversity is a potential resource for children's social-cognitive development, providing children with opportunities to build cross-ethnic friendships, which in turn provide children with social experiences that can enhance their ability to tune into others' minds. The current study opens new avenues for research on how school-aged children's social experiences in diverse classrooms shape their social-cognitive development.

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## DATA AVAILABILITY STATEMENT

The data, analytic code, and materials necessary to reproduce the analyses presented here are not publicly accessible. Data, analytic code, and materials are available from the first author upon request. The analyses presented here were not pre-registered.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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