Peer Ability and Dynamics of Classrooms

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Abstract

This study examines the impact of peer ability on students' cognitive skills and academic outcomes using a unique dataset from large-scale fieldwork in Turkish primary schools. Leveraging the random assignment of students to classrooms, I show that exposure to higher-ability peers enhances fluid intelligence, cognitive empathy, and math and verbal test scores. These effects emerge as early as the first grade and sustain into the later grades. Investigating underlying mechanisms, I document that peer ability reshapes classroom social networks primarily through increasing ability-based homophily among high-ability students and decreasing it among low-ability students, without significantly altering the quantity or overall quality of social ties. Additionally, I find evidence that teachers respond to classroom ability composition by adapting their pedagogical practices. These findings provide new insights into how peer composition shapes student development beyond traditional academic domains.

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1 Introduction

The role of peer interactions in shaping individual outcomes has been a key focus in economics over the last few decades. Despite the empirical challenges highlighted by Manski (1993), research has consistently shown that peers influence behavior across a wide range of domains. Advances in data availability and methodological tools have enabled researchers to extend their investigations into areas such as crime (Calderon, 2024), mental health (Kiessling and Norris, 2023), fertility (Rossi and Xiao, 2024), and voting behavior (Harmon et al., 2019). Among these, education has received the most sustained attention, as understanding peer effects can directly inform policies aimed at improving student outcomes and designing more effective educational interventions.

Building on this broad recognition of peer influence, research in education has explored how peer effects shape student achievement. Early pioneering work by Sacerdote (2001), Zimmerman (2003), and Hanushek et al. (2003) laid the foundation for this field, demonstrating the importance of peer composition in shaping academic outcomes. Subsequent reviews, such as those by Sacerdote (2011), Sacerdote (2014), and Barrios-Fernandez (2023), provide a synthesis of the progress made in understanding peer effects in education. More recent work has shifted focus from merely identifying peer effects to exploring how they can be leveraged to improve educational outcomes. For instance, Alan and Kubilay (2025) evaluate a program where socially connected students are tasked with delivering a curriculum to younger peers, demonstrating substantial benefits. Similarly, List and Uchida (2024) show that exposure to peers with preschool education helps sustain intervention effects, preventing fade-out over time.

In this paper, I examine the impact of peer ability on students' cognitive skills and academic outcomes, with a particular focus on understanding the mechanisms driving these social spillovers. To address these questions, I leverage a rich dataset collected through large-scale fieldwork conducted in two large urban provinces in southeastern Turkey. The Turkish public education system provides an ideal setting for studying peer effects, as students are randomly assigned to classrooms and teachers at the beginning of the first grade. The random allocation ensures that classroom peer composition is exogenously determined, effectively eliminating concerns about sorting or selection into peer groups.

The dataset that I use captures a cohort of first-grade students at the very start of the academic year, prior to any exposure to teachers or peers, providing a reliable baseline for

analysis. I measure peer ability using students' fluid intelligence scores, assessed through Raven's Progressive Matrices Test (Raven and Court, 1998). To isolate peer ability, I calculate the leave-own-out-mean of classroom fluid intelligence scores, a metric that excludes an individual's score when calculating peers' average ability.

First, I evaluate the impact of peer ability on a broad set of student outcomes, including cognitive skills and academic performance. My findings indicate that peer ability positively affects both cognitive skills, such as fluid intelligence and cognitive empathy, and academic achievement, as measured by math and verbal tests. Examining heterogeneities, my findings suggest that students who attended preschool and who were of higher ability in the beginning of the first grade benefit more from exposure to high-ability peers, suggesting that early skills may enhance students' capacity to leverage peer interactions.

Next, I investigate the mechanisms through which peer ability affects student outcomes, drawing on channels proposed in the existing literature (Puljic, 2023; Coveney and Oosterveen, 2021; de Gendre and Salamanca, 2020). I provide suggestive evidence that both classroom social networks and direct social learning play key roles in transmitting peer effects. Peer ability reshapes social networks by altering ability-based segregation in opposite directions for different student types: high-ability students increasingly form friendships with peers of similar ability, reinforcing homophilic patterns, while low-ability students become less likely to form in-group ties, reducing segregation among this group. Consistent with a social-learning channel, exposure to higher-ability classmates raises the average ability of students' direct friends. By contrast, I find no systematic evidence that changes in behavioral conduct or conformism account for the effects. Finally, I provide evidence on teachers adjusting their teaching methods according to their classrooms' ability level. These patterns highlight the importance of social dynamics and peer interactions in shaping the spillovers of ability.

I contribute to the literature in several ways. First, I expand the evidence base of peer effects research beyond academic performance indicators to include general cognitive skills that are not domain specific, such as fluid intelligence and cognitive empathy. I demonstrate that peer ability causally and positively affects students' fluid intelligence and cognitive empathy in the context of Turkish primary schools. Black et al. (2013) is the only study to assess the impact of peer characteristics on intelligence, examining a sample of Norwegian men at age 18, but they find no significant effects. The divergence in findings may be attributed to differences in the age of the study populations, given the greater malleability

of cognitive and non-cognitive skills during earlier developmental stages (Cunha et al., 2010).

Second, I address a common limitation in prior studies, which often rely on proxies like GPA or centralized exam scores. While these proxies are strong predictors of academic success, they can be noisy measures of underlying ability (Roth et al., 2015). To the best of my knowledge, Sojourner (2013) is the only other study to measure peer ability using an ability test administered before classroom exposure. Drawing on rich field data, I employ a standardized measure of cognitive ability derived from a non-verbal assessment tool (Raven and Court, 1998), providing a more refined estimate of peer ability effects.

Third, I leverage a longitudinal dataset that tracks students over the course of primary school. The majority of peer effects studies rely on cross-sectional data, which limits their ability to capture how peer influences evolve over time. In contrast, my study follows students from the beginning of primary school, enabling me to document not only the immediate impact of peer ability but also its cumulative effects as students progress through primary school. This allows me to provide new insights into the dynamics of peer effects, particularly in cognitive and social skill development.

Fourth, I provide a detailed examination of the mechanisms driving peer effects, with a particular focus on the role of social networks. To date, only two other studies have examined peer effects in educational settings using classroom social networks (Carrell et al., 2013; Wu et al., 2023). Both studies investigate interventions aimed at improving the academic performance of low-achieving students by mixing them with high-achieving peers and document a strong tendency for students to form friendships based on initial ability, highlighting homophily as a key dynamic. Wu et al. (2023) further shows that incentivizing students to assist peers reduces homophily. Building on these findings, I leverage friendship nominations in my data to demonstrate that peer ability shapes classroom social networks, particularly through ability-based homophily, even in the absence of targeted interventions. Additionally, I provide evidence for direct social learning and show that teachers may alter their teaching methods in reaction classroom ability compositions (Duflo et al., 2011; Booij et al., 2017).

Finally, I provide evidence from a novel context: primary schools in Turkey. While the literature on peer effects is extensive, it primarily focuses on developed countries, with limited research in low- and middle-income settings (Duflo et al., 2011; Garlick, 2018). Turkey presents a particularly interesting case due to its centralized and highly standardized education system, where students are randomly assigned to classrooms at the start of primary school. This institutional feature minimizes selection concerns and allows for a clean identi-

fication of peer effects.

The structure of the paper is as follows. Section 2 provides an overview of the education system in the study country and outlines the contextual factors relevant to the identification strategy. Section 3 details the fieldwork and describes the dataset used in the analysis. In Section 4, I present the empirical framework, followed by the main results in Section 5. Section 5.2 explores heterogeneities in the estimated peer effects, and finally, Section 6 concludes the study.

2 Background and Context for Identification

The education system in Turkey follows a three-tier structure, consisting of primary (grades 1-4), middle (grades 5-8), and secondary (grades 9-12) education. Schooling is compulsory for 12 years, and students typically begin primary school at age 6. This study focuses on public primary schools in Adana and Gaziantep, two large urban centers in southeastern Turkey with significant ethnic and socioeconomic diversity. Furthermore, both cities have experienced substantial refugee inflows, and therefore, they provide an ideal setting to explore heterogeneities in peer effects across different student backgrounds.

School enrollment in Turkey is determined by catchment areas, where students are assigned to a small set of nearby public schools based on their residential address. Once enrolled in a school, students are randomly assigned to classrooms, a policy mandated by the Ministry of Education to ensure a fair and balanced distribution of students across classrooms. This random assignment is stratified by key demographic characteristics, including gender and refugee status, ensuring proportional representation across classrooms. Assignment to a classroom is also accompanied by a random assignment to a teacher. Importantly, the assignment is binding for the entire primary school period: students remain in their assigned classroom with the same teacher for all subjects throughout grades 1-4. This teacher-student stability distinguishes the Turkish system from those where teachers rotate frequently, allowing for a more controlled setting for the examination of peer effects over time.

Due to this institutional structure, students spend most of their school day exclusively within their assigned classroom, with limited cross-classroom interactions. As a result, the assigned classmates define the primary peer group for each student's academic and social development.

The random classroom assignment policy ensures that students are exogenously exposed to peers of varying ability levels, forming the basis of my identification strategy. Since students cannot self-select into classrooms, differences in peer ability across classrooms are as good as random, conditional on school fixed effects. This setting enables a credible causal estimation of peer ability effects on student outcomes. In Section 4, I formally validate the identification assumption by demonstrating that variation in peer ability is uncorrelated with baseline student characteristics.

3 Data and Measurement

3.1 Timeline of Data Collection and Sample

Baseline data collection took place in September and October 2022, during the first days of the academic year. During this time, students were just beginning to adjust to the school environment. Given this early timing, only a limited amount of data was collected from students, consisting of their demographic characteristics and fluid intelligence. In contrast, teacher data collection was more comprehensive, covering demographics, cognitive skills, personality traits, and teaching styles.

It is important to note that the baseline data collection occurred during the first days of the academic year, before students and teachers had meaningful exposure to one another. At this stage, peer relationships had not yet formed, and teachers had limited knowledge of their students' abilities and behaviors. This timing ensures that the collected baseline measures reflect students' pre-existing characteristics rather than any classroom dynamics or teacher influences that might emerge later in the year.

In April and May 2023, at the end of the first grade, the second wave of data collection was conducted in the same classrooms to measure a broader range of student outcomes, including fluid intelligence, cognitive empathy, math scores, and verbal scores. To track potential changes over time, the teacher survey was also re-administered. This process was repeated in April and May 2024 (end of second grade) and again in April and May 2025 (end of third grade), following the same procedures. Figure A4 illustrates the timeline of the data collection.

As a result of the data collection efforts, the assembled sample consists of roughly 7700 students from 353 classes in 76 schools. Table A1 presents summary statistics on the demo-

graphics of the students in the sample. The sample is balanced in terms of gender. About 15% of the students are refugees, while around 67% of the students previously attended preschool. The average age in terms of months at the beginning of first grade was 78.35 months, which is about the standard age to start primary school.

3.2 Student Data

Student data comprises students' demographic characteristics such as age in months, gender, refugee status, preschool attendance, and various outcomes such as fluid intelligence, cognitive empathy, math scores, and verbal scores. Furthermore, I utilize students' classroom social networks and conformism to assess potential mechanisms. In the next subsections, I provide detailed information on how each student measure was elicited.

3.2.1 Cognitive Skills

To measure students' cognitive skills, I rely on two well-established psychological tests: Raven's Progressive Matrices Test (Raven and Court, 1998) and the Reading the Mind in the Eyes test (Baron-Cohen et al., 1997). These tests measure fluid intelligence and cognitive empathy, respectively. By using these two distinct but complementary tests, I capture a comprehensive picture of the students' cognitive capabilities. Fluid intelligence provides insight into general cognitive processing power, while cognitive empathy sheds light on socio-cognitive skills. Both dimensions are critical for understanding how students learn and interact within the school environment.

Students' fluid intelligence was assessed using Raven's Progressive Matrices Test. This test is widely recognized for its robustness in evaluating abstract reasoning and problem-solving abilities, which are core components of fluid intelligence. The test consists of multiple-choice items, each presenting a matrix of geometric patterns with one pattern missing[1]. The students are required to identify the missing pattern from a set of options. This non-verbal assessment minimizes cultural and linguistic biases, making it an ideal tool for our purposes that involve refugee students. Higher scores on Raven's Progressive Matrices Test indicate greater fluid intelligence, reflecting the students' capacity for logical thinking, pattern recognition, and cognitive adaptability.

[1]See Figure A5 for an example question

Cognitive empathy, the ability to understand and predict others' emotions and perspectives, was measured using the Reading the Mind in the Eyes Test. This test involves presenting students with photographs of individuals' eye regions and asking them to select the emotion or mental state that best describes what the person in the photograph is feeling[2]. This ability to accurately read and interpret emotional states is crucial for effective social interactions and has been linked to better interpersonal relationships, enhanced cooperation, and reduced conflict (Alan et al., 2021). Higher scores on the Reading the Mind in the Eyes test indicate a stronger ability to empathize cognitively, which can contribute positively to students' social dynamics and overall school experience. Students answered a subset of 10 questions from the original test which included adapted responses in a way that students in this age group can easily understand.

3.2.2 Academic Scores

To evaluate students' academic performance, students took standardized test that measured their mathematics and verbal skills. These tests are designed to fit with the educational standards and learning objectives set by the Ministry of Education, ensuring that the content is relevant and appropriate for the students' grade levels.

3.2.3 Social Networks

During data collection, students were asked to nominate their best friends in the classroom. Starting from second grade, students were encouraged not to choose more than five friends. Based on their answers, I construct the social network of each classroom and generate certain statistics that summarize friendship formation and homophily in classrooms[3].

Firstly, to investigate the effect of peer ability on friendship formation, I examine four key social network measures that capture the quantity and quality of students' ties within their classrooms. The first two measures directly rely on friendship nominations that students receive from their peers, capturing both extensive and intensive dimensions of classroom popularity. *Isolate* is a binary indicator that equals 1 if a student receives no friendship nominations, and 0 otherwise (Alan et al., 2021). *In-degree ties* represent the total count of

[2]See Figure A6 for an example question.

[3]See Figure A7 for an example classroom social network.

friendship nominations received, thus providing a direct measure of a student's popularity within their classroom network. The third measure, *reciprocity*, captures the proportion of mutual nominations relative to all nominations received. A friendship nomination is mutual (or reciprocal) if two students nominate each other. Reciprocal friendships are typically perceived as higher quality, reflecting greater cooperation and interpersonal trust (Gifford-Smith and Brownell, 2003). Empirical evidence provided by Lavy and Sand (2019) further demonstrates the causal benefits of reciprocal friendships, highlighting their positive impacts on both immediate academic performance and long-run educational outcomes, such as standardized test scores and high-school completion rates. Finally, the *clustering coefficient*, also known as transitivity (Watts and Strogatz, 1998), measures the interconnectedness among a student's direct friends. Calculated at the individual level, it represents the fraction of a student's direct peers who are themselves connected, ignoring the directionality of the original nominations. Higher clustering values indicate tighter, more cohesive peer groups and serve as proxies for greater trust within networks (Karlan et al., 2009).

Next, to assess the impact of peer ability on ability-based homophily in classrooms, I construct an individual level version of Coleman's excess homophily index (Coleman, 1958). Homophily refers to the tendency for individuals to associate with others who are similar to themselves. Excess homophily index for student i in school s and classroom c of group g is calculated as follows:

$$Index_{iscg} = \frac{O_{iscg} - E_{iscg}}{1 - E_{iscg}} \quad \text{where} \quad O_{iscg} = \frac{T_{iscg}}{T_{isc}} \quad \text{and} \quad E_{iscg} = \frac{N_{scg} - 1}{N_{sc} - 1} \tag{1}$$

where $Index_{iscg}$ is the Coleman's excess homophily index for student i in school s and classroom c of group g. O_{iscg} is the observed share of within-group ties calculated by dividing the number of within-group ties of student i, T_{iscg}, to number of all ties of student i, T_{isc}. E_{iscg} is the expected share of within-group ties calculated by dividing the number of students of the group g minus the student i by the total number of students minus the student i. The difference between the observed and expected share of within-group ties is finally normalized by $1 - E_{iscg}$ or E_{iscg} depending on the sign of the numerator so that the final measure ranges between -1 and 1. A higher value of this index indicates a higher tendency to form social ties with in-group members. I divide students into two groups based on their initial ability level within their school and calculate their propensity to nominate students of the same group based on the formula described in the previous paragraph.

3.2.4 Conformism Task

To capture a student's susceptibility to peer influence in ambiguous decision-making contexts, I utilize a novel decision task that is focused explicitly on informational social conformity. Informational conformity occurs when individuals adjust their decisions based on peer behavior due to uncertainty or ambiguity about the correct choice, viewing peers' actions as a valuable source of information (Hung and Plott, 2001; Goeree and Yariv, 2015). This contrasts with normative conformity, where individuals conform primarily due to social pressure or the desire to align with perceived group norms, even when the correct answer is known or clear.

In this task, students participated in four rounds of decision-making. Each round began with students independently rating a painting without any contextual information or reference. Following their initial rating, they observed peer ratings intentionally chosen to differ from their own initial rating, introducing ambiguity regarding the accuracy or appropriateness of their initial judgment. Students were then given the opportunity to revise their ratings.

For each round, I create a binary indicator equal to 1 if the student revised their rating toward the direction of the peer ratings, and 0 otherwise. Summing these indicators across the four rounds, I generate an individual-level measure of conformism behavior. Finally, I standardize this measure across students to have a mean of 0 and a standard deviation of 1.

3.3 Teacher Measurements

While students participated in our data-collection activities, their teachers completed an extensive survey covering demographic characteristics, cognitive skills, personality traits, and teaching pedagogy. First, the demographic information includes teachers' age, gender, marital status, number and ages of children, teaching experience, tenure, and educational background. Secondly, cognitive abilites are elicited through established psychological instruments. Specifically, teachers completed adult versions of Raven's Progressive Matrices Test (Raven and Court, 1998) to evaluate fluid intelligence and the Reading the Mind in the Eyes Test (Baron-Cohen et al., 1997) to measure cognitive empathy. The implementation and relevance of these cognitive measures are discussed in detail in Section 3.2.1. Third, teachers responded to survey items designed to elicit comprehensive data on teachers' personality traits and their preferred pedagogical approaches. Our survey items specifically cap-

tured four dimensions of teaching pedagogy: *inquiry-based pedagogy*, involving active learning through questioning, exploration, and investigation; *modern teaching methods*, representing innovative, technology-integrated, and student-centered instruction; *extrinsic motivation*, referring to teachers' use of external incentives to enhance student performance; and *emotional warmth*, emphasizing empathy, kindness, and a supportive classroom environment. Based on teacher responses, I constructed a continuous measure for each pedagogical dimension using principal-component analysis. Finally, teachers provided subjective evaluations of their students' academic performance and behavioral outcomes and rated each of their students from 1 to 5. I standardize these to have a mean of 0 and standard deviation of 1.

4 Empirical Analysis

4.1 Identification

The primary variable of interest in this study is peer ability, which is operationalized as the leave-own-out mean of baseline fluid intelligence within classrooms[4]. The identification strategy relies on the random assignment of students to classrooms within schools. This institutional feature eliminates concerns about selection into classrooms based on students' baseline characteristics, enabling causal interpretation of the relationship between peer ability and student outcomes.

To verify this identifying assumption, I conduct a balance test to assess whether students' baseline characteristics are uncorrelated with assigned peer ability. Specifically, I estimate the following equation:

$$\overline{PA}_{(-i)sc0} = \beta_0 + \beta_1 A_{isc0} + \beta_2 SC_{isc} + \delta_s + \epsilon_{isc}$$

where $\overline{PA}_{(-i)sc}$ represents peer ability, defined as the leave-own-out mean of baseline fluid intelligence for student i in classroom c of school s. A_{isc0} is the students' own fluid intelligence at baseline. The vector SC_{isc} includes key baseline student characteristics: age (in months), gender, refugee status, and preschool attendance. δ_s represents school fixed

[4]Figure 1 presents the distribution of peer ability, both in its original form and after residualizing with school fixed effects and student-level controls. While absorbing fixed effects reduces some variation, the residual distribution retains a standard deviation of 0.53, indicating substantial remaining variation for analysis.

effects, and ϵ_{isc} is the error term, which is clustered at the class level.

Under random assignment, conditional on school fixed effects, student characteristics should not predict peer ability. I test this assumption by examining whether the coefficients on SC_{isc} are statistically significant. Table 1 presents the results of this balance test. None of the student characteristics are significantly associated with peer ability, as all p-values exceed conventional levels of statistical significance. Moreover, an F-test of joint significance yields a p-value of 0.26, further confirming that student characteristics are not associated with assigned peer ability.

In addition to the balance test, I assess robustness by evaluating how the estimated impact of peer ability varies across different model specifications with the inclusion of additional control variables. As discussed in Section 5, the estimated coefficients remain largely stable, reinforcing the validity of the identifying assumption.

Overall, these results confirm that students are randomly assigned to classrooms within schools, validating the use of peer ability as an exogenous measure. Consequently, the results presented in subsequent sections can be interpreted as causal.

4.2 Empirical Framework

Throughout the paper, I estimate variations of the following equation:

$$Y_{isct} = \beta_0 + \beta_1 \overline{PA}_{(-i)sc0} + \beta_2 A_{isc0} + \beta_3 SC_{isc} + \delta_s + \epsilon_{isct} \tag{2}$$

where $t = 1, 2, 3$. Y_{isct} is the outcome of student i in school s and classroom c. $\overline{PA}_{(-i)sc0}$ is the main variable of interest that captures peer ability: leave-own-out mean of baseline fluid intelligence. A_{isc0} is the students' fluid intelligence at baseline. SC_{isc} is a vector of time-invariant student characteristics that include age in months, gender, refugee status, and preschool attendance. δ_s denotes school fixed effects. ϵ_{icst} is the error term clustered at the class level.

The setting described in the previous sections and the outlined specification addresses the key challenges in estimating peer effects, as identified by Manski (1993). Specifically, this approach overcomes the reflection problem by using peer ability calculated from pre-treatment measurements of students' fluid intelligence, ensuring that the measure is not

influenced by contemporaneous outcomes. Additionally, the random assignment of students to classrooms within schools eliminates concerns about the endogeneity of peer groups, allowing for a causal interpretation of the estimates of the impact of peer ability on student outcomes.

5 Results

In this section, I present the results of the empirical analysis. I discuss the main results in Section 5.1, and in Section 5.3, I discuss potential mechanisms that explain my findings.

5.1 Impact on Cognitive Skills and Academic Scores

This section examines the impact of peer ability on various student outcomes, as detailed in Section 3. All student outcomes evaluated here are standardized versions of the number of correct answers in each test. Table 2 presents the estimated impact of peer ability on students' fluid intelligence, cognitive empathy, math scores, and verbal scores. Panel 1 reports the estimated effects measured at the end of first grade, while Panel 2 presents estimates from the second grade and Panel 3 presents the estimates from the third grade.

The results indicate that peer ability has statistically significant and positive impacts on student outcomes, encompassing both cognitive skills and academic achievement. In the first grade, a one standard deviation increase in peer ability leads to an increase of 0.03 SD in fluid intelligence, 0.06 SD in cognitive empathy, 0.09 SD in math scores, and 0.10 SD in verbal scores. These impacts persist through the second and third grades. By the end of second grade, the corresponding gains rise to 0.06 SD for fluid intelligence, 0.05 SD for cognitive empathy, 0.11 SD for math, and 0.10 SD for verbal scores. At the end of third grade, the effect on fluid intelligence fades, but peer ability continues to significantly impact other outcomes by raising cognitive empathy by 0.07 SD, math scores by 0.09 SD, and verbal scores by 0.11 SD.

To assess the robustness of the findings, I conduct three additional analyses. First, Figure A1 presents results that are obtained from a specification that does not include individual-level characteristics of students as controls. Second, Figure A2 presents results using a restricted sample of students with complete data across all outcomes, ensuring that missing observations do not influence the results. Third, Figure A3 reports estimates from an

extended specification that includes controls for classroom characteristics as well as a comprehensive set of teacher characteristics, capturing their demographic attributes, cognitive skills, personality traits, and teaching methods. Across all robustness checks, the results remain highly consistent with the main estimates. It is worth noting that the stability of estimates after controlling for teacher characteristics suggests that the observed effects are not driven by differences in teacher quality or instructional practices. This strengthens the interpretation that peer ability independently influences student outcomes.

These results contribute to the literature in several key ways. First, while previous research has established the impact of peer ability on academic achievement, I provide novel evidence that peer ability also causally affects foundational cognitive skills, such as fluid intelligence and cognitive empathy. This expands the scope of peer effects beyond academic outcomes to fundamental cognitive processes. Notably, Black et al. (2013) examined peer effects on cognitive ability using a sample of Norwegian men at the age of 18 but found no significant impact. The divergence in findings may stem from differences in the study populations, particularly the greater malleability of cognitive and non-cognitive skills at earlier developmental stages (Cunha et al., 2010). Second, the estimated impact of peer ability is comparable in magnitude to the average effect of educational interventions in similar contexts (Evans and Yuan, 2022). This underscores the substantial role that peers play in the education production function, suggesting that peer influences may be as consequential as targeted policy interventions. Finally, I establish that ability peer effects exist in a novel context: primary schools in Turkey. While the literature on peer effects is extensive, it has largely focused on student populations in developed countries, with relatively few studies examining these dynamics in low- and middle-income settings. For instance, Duflo et al. (2011) provides evidence on peer effects in Kenyan primary schools, while Garlick (2018) documents positive peer effects in the context of South African university students. My findings contribute to this growing body of research by demonstrating that peer effects are not only significant in shaping academic performance but also play a crucial role in cognitive development.

5.2 Heterogeneities

In this section, I examine heterogeneities in the impact of peer ability on student outcomes across key student characteristics: gender, refugee status, preschool attendance, and initial ability. These characteristics are argued to be important determinants of peer relationships

by previous literature (Rose and Rudolph, 2006; Schwartz et al., 2021; Hay et al., 2004). To explore these differences empirically, I estimate the main specification separately by subgroups and test whether the resulting coefficients differ significantly between groups. Figures 2–5 illustrate differences in estimated peer effects across these subgroups.

Across all subgroup analyses, differences in peer ability effects are statistically indistinguishable from zero. Nonetheless, examining these patterns is valuable from an exploratory standpoint, as it still provides insights into how peer effects may evolve differently across student groups and over time.

Firstly, I report the heterogeneity based on the gender of the students in Figure 2. The estimated impact of peer ability on cognitive empathy appears to be slightly smaller for female students compared to male students in the first grade. One possible explanation is that female students, on average, exhibit higher baseline levels of cognitive empathy, leaving less room for improvement. Gender-based differences become clearer in math scores, emerging in the second grade and expanding into the third grade, where female students appear to benefit relatively more from peer interactions. In contrast, no consistent gender differences are apparent in verbal scores or fluid intelligence, suggesting similar peer-influence dynamics across genders in these domains.

Figure 3 examines differences according to refugee status. Refugee students initially seem to derive smaller academic benefits from peer ability compared to native students in Grades 1 and 2, though this gap disappears by Grade 3. However, no clear or consistent patterns emerge for fluid intelligence or cognitive empathy. It is also important to note that due to the lower share of refugee students in the sample, the confidence intervals of the estimated impacts are quite large, compared to the native students.

Figure 4 reports the differences based on students' preschool attendance. The role of preschool attendance in shaping peer effects becomes progressively pronounced over time. In the first grade, there are minimal differences in the estimated impact of peer ability between students with and without preschool experience. However, by the second grade, students who attended preschool exhibit larger peer effects across all outcomes. These differences further grow in the third grade. These findings are in line with List and Uchida (2024) and they suggest that early educational experiences may enhance students' ability to leverage peer interactions for learning, potentially by improving foundational skills that facilitate engagement in the classroom.

Lastly, Figure 5 presents the differences in the estimated impact of peer ability based on students' initial ability. For this part of the analysis, students are divided into two categories based on whether they are above or below the median in the ability distribution of their school. I document a clear and consistent pattern across all outcomes in the advantage of high ability students. The differences in the estimated impact of peer ability are very small in the first grade, except in fluid intelligence. However, starting with the second grade, I observe differences across all outcomes. These patterns suggests that cognitive and academic benefits from peers may compound differently depending on students' baseline abilities, with high-ability students increasingly gaining from interactions that reinforce perspective-taking ability and mathematical reasoning.

Taken together, these findings suggest that while peer ability exerts a broadly positive influence on student outcomes, the magnitude and dynamics of these effects vary across student characteristics. Differences by preschool attendance and initial ability, in particular, highlight the importance of early skill formation in amplifying peer effects.

5.3 Potential Mechanisms

5.3.1 Social Networks

In this section, I examine the impact of peer ability on two important dimensions of classroom social networks: friendship formation and ability-based homophily. Previous studies have identified these as crucial channels through which peer ability influences social structures within classrooms.

Higher-ability students typically foster more robust and socially vibrant networks, as they tend to be preferred as friends, collaborators, and partners in various classroom activities (Nowicki, 2003; Walker and Nabuzoka, 2007; Nepi et al., 2015; Palacios et al., 2019). Table A2 presents associations between ability and social measures from my dataset to support these claims, demonstrating that higher-ability students are significantly less likely to be socially isolated, receive more friendship nominations from classmates, have higher rates of reciprocal friendships, and belong to peer groups that are more tightly connected. Such social advantages may arise because higher-ability students are often perceived by peers as socially skilled and competent, further elevating their status in classroom networks (Newcomb et al., 1993; Gifford-Smith and Brownell, 2003).

Table 3 presents the estimated impact of peer ability on the measures that summarize friendship formation in classrooms. The findings indicate that peer ability has no significant effect on most outcomes, except for reciprocity, which shows a 7% decrease in effect size during the second grade, though this effect disappears by the third grade. On the other hand, peer ability appears to have a significant and negative impact on the clustering coefficient by roughly 2% in effect size in the third grade. These results suggest that while peer ability does not appear to influence how many friendships are formed; however, it may have a subtle effect on their quality. However, these patterns are not consistent enough to support strong conclusions.

Conversely, increased peer ability can widen performance gaps among students, thereby intensifying homophily, students' preference to form friendships primarily with peers of similar academic ability (Carrell et al., 2013). Such ability-based sorting occurs as high-ability students cluster due to shared academic interests or comparable learning paces, while low-ability students may bond with each other in response to perceived differences or social exclusion. Several longitudinal studies confirm that academic similarity is a persistent driver of friendship formation across educational contexts (Flashman, 2012; Shin and Ryan, 2014; Smirnov and Thurner, 2017).

Table 4 presents the estimated impact of peer ability on students' excess propensity to nominate peers from their own ability group. Column 1 reports results for high-ability students, while Column 2 reports results for low-ability students. For high-ability students, an increase in peer ability significantly increases their likelihood of forming friendships within their own ability group. In contrast, for low-ability students, higher peer ability leads to a significant reduction in their in-group nominations, suggesting decreased homophily. Rather than withdrawing into homogeneous groups, these students appear more inclined to reach out to higher-ability classmates which may suggest a desire to connect or learn from them. This divergent response from different ability groups carries on to the second grade. By the third grade, the impact on low-ability students fades, while the reinforcing effect among high-ability students remains strong and statistically significant. These findings underscore that peer effects on network formation are not symmetric across the ability distribution and that low-ability students may actively seek ties to more academically advantaged peers in high-ability classrooms.

Taken together, these results indicate that peer ability influences classroom social networks primarily through ability-based homophily, rather than through changes in the quan-

tity or quality of friendships. While peer ability does not significantly affect how many friendships students form or the overall quality of those ties, it reshapes the composition of students' social circles by altering their tendency to associate with peers of similar ability. A key finding is that this effect is asymmetric: high-ability students become increasingly likely to form in-group friendships, reinforcing homophilic patterns, whereas low-ability students exhibit a decrease in in-group homophily. This asymmetry may potentially explain my findings in Section 5.2, which report that high-ability students are increasingly benefiting from exposure to higher peer ability. These findings also align with evidence from Carrell et al. (2013) and Wu et al. (2023), who show that ability-mixing interventions can inadvertently intensify homophily. My results extend their insights by demonstrating that such sorting can also emerge endogenously, even in the absence of explicit interventions, and that its direction may vary meaningfully across the ability distribution.

5.3.2 Social Learning

Social learning can be a key mechanism for understanding peer effects in classroom environments, as it captures the ways in which students influence each other's behaviors, skills, and decisions. Previous literature highlights two main pathways through which social learning occurs. First, direct knowledge spillovers happen when students share information, collaborate, or explain concepts to each other, thereby enhancing their peers' learning (Wu et al., 2023). Second, indirect social learning occurs when students observe and imitate the behaviors or decisions of their peers (Bursztyn et al., 2019; Xu et al., 2022).

To examine direct knowledge spillovers, I calculate a proxy measure, which is the average ability levels of students' direct peers, defined by the self-reported friends of a student. Column 2 of Table 5 presents the estimated impact of peer ability on the mean ability of direct peers. The results show that a one standard deviation increase in peer ability leads to a 0.21 SD increase in the mean ability of direct peers by the end of the first grade. This effect becomes slightly larger over time, growing to 0.24 SD by the end of the second grade and to 0.22 SD by the end of the third grade.

Secondly, I explore whether peer ability has an impact on indirect social learning by leveraging a measure of conformism that is elicited via a novel decision task. Column 1 of Table 5 presents the estimated impact of peer ability on students' conformism. The results show no significant relationship between peer ability and conformism, suggesting that indirect

social learning through behavioral imitation does not play a role in this context.

Taken together, these results highlight the role of direct knowledge spillovers in explaining the social spillovers of ability in classrooms. Peer ability significantly increases the average ability of students' direct peers, with this effect strengthening over time. However, the lack of an impact on conformism indicates that indirect social learning through behavioral imitation does not contribute to the observed peer effects.

5.3.3 Learning Environment

Another mechanism that was put forward by previous literature is the learning environment, which encapsulates the behaviors of both students and their teachers.

Firstly, I explore the impact of peer ability on students' behavioral attitudes. High-ability peers may foster a more stimulating and cooperative learning environment (Booij et al., 2017; Feld and Zölitz, 2017), while low-ability peers may disrupt classroom dynamics (Scott A. Imberman et al., 2012; Lavy and Schlosser, 2011; Lavy et al., 2012; Lazear, 2001). To test this, I leverage behavioral ratings provided by teachers, who evaluated each student on a scale of 1 to 5 based on the overall behavioral attitudes of students. Table 6 presents the results, which show that peer ability does not significantly affect students' behavioral ratings.

Secondly, I explore the impact of classroom ability on teachers' teaching pedagogy. Teachers may adapt their practices in response to classroom ability levels, as suggested by Duflo et al. (2011), Lavy et al. (2012), and Booij et al. (2017). To isolate the effect of classroom ability, I restrict the sample to classrooms where teachers did not change during the study period and collapse the data to the classroom level, using classroom-average of baseline fluid intelligence as the independent variable. Table 7 shows the estimated impact of classroom ability on teaching pedagogy.

An increase in classroom ability level leads to a sizable impact on inquiry-based teaching methods of 0.10 SD in first grade, 0.2 SD in second grade, and 0.26 SD in third grade although only the latter is statistically significant. This result suggests that higher classroom ability levels may encourage teachers to adopt more inquiry-based teaching methods, potentially due to the perceived readiness or capability of higher-ability students to engage in such pedagogical practices. However, the lack of statistical significance in the first-grade estimate suggests that this relationship may strengthen as teachers gain more experience with their

classrooms over time.

The remaining pedagogical measures do not exhibit a fully consistent pattern over time, nor are the estimates precise enough to support strong conclusions. There is suggestive evidence of an increasing use of modern teaching methods and a decline in emotional warmth as peer ability rises, particularly in later grades. However, these trends are not statistically robust, and a larger sample would be required to draw firm conclusions about the evolution of these teaching practices.

Taken together, these findings suggest that classroom ability influences the learning environment, particularly through teachers' adaptation of their teaching methods. Higher-ability classrooms appear to encourage the use of inquiry-based approaches while discouraging reliance on extrinsic motivation. In contrast, students do not seem to alter their behavioral attitudes based on their exposure to varying levels of peer ability.

6 Conclusion

This study provides new insights into the impact of peer ability on students' cognitive skills and academic outcomes, with a particular focus on the mechanisms driving these effects. Using uniquely rich data from large-scale fieldwork in Turkey, I exploit the random assignment of students to classrooms to causally estimate the impact of peer ability. The findings demonstrate that peer ability significantly influences a broad range of student outcomes, including fluid intelligence, cognitive empathy, math, and verbal scores. Importantly, these effects are evident as early as the first grade and grow larger by the end of the second grade, underscoring the cumulative nature of peer effects over time.

In addition to establishing the presence of peer ability effects, this study sheds light on the mechanisms through which these social spillovers occur. I show that peer ability impacts classroom social networks, driving ability-based homophily in opposite directions depending on students' initial ability. High-ability students increasingly form friendships with peers of similar ability, whereas low-ability students reach out to their high-ability peers more when they are exposed to a higher level of peer ability. These patterns point to a shift in network composition, not just network size or quality. Furthermore, I find evidence that social learning, particularly through direct knowledge spillovers, plays a central role in explaining these effects. Exposure to higher peer ability increases the average ability of

students' direct peers, suggesting that knowledge-sharing dynamics may be at work. Finally, I provide evidence that teachers alter their teaching pedagogy over time based on students' ability levels.

These findings contribute to the growing literature on peer effects in several important ways. First, I extend the literature by demonstrating that peer ability affects not only academic outcomes but also cognitive skills such as fluid intelligence and cognitive empathy, highlighting the broader developmental implications of peer interactions. Second, by using fluid intelligence as a standardized and robust measure of ability, I improve upon prior studies that rely on noisier proxies like GPA. Third, the study offers a comprehensive assessment of the mechanisms behind peer effects, leveraging detailed social network data and innovative measures of social learning to uncover their reaction to peer ability. Finally, the study provides evidence from a novel context—primary schools in Turkey—broadening our understanding of peer effects beyond the settings of developed countries, where most previous research has been conducted.

The policy implications of these findings are clear: peer groups play a fundamental role in shaping both the academic and cognitive development of students. This underscores the importance of considering peer composition when designing educational interventions and policies. Fostering inclusive classroom environments that mitigate ability-based segregation may enhance the benefits of peer learning while promoting classroom cohesiveness.

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7 Tables

Table 1: Balance Table

	Peer Ability
Fluid Intelligence	-0.008
	(0.01)
Female	0.002
	(0.01)
Refugee	-0.031
	(0.02)
Attended Preschool	0.026
	(0.02)
Age (in months)	0.000
	(0.00)
N	7679
R-Squared	0.72
F-test	0.26

Note: Each cell reports the OLS estimates of the variables in the corresponding row on peer ability. The regressions include controls for school fixed effects. Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 2: Impact on Cognitive Skills and Academic Scores

	Fluid Intelligence	Cognitive Empathy	Math Score	Verbal Score
Panel 1. First Grade:				
Peer Ability	0.03*	0.06***	0.09***	0.10***
	(0.02)	(0.02)	(0.02)	(0.03)
Outcome Mean	0.00	-0.00	-0.00	0.00
N	7558	7495	7456	7456
Panel 2. Second Grade:				
Peer Ability	0.06***	0.05**	0.11***	0.10***
	(0.02)	(0.02)	(0.02)	(0.02)
Outcome Mean	-0.00	-0.00	-0.00	-0.00
N	6656	6656	6656	6656
Panel 3. Third Grade:				
Peer Ability	0.02	0.07***	0.09***	0.11***
	(0.02)	(0.02)	(0.03)	(0.03)
Outcome Mean	0.00	0.00	0.00	0.00
N	5808	5792	5789	5789

Note: Each cell reports the OLS estimates of peer ability on the student outcome in the corresponding column. The regressions include controls for student demographics such as gender, refugee status, preschool attendance, and school fixed effects. Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3: Impact of Peer Ability on Friendship Formation

	Quantity		Quality	
	Isolated	In-degree Ties	Reciprocity	Clustering Coef.
Panel 1. First Grade:				
Peer Ability	0.01	-0.00	0.01	0.01
	(0.01)	(0.09)	(0.01)	(0.01)
Outcome Mean	0.18	2.62	0.21	0.29
N	7679	7515	7515	7515
Panel 2. Second Grade:				
Peer Ability	0.01	-0.05	-0.02*	0.01
	(0.01)	(0.07)	(0.01)	(0.01)
Outcome Mean	0.13	3.43	0.30	0.34
N	6656	6656	6656	6656
Panel 3. Third Grade:				
Peer Ability	0.00	-0.02	-0.01	-0.01*
	(0.01)	(0.07)	(0.01)	(0.01)
Outcome Mean	0.11	3.52	0.38	0.42
N	5822	5745	5745	5745

Note: Each cell reports the OLS estimates of peer ability on the student outcome in the corresponding column. The regressions include controls for student demographics such as gender, refugee status, preschool attendance, and school fixed effects. Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Impact of Peer Ability on Ability-based Homophily

	High Ability Students	Low Ability Students
Panel 1. First Grade:		
Peer Ability	0.16***	-0.08**
	(0.03)	(0.04)
Outcome Mean	0.18	-0.08
N	3789	3411
Panel 2. Second Grade:		
Peer Ability	0.09***	-0.09**
	(0.02)	(0.04)
Outcome Mean	0.15	-0.09
N	3426	2974
Panel 3. Third Grade:		
Peer Ability	0.12***	0.03
	(0.02)	(0.04)
Outcome Mean	0.12	-0.09
N	3056	2499

Note: Each cell reports the OLS estimates of peer ability on the student outcome in the corresponding column. The regressions include controls for student demographics such as gender, refugee status, preschool attendance, and school fixed effects. Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Impact of Peer Ability on Social Learning

	Conformism	Mean Ability of Direct Peers
Panel 1. First Grade:		
Peer Ability	0.03	0.21***
	(0.03)	(0.01)
Outcome Mean	-0.00	0.00
N	7677	7515
Panel 2. Second Grade:		
Peer Ability	0.00	0.24***
	(0.03)	(0.02)
Outcome Mean	-0.00	0.00
N	6655	6656
Panel 3. Third Grade:		
Peer Ability	0.02	0.22***
	(0.03)	(0.02)
Outcome Mean	-0.00	-0.00
N	5821	5745

Note: Each cell reports the OLS estimates of peer ability on the student outcome in the corresponding column. The regressions include controls for student demographics such as gender, refugee status, preschool attendance, and school fixed effects. Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Impact of Peer Ability on Behavioral Rating

	Behavioral Rating
Panel 1. First Grade:	
Peer Ability	-0.05
	(0.03)
Outcome Mean	0.00
N	7497
Panel 2. Second Grade:	
Peer Ability	0.03
	(0.04)
Outcome Mean	0.00
N	6591
Panel 3. Third Grade:	
Peer Ability	-0.02
	(0.04)
Outcome Mean	-0.00
N	5662

Note: Each cell reports the OLS estimates of peer ability on the student outcome in the corresponding column. The regressions include controls for student demographics such as gender, refugee status, preschool attendance, and school fixed effects. Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

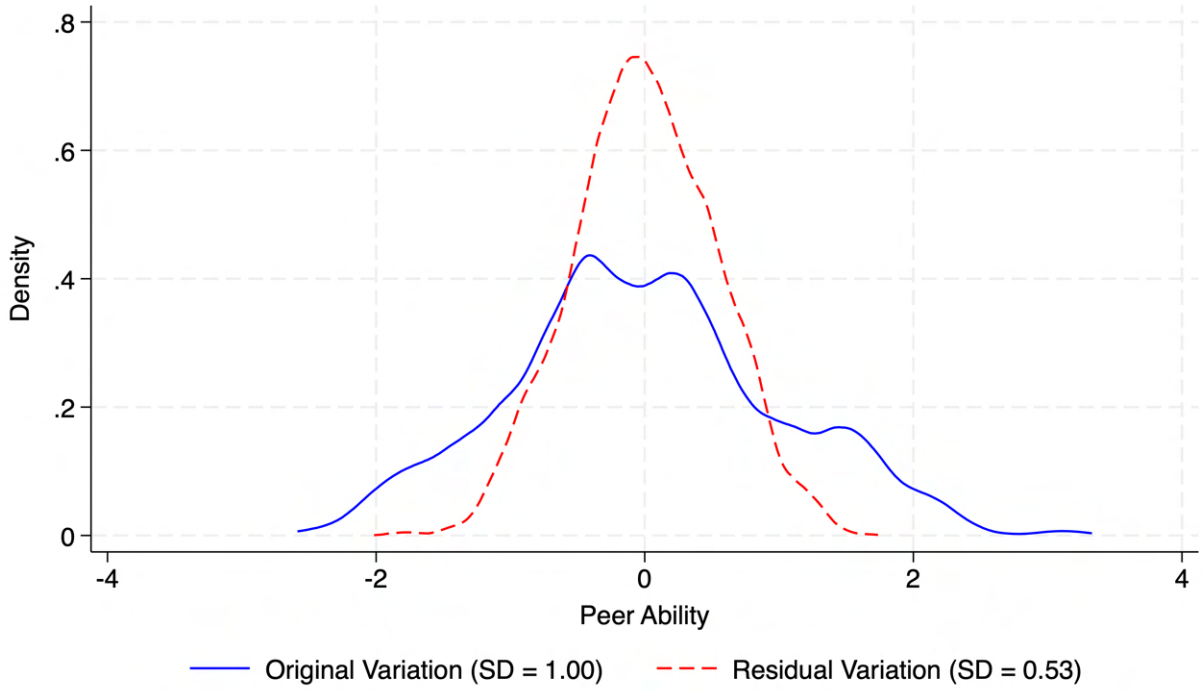
Table 7: Impact of Classroom Ability on Teaching Pedagogy

	Inquiry-based Pedagogy	Modern Teaching Methods	Extrinsic Motivation	Emotional Warmth
Panel 1. First Grade:				
Peer Ability	0.10	-0.02	-0.12	-0.07
	(0.14)	(0.14)	(0.12)	(0.12)
Outcome Mean	0.04	0.05	-0.04	0.06
N	236	234	235	236
Panel 2. Second Grade:				
Peer Ability	0.20	0.08	-0.02	-0.16
	(0.13)	(0.15)	(0.11)	(0.10)
Outcome Mean	0.01	0.01	-0.01	0.04
N	237	236	236	238
Panel 3. Third Grade:				
Peer Ability	0.26**	0.13	0.07	-0.06
	(0.11)	(0.11)	(0.12)	(0.10)
Outcome Mean	0.01	0.01	-0.01	0.04
N	238	236	236	239

Note: Each cell reports the OLS estimates of peer ability on the student outcome in the corresponding column. The regressions include controls for the share of student demographics such as gender, refugee status, preschool attendance, and school fixed effects. Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

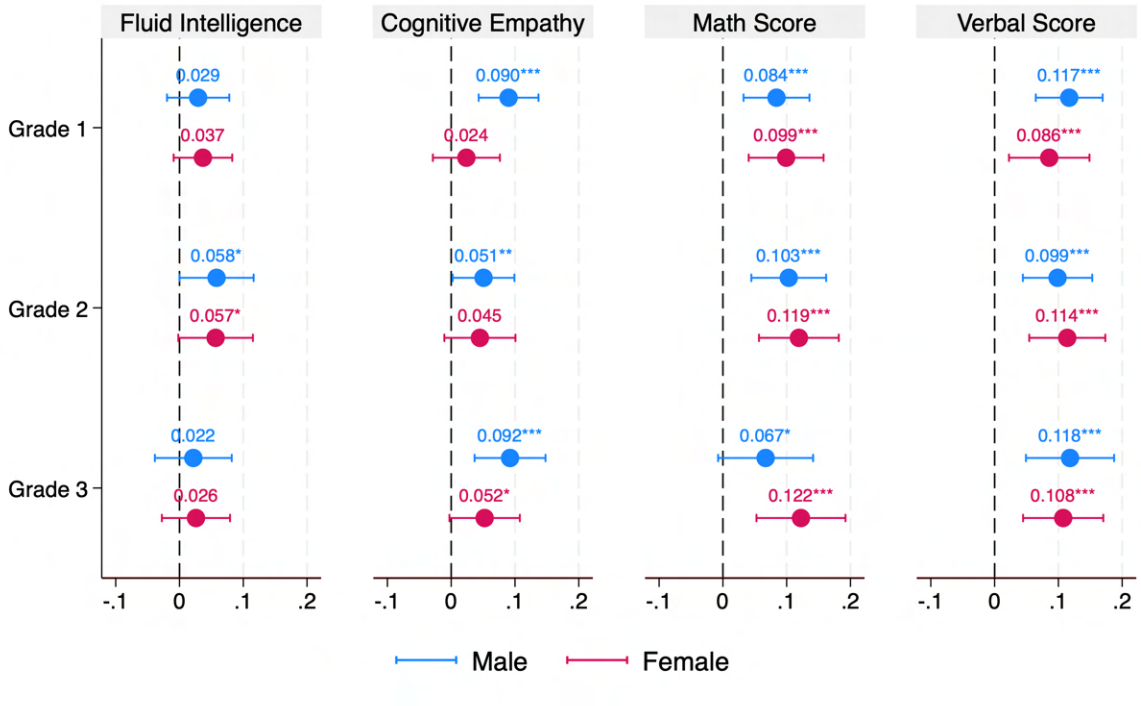
8 Figures

Figure 1: Distribution of Peer Ability



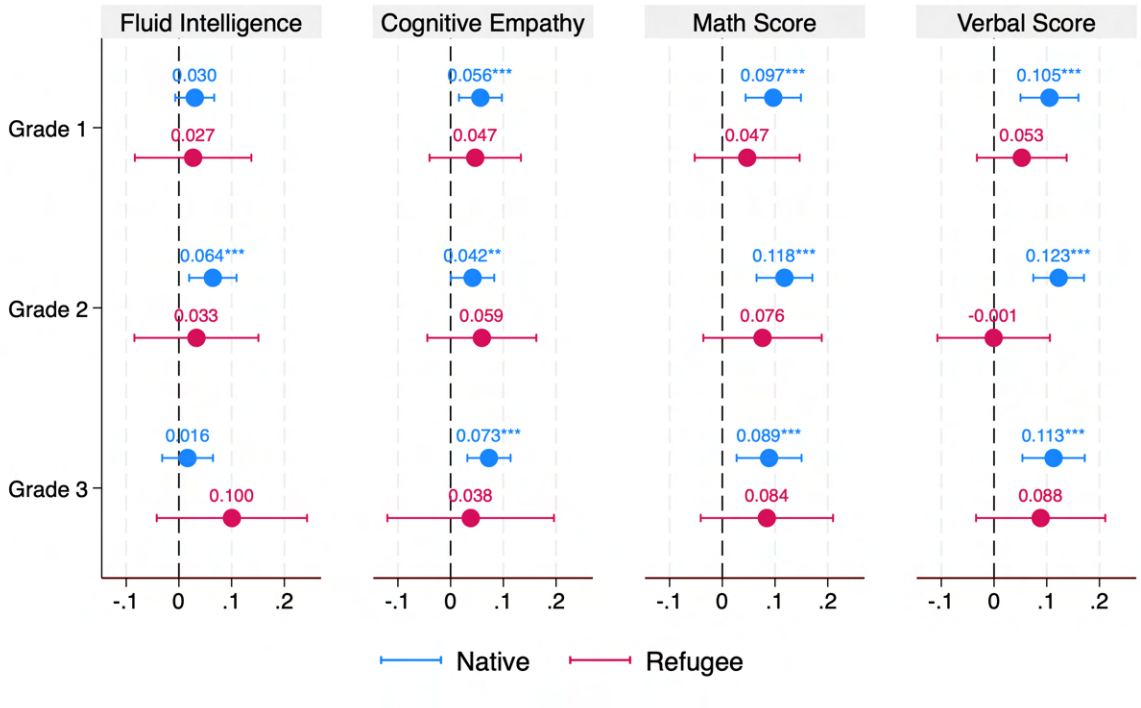
Note: The figure plots the distribution of peer ability as measured by leave-own-out-mean of baseline fluid intelligence. The blue line indicates the overall distribution. The dashed red line indicates the residual variation that is left after controlling for school fixed effects, baseline fluid intelligence, and student demographics such as gender, refugee status, preschool attendance, and age.

Figure 2: Heterogeneity in the Impact of Peer Ability based on Gender



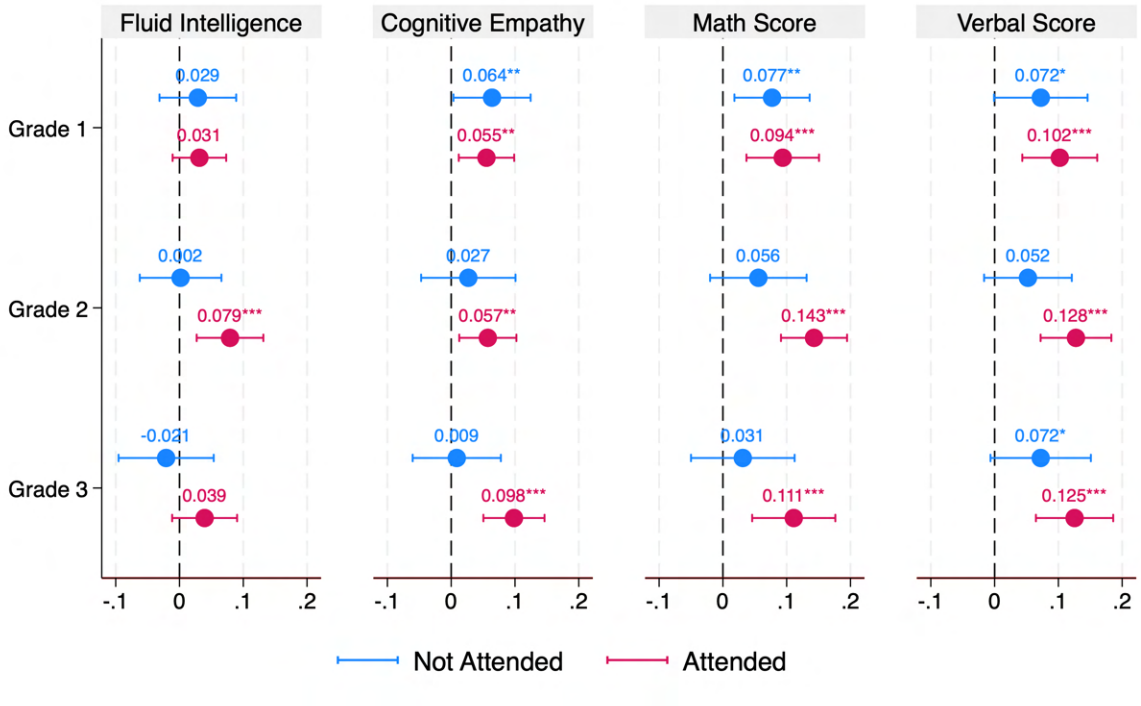
Note: Each point indicates the estimated impact of peer ability on outcome specified at the top of each column, for the student subgroup that is specified in the legend. The regressions include controls for students' refugee status, preschool attendance, age, initial ability and school fixed effects.

Figure 3: Heterogeneity in the Impact of Peer Ability based on Refugee Status



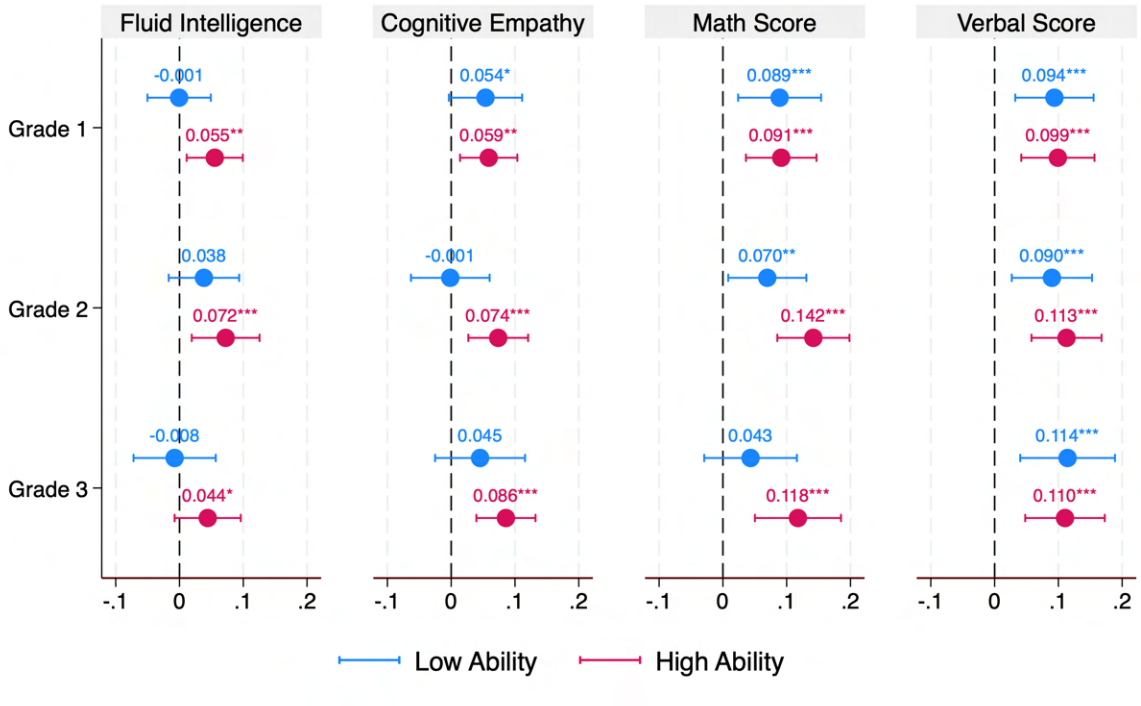
Note: Each point indicates the estimated impact of peer ability on outcome specified at the top of each column, for the student subgroup that is specified in the legend. The regressions include controls for students' gender, preschool attendance, age, initial ability and school fixed effects.

Figure 4: Heterogeneity in the Impact of Peer Ability based on Preschool Attendance



Note: Each point indicates the estimated impact of peer ability on outcome specified at the top of each column, for the student subgroup that is specified in the legend. The regressions include controls for students' gender, refugee status, age, initial ability and school fixed effects.

Figure 5: Heterogeneity in the Impact of Peer Ability based on Initial Ability



Note: Each point indicates the estimated impact of peer ability on outcome specified at the top of each column, for the student subgroup that is specified in the legend. The regressions include controls for students' gender, refugee status, preschool attendance, age, initial ability and school fixed effects.

A Appendix

A.1 Tables

Table A1: Descriptive Statistics on Student Demographics

	(1) Mean	(2) SD
Student characteristics:		
Female	0.49	(0.50)
Refugee	0.15	(0.35)
Attended Preschool	0.67	(0.47)
Age (in months)	78.39	(5.70)

Note: The table presents the summary statistics on students' key demographic characteristics.

Table A2: Association Between Ability and Friendship Formation

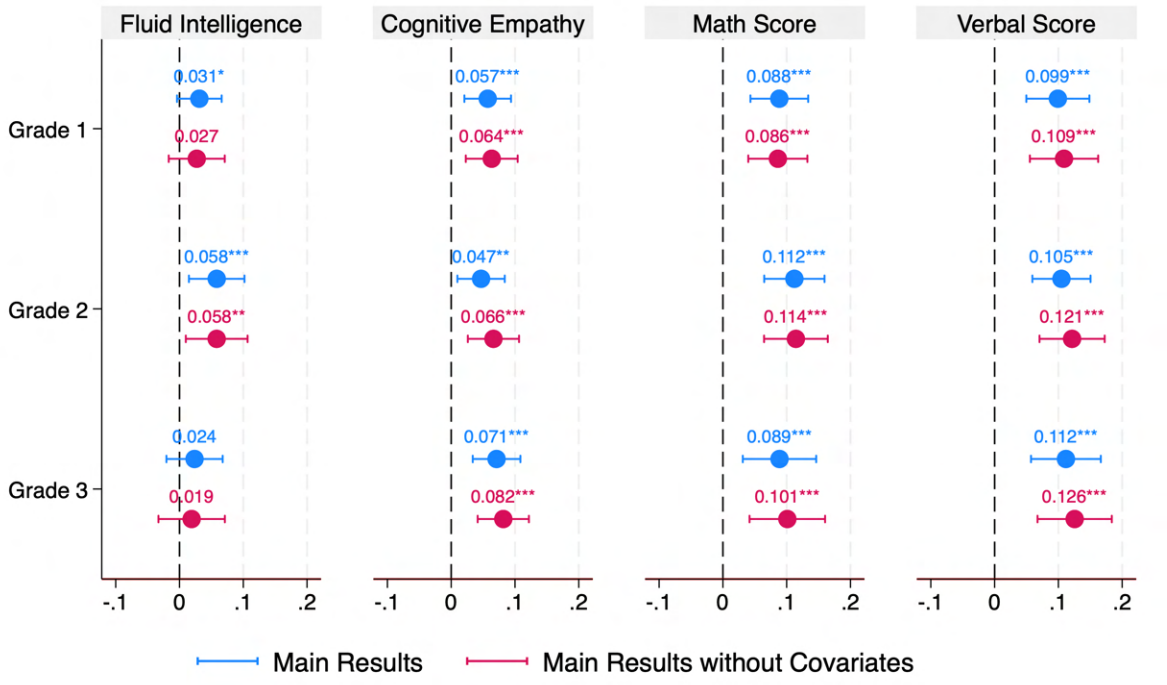
	Quantity		Quality		Social Skills	Behavioral Attitude
	Isolated	In-degree Ties	Reciprocity	Clustering Coef.	Cognitive Empathy	Behavioral Rating
Panel 1. First Grade:						
Baseline Ability	-0.02***	0.24***	0.03***	0.01***	0.18***	0.12***
	(0.00)	(0.03)	(0.00)	(0.00)	(0.01)	(0.01)
Outcome Mean	0.18	2.62	0.21	0.29	-0.00	0.00
N	7679	7515	7515	7515	7495	7497
Panel 2. Second Grade:						
Baseline Ability	-0.02***	0.39***	0.03***	0.01**	0.16***	0.13***
	(0.00)	(0.03)	(0.00)	(0.00)	(0.01)	(0.01)
Outcome Mean	0.13	3.43	0.30	0.34	-0.00	0.00
N	6656	6656	6656	6656	6656	6591

Note: Each cell reports the OLS estimates of baseline ability on the student outcome in the corresponding column. The regressions include controls for school fixed effects. Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

A.2 Figures

A.2.1 Results

Figure A1: Main Results without Covariates

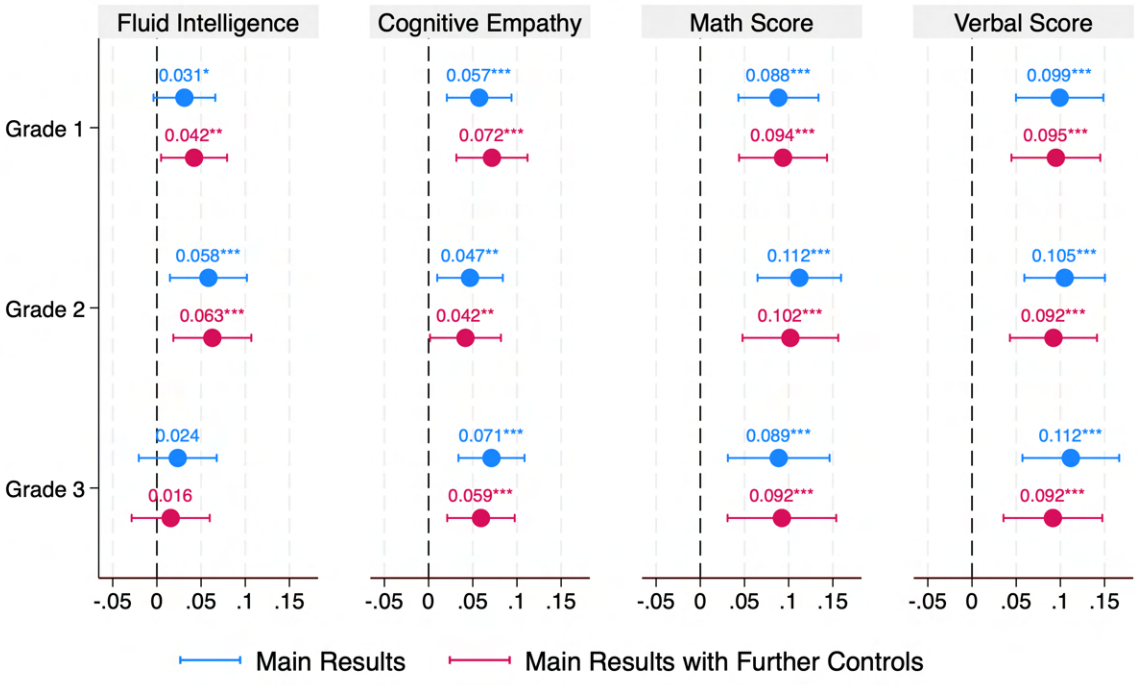


Note: Each point reports the OLS estimates of peer ability on the student outcome in the corresponding column. The estimates in blue are from the main specification which include controls for school fixed effects, individual characteristics(gender, refugee status, preschool attendance, age). The estimates in red are obtained from a specification that does not control for individual characteristics. Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Figure A2: Main Results with Balanced Sample

Note: Each point reports the OLS estimates of peer ability on the student outcome in the corresponding column. The estimates in blue are from the main specification which include controls for school fixed effects, individual characteristics(gender, refugee status, preschool attendance, age). The estimates in red are obtained from a restricted sample that is balanced across waves). Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Figure A3: Main Results with Further Controls



Note: Each point reports the OLS estimates of peer ability on the student outcome in the corresponding column. The estimates in blue are from the main specification which include controls for school fixed effects, individual characteristics(gender, refugee status, preschool attendance, age). The estimates in red additionally controls for classroom characteristics (share of refugees, share of females, share of students who attended preschool), and teacher characteristics(age, experience, being tenured, personality traits, teaching methods). Standard errors, presented in parentheses, are clustered at the class level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

A.2.2 Inventory

Figure A4: Timeline of Data Collection

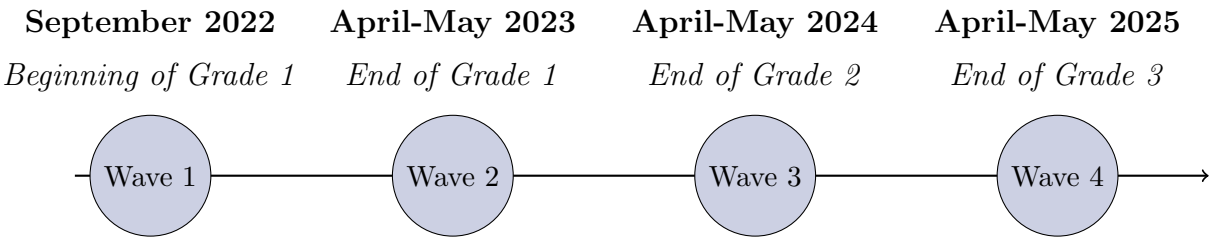


Figure A5: Example Question from Raven's Progressive Matrices Test

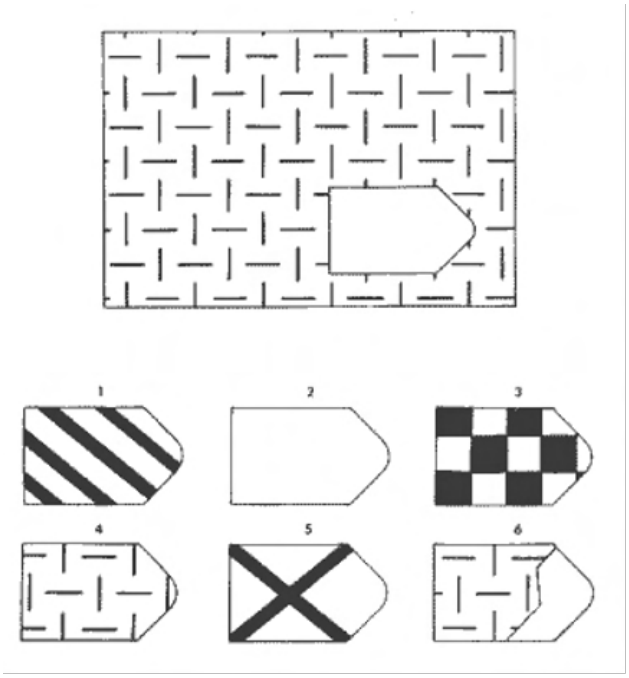


Figure A6: Example Question from Reading the Mind in the Eyes Test

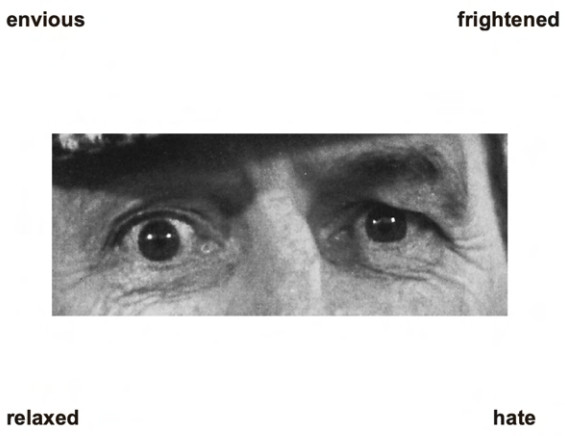
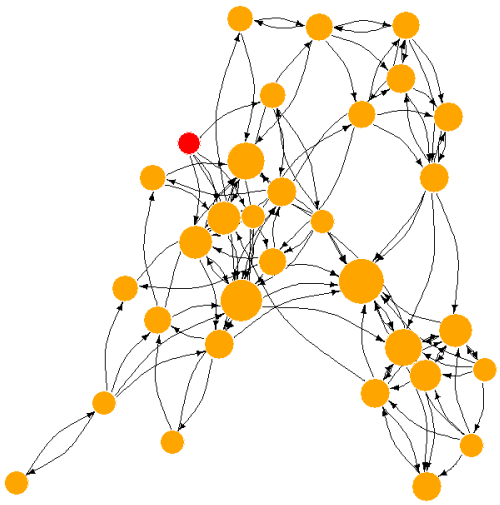


Figure A7: Example Classroom Social Network



Note: The figure presents the social network of a classroom. Each node indicates a student. The size of a node is proportional to the number of nominations received by the student. A node is red if that student is isolated, i.e., the student did not receive any nominations from their classmates.