

Künstler-Sment, Julia; Kocaj, Aleksander; Lorenz, Georg; Jansen, Malte

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The Role of All-Day Schooling in Friendship Segregation Between Students with Different Language Backgrounds

Julia Künstler-Sment  · Aleksander Kocaj · Georg Lorenz · Malte Jansen

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Abstract All-day schools in Germany aim to provide increased opportunities for friendships between students with different language backgrounds as compared to half-day schools. Moreover, the extended shared time spent during extracurricular activities might foster friendships between students with different native languages and reduce language-based segregation in students' friendship networks. This study investigated friendships between students with the same native language (language-based friendship segregation) and compared them across half-day and all-day schools to test these propositions. We analyzed social network data from the IQB Trends in Student Achievement 2018 study, including information from 28,239 secondary school students (mean age 15.51 years; 49.7% girls), of whom 17,004 attended half-day schools and 11,235 attended all-day schools. We conducted separate analyses for German and non-German native speakers using multilevel analyses and applied propensity score matching to control for school-selection effects. Our results reveal that all-day schooling is associated with lower language-based friendship segregation

✉ J. Künstler-Sment · A. Kocaj

Institute for Educational Quality Improvement (IQB), Humboldt-Universität zu Berlin
Unter den Linden 6, 10099 Berlin, Germany
E-Mail: julia.kuenstler-smment@iqb.hu-berlin.de

A. Kocaj
E-Mail: aleksander.kocaj@iqb.hu-berlin.de

G. Lorenz
Education Department, University of Potsdam
Karl-Liebknecht-Straße 24–25, 14476 Potsdam, Germany
E-Mail: georg.lorenz@uni-potsdam.de

M. Jansen
Institute of Mind, Brain and Behavior (IMBB), Department of Psychology, HMU Health and Medical University Potsdam
Villa Carlshagen, Olympischer Weg 1, 14471 Potsdam, Germany
E-Mail: malte.jansen@hmu-potsdam.de

for German native speakers but not for non-German native speakers. This difference in friendship segregation among German native speakers can be attributed neither to varying opportunity structures for intergroup friendships nor to varying participation in extracurricular activities. We discuss the results in terms of the goals of all-day schooling, implications for educational practices, and future research needs.

Keywords All-day school · Half-day school · Extracurricular activities · Friendship segregation · Native language background

Die Rolle der Ganztagschule bei der Freundschaftssegregation zwischen Schülerinnen und Schülern mit unterschiedlichen sprachlichen Hintergründen

Zusammenfassung Ganztagschulen in Deutschland zielen darauf ab, im Vergleich zu Halbtagschulen verstärkt Gelegenheiten für Freundschaften zwischen Schülerinnen und Schülern unterschiedlicher sprachlicher Hintergründe zu schaffen. Darüber hinaus könnte die verlängerte gemeinsame Zeit während außerunterrichtlicher Aktivitäten Freundschaften zwischen Schülerinnen und Schülern mit unterschiedlichen Muttersprachen fördern und sprachbasierte Segregation in den Freundschaftsnetzwerken an Ganztagschulen im Vergleich zu Halbtagschulen verringern. Die vorliegende Studie untersucht sprachbezogene Freundschaftssegregation, verstanden als die Tendenz, Freundschaften mit gleichsprachigen Peers zu schließen, und vergleicht diese zwischen Halb- und Ganztagschulen. Die Analysen basieren auf Daten des IQB-Bildungstrends (Becker et al. 2022) mit 28.239 Sekundarschülerinnen und -schülern (15,51 Jahre alt; 49,7 % Mädchen), davon 17.004 an Halbtagschulen und 11.235 an Ganztagschulen. Die Analysen wurden mittels Mehrebenenanalysen separat für deutsche und nichtdeutsche Muttersprachlerinnen und -sprachler durchgeführt, ergänzt durch Propensity-Score-Matching, um schulische Selektionseffekte zu kontrollieren. Die Ergebnisse zeigen, dass der Besuch einer Ganztagschule mit einer verringerten sprachbasierten Freundschaftssegregation bei deutschen, nicht jedoch bei nichtdeutschen Muttersprachlerinnen und -sprachlern assoziiert ist. Diese Unterschiede in der Freundschaftssegregation unter deutschen Muttersprachlerinnen und -sprachlern können nicht auf Gelegenheitsstrukturen für interethnische Freundschaften oder die Teilnahme an außerunterrichtlichen Aktivitäten zurückgeführt werden. Die Ergebnisse werden in Bezug auf die Ziele von Ganztagschulen diskutiert und Implikationen für die weitere Forschung abgeleitet.

Schlüsselwörter Ganztagschule · Halbtagschule · Außerunterrichtliche Aktivitäten · Freundschaftssegregation · Muttersprachlicher Hintergrund

1 Introduction

In many European countries, including Germany, students with immigrant backgrounds are disadvantaged with regard to a variety of educational outcomes, such as

school achievement (e.g., Henschel et al. 2023; Schotte et al. 2018), the attainment of certificates (e.g., Becker et al. 2023), and dropout rates (e.g., Mishra and Müller 2022). Both the academic and the social experience of attending school are different for students who belong to the ethnic majority group in a country vs. students who have ethnic minority backgrounds (Diehl et al. 2016; Jackson 2020). One reason for such inequalities, highlighted repeatedly by research, is a lower level of proficiency in the majority language of instruction of immigrants (Kristen 2019).

The school context has particular significance in facilitating language-minority students' (e.g., non-German native speakers) proficiency in the majority language (e.g., German; Seuring et al. 2020). In addition to language teaching, it can provide opportunities for social relationships across (language-)minority and majority students, promoting both academic achievement (Diehl et al. 2016; Jackson 2020) and social integration through peer interactions (Boda et al. 2023; Oczlon et al. 2023). One central school-level measure that might foster social relationships between German native speakers and non-German native speakers is the establishment of all-day schools (Terhart and von Dewitz 2018).

The transformation of Germany's educational landscape since 2001, from traditional half-day to all-day schools, has followed ambitious goals. Among them were not only the enhancement of student achievement but also the reduction of social and ethnic inequality and fostering of a more inclusive social environment (Fischer et al. 2014; Rehm 2018; Steiner 2009). At all-day schools where various extracurricular activities are offered throughout the school day or in the afternoon, students spend more shared time in school, which provides more opportunities for developing friendships within and across language groups (Kanevski et al. 2011; Schaefer et al. 2011, 2018). Although half-day schools also offer extracurricular activities, they do so to a lesser extent than all-day schools (Künstler-Sment et al. 2025). Thus, extracurricular activities might be one driver of possible all-day school effects on (interethnic) social relationships.

Various studies underscore the role of extracurricular activities in fostering interethnic friendships, which contribute positively to identity development, well-being, and the reduction of intergroup bias and prejudice (Schaefer et al. 2011, 2018). However, little research has investigated peer relationships among members of minority groups (non-German native speakers) and majority groups (German native speakers) and compared them between half-day and all-day schools.

This study compared friendships between non-German and German native speakers in all-day and half-day schools. We explored differences in opportunity structure between the school types, as all-day schools are assumed to be more diverse than half-day schools in Germany and provide more opportunities for intergroup friendships (i.e., the presence of classmates with different native languages). This assumption is based on the fact that immigrant students are overrepresented in nonacademic tracks, which have a higher proportion of all-day schools (Künstler-Sment et al. 2025). We used social network data from the IQB Trends in Student Achievement 2018 study (Stanat et al. 2022) to investigate the relationship between all-day school attendance and friendships within and between language groups.

While the distinction between half-day and all-day schools is particularly prominent in Germany, the mechanisms explored in this study—particularly the extended

shared time during extracurricular activities and its possible effect on friendship formation—are relevant in a broader international context. Many countries, including the United States and other European nations, grapple with how diverse models of school organization (e.g., after-school programs, extended-day schools) influence social integration (e.g., Schüpbach et al. 2012; Zief et al. 2006), making our findings applicable beyond the German case.

2 Theoretical Background

2.1 Language-Based Friendship Segregation

Segregated social networks that are characterized by shared traits such as the language background of the connected individuals tend to duplicate resources and thus promote bonding social capital (Jusri and Kleinert 2018; Putnam 2007). Integrated networks connecting individuals of different linguistic backgrounds, on the other hand, typically expand resources by bringing together individuals from diverse backgrounds, facilitating the exchange of resources and thus promoting bridging social capital (Borgatti and Halgin 2011; Erickson 2003; Lin 2001; Portes 1998). Bridging social capital, such as access to information and support, enhances students' achievement, academic self-concept, life satisfaction (Hewstone 2015), and proficiency in the language of instruction (Seuring et al. 2020; Wölfer et al. 2019), as well as acceptance and sense of belonging at school. Moreover, positive contact and cooperation among students of different ethnic backgrounds foster positive interactions, reduce ethnic discrimination, and strengthen feelings of school belonging (Graham 2018; Schachner et al. 2015; Schwarzenthal et al. 2018).

Consequently, integrated networks ensure equitable resource access for students, including both minority groups (non-German native speakers) and the majority group (German native speakers). Conversely, segregated networks tend to increase resource disparities and thus possibly reproduce inequality. For example, majority group students often have more family resources and social capital that they tend to share primarily with other majority group peers within their social circles. At the same time, networks characterized by language segregation limit the access of nonnative speakers with fewer family social resources to social capital.

Segregation occurs at multiple levels, including group-level and individual-level segregation. A key opportunity-based mechanism involves the structural composition of classrooms and schools, determining the number and diversity of peers available for interaction. While segregation is often examined at the network level, Bojanowski and Corten (2014) argue that it can also be analyzed at the group or individual level, depending on the research focus. A micro-level approach, which focuses on a student's individual friendship network within a classroom, provides insights into that student's everyday social integration and their experiences of segregation and integration. In this study, we describe segregation and integration along a spectrum: Segregation occurs when friendships of individual students are primarily confined to their own language groups, whereas integration reflects a balanced distribution of

intergroup friendships in their network, fostering broader social connections across different language backgrounds.

We discuss ethnic composition in relation to opportunity structure, which refers to the availability of classmates from different language backgrounds. The likelihood that students encounter peers from different linguistic or ethnic backgrounds depends on the structural composition of their schools and classrooms, which in turn affects friendship formation (Leszczensky et al. 2022; Leszczensky and Stark 2019). By a determination of who is present in the classroom and how much time students spend together, organizational factors primarily influence the quantity of potential intergroup and intragroup contacts.

However, having classmates from different backgrounds does not automatically reduce friendship segregation. Individual choices and social mechanisms—such as homophily, the tendency to befriend similar others—may strongly shape actual social interactions and friendships (Moody 2001). Thus, friendship segregation may persist even in organizational contexts that maximize structural diversity if students' preferences for ingroup relationships remain strong (Smith 2018; Vermeij et al. 2009).

Macro-level structural factors, such as school type (all-day vs. half-day), might further shape social integration by influencing both the extent and context of peer interactions (Sauerwein et al. 2018). Even at comparable levels of classroom diversity, all-day schools, with their extended hours and extracurricular activities, can provide more opportunities for cross-group friendships than half-day schools, where interactions are confined mainly to classroom settings (Schaefer et al. 2018). These assumptions are the subject of the current study.

2.2 Theoretical Explanations of Language-Based Friendship Segregation

In line with social network theory (Lewis 2015), we distinguish two mechanisms through which school organization (i.e., all-day schooling) may affect language-based friendship segregation. Mechanisms can be opportunity based—related to the structural availability of potential contacts—or preference based, reflecting students' tendencies to seek out specific contacts. Both types of mechanisms can affect the ratio of intergroup and intragroup relationships.

Structuralist theory (Blau 1977) focuses on opportunity-based mechanisms: It emphasizes that ethnic homogeneity in friendship networks often stems from limited opportunities for individuals to interact with peers from different ethnic backgrounds. Sociostructural aspects, such as the organization of schools, impact the opportunities for students from different ethnic groups to spend time together and thus develop interethnic friendships (Boda 2021). Because all-day schools tend to be more diverse than half-day schools in Germany, they should offer more opportunities for intergroup friendships. Consequently, German speakers should have more opportunities for intergroup friendships in all-day schools compared to half-day schools, while non-German speakers (at least from well-represented language groups) have more chances to connect with same-language peers (Boda 2021; Kroneberg and Lorenz 2024). School organizational features, such as all-day vs. half-day formats, thus structure the opportunities for intergroup friendship formation by affecting class-

room diversity and time spent together. In this framework, increased diversity or longer shared time at all-day schools increases the quantity of opportunities for intergroup ties but does not guarantee their realization.

How might preferences for ingroup friendships (i.e., homophily) differ between all-day and half-day schools? Initially, intergroup contact theory (Allport 1985; Pettigrew 1998) addresses both dimensions: It recognizes that opportunities for contact (structural diversity, shared activities) are necessary, but it also highlights that preference-based mechanisms (i.e., willingness to engage with outgroup members) determine whether these opportunities result in positive intergroup relationships. Moreover, the theory posits that contact under the right conditions can improve the quality of relationships and reduce prejudice. Thus, while greater school diversity may increase openness and reduce homophily among majority students (Binder et al. 2009; Boda et al. 2023), it can simultaneously reinforce homophily among minority groups.

Previous research has shown that individual identity-related characteristics—such as ethnicity, religion, and national affiliation—are important factors influencing the formation of school friendship networks, as they often shape social preferences and perceived group boundaries (Leszczensky et al. 2022; Windzio and Wings 2014). However, the actual formation of ingroup and outgroup ties depends not only on these preferences but also on opportunity structures (i.e., the availability of diverse peers within the school context). Leszczensky et al. (2022) demonstrated that structural diversity in classrooms significantly increases the likelihood of intergroup friendships, highlighting opportunity as a necessary condition. At the same time, preferences for similarity (homophily) may reinforce segregation patterns, especially when structural opportunities for cross-group contact are limited. Windzio and Wings (2014), for example, found that religious homophily contributed to persistent social segregation despite diverse school contexts. Our study builds on this literature by examining how the organization of all-day vs. half-day schooling might impact language-based friendship segregation.

While intergroup contact theory (Allport 1985; Pettigrew 1998) has been widely applied in educational research, its underlying assumptions require additional consideration when analyzing adolescent peer relations. In contrast to adult social contexts—in which ethnic identities often serve as stable categories structuring intergroup contact—adolescents may perceive ethnic boundaries as more fluid and less salient (Leszczensky et al. 2022). Consequently, opportunities for interethnic friendships within classrooms often translate into actual interethnic friendships (Kroneberg and Lorenz 2024). In school settings, however, language proficiency significantly shapes students' everyday experiences, influencing classroom participation, extracurricular involvement, and informal peer interactions. Thus, opportunities for forming friendships between students with different language backgrounds are closely linked to language-related competencies. Nevertheless, linguistic background remains a salient social marker within schools, shaping social preferences and access to peer networks (Wölfer et al. 2019). Consequently, the present study emphasizes language background over ethnic origin as a meaningful dimension for examining patterns of friendship segregation.

Finally, focus theory (Feld 1981) describes an opportunity-based mechanism with implications for the quantity and quality of social relationships: It provides an analytical framework to understand how shared extracurricular activities in schools may create focal points for interaction. By organizing students around shared activities, schools can increase both the opportunities for and the quality of intergroup friendships, depending on the intensity and structure of these shared foci. In this way, extracurricular activities may foster friendships between students of different language backgrounds, even at similar levels of opportunities for such friendships (given at least minimal opportunities for such friendships).

2.3 Friendships in All-Day Schools and Half-Day Schools

The educational landscape in Germany has undergone a significant transformation over the past two decades, marked by a continuous increase in the number of all-day schools (Rehm 2018). The Standing Conference of the Ministers of Education and Cultural Affairs (*Kultusministerkonferenz*; KMK) has defined all-day schools as institutions offering curricular and extracurricular activities at least 3 days a week for a minimum of 7 hours per day (KMK [*Sekretariat der Ständigen Konferenz der Kultusminister der Länder in der Bundesrepublik and Deutschland*] 2021). These schools are categorized into mandatory, partially mandatory, and voluntary types based on student attendance requirements. The proportion of half-day schools is significantly higher in academic track schools than in all-day schools (Künstler-Sment et al. 2025). This may account for the dissimilarity in student composition with respect to social and ethnic backgrounds between the two types of schools (Berkemeyer 2015). Specifically, all-day schools might be more diverse than half-day schools, offering students more opportunities to interact with peers with different language backgrounds, thereby offering more structural opportunities for intergroup contact—an opportunity-based mechanism primarily affecting the number of possible encounters.

In all-day schools, the additional time spent in school overall provides students with increased opportunities to interact with peers from different language groups. By extending the school day and offering a broader range of extracurricular activities, all-day schools expand the number of contexts in which students from different backgrounds may interact. This increased shared time is expected to affect the quantity of potential intergroup and intragroup encounters. Students who spend more time together (Block 2018) and participate in both classroom learning and extracurricular activities (Fischer 2011; Fredricks and Simpkins 2013; Frei et al. 2021) often develop stronger social bonds with their peers. Additionally, physical proximity between students, such as seating neighbors, enhances the likelihood of social interaction and friendship formation (Back et al. 2008; Rohrer et al. 2021; van den Berg and Cillessen 2014). In line with focus theory (Feld 1981), this environment could promote friendships between different language groups and thus reduce friendship segregation.

However, opportunity alone may not suffice. The realization of these potential intergroup friendships depends on preference-based mechanisms—namely, students' willingness to form ties across language groups and the quality of the contact sit-

uations provided. At the same time, extracurricular activities can provide meaningful opportunities for positive interactions between students from different language backgrounds, potentially extending beyond the mere availability of diverse peers (Fredricks and Simpkins 2013; Watkins et al. 2007). Through shared interests, cooperative goals, and informal exchanges, extracurricular activities may help foster friendships (Karweit 1983; Schaefer et al. 2018). These features highlight how extracurricular activities, when well structured, can offer further opportunities for intergroup relationships even at constant levels of school and classroom diversity.

However, findings by Schaefer et al. (2018) complicate this assumption. Their study on ethnic friendship segregation in high school extracurricular activities highlights that extracurricular activities often exhibit lower diversity than the school as a whole, thereby limiting opportunities for intergroup friendships. This homogeneity is partly attributed to selection effects (Clotfelter 2002), as students tend to self-select into activities with peers who share similar backgrounds. Preference-based mechanisms drive selection processes and can reinforce segregation, even in contexts that maximize structural opportunity. As a result, extracurricular activities might not automatically foster friendships between language groups unless they are intentionally designed to include diverse participants and meet the facilitating conditions outlined in intergroup contact theory (Allport 1985; Pettigrew 1998).

3 State of Research

Multiple studies have explored friendship dynamics in all-day vs. half-day schools. The longitudinal PIN (Peers in Netzwerken) study in Germany (Kanevski et al. 2011) examined the friendship development of adolescents attending all-day schools compared to their peers in half-day schools. Contrary to expectations, students in all-day schools did not have more mutual friendships with peers, on average, than students in half-day schools. However, all-day students reported a greater sense of support, and this positive trend increased over time. The study by Künstler-Sment et al. (2025), which used the same data as the present study, focused on the social integration of students in all-day vs. half-day schools, specifically participation in extracurricular activities. The study found that higher participation rates in extracurricular activities correlated with higher densities of friendship networks. Students in all-day schools exhibited significantly higher engagement in extracurricular activities, and this heightened participation correlated with increased levels of social integration. However, the effects were small. Moreover, the studies did not investigate the effects of all-day schooling on friendships between different language groups.

Some insights on the possible effects of all-day schooling on friendships between language groups can be gained from studies investigating the effects of school composition on intergroup friendships between students. Qualitative studies suggest that extracurricular activities help adolescents form friendships across diverse demographic groups (Watkins et al. 2007). Moody's (2001) school-level study indirectly supports the idea that extracurricular activities reduce friendship segregation by highlighting a strong association between the degree to which students from different racial backgrounds form friendships and lower levels of racial friendship

segregation. Knifsend and Juvonen (2017) also found that more interethnic contact within extracurricular activities correlated with increased interethnic friendships in multiethnic middle schools in the United States. Schaefer et al. (2011) examined the interactions between individuals from different ethnic groups in sports, arts, and academic settings. Interestingly, the study reported only a weak relationship between participation in sports activities and friendships in general, while art activities were particularly conducive to forming friendships. Notably, the authors also found that extracurricular activities, especially contact sports, promoted interethnic friendships and thereby reduced ethnic friendship segregation. Another study, though, found that interethnic contact was increased in sports activities, yet participation in sports did not result in more positive interracial attitudes (Chu and Griffey 1985).

4 Research Question and Hypotheses

In Germany, students with an immigration background are underrepresented in academic track schools and overrepresented in other school types, which are more often all-day schools than academic track schools (Künstler-Sment et al. 2025). Hence, it is likely that all-day schools in Germany have greater student diversity than half-day schools because the percentage of all-day schools with an academic track is lower than in other schools. Following structuralist theory on intergroup relationships (Blau 1977; Kroneberg and Lorenz 2024), all-day schools should thus provide more opportunities for friendships between different language groups than half-day schools, in which a higher share of students are native speakers.

Ethnically diverse school settings provide German native speakers more opportunities for friendships with non-German native speakers than less diverse school settings do. In contrast, depending on their language group, non-German native speakers may also have more opportunities to interact with ingroup peers (i.e., those with the same non-German native language) in more ethnically diverse school settings (Boda 2021; Kao and Joyner 2004), potentially leading to more friendships within their own language group. Thus, the associations between attended school type (all-day school or half-day schools) and language-based friendship segregation might vary between German native speakers and nonnative speakers. Moreover, according to focus theory (Feld 1981), attending all-day schools and engaging in extracurricular activities may enhance opportunities for interethnic contact by involving students from diverse language backgrounds in collaborative projects, such as sports activities. These considerations lead to the following hypotheses:

- H 1a* Among German native speakers, language-based friendship segregation is less pronounced (i.e., more friendships with peers with non-German native languages) in all-day schools compared to half-day schools.
- H 1b* This difference between half-day and all-day schools should be smaller for non-German native speakers.

We assume that the effects of all-day schooling might be attributed to differences in opportunity structures (i.e., the presence of classmates with different native languages) and increased contact due to more extracurricular activities compared to half-day schools.

Additionally, all-day schooling, by allowing students to spend more time together with classmates with different native languages, can reduce the tendency to form friendships with similar others (i.e., homophily), according to intergroup contact theory (Allport 1985; Pettigrew 1998). The second hypothesis thus states:

H 2 Even after controlling for opportunity structure, language-based friendship segregation among German native and non-German native speakers is less pronounced (i.e., more self-reported friendships between different language groups) in all-day schools than in half-day schools.

We further tested whether participation in extracurricular activities is a central mechanism underlying the effects of all-day schooling on friendships between language groups, which may (partially) explain the (possible) effect of all-day schools on language-based friendship segregation. Participation in specific extracurricular activities might affect friendships within and across language groups even after differences in the opportunity structure are controlled for. These effects could be associated with additional time spent during extracurricular activities (Back et al. 2008; Block 2018; Rohrer et al. 2021; van den Berg and Cillessen 2014). This leads to the following hypothesis:

H 3 Accounting for the effects of extracurricular activities reduces the effect of all-day schooling on language-based friendship segregation.

5 Data and Method

5.1 Data and Sample Description

We analyzed data from the Trends in Student Achievement study 2018 (Stanat et al. 2022) conducted by the Institute for Educational Quality Improvement (IQB) at the Humboldt-Universität zu Berlin, which assessed the school achievement of German ninth-graders in mathematics and the natural sciences, namely biology, chemistry, and physics, toward the end of middle school (Stanat et al. 2019). Data collection took place from April to June 2018. It included subject-specific achievement tests lasting 120 min and short tests to evaluate basic cognitive skills lasting 20 min. Student questionnaires of 45 min were administered to gather individual background information and information on social networks.

The study's initial sample included 44,941 students from 1462 schools across Germany and was representative at the national and state levels. Classes with less than 75% participation in the social network survey were excluded. This exclusion resulted in a sample of 28,239 students, of whom 17,004 attended half-day schools and 11,235 attended all-day schools. The mean age of the participants was 15.51

years ($SD=0.60$ years), and 49.7% were female. Concerning immigration background (at least one parent born abroad), 67.6% of the participants reported having none, and 72.1% stated they spoke German or almost always spoke it at home. Furthermore, 69.4% of the students were born in Germany. The mean International Socio-Economic Index of Occupational Status of parents (HISEI) was 53.08 ($SD=20.39$), and the mean index of the highest level of parental education (HISCED) was 4.32 ($SD=1.51$). Regarding school types, 45.6% of the students attended schools with an academic track.

In this study, students were classified into two groups based on their responses to a question in the parental questionnaire about the language the child first learned in their family (mother tongue). The first group consisted of students whose declared mother tongue was German, while the second group were students with non-German mother tongues, encompassing various languages such as Arabic, Bosnian, Croatian, Farsi/Dari, Greek, Italian, Kurdish, Polish, Romanian, Russian, Serbian, Turkish, and Vietnamese. The results are presented separately for these two distinct groups, categorized by the students' declared native language: German native speakers (15,990 students from 672 half-day schools and 10,639 students from 421 all-day schools) and non-German native speakers (1014 students from 329 half-day schools and 596 students from 162 all-day schools).

5.2 Measures

5.2.1 Dependent Variable

Language-based friendship segregation. In this study, we operationalized the dependent variable from a social network perspective, following the approach of Wölfer et al. (2019). In a peer nomination procedure, students were asked to nominate all their friends in the class using a class roster ("Who are your friends in the class?"). Based on these data, we used reciprocal nominations to construct social networks for each class. Reciprocal nominations provide a more valid and reliable indicator of actual peer relationships, as they reflect mutual agreement and reduce the likelihood of measurement errors associated with unidirectional ties (Veenstra et al. 2013; Wölfer et al. 2012). To differentiate between friendships within and between language groups, we utilized information about students' native languages obtained from parental questionnaires (Becker et al. 2022). These connections served as the foundation for establishing the students' language-based friendship segregation.

¹ The EI index is mathematically equivalent to another commonly used measure of network segregation, *ingroup share*. The latter can be computed from the *EI index* using a linear transformation: $ingroup\ share = \frac{1 - EI\ index}{2}$. Conversely, the *EI index* can be computed from the *ingroup share* as follows: $EI\ index = 1 - 2 \times Ingroup\ share$. These formulas follow from the definitions $EI\ index = \frac{E-I}{E+I}$ and $ingroup\ share = \frac{I}{E+I}$. The two indices differ only in their scales and interpretation: The *EI index* ranges from -1 (only ingroup ties) to +1 (only external ties), whereas the *ingroup share* ranges from 0 to 1 and expresses the proportion of ingroup ties among all ties.

We measured language-based friendship segregation using the *EI index*¹ (Krackhardt and Stern 1988; Wölfer et al. 2019), which captures the ratio between intergroup (*E*) and intragroup (*I*) friendships. The index is calculated as follows:

$$E - I \text{ index} = \frac{E - I}{E + I}$$

where

- E* = number of *external* (i.e., between groups) ties (e.g., friendships between students from different language groups);
- I* = number of *internal* (i.e., within a group) ties (e.g., friendships within the same language group).

Thus, the *E-I index* offers a standardized measure ranging from -1 (complete segregation) to $+1$ (complete integration).

5.2.2 Independent Variables

All-day schooling. We aimed to compare two groups of schools: half-day schools with extracurricular activities fewer than three times a week and all-day schools with mandatory extracurricular activities more than 3 days a week. To create the variable of all-day schooling, we used questionnaire responses from school principals. We first used the item “On how many days per week does your school offer afternoon programs in ninth grade?” to determine whether a school was a half-day or all-day school. Then we used the item “What is the form of all-day operation at your school?” to distinguish between half-day (without extracurricular activities) and mandatory all-day schooling (obligatory participation in extracurricular activities). The resulting variable is a measure at the school level.

Participation in extracurricular activities. We used the frequency of students’ participation in the following school extracurricular activities: academic courses for high achievers, academic courses for struggling students, sports, art (musical/artistic offerings, craft offerings), and digital literacy (technology/internet/media). To measure students’ involvement in extracurricular activities, we used answers provided in the student questionnaire: “How often do you take part in the following activities at your school?” For each type of extracurricular offer, we formed a scale ranging from 0 to 1 (0=not at all or irregularly, 1=once or more frequently). We included each extracurricular activity as a separate variable. Additionally, we incorporated all activities into the analysis model simultaneously.

5.2.3 Covariates

Opportunity structure. To compare opportunities for friendships between language groups across the school types, we considered the native language diversity in classrooms regarding students’ language backgrounds. For this, we calculated native language diversity indices using Simpson’s diversity index (Magurran 2013; Simpson 1949). This index assesses the similarity or dissimilarity of language group compo-

sition in a class, with higher values indicating greater diversity between language groups and lower values suggesting a more homogeneous composition.

Background variables. We included several variables in our analyses to ensure that the effects of our main variables would be accurately assessed. Gender differences, highlighted by girls' greater involvement in extracurricular activities than boys (Meier et al. 2018), were controlled for. Furthermore, cognitive abilities, measured by the Berlin Test of Fluid and Crystallized Intelligence (BEFKI; Wilhelm et al. 2014), were taken into account because previous research has linked cognitive abilities to prosocial behavior in school (Bellanti and Bierman 2000), potentially influencing the willingness to interact with outgroup members. Higher cognitive abilities may help students navigate linguistic and cultural differences, making intergroup interactions more likely (Zhu et al. 2023). Additionally, we utilized indicators such as books at home (Heppt et al. 2022; Sieben and Lechner 2019) and the social status measured by the HISEI (Ganzeboom et al. 1992) and the HISCED (OECD 2015; Rolfe 2021) as proxies for the cultural capital of the family. These factors were considered due to their known influence on socioemotional development, as lower social status has been associated with diminished levels of socioemotional development (Baumert et al. 2006; Frei et al. 2016; Scharenberg et al. 2020). Moreover, we considered students' immigrant background (0 = the student or at least one parent was born outside Germany, 1 = the student and both parents were born in Germany), whether students spoke German at home (0 = not always German, 1 = always or almost always German), and their country of origin (0 = not born in Germany, 1 = born in Germany), as students with an immigrant background often experience heightened levels of rejection and isolation (Plenty and Jonsson 2017). Class size was controlled for because it influences the number of potential friendships, which can affect segregation patterns (Veenstra and Dijkstra 2011). Additionally, we considered the school track (academic track vs. other types of schools), as students in different school tracks may have different opportunities for developing interethnic friendships. Finally, we controlled for the federal state to account for regional differences that may have affected our results (Berkemeyer 2015).

5.3 Handling of Missing Data

The *multivariate imputation by chained equations* procedure was used to handle missing data on the background variables ($m=20$ imputations), taking into account the hierarchical structure of the data (i.e., students nested in classrooms; Grund et al. 2018). This was implemented using the mice package (van Buuren 2007; van Buuren and Groothuis-Oudshoorn 2011) and mitml (Grund et al. 2016). Each imputed dataset was analyzed separately, and the results were pooled to obtain a single estimate per parameter using Rubin's rules (1987) for combining multiple imputations (Table E1 in the Online Appendix).

5.4 Statistical Analyses

In this study, we conducted our analysis separately for two groups: German native speakers and non-German native speakers. To examine the means and standard devi-

ations of half-day and all-day schools, as well as the mean differences between these school types, we used the *eatRep* package (Weirich et al. 2022), which corrected for the hierarchical data structure and complex sampling design using a jackknife procedure. A multivariate analysis of variance and chi-square tests were used to determine whether students attending half-day school differed systematically from those attending all-day school. These analyses aimed to identify characteristics in which the two school types differed.

To test *H 1a* and *H 1b*, we used the packages *lme4* (Bates et al. 2015) and *eatGADS* (Becker 2020) for multilevel analyses. We constructed two separate multilevel models to examine language-based friendship segregation among German and non-German native speakers without controlling for the opportunity structure and background variables. The first model (model 1) controlled solely for all-day schooling at the school level, while the second model (model 2) included additional controls for participation in extracurricular activities (including academic courses for high achievers and for struggling students, sports, art, and digital literacy) at the student level, in addition to all-day schooling at the school level. We examined the regression coefficients of the primary predictor, all-day schooling.

In the second step, we used propensity score matching (PSM), a statistical method that minimizes selection bias by ensuring comparable groups based on observed traits (Rosenbaum and Rubin 1983). This serves the aim of controlling for the opportunity structure (native language diversity) and background variables in order to test the remaining hypotheses surrounding reduced outgroup prejudice and the influence of extracurricular activities on language-based friendship (de-)segregation. This approach involved calculating a propensity score for each student, indicating the probability of attending either school type (half-day or all-day) based on relevant characteristics (covariates). The PSM was performed using the *MatchIt* package (Ho et al. 2011) and the *optmath* package (Hansen and Olsen Klopfer 2006). We performed PSM for each of the 20 imputations separately. For each iteration, we used the *matchit* function to estimate the propensity scores for variable all-day schooling (Sect. 5.2.2) based on all covariates (Sect. 5.2.3). Subsequently, we compared students from both half-day and all-day schools with similar propensity scores for their language-based friendship segregation.

We explored various matching methods, including nearest neighbor matching, optimal pair matching, optimal full matching, and exact matching. Following experimentation, Mahalanobis distance matching (Rosenbaum and Rubin 1985; Sect. 6.3) produced the most optimal matches across the two groups (German native speakers and non-German native speakers). Consequently, we chose this method for our analysis (Table E2 in the Online Appendix). The treatment variable considered was all-day schooling. We used linear regression with a probit link function as the distance metric for matching. We applied a caliper of 0.1, meaning that pairs of students were matched if their propensity scores differed by no more than 0.1 standard deviation. The matching ratio was set to 2:1, indicating that for every treated subject (students attending all-day schools), we selected two control subjects (students attending half-day schools) to create matched pairs. We chose this ratio to maintain balance between the treated and control groups, ensuring more accurate comparisons between the two groups (half-day and all-day schools) in subsequent analyses.

To ensure a robust estimation of the effects of all-day schooling on friendship segregation, we combined PSM with multilevel modeling. Matching was used as a preprocessing step to create a balanced sample of students from half-day and all-day schools, reducing potential selection bias. However, since students remain nested within classrooms even after matching, a multilevel approach was necessary to account for this hierarchical data structure. We applied multilevel models with random intercepts for classrooms to control for within-classroom dependencies in friendship segregation. This combined approach allows us to estimate the effects of all-day schooling while addressing both selection bias and the clustering of students within classrooms.

We conducted a weighted multilevel analysis using the matched data. Model 3 examined the relationship between the outcome variable, language-based friendship segregation, and the central independent variable corresponding to *H 2*, attending all-day schools at the school level (with all covariates already being controlled through the matching). We additionally controlled for participation in extracurricular activities (including academic courses for high achievers and for struggling students, sports, art, and digital literacy) at the student level in model 4 and all-day schooling at the school level. Moreover, we conducted additional analyses by computing *Z*-tests to compare the beta coefficients of all-day schooling before and after PSM (Clogg et al. 1995). This allowed us to assess any changes in the significance of the association between all-day schooling and friendship segregation after applying the matching technique.

To test *H 3*, we first estimated the effect of all-day schooling on friendship segregation without including extracurricular activities (model 3). We then introduced extracurricular participation as a covariate to assess whether the coefficient for all-day schooling decreased (model 4). To determine whether this reduction was significant, we compared the beta coefficients of all-day schooling before and after adding extracurricular activities using *Z*-tests (Clogg et al. 1995). If the coefficient for all-day schooling in model 4 is significantly lower than in model 3, this would suggest that extracurricular activities account for part of the observed effect, supporting *H 3*.

6 Results

6.1 Descriptive Statistics

Table 1 provides a detailed comparison between German native speakers and non-German native speakers in both half-day and all-day schools across various factors. Among German native speakers, language-based friendship segregation was lower in all-day schools than in half-day schools ($M_{ad}=0.113$, $SD_{ad}=0.342$ vs. $M_{hd}=0.213$, $SD_{hd}=0.396$, $d=-0.270$, $SE=0.016$, $p<0.001$). This suggests that German native speakers in all-day schools tend to have more friendships between language groups. For non-German native speakers, the results showed a different pattern. Non-German native speakers in all-day schools exhibited a slightly higher level of language-based friendship segregation compared to those in half-day schools, suggesting that they may have fewer friendships across language groups. However, this difference was not

Table 1 Descriptive statistics and mean differences between half-day and all-day schools

	German native speakers				Non-German native speakers				<i>d</i>	<i>SE</i>		
	Half-day schools		All-day schools		Half-day schools		All-day schools					
	<i>M_{hd}</i>	<i>SD_{hd}</i>	<i>M_{ad}</i>	<i>SD_{ad}</i>	<i>M_{hd}</i>	<i>SD_{hd}</i>	<i>M_{ad}</i>	<i>SD_{ad}</i>				
<i>Dependent variable:</i>												
Language-based friendship segregation	0.213	0.396	0.113	0.342	-0.270*	0.016	-0.432	0.409	-0.444	0.405	0.030	0.035
<i>Extracurricular activity participation:</i>												
Academic courses for high achievers	0.015	0.123	0.038	0.192	0.141*	0.003	0.030	0.170	0.081	0.273	0.227	0.018
Academic courses for struggling students	0.012	0.110	0.030	0.170	0.123*	0.003	0.032	0.176	0.067	0.251	0.162	0.017
Art	0.121	0.326	0.120	0.324	-0.004	0.008	0.127	0.333	0.160	0.367	0.094	0.031
Sports	0.132	0.339	0.226	0.418	0.247*	0.009	0.174	0.379	0.256	0.437	0.200	0.033
Digital literacy	0.055	0.228	0.127	0.333	0.251*	0.006	0.074	0.261	0.161	0.367	0.272*	0.027
<i>Covariates:</i>												
Native language diversity	0.108	0.142	0.099	0.151	-0.060	0.011	0.322	0.142	0.337	0.135	0.112	0.018
Gender	0.519	0.500	0.449	0.497	-0.142*	0.011	0.562	0.496	0.485	0.500	-0.154	0.039
Immigrant background	0.750	0.433	0.679	0.468	-0.164*	0.016	0.002	0.042	0.005	0.067	0.048	0.004
Spoken German at home	0.801	0.399	0.713	0.452	-0.207*	0.015	0.044	0.205	0.020	0.139	-0.138	0.011
Country of origin	0.770	0.421	0.688	0.463	-0.185*	0.016	0.031	0.174	0.032	0.176	0.003	0.013
Social background	56.433	19.801	49.069	19.885	-0.371*	0.719	45.031	21.524	38.402	19.708	-0.321*	2.193
Highest parental occupational status	4.588	1.385	4.050	1.499	-0.373*	0.042	3.536	1.859	2.926	1.924	-0.322*	0.157
Number of books at home	3.961	1.427	3.359	1.483	-0.414*	0.048	2.794	1.297	2.405	1.251	-0.306*	0.112

Table 1 (Continued)

	German native speakers				Non-German native speakers							
	Half-day schools		All-day schools		Half-day schools		All-day schools					
	<i>M_{hd}</i>	<i>SD_{hd}</i>	<i>M_{ad}</i>	<i>SD_{ad}</i>	<i>M_{hd}</i>	<i>SD_{hd}</i>	<i>M_{ad}</i>	<i>SD_{ad}</i>				
Cognitive abilities	0.337	1.070	-0.084	1.113	-0.386*	0.037	0.074	1.101	-0.514	1.197	-0.512*	0.100
Class size	25.598	3.780	25.081	4.359	-0.127	0.320	25.517	3.821	23.925	4.664	-0.373*	0.673
School track	0.611	0.488	0.186	0.389	-0.963*	0.033	0.546	0.498	0.150	0.358	-0.913*	0.059

**p* < 0.001

The data include 15,990 half-day students and 10,639 all-day students for German native speakers, and 1014 half-day students and 596 all-day students for non-German native speakers. The language-based friendship segregation represents a score ranging from -1 (only friendships between language groups) to 1 (only friendships within language group). Each extracurricular activity is measured on a scale ranging from 0 to 1 (0 = not at all or irregularly, 1 = once a week or more frequently).

Covariates: native language diversity (higher values indicating greater diversity between language groups), gender (0 = male, 1 = female), immigrant background (0 = the student or at least one parent was born outside Germany, 1 = the student and both parents were born in Germany), spoken German at home (0 = not always German, 1 = always or almost always German), country of origin (0 = not born in Germany, 1 = born in Germany), social background (as operationalized by HISEI, the highest international socioeconomic index of occupational status of the parents; Ganzeboom et al. 1992), highest parental occupational status (as operationalized by HISCED, the index of the highest educational level of parents; OECD 2015), number of books at home (1 = 0–10 books, 2 = 11–25 books, 3 = 26–100 books, 4 = 101–200 books, 5 = 201–500 books, 6 = more than 500 books), cognitive abilities (as measured by the Berlin Test of Fluid and Crystallized Intelligence [BEFKI] test; Wilhelm et al. 2014), class size, and school track (0 = non-academic track, 1 = academic track)

statistically significant, and the corresponding effect size was small ($M_{ad} = -0.444$, $SD_{ad} = 0.405$ vs. $M_{hd} = -0.432$, $SD_{hd} = 0.409$, $d = 0.030$, $SE = 0.035$, $p = 0.732$).

Next, we compared participation rates in extracurricular activities between all-day and half-day schools. Among German native speakers, the mean participation rates for academic courses among high achievers were higher in all-day schools than in half-day schools ($M_{ad} = 0.038$, $SD_{ad} = 0.192$ vs. $M_{hd} = 0.015$, $SD_{hd} = 0.123$, $d = 0.141$, $SE = 0.003$, $p < 0.001$). Similarly, participation rates for academic courses among struggling students were higher in all-day schools than in half-day schools ($M_{ad} = 0.030$, $SD_{ad} = 0.170$ vs. $M_{hd} = 0.012$, $SD_{hd} = 0.110$, $d = 0.123$, $SE = 0.003$, $p < 0.001$). Regarding sports ($M_{ad} = 0.226$, $SD_{ad} = 0.418$ vs. $M_{hd} = 0.132$, $SD_{hd} = 0.339$, $d = 0.247$, $SE = 0.009$, $p < 0.001$), and for digital literacy activities ($M_{ad} = 0.127$, $SD_{ad} = 0.333$ vs. $M_{hd} = 0.055$, $SD_{hd} = 0.228$, $d = 0.251$, $SE = 0.006$, $p < 0.001$), mean participation rates were also higher in all-day schools than in half-day schools. These findings highlight a substantial increase in extracurricular participation among students in all-day schools, underscoring the broader opportunities available to them compared to their counterparts in half-day schools. Notably, participation in the art domain was almost the same in half-day and all-day schools ($M_{ad} = 0.120$, $SD_{ad} = 0.324$ vs. $M_{hd} = 0.121$, $SD_{hd} = 0.326$, $d = -0.004$, $SE = 0.008$, $p = 0.879$), indicating comparable engagement in extracurricular activities.

Among non-German native speakers, participation in extracurricular activities showed no significant differences between half-day and all-day schools, except for digital literacy. In this case, the participation rate was significantly higher in all-day schools than in half-day schools ($M_{ad} = 0.161$, $SD_{ad} = 0.367$ vs. $M_{hd} = 0.074$, $SD_{hd} = 0.261$, $d = 0.272$, $SE = 0.027$, $p < 0.001$). However, for all other categories of extracurricular activities, there were no significant differences in participation between half-day and all-day schools. This could be attributed to the considerably smaller sample size for non-German native speakers (1014 students from half-day schools and 596 students from all-day schools). Considering effect sizes (d) rather than p -values, both groups showed overall higher participation in extracurricular activities at all-day schools compared to half-day schools. However, due to the sample size, some of these differences were not statistically significant for non-German native speakers.

Demographically, when the characteristics of the student sample presented in Table 1 are examined, it becomes evident that students in all-day schools—both German and non-German native speakers—were less frequently enrolled in academic-track schools, demonstrated lower cognitive performance, and reported fewer educational resources at home (e.g., fewer books, lower parental occupational status). The proportion of students who always spoke German at home or who were born in Germany was also lower in all-day settings than in half-day settings. Among non-German native speakers, all-day students additionally attended smaller classes on average than half-day students. These findings highlight that half-day and all-day schools differ in student composition. However, regarding the opportunity structure, native language diversity in classes at half-day schools did not differ from all-day schools.

6.2 Before PSM: Effects of All-Day Schooling on Language-Based Friendship Segregation Without Controlling for Opportunity Structure

Before implementing PSM, we constructed two separate multilevel regression models to investigate language-based friendship segregation among German native speakers and non-German native speakers (Table 2). In the first model (model 1), we solely included all-day schooling as a predictor at the school level. This analysis revealed a significant negative association between all-day schooling and language-based friendship segregation among German native speakers ($\alpha = -0.068$, $SE_b = 0.010$, $p < 0.001$), while among non-German native speakers, the association was not significant ($\alpha = 0.016$, $SE_b = 0.027$, $p = 0.552$). This indicates that the language-based friendship segregation among native German speakers was less pronounced in all-day schools (i.e., more friendships between different language groups) than in half-day schools, which is consistent with our hypothesis H 1a. However, there were no differences in the language-based friendship segregation between half-day and all-day schools among non-German native speakers, which is contrary to our hypothesis H 1b.

Similar results were obtained in the second model (model 2), for which we included additional controls for participation in extracurricular activities at the student level and all-day schooling at the school level. Among German native speakers, all-day schooling remained significantly associated with friendship segregation ($\beta_a = -0.066$, $SE_b = 0.010$, $p < 0.001$), whereas among non-German native speakers, the association remained nonsignificant ($\beta_a = 0.010$, $SE_b = 0.027$, $p = 0.708$). These findings indicate that friendship segregation was higher in half-day schools compared to all-day schools among German native speakers, even after extracurricular activities were accounted for, while no significant difference between school types seemed to exist among non-German native speakers.

Comparing the regression coefficients between the models (model 1 vs. 2) in Table 5, we found that the regression coefficients for the central predictor of all-day schooling were not significantly different between model 1 and model 2 for either German or non-German native speakers. This suggests that the association between all-day schooling and friendship segregation remains consistent after consideration of participation in extracurricular activities as an additional predictor in the analyses.

6.3 Assessment of Parallelization of the Comparison Groups After PSM

We applied PSM separately for German and non-German native speakers. Figure 1 illustrates the distribution of propensity scores and covariates before and after the matching process. The propensity score indicates the likelihood of attending an all-day school given specific covariates while ensuring parallelization between students attending half-day and all-day schools. We observed noticeable differences in covariates between half-day and all-day schools before matching, represented by the white points. After matching, as denoted by the black points, nearly all data points fall within this acceptable range, indicating sufficient parallelism between the two school types. Following Rubin's recommendation (2001), the balance statistic, with standardized mean differences for all covariates across procedures ranging be-

Table 2 Before propensity score matching: multilevel regression models for language-based friendship segregation

	Model 1			Model 2		
	German native speakers B^a	Non-German native speakers B^a	Non-German native speakers p	German native speakers B_a	German native speakers SE^b	Non-German native speakers B^a
(Intercept)	0.198	0.000	0.000	0.198	0.008	0.000
<i>Student level:</i>						
Academic courses for high achievers	-	-	-	0.002	0.014	0.912
Academic courses for struggling students	-	-	-	-0.045	0.015	0.003
Sports	-	-	-	-0.016	0.006	0.004
Art	-	-	-	0.023	0.006	0.000
Digital literacy	-	-	-	-0.005	0.008	0.544
<i>School level:</i>						
All-day schooling	-0.068	0.010	0.000	-0.066	0.010	0.000
ICC	0.359	0.160	0.552	0.358	0.027	0.157

^a Average mean of beta coefficients across 20 imputations (averaged).

^b Pooled standard error (Rubin 1987). Language-based friendship segregation represents a score ranging from -1 (only friendships between language groups) to 1 (only friendships within language group). Models were estimated using a single independent variable in each case. The intraclass correlation coefficient (ICC) indicates how much of the total variance is attributable to the group level (in this case, schools).

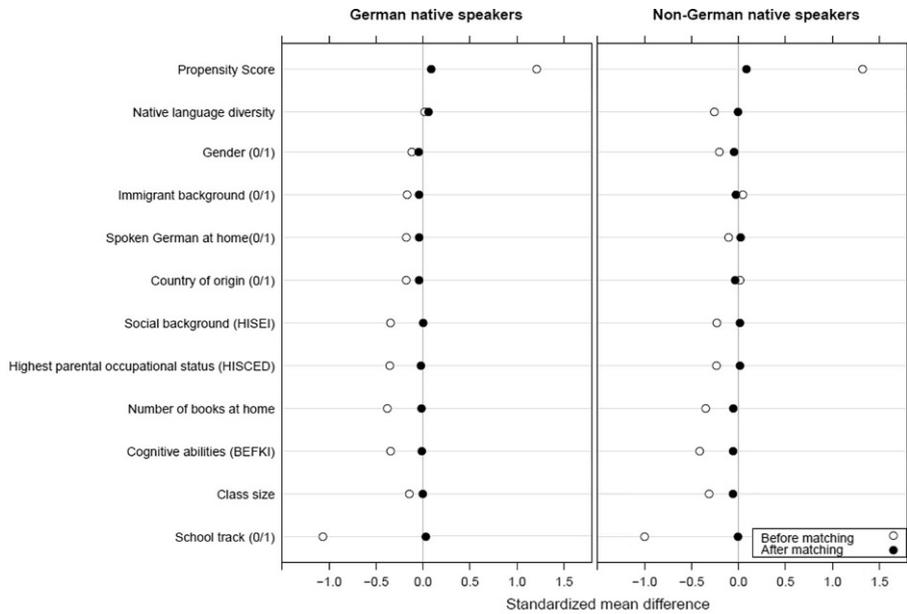


Fig. 1 Distribution of propensity scores and covariates, showing standardized mean differences between students at half-day and all-day schools before and after Mahalanobis distance matching. Propensity score matching refers to German native speakers and non-German native speakers. Propensity scores for federal states have been removed from the figure. Covariates: native language diversity (higher values indicating greater diversity between language groups), gender (0= male, 1= female), immigrant background (0= the student or at least one parent was born outside Germany, 1= the student and both parents were born in Germany), spoken German at home (0= not always German, 1= always or almost always German), country of origin (0= not born in Germany, 1= born in Germany), social background (as operationalized by the HISEI, the highest international socioeconomic index of occupational status of the parents; Ganzeboom et al. 1992), highest parental occupational status (as operationalized by the HISCED, the index of the highest educational level of parents; OECD 2015), number of books at home (1= 0–10 books, 2= 11–25 books, 3= 26–100 books, 4= 101–200 books, 5= 201–500 books, 6= more than 500 books), cognitive abilities (as measured by the Berlin Test of Fluid and Crystallized Intelligence [BEFKI] test; Wilhelm et al. 2014), class size, and school track (0= nonacademic track, 1= academic track)

tween > -0.25 to < 0.25 , was deemed acceptable in our study. Table 3 shows balance measures before and after PSM for both German and non-German native speakers. Before matching, significant differences existed between the treated (all-day schools) and control (half-day schools) groups. After matching, these differences decreased, indicating improved balance. This suggests that PSM successfully reduced imbalances between treated (all-day schools) and control (half-day schools) groups for both German and non-German native speakers.

6.4 After PSM: Effects of All-Day Schooling on Language-Based Friendship Segregation with Control for Opportunity Structure

After implementing PSM to parallelize both comparison groups, we conducted two multilevel regression analyses (models 3 and 4) to explore language-based friendship segregation in half-day and all-day schools (Table 4). Model 3 investigated the

Table 3 Summary of balance in propensity score matching

	German native speakers		Non-German native speakers	
	Before match- ing	After match- ing	Before match- ing	After match- ing
Means treated	0.5413	0.4846	0.5285	0.4810
Means control	0.3036	0.4675	0.2729	0.4646
Standardized mean differ- ence	12.090	0.0871	13.207	0.0849
Variance ratio	0.8409	1.0829	0.7773	1.0635
eCDF mean	0.2883	0.0204	0.3042	0.0185
eCDF maximum	0.4548	0.0608	0.5071	0.0631

The balance measures were calculated before and after performing propensity score matching. Lower values of standardized mean difference indicate a better balance between the treated (all-day schools) and control (half-day schools) groups. A variance ratio close to 1 suggests a better balance in variances between the treatment and control groups. Lower values of empirical cumulative distribution function (eCDF) mean and eCDF maximum indicate improved balance across covariates after matching.

relationship between language-based friendship segregation and attendance at all-day schools at the school level, with covariates already controlled through matching. Additionally, model 4 examined the same relationship while also considering participation in extracurricular activities at the student level as an additional predictor. In model 3, attending an all-day school was significantly associated with reduced friendship segregation among German native speakers ($\beta_a = -0.062$, $SE_b = 0.010$, $p < 0.001$), while for non-German native speakers, the association was not significant ($\beta_a = -0.011$, $SE_b = 0.034$, $p = 0.746$). Similarly, in model 4, the association remained significant for German native speakers ($\beta_a = -0.057$, $SE_b = 0.017$, $p = 0.001$) but not for non-German native speakers ($\beta_a = -0.017$, $SE_b = 0.033$, $p = 0.606$).

Table 5 shows the z -scores and p -values for comparisons of beta coefficients related to all-day schooling before and after PSM for both German native speakers and non-German native speakers. The comparisons indicate no significant differences in the beta coefficients between the different models. This suggests that PSM does not significantly alter the central regression coefficients capturing the effects of all-day schooling. Therefore, neither the opportunity structure nor extracurricular activities appear to act as mechanisms for the effect of all-day schooling, which is contrary to our hypothesis $H 2$.

6.5 Effect of Extracurricular Activities on Friendship Segregation

To assess whether extracurricular activities reduce the effect of all-day schooling on language-based friendship segregation ($H 3$), we conducted separate Z -tests for German and non-German native speakers (Table 5). For German native speakers, the test yielded $Z = -0.254$, $p = 0.800$, while for non-German native speakers, $Z = 0.127$, $p = 0.899$. Since neither test indicates a significant reduction in the effect after extracurricular participation was accounted for, $H 3$ is not supported.

Table 4 After propensity score matching: multilevel regression models for language-based friendship segregation

	Model 3			Model 4								
	German native speakers <i>B^a</i>	<i>SE_b</i>	<i>P</i>	Non-German native speakers <i>B^a</i>	<i>SE_b</i>	<i>P</i>	German native speakers <i>B^a</i>	<i>SE_b</i>	<i>P</i>	Non-German native speakers <i>B^a</i>	<i>SE_b</i>	<i>P</i>
(Intercept)	0.182	0.009	0.000	-0.435	0.023	0.000	0.170	0.069	0.014	-0.413	0.103	0.000
<i>Student level:</i>												
Academic courses for high achievers	-	-	-	-	-	-	-0.002	0.017	0.906	0.188	0.083	0.024
Academic courses for struggling students	-	-	-	-	-	-	-0.041	0.021	0.051	-0.016	0.073	0.827
Sports	-	-	-	-	-	-	0.072	0.010	0.000	0.175	0.050	0.000
Art	-	-	-	-	-	-	0.021	0.010	0.036	-0.019	0.043	0.659
Digital literacy	-	-	-	-	-	-	-0.004	0.009	0.657	-0.027	0.047	0.566
<i>School level:</i>												
All-day schooling	-0.062	0.010	0.000	-0.011	0.034	0.746	-0.057	0.017	0.001	-0.017	0.033	0.606
ICC	0.329			0.169			0.328			0.164		

^a Average mean of beta coefficients across 20 imputations (averaged).

^b Pooled standard error (Rubin 1987). The language-based friendship segregation represents a score ranging from -1 (only friendships between language groups) to 1 (only friendships within language group). The intraclass correlation coefficient (ICC) indicates how much of the total variance is attributable to the group level (in this case, schools).

7 Discussion

7.1 Summary and Interpretation

Because immigrant students are overrepresented in educational tracks with a higher proportion of all-day schools, language-based friendship segregation may be less pronounced in these schools compared to half-day schools. To better understand this relationship, we examined the role of opportunity structures as a key mechanism underlying the effects of all-day schooling on language-based friendship segregation. Structuralist theory (Blau 1977; Kroneberg and Lorenz 2024) suggests that extended time spent together and increased interaction in diverse settings can help reduce segregation by providing more opportunities for intergroup contact. Building on this, we drew on focus theory (Feld 1981) and intergroup contact theory (Allport 1985; Pettigrew 1998) to formulate two key assumptions regarding the impact of all-day schooling and extracurricular activities on homophily preferences. First, attending all-day schools and engaging in extracurricular activities may enhance opportunities for interethnic contact, fostering friendships across language groups. Second, all-day schooling may mitigate language-based homophily by reducing stereotypes and prejudices through increased interaction in diverse settings.

Regarding *H 1a*, which proposed that German native speakers in all-day schools exhibit lower levels of language-based friendship segregation than those in half-day schools, our findings support this hypothesis. German native speakers at all-day schools reported significantly more friendships with non-German native speakers than at half-day schools. Our findings also support *H 1b*, which hypothesized that the difference in language-based friendship segregation between school types would be smaller for non-German native speakers. Among this group, friendship segregation did not significantly differ between all-day and half-day schools, suggesting that while all-day schooling fosters intergroup friendships for German native speakers, it does not have the same effect for non-German native speakers. Social network studies indicate that ethnic minorities tend to exhibit stronger ingroup friendship preferences than majority groups do (Smith 2018; Vermeij et al. 2009), which could explain why only German native speakers in our study showed reduced segregation

Table 5 Z-scores and *P*-values for “all-day schooling” beta coefficient: comparisons before and after PSM

Comparison	German native speakers		Non-German native speakers	
	<i>Z</i> -score	<i>p</i>	<i>Z</i> -score	<i>p</i>
Model 1 vs. 2	−0.141	0.888	0.157	0.875
Model 1 vs. 3	−0.424	0.671	0.622	0.534
Model 1 vs. 4	−0.558	0.577	0.774	0.439
Model 2 vs. 3	−0.283	0.777	0.484	0.629
Model 2 vs. 4	−0.456	0.648	0.633	0.527
Model 3 vs. 4	−0.254	0.800	0.127	0.899

The beta coefficients for “all-day schooling” in models 1 and 2 were derived from analyses conducted before implementing propensity score matching (PSM; Table 2). For models 3 and 4, the beta coefficients for “all-day schooling” were based on analyses conducted after the application of PSM (Table 4).

in all-day schools. Instead of forming new interethnic connections, minority students may use increased interaction opportunities to strengthen existing ingroup friendships. Another explanation could be the fact that increasing diversity often reduces opportunities for intergroup contact among ethnic minorities rather than increasing them, as is the case for ethnic majority students (Kroneberg and Lorenz 2024).

Hypothesis *H* 2 was not supported, indicating that opportunity structures (classroom native language diversity) and other covariates do not significantly influence the effects of all-day schooling on language-based friendship segregation, nor do they function as reducing mechanisms in this process. These findings align with research showing that diversity alone does not automatically foster interethnic friendships unless accompanied by targeted initiatives (Leszczensky and Stark 2019; Moody 2001). Simply sharing a space with peers from different language backgrounds provides opportunities for contact but does not necessarily lead to meaningful social ties, as network structures and group norms likely play crucial roles. Our study suggests that while non-German native speakers in schools interact more frequently with German-speaking peers, their social networks remain primarily within their own language group.

Contrary to our expectations, our study found that opportunity structures (classroom native language diversity) were similar in both all-day and half-day schools, suggesting that all-day schools do not inherently offer better structural conditions for interethnic friendships. Even if language diversity is comparable across school types, it may play a greater role in shaping friendship networks in all-day schools due to factors such as extended shared time, participation in extracurricular activities, and the overall school environment. Nonetheless, our study design does not allow us to determine whether this is the case. Opportunity structures may function more as a foundational framework that enables intergroup friendships rather than as an active mechanism shaping them. These results highlight an important distinction between classroom diversity and friendship segregation. While all-day schools may provide more opportunities for interethnic contact due to their diverse student composition, this does not automatically translate into greater integration within friendship networks, particularly for non-German native speakers. Thus, while structural factors create the conditions for potential integration, the actual formation of intergroup friendships depends more on the quality of interactions and individual social preferences.

We found no support for hypothesis *H* 3, which proposed that extracurricular activities would reduce the effect of all-day schooling on language-based friendship segregation. The beta coefficient for all-day schooling remained primarily unchanged even after extracurricular participation was controlled for, indicating that extracurricular activities do not serve as a reducing mechanism. One possible explanation is that overall participation in extracurricular activities was low among both German and non-German native speakers, regardless of whether they attended all-day or half-day schools. It is also possible that homophilous selection processes shape extracurricular activities. That is, similar students may tend to attend the same extracurricular activities. As a result, the composition of participants in such activities might be more homogeneous than the school or classroom composition (Sauerwein et al. 2018; Schaefer et al. 2018). Although Table 1 indicates that non-German

native speakers participated in extracurricular activities more frequently than their German counterparts, this finding aligns with the broader goals of all-day schooling—particularly in providing additional opportunities and support for all students, including those from disadvantaged backgrounds (e.g., Steiner 2009). However, in terms of segregation, our results suggest that non-German native speakers primarily engage with peers from their own language group within extracurricular activities, reinforcing existing social networks and segregation rather than fostering new inter-group friendships.

7.2 Strengths and Limitations

Our study provides insights into the associations between all-day schooling and social integration among secondary school students. We minimized selection biases across school types by employing PSM techniques. Additionally, our study's substantial sample size and representative sampling (IQB Trends in Student Achievement 2018 study; Stanat et al. 2022) provide high statistical power, enabling the detection of even subtle differences. The strength of our study lies in its comprehensive investigation of classroom friendships through a peer nomination process, in which students listed all their friends using a class roster. By using reciprocal nominations, we have enhanced the accuracy and reliability of the data, capturing mutual friendships. Overall, this approach provides a robust assessment of peer relationships, which is crucial for understanding social development. Thus, our study offers a descriptive understanding of the distinctions between half-day and all-day schools in terms of friendship segregation.

Our study has several limitations that must be considered when interpreting the results. First, the cross-sectional design did not allow us to investigate the evolution of friendships between language groups over time. Second, our study simplifies institutional variation to a binary distinction between half-day and all-day schools. While this aids comparison, it may overlook nuances such as differences in extracurricular activities and levels of mandatory participation, which could impact intergroup friendships. For example, the quality of extracurricular activities and their impact on social relationships were not explored despite capturing the quantity of participation in them. Third, the data collected in the Trends in Student Achievement 2018 study (Stanat et al. 2022) only included class-level social networks, limiting our ability to make specific claims about social networks and friendships between language groups within individual extracurricular activities or at the school level. Another limitation is that our study focuses on in-school friendships, potentially overlooking how all-day schooling affects friendships outside of school. Extended school hours may reduce opportunities for peer interactions in neighborhood settings or community activities, shaping students' overall social network composition. While this could strengthen in-school friendships, it might also limit exposure to diverse friendships beyond school. Fourth, information on the students' language backgrounds was collected with the parent questionnaires instead of by direct self-reports. This may have led to limitations, particularly for students in higher grades, as their language and cultural identities may evolve over time due to socialization processes. As a result, the dominant language (German, in this case) may progressively take precedence

in their peer interactions. Fifth, the data included only information on the first language learned (the mother tongue), which may not accurately reflect the diversity of linguistic abilities and identities. A more comprehensive assessment of language skills and linguistic and cultural identity of students could be beneficial to capture language-based friendship segregation more accurately. Sixth, we controlled for language at home and the parents' and students' country of birth simultaneously, which may have resulted in over-control. Finally, the study's limitations include the potential influence of unseen disparities between half-day and all-day schools. From a theoretical perspective, it is essential to consider whether important predictors of all-day schooling, such as local school offerings, parental and student school choice motives, academic performance, transition recommendations, and school profiles, have been overlooked or are unobservable.

7.3 Future Research

Future research should take up the exciting opportunities to address the limitations of our study and gain deeper insights into the interplay among all-day schooling, extracurricular activities, and friendships between language groups. Longitudinal studies spanning multiple years can provide a dynamic perspective on how these relationships evolve over time. Such an approach would be particularly beneficial to explicitly establish the temporal relationship between participation in extracurricular activities and friendships, helping discern whether individuals form friendships as a result of engaging in extracurricular activities together or if existing friendships influence the decision to participate in extracurricular activities together (Schaefer et al. 2011). Future research should also explore the qualitative dimensions of extracurricular activities, considering elements such as the content, the level of student engagement, and the enjoyment students experience when participating in these activities. Such an exploration can start to unravel how the quality of activities shapes the development of social bonds. To gain a deeper understanding of the correlations between language-based friendship segregation and various factors, targeted surveys that focus on specific language groups could be conducted. For instance, future studies could examine the relationships among language-based friendship segregation, immigration-related disparities in skills acquisition, educational aspirations, and motivation with different language backgrounds, such as Polish, Turkish, or Vietnamese. Linking the results with other questionnaire data on well-being and school/social integration could help us to understand the impact of language-based friendship segregation on well-being and social integration. By addressing these research avenues, studies can contribute to a more comprehensive understanding of how all-day schooling and extracurricular activities impact social relationships among secondary school students, ultimately informing the development of more effective educational policies and interventions.

7.4 Educational Policies and Interventions

The expansion of all-day schooling was motivated, in part, by the goal of social integration of disadvantaged student groups, such as students with a non-German

native language background (e.g., Steiner 2009). Spending more time together in the classroom and participating in extracurricular activities might offer increased opportunities for interethnic interactions, potentially fostering the development of friendships, particularly across ethnic boundaries. Our findings reveal that extracurricular activities tend to contribute to friendship development between language groups. Regardless of the type of school (half-day vs. all-day school), students with a non-German native language background participate more in extracurricular activities than their German native language counterparts, indicating that these initiatives effectively reach disadvantaged student groups.

The critical question is how to foster interethnic friendships for all students, given the societal importance of valuing diversity and plurality. This highlights the need for educational policies and practices that promote inclusive environments, ensuring that extracurricular activities contribute positively to social integration without inadvertently reinforcing segregation patterns. Balancing the benefits of targeted support with the broader goal of fostering inclusive friendships is crucial for creating a more harmonious and diverse educational landscape.

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Data Availability The data were made available by the Research Data Centre at the Institute for Educational Quality Improvement (FDZ at IQB).

Conflict of interest J. Künstler-Sment, A. Kocaj, G. Lorenz, and M. Jansen declare that they have no competing interests.

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Julia Künstler-Sment 1986, Dr. phil., researcher at the Institute for Educational Quality Improvement (IQB), Humboldt-Universität zu Berlin. Fields of research: all-day and half-day schools, social integration, social network analysis. Publications: Are Adolescents More Socially Integrated in All-Day Schools than in Half-Day Schools? *Zeitschrift für Pädagogische Psychologie*, 2025 (with A. Kocaj, G. Lorenz and M. Jansen); Standardisierter Datenmanagementplan für die Bildungsforschung (Stamp)—Ein projektbegleitendes Tool für das Forschungsdatenmanagement. *Zeitschrift für Erziehungswissenschaft*, 2024 (with S. Eckert, G. Favella, M. Kerwer and M. Jansen).

Aleksander Kocaj 1987, Dr. rer. nat., researcher at the Institute for Educational Quality Improvement (IQB), Humboldt-Universität zu Berlin. Fields of research: students with special educational needs, inclusive education, classroom composition. Publications: Exploring Individual Changes in Disability Status and Their Relations to Reading Comprehension Development. *Remedial and Special Education* 46, 2025 (with K. S. Cortina, A. F. Vereb and J. F. Carlisle); Der Umfang an eingeschätzten sonderpädagogischen Unterstützungsbedarfen und Kompetenzunterschiede an Förderschulen und allgemeinen Schulen. *Zeitschrift für Erziehungswissenschaft*, 2025 (with C. Gresch, L. Külker and P. Kohrt).

Georg Lorenz 1982, Dr. rer. pol., Assistant Professor in Sociology at Utrecht University, the Netherlands. Fields of research: inequality, sociology of education, social networks, discrimination, social cohesion. Publications: Social Network Effects on Educational Inequality: The Role of Similarity Bias in Social Influence. *Research in Social Stratification and Mobility*, 2025 (with T. Hovestadt); Non-native Accents among School Beginners and Teacher Expectations for Future Student Achievements. *Sociology of Education*, 2023 (with I. Kogan, S. Gentrup, C. Kristen and P. Stanat).

Malte Jansen Dr. rer. nat., Full Professor of Educational Psychology, Institute for Mind Brain, and Behavior (IMBB) at Health and Medical University Potsdam (HMU). Fields of research: Self-concept and motivation, social relations and social networks in the classroom, grading, educational inequalities. Publications: Social comparison effects on academic self-concepts—Which peers matter most? *Developmental Psychology*, 2022 (with Z. Boda and G. Lorenz); Comparing different facets of the social integration of high-achieving students in their classroom: No gender stereotyping, but some nonlinear relationships. *Journal of Educational Psychology*, 2023 (with C. Neuendorf).