

Social Networks, School Segregation, and Educational Inequality

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Before starting the PhD, I attended an information event on doing a PhD. There it was stressed that the dissertation period would be marked by severe fluctuations in mood and satisfaction. At the interview for one of the PhD positions in the SOCIALBOND project, I referred to that event and confidently reported that I was aware of (if not even prepared for) this. Oh boy, was I in for a ride (as probably everyone in the dissertation process): While there were a substantial amount of low points and periods during this time, I was also fortunate enough to collect many positive experiences. Importantly, my short experience in life has already taught me that I (or everyone?) tend to forget about the negative aspects and that I will soon look fondly back to this period in my life. I am grateful for all the good—but also bad—experiences that I made during this time, the things I learnt, the friends I gained, and the support I could rely on.

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Table of content

| | | |
|------------------|--|-----------|
| Chapter 1 | Introduction | 1 |
| 1.1 | Background and aim of this dissertation..... | 2 |
| 1.2 | Social capital..... | 4 |
| 1.3 | Social capital and inequality in educational outcomes | 5 |
| 1.4 | Dissertation framework and chapter overview | 8 |
| 1.4.1 | Dissertation framework..... | 8 |
| 1.4.2 | Summary of dissertation chapters | 12 |
| 1.4.3 | Status of the papers and contribution of co-authors..... | 15 |
| 1.5 | Conclusion | 16 |
| Chapter 2 | Limited opportunities: Adolescents' access to social capital in secondary schools in three European countries | 21 |
| 2.1 | Introduction..... | 23 |
| 2.2 | Theory and previous research | 25 |
| 2.2.1 | Social capital and cultural resources | 25 |
| 2.2.2 | Access to socioeconomic and cultural resources: Between- and within-school processes | 28 |
| 2.2.3 | Comparing between-school sorting across countries | 31 |
| 2.3 | Data, Method, and Measures | 32 |
| 2.3.1 | Data | 32 |
| 2.3.2 | Method | 33 |
| 2.3.3 | Measures..... | 35 |
| 2.4 | Result | 37 |
| 2.4.1 | Linear regressions | 37 |
| 2.4.2 | Decomposition of variance..... | 39 |
| 2.4.3 | Within-Between Models | 41 |
| 2.5 | Discussion and Conclusion | 48 |
| Chapter 3 | Social networks and educational decisions: Who has access to social capital and for whom is it beneficial? | 52 |
| 3.1 | Introduction..... | 54 |
| 3.2 | Theory and past research | 56 |
| 3.2.1 | Scope conditions for the mobilisation of social capital..... | 57 |
| 3.2.2 | Network segregation along socioeconomic differences..... | 58 |
| 3.2.3 | The role of social capital in educational decisions..... | 60 |
| 3.3 | Data, measures, and analytical strategy | 61 |
| 3.3.1 | Data | 61 |
| 3.3.2 | Methods and analytical strategy | 63 |

| | | |
|------------------|--|------------|
| 3.3.3 | Measurements..... | 67 |
| 3.4 | Results..... | 71 |
| 3.4.1 | Summary statistics..... | 71 |
| 3.4.2 | Measuring Segregation with Network Models..... | 75 |
| 3.4.3 | Social capital and ambitious choices..... | 79 |
| 3.5 | Discussion | 83 |
| 3.6 | Appendix..... | 87 |
| Chapter 4 | Social networks, cultural capital, and educational inequality: Investigating network mechanisms and differences in academic achievement | 90 |
| 4.1 | Introduction..... | 92 |
| 4.2 | Theoretical background | 94 |
| 4.2.1 | Cultural capital | 94 |
| 4.2.2 | Selection | 95 |
| 4.2.3 | Peer influence and intergroup inequality | 96 |
| 4.3 | Data, measurements, method, and analytical strategy | 98 |
| 4.3.1 | Data | 98 |
| 4.3.2 | Measurements..... | 99 |
| 4.3.3 | Method: Stochastic actor-oriented models..... | 100 |
| 4.3.4 | SAOM model specification..... | 101 |
| 4.3.5 | Analytical plan | 102 |
| 4.4 | Results..... | 103 |
| 4.4.1 | Descriptive results | 103 |
| 4.4.2 | Meta-analysis of networks | 106 |
| 4.4.3 | Simulations..... | 112 |
| 4.5 | Discussion and Conclusion | 116 |
| 4.6 | Appendix..... | 119 |
| | I References | 122 |
| | II Eidesstattliche Erklärung | 136 |
| | III Curriculum Vitae | 137 |

Chapter 1

Introduction

1.1 Background and aim of this dissertation

Wealth and income inequalities are growing over time. These inequalities are, amongst others, connected to slower economic development (Alesina & Rodrik, 1994), increasing crime rates (Fajnzylber et al., 2002), worse health outcomes and well-being for the populace (Wilkinson & Pickett, 2019), and an environment that fosters political radicalisation (Gu & Wang, 2022). Hence, social inequality and its reproduction over time are major societal concerns. Therefore, the transmission of educational (and social) advantage from one generation to the next has also been a long-standing sociological interest (Blau & Duncan, 1967; Boudon, 1974; Bourdieu & Passeron, 1990; Bowles & Gintis, 1977; Breen & Goldthorpe, 1997).

One central aspect in the reproduction of social inequality is the educational system because individuals' social background is connected to their educational success and their future social position (Breen & Jonsson, 2005; DiPrete, 2020). Sociologically, differential family resources, which are beneficial for learning, provide skills for, and knowledge of, the educational system or alter the cost/risk calculation of educational choices are a common explanation for the social gradient in educational outcomes (Boudon, 1974; Bourdieu & Passeron, 1990; Breen & Goldthorpe, 1997; Erikson & Jonsson, 1996; Jæger & Breen, 2016; Stocké, 2007). While research consistently shows that students with an advantaged socioeconomic family background fare better in the educational system and achieve better educational outcomes compared to their less advantaged counterparts, the vast majority of research neglects the role of social relationships.

However, educational careers do not unfold in a social vacuum. Students attend educational institutions, such as kindergartens, schools, or universities. Within these educational institutions, they—and their parents—are embedded in networks of social relationships (McPherson, 2004; Small, 2009): Students find friends and their parents are connected with other parents. By setting educational norms, acting as a role model, helping directly with school work, or offering school-related information, individuals influence each other's school grades, aspirations, educational decisions, or school absenteeism (Flashman 2012, 2014; Gremmen et al. 2017; Kretschmer et al. 2018; Kretschmer and Roth 2020; Lorenz et al. 2020; Rambaran et al. 2017). Hence, social networks provide access to valuable resources, which are associated with an individual's educational outcomes. These resources accessed through social networks can be conceptualized as social capital (Lin 2001). While research in the adult population shows that social networks and the embedded social capital tend to increase socioeconomic inequality (Lin 2001; DiMaggio & Garrip 2012), less is known about the role of social networks in

socioeconomic inequalities in the educational context. Since schools occupy a central role in the reproduction of social inequality (Bourdieu & Passeron, 1990; Bowles & Gintis, 1977), investigating the role of social networks in the school context is important due to their potential connection to socioeconomic differences in educational attainment. Knowledge of this would not only provide another piece in the puzzle of educational inequality but would also help to identify potential ways to alleviate inequalities via social relationships. Accordingly, the overarching question of this dissertation will be:

How are adolescents' and their parents' social networks—and the social capital embedded in them—connected to socioeconomic educational inequality?

This dissertation approaches this question from two angles. Firstly, educational inequality can be linked to the resources (i.e. social capital) individuals have in their personal networks. To be more precise, students' socioeconomic background may be related to the extent of social capital at their disposal, which, in turn, means that adolescents—depending on their social origin—can access and mobilize different amounts of social capital to foster their educational careers (i.e. differential social capital access). Secondly, educational inequality can be found in the way social capital is associated with individuals' educational outcomes, for example, in terms of better school grades or a higher educational degree, yet, depending on adolescents' social origin, social capital may be more or less beneficial (i.e. differential returns to social capital).¹ Both of these aspects—differential social capital access and differential returns to social capital—may be related to educational inequality between different socioeconomic groups.

The first chapter provides an overview and a more thorough explanation of the ways, which I have set out above, that social capital relates to socioeconomic educational inequality. First, I sketch this dissertation's understanding of social capital (chapter 1.1.). Second, I explain how social capital relates to socioeconomic educational inequality (chapter 1.2.). These two subchapters provide a brief overview of this dissertation's theoretical background but are more thoroughly outlined throughout chapters 2 to 4. In chapter 1.3, I transfer the theoretical arguments into the analytical approach and present the research plan as well as summaries of the three empirical chapters used in this dissertation. I end with a conclusion where I provide

¹ While the terms 'to benefit', 'beneficial', and 'return to' might imply a causal relationships, I cannot establish causality in my presented analyses as discussed in chapter 1.4. I also discuss issues regarding causality—as well as steps taken in this direction—in the respective empirical chapters. However, as this is the terminology offered by Lin (1999; 2001; Lin & Erickson, 2008), I rely on these terms at various stages throughout this dissertation.

an answer to my research question, highlight limitations, and suggest directions for future research (chapter 1.4).

1.2 Social capital

In recent years ‘social capital’ has become a buzzword and has also found its way into the everyday language (Portes, 1998). Due to its broad application in and outside of academia, the term lacks a clear definition and scholars fear that it will ‘become a handy catch-all, for-all, cure-all sociological term’ (Lin and Erickson 2008: 1). Scientifically, the issue can be found in the multitude of scholars who brought forward their definition of social capital (Bourdieu, 1986; Burt, 2005; Coleman, 1988; Field, 2017; Lin, 2001), which spurred research—again altering the concept or its measurements. Due to this lack of a clear definition, it is worthwhile to outline the understanding of social capital I apply in this thesis.

While Coleman’s social capital approach can be considered the most influential and popular in educational research (Coleman, 1988; Dika & Singh, 2002), I instead build on the social capital approach of Lin, who defines social capital as ‘resources that are embedded in social networks’ (Lin, 1999b, 2001; Lin & Erickson, 2008). Since Lin solely focuses on resources and disregards, for example, values and norms, his social capital approach can be considered the most narrow approach (Roth, 2014a). In investigating labour market success, he sees the role of social capital in the exchange of information, the possibility of ‘putting in a good word’ with a potential employer, or as a kind of ‘social certificate’, which highlights an individual’s social standing (Lin, 1999: 199; 2001). Accordingly, his research conceptualizes socioeconomic resources as social capital, since these are to be assumed connected to labour market outcomes.

However, when applying Lin’s concept to the analysis of educational outcomes, it seems worthwhile to broaden this definition to include values and norms as well as to emphasize resources that are valuable in the field of education (instead of the labour market). Educational research suggests that peers can—in addition to sharing resources (e.g. information or knowledge)—provide certain educational norms, which are positively (or negatively) associated with individuals’ educational outcomes (Flashman, 2012). Hence, I incorporate norms and values as a theoretical mechanism into my social capital understanding (for a similar approach see, Hoenig 2019 and Roth 2014). Moreover, since this dissertation is situated in the educational context, I investigate resources and the associated norms and values that are (potentially) associated with educational outcomes, such as friends’ reading habits (chapter 2), friends’ books at home (chapter 2), friends’ parents’ educational background (chapter 3), and

friends' school grades (chapter 4).

Regardless of these deviations, I still consider Lin's approach as the most suitable one for use in this dissertation as it focuses on resources—but also the associated norms and values—embedded in social networks (i.e. in friendship networks or networks of contacts among parents). The suitability is improved because Lin's social capital theory provides a comprehensive framework with regard to the association of social capital and social inequality (Lin, 1999b, 2000). The next section shows how the framework can be applied to the educational system to investigate social relationships and educational inequality.

1.3 Social capital and inequality in educational outcomes

According to Lin (1999; 2000; 2001), social capital can be linked to inequality in different ways: access to social capital and benefits from social capital (or in social network terminology: selection and influence). First of all, social capital can contribute to social inequality because access to it differs systematically between social groups. Hence, while individuals might benefit equally from having social capital, their access to valuable resources can differ.

Systematic differences in social capital access can be explained by the tendency of personal networks to be homogeneous²: Personal networks tend to consist of individuals which are similar (Blau 1994; McPherson et al. 2001). This means that socioeconomically advantaged individuals tend to associate with other advantaged individuals—providing a social capital surplus for them. This network homogeneity can be traced back to differences in the opportunity structure due to socially segregated contexts as well as the selection of relationship partners once students attend a school.

The opportunity structure refers to the availability of individuals in a given context (Blau, 1977; Wimmer & Lewis, 2010). Since personal networks resemble the composition of a context (Marsden, 1990a; McPherson, 2004), the extent of social segregation between contexts is connected to unequal access to social capital. Hence, contextual segregation provides a certain baseline for social capital access. Considering the educational system, this means that a larger extent of social segregation between schools provides an elevated baseline for social capital

² Here, I rely on Wimmer and Lewis (2010) distinction between 'homogeneity' and 'homophily'. While 'homogeneity' describes the composition of networks, 'homophily'—as a tie generating mechanism—refers to the 'preference' for relationships with similar others above and beyond the contextual opportunity structure and other tie generating mechanisms (i.e. structural network effects and shared foci).

access for socioeconomically advantaged students. Conversely, chances of accessing social capital—to potentially benefit from it—are reduced for socioeconomically disadvantaged students.

Socioeconomic school segregation can be explained by several factors, such as neighbourhood segregation, between-school tracking, as well as school preferences. Firstly, the school a student attends is connected to the student's neighbourhood, because proximity plays a dominant role in a student's school choice (Denessen et al., 2005). Since neighbourhoods tend to be socially segregated (Karsten, 2010), schools tend to be socially segregated, too. Secondly, in formally stratified school systems, such as the German or the Dutch system, school tracking further increases school segregation (Jenkins et al., 2008). Since the educational degree a student obtains is fundamental for the eventual labour market position, socioeconomically advantaged students (and their parents) favour attending upper-track schools and less advantaged individuals are more likely to attend lower or intermediate-track schools (M. Jackson & Jonsson, 2013; Solga & Wagner, 2010). Lastly, individuals' school preference also contributes to social school segregation as ethnic majority and socioeconomically advantaged students (and their parents) tend to avoid schools which are perceived as less favourable (Jheng et al., 2022; Kruse, 2019). School segregation structures access to social capital even before adolescents enter school.

After considering the baseline opportunities to access social capital due to school segregation, I turn to the selection of relationship partners once students are in a given school and how these contribute to differences in social capital access. The selection into relationships can be explained via various tie formation mechanisms, such as 'homophily', shared foci, and structural network effects (Wimmer & Lewis, 2010). Firstly, the preference for choosing similar others as friends (i.e. 'homophily') can provide a social capital surplus for socioeconomically advantaged students as they tend to befriend each other. Moreover, similar cultural preferences, tastes, and attitudes—which are connected socioeconomic background (Bourdieu, 1984; Chan & Goldthorpe, 2007; Lewis & Kaufman, 2018) may also increase the chances of socioeconomically similar individuals. Hence, 'homophily' can lead to socially-segregated networks with a social capital advantage for already privileged individuals.

Secondly, shared foci may also foster these socially segregated relationships (Feld, 1981). For example, socially selective extracurricular activities (Frank et al., 2008, 2013; Schaefer et al., 2011) or students living close sharing the same bus stop or walking the same way to school (Kruse et al., 2016; Mouw & Entwisle, 2006) can contribute to network segregation and, thus, differential social capital access. Thirdly, structural social network effects, such as reciprocity

and transitive closure, can amplify even small levels of network segregation (Kossinets & Watts, 2009).

Taken together, socioeconomically advantaged students have better access to social capital due to the segregation of schools as well as social networks and social inequality may be perpetuated via this unequal access.

Besides unequal social capital access, social capital may also be connected to educational outcomes via differential return to social capital. To be more precise, the return from (the nominally same amount of) social capital might be unequal between different social groups, for example, because individuals of certain social groups can draw better on their social capital or get bigger rewards (Lin, 2000).³ Moreover, also scholars linking social networks and inequality suggest that social relationships tend to amplify initial starting differences between social groups (DiMaggio & Garip, 2011, 2012). They argue that segregated social relationships and subsequent influence can increase inter-group inequality. This argument rests on the assumption that advantaged individuals have a higher likelihood of adopting beneficial practices (i.e. health practices or technological advances). Due to homogeneous relationships, on the one hand, and differential influence (in terms of adopting practices), on the other hand, the adoption of beneficial practices diffuses more quickly amongst the already advantaged. For example, DiMaggio and Garrip (2011) showed that the adoption of internet use in the US proceeded quite unequally between social groups because higher socioeconomic status is associated with an increased chance of adoption. Since there is substantial socioeconomic homophily, internet usage did diffuse unequally in different socioeconomic groups increasing inter-group inequality. Hence, there is evidence that social networks increase inequality between social groups (e.g. Garip, 2008; Lin, 2001; Manzo, 2013; Pampel et al., 2010; Zhao & Garip, 2021).

However, with regard to socioeconomic inequalities of educational outcomes, I argue that the set-up in the educational field is different from the adoption of innovative or other practices, which are not widespread in the population. Children and adolescents from advantaged households tend to already possess relevant skills and knowledge that help them succeed in school (Boudon, 1974; Bourdieu & Passeron, 1990). Educational aspirations and expectations

³ For example, it is conceivable that socioeconomically advantaged individuals are less hesitant drawing on their social capital (Calarco, 2011; Lareau, 2011) or that the individuals who provide social capital are reluctant to share their social capital with disadvantaged, because they are either not confident that resources are used well or are concerned about negative consequences for themselves (see, for example, Smith (2005) for the reluctance to share job information among ‘Black Urban Poor’).

are already rather high and school grades tend to be above average. Hence, there is little room for improving their initial advantage via social capital—a ‘ceiling effect’ may be observed (see also Schwenzer, 2019). Socioeconomically less advantaged students, on the other hand, may benefit from having advantaged friends and the resources they can provide. Advantaged friends may increase their motivation, provide different norms towards school, and instil greater educational aspirations. They can help with school work and, eventually, offer information and guidance when it comes to aiming for better educational degrees (Choi et al., 2008; Forster & van de Werfhorst, 2019; Helbig & Marczuk, 2021). Thus, I argue, that socioeconomically disadvantaged students can compensate for the lack of resources at home via their social capital.

In summary, I argue that there are two sides when it comes to the association between social capital and socioeconomic inequality in educational outcomes. On the one hand, disadvantaged individuals will usually suffer a social capital deficit, because (1) they tend to attend schools providing fewer chances to access social capital and (2) socially segregated networks further limit social capital access. On the other hand, if socioeconomically disadvantaged students establish social relationships with more advantaged peers and have access to social capital, they particularly benefit because social capital helps them to compensate for a lack of family resources.

This theoretical framework is empirically tested in this dissertation. To provide a comprehensive overview, I outline the research plan and analytical approach in the next section.

1.4 Dissertation framework and chapter overview

1.4.1 Dissertation framework

This dissertation wants to provide a comprehensive picture of how social relationships relate to educational inequality for students with different socioeconomic backgrounds. This not only includes the relationships between students or parents and its relevance for inequality in educational outcomes but also preceding aspects, which make relationships more or less likely in the first place. Figure 1.1 depicts the framework and gives an overview of the dissertation’s structure.

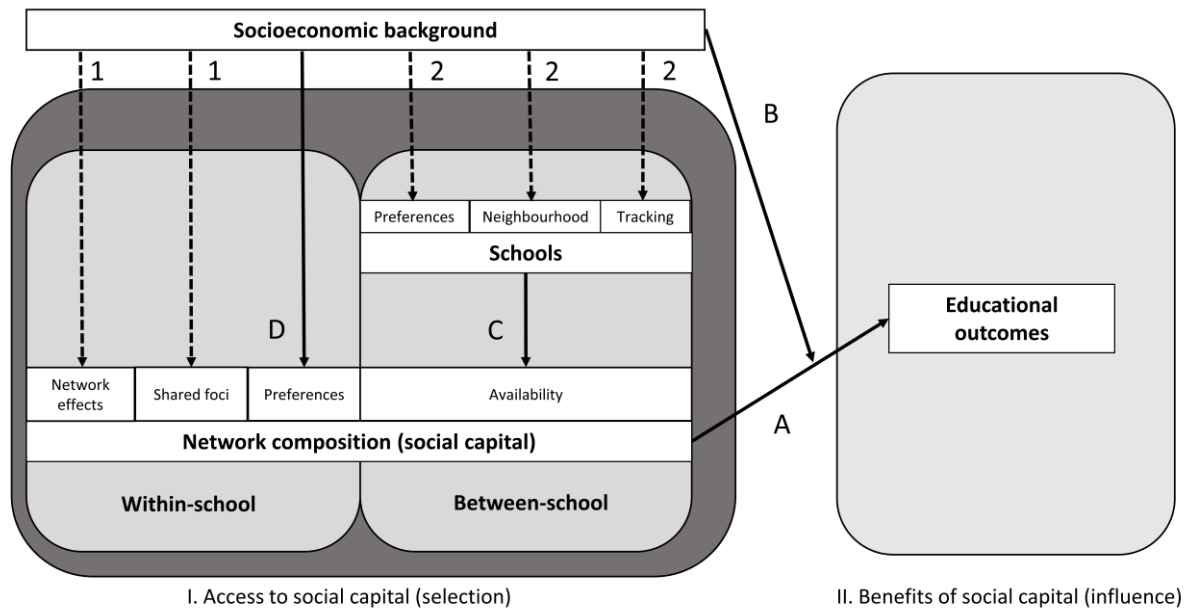


Figure 1.1: Dissertation framework

Note: Bold arrows show aspects investigated in this dissertation. Dashed arrows show aspects this dissertation does not investigate but which are part of the argument.

The starting point is the student's socioeconomic background. While previous research established the connection between socioeconomic background and educational outcomes, this dissertation investigates the access to social capital (left-hand side of figure 1), educational benefits of social capital (arrow A) and how social capital benefits differ by socioeconomic background (arrow B).

Socioeconomic differences in network composition and, thus, unequal social capital access (left-hand side of figure 1) can be found in differences in the availability at the school level (between-school) and relationship processes once students are in the school (within-school). As explained, differences in availability can be traced back to segregated neighbourhoods, school tracking, and school preferences (dashed arrows 2). These aspects result in socially-segregated and, thus, rather homogenous schools. Since schools provide the pool of peers adolescents can select their friends from, friendship networks also tend to be homogenous. Schools provide the opportunity structure for friendship relationships and set a certain baseline when it comes to social capital access (arrow C). However, in addition to the contextual composition, the homogeneity of networks is exacerbated by the selection of select similar individuals as friends due to homophily (arrow D) but also shared foci or structural network effects (dashed arrows 1), which are addressed but their contribution to unequal social capital access not specifically investigated in this dissertation.

These two factors (between-school sorting and within-school relationship selection) contribute to a social capital deficit for socioeconomically disadvantaged adolescents. Chapters 2 and 3 investigate the distribution of students' from different socioeconomic backgrounds across schools and school types to assess differences in their social capital access due to between-school processes. Chapters 3 and 4 focus on within-school patterns of friendship choices and parental contacts to answer whether advantaged individuals have better access to social capital due to relationship preferences ('homophily').

When it comes to the benefits of social capital (right-hand side of figure 1), this dissertation seeks to answer whether friends (and friends' parents) play a role in an individual's educational career (arrow A). Moreover, the aim is to answer whether there are differential returns from social capital for adolescents from socioeconomically more or less privileged families (arrow B). Chapters 3 and 4 investigate the benefit of social capital for two educational outcomes, namely educational decisions and school grades. They also address whether there are differential returns from social capital for more or less advantaged students.

Table 1.1: Overview of the studies included in this dissertation

| | Study 1 (Chapter 2) | Study 2 (Chapter 3) | Study 3 (Chapter 4) |
|-----------------------------------|---|---|---|
| Title | Limited opportunities: Adolescents' access to social capital in three European countries | Social networks and educational decisions: Who has access to social capital and for whom is it beneficial? | Social networks, cultural capital, and educational inequality: Investigating network mechanisms and cultural capital differences in academic achievement |
| Author(s) | Lenkewitz, Sven | Lenkewitz, Sven; Wittek, Mark | Lenkewitz, Sven |
| Research question(s) | (1) How does <i>access to social capital</i> differ between adolescents from different social backgrounds in the school context? (2) To what extent is social capital access connected to friendship selection as opposed to school sorting? | (1) Are students' or parents' social networks segregated by socioeconomic background? (2) Are parents' networks more segregated than their children's networks? (3) How is social capital embedded in these networks linked to educational decisions? | (1) Do students with more cultural capital have a network advantage concerning school grades compared to their schoolmates? (2) To what extent do selection and influence processes contribute to the school grade differences of students with a low/high amount of cultural capital over time? |
| Dependent variable(s) | (1) Friends' reading habits (2) Friends' books at home (3) Friends' socioeconomic status family background | (1) a. Friendship networks b. Parents' contact network (2) Ambitious educational decisions | (1) Friendship network (2) Students' school grades |
| Core independent variables | Socioeconomic status (ISEI) Educational background Ethnic minority status | Friends' academic family background | Books at home Opera/theatre/museum attendance |
| Data | CILS4EU Wave 1 | CILS4EU Wave 1 to Wave 7 | SOCIALBOND Wave 1 and Wave 2 |
| Statistical method | Within-between random effects (REWB) models | (1) Exponential random graph models (ERGM) with average marginal effects (AME) (2) Linear probability models with classroom fixed effects | (1) Stochastic actor-oriented models (SIENA) (2) Simulations based on SIENA models |
| Current status | Resubmitted to <i>Social Networks</i> | Accepted for publication in <i>Kölner Zeitschrift für Soziologie & Sozialpsychologie</i> | Published on SocArxiv |

1.4.2 Summary of dissertation chapters

The three dissertation chapters tackle either different aspects of this framework or combine both aspects in one chapter. Each of the chapters 2 to 4 are self-contained studies on different aspects of the framework in chapter 1.3.1. Table 1.1 gives an overview of the three studies and their current status. I am the sole author of the empirical studies provided in chapters 2 and 4. Chapter 3 contains a study co-authored with Mark Wittek.

Chapter 2, *Limited opportunities: Adolescents' access to social capital in three European countries*, investigates access to social capital as the outcome of school sorting and friendship selection in three European countries Germany, the Netherlands, and Sweden. Since it focuses on social capital access in the school system, in addition to the more conventional measure of social capital (i.e., socioeconomic score (ISEI)), I investigate the access to cultural resources, namely friends' reading habits and friends' number of books at home.

This chapter aims to identify the extent that school sorting and friendship selection contribute to social capital access and whether there are differences between the three investigated countries. The chapter relies on the first wave data of the *Children of Immigrants Longitudinal Study in 4 European Countries* (CILS4EU) research project and uses of Within-Between Random Effects (REWB) models to differentiate between school sorting and friendship selection.

Results show that social capital access is strongly associated with the composition of adolescents' schools. Especially, the socioeconomic composition, but also—albeit to a smaller extent—the share of minority students, play a substantial role in social capital access. When it comes to social capital access due to friendship selection, socio-demographic characteristics play a negligible role. There are, however, relevant differences between countries and social capital measurements.

Considering country differences, school sorting is much more important in the formally stratified school systems of Germany and the Netherlands. The Swedish school system restricts social capital access less, but even in this 'role model' of a comprehensive school system, social capital access is still connected to school sorting to a substantial extent.

There are also differences concerning the three investigated social capital resources, friends' reading habits, friends' books at home, and friends' ISEI background. School sorting plays the biggest role with regard to friends' ISEI background and their books at home. Having friends with beneficial reading habits, on the other hand, is associated less with school sorting. This

may point to the fact that reading habits are less strongly associated with socio-demographic characteristics or that friendship selection is more important for this resource.

In summary, this study found that social capital access is substantially restricted by school sorting leading to a social capital deficit for socioeconomically disadvantaged students even before entering school. Friendship selection based on socio-demographic characteristics, on the other hand, contributes little to social capital differences.

Chapter 3, *Social networks and educational decisions: Who has access to social capital and for whom is it beneficial?*, investigates the socioeconomic differences in social capital access of adolescents as well as their parents and the connection of these two sources of social capital with educational decisions. In addition to that, my co-author and I analyze whether the benefits of social capital differ between socioeconomic groups. We focus on the decision to remain in the educational system instead of entering the labour market or dropping out and define this as an *academically ambitious decision*. To have a narrow link between the outcome of interest and social capital, we measure social capital by the tertiary educational background of friends' parents. Since chapter 3 focuses on socioeconomic differences in social capital access as well as the connection between social capital and educational decisions, this chapter is divided into two parts.

Firstly, relying on the German subsample of the first CILS4EU wave, we investigate adolescents' and their parents' access to social capital systematically. We look at complete friendship networks, but also complete networks of parental contact, and investigate social capital inequalities between and within school types. Moreover, we analyze whether the extent of network segregation differs between adolescents' friendship networks and the networks of parental contacts.

To assess school-type differences, we identify whether adolescents or their parents have social capital (i.e. whether they have at least one person in their personal network with a university background). We show school-type differences in social capital access descriptively as the share of individuals with social capital. Additionally, we zoom in and investigate the structure of adolescents' and parents' social networks via Exponential Random Graph Models (ERGM). We find that social capital is not only unequally distributed across school types, but our ERG models also emphasize that social relationships are socially-segregated which further restricts access for less privileged families. By calculating average marginal effects (AME), we find that parents' networks are substantially more segregated than their children's friendship networks.

Secondly, we analyze whether social capital is associated with adolescents' educational decisions. To this end, we merge data from the CILSEU-DE extension to assess adolescents' educational careers. While the original CILS4EU data contains three waves starting in 9th grade, the CILS4EU-DE data set provides information on four additional waves. This allowed us to reconstruct adolescents' educational careers and identify whether they realized academically ambitious educational decisions. Here, we estimated linear probability models with classroom fixed effects. To capture whether social capital provides different returns for different social groups, we ran additional models for individuals with and without an academic family background separately. Results show that social capital increases the chances of making academically ambitious decisions. This is especially the case when social capital is accessed by parents, emphasizing the important role parents play in their children's educational careers. Moreover, the subsample-specific models reveal that social capital particularly benefits adolescents from less advantaged families. This result highlights that social capital can be a substitute for a lack of relevant educational resources at home and, therefore, mitigate educational inequalities. However, considering both parts of this chapter together, we conclude that access to social capital is substantially restricted for those families who would need it the most. Unequal access occurs not only due to school sorting but also due to segregated relationships within schools—especially for parents' networks.

Chapter 4, *Social networks, cultural capital, and educational inequality: Investigating network mechanisms and differences in academic achievement*, analyses the co-evolution of friendship networks and adolescents' school grades. Based on Bourdieu's cultural capital framework, this chapter investigates the following questions: (1) Do students with more cultural capital have a network advantage concerning school grades compared to their schoolmates? (2) To what extent do selection and influence processes contribute to school grade differences of students with different amounts of cultural capital over time?

To this end, this chapter uses data from the research project "Social Boundary-Making in Adolescence" (SOCIALBOND) and so-called stochastic actor-oriented models (SAOMs) are employed. In a first step, SAOMs are estimated for adolescents' friendship networks and I use them to assess whether adolescents with more cultural capital have an increased likelihood of selecting high(er) achieving peers as friends and if friends do influence each others' school grades. Afterwards, the results of these models are used for simulation purposes. Since SAOMs are based on simulations, they allow me to simulate results, which would come about due to different model parameters and, thereby, explore the realm of alternative scenarios. With these simulations, I assess whether observed parameters increase or mitigate inequality between

adolescents with more or less cultural capital and show how results would change under different conditions.

SAOM results show that, compared to students with less cultural capital, adolescents with more cultural capital have an increased tendency to select peers who have better school grades. This suggests that culturally-advantaged students have a more advantageous social network composition. Results also show that friends influence each other's school grades. Based on these empirical findings, I explore simulations with different model specifications. These simulations show that social network processes can favour adolescents with less cultural capital. The achievement gap between students with less vs. more cultural capital decreases with larger peer influence parameters. However, contrary to expectations, different homophily parameters in the selection part barely change the achievement gap. An explanation for this finding may be that the parameters (i.e. school grades and cultural capital)—although already showing an association—are not correlated enough.

These counterintuitive findings (i.e. culturally more-advantaged students tend to have advantageous networks, but culturally less-advantaged students benefit more from social network processes) can be explained by the situation that culturally-advantaged students do indeed have a better social network composition *compared to their peers*. However, *compared to their own* school grades, their friends have—on average—worse school grades. Their initially already rather good school grades make it complicated to select into networks, which could eventually be beneficial for them. Conversely, more disadvantaged students tend to have worse school grades, which makes it more likely for them to select higher-achieving peers as friends. A larger extent of peer influence then helps these students to improve their school grades. Regardless of these findings, the achievement gap remains in all simulated scenarios substantial.

1.4.3 Status of the papers and contribution of co-authors

Chapter 2 consists of the paper ‘Limited opportunities: Adolescents’ access to social capital in three European countries’ is in the revise and resubmit phase and has been resubmitted to *Social Networks*. I am the sole author of this paper.

Chapter 3 consists of the paper ‘Social networks and educational decisions: Who has access to social capital and for whom is it beneficial?’ has been accepted for publication in *Kölner Zeitschrift für Soziologie und Sozialpsychologie*. As the lead author, I developed the research question, analytical set-up, prepared the data, conducted the analyses throughout the complete

process of the paper and wrote the first draft. After the first draft, my co-author Mark Wittek (University of Cologne) and I contributed equally to all written parts of the chapter.

Chapter 4 consists of ‘Social networks, cultural capital, and educational inequality: Investigating network mechanisms and differences in academic achievement’ has been published on SocArxiv. I am the sole author of this paper.

1.5 Conclusion

The reproduction of educational and social inequality is a longstanding societal as well as scientific concern. While an abundance of research established the relevance of individuals’ social origin for their educational career (M. Jackson & Jonsson, 2013; Jenkins et al., 2008), how social networks relate to the reproduction of educational inequality demands further attention.

This dissertation, therefore, investigates how social relationships—and the embedded social capital—between adolescents and parents are connected to socioeconomic inequalities in educational outcomes. To arrive at a comprehensive picture, I analyze the emergence of social relationships as well as their association with educational outcomes. Specifically, I look at the social segregation of social relationships due to different opportunities as well as relationship selection, which may hinder socioeconomically disadvantaged individuals from establishing social ties with their more advantaged peers. Access to these peers is important because, due to their background socioeconomically, advantaged individuals possess more relevant educational resources (i.e. information, knowledge, but also norms) which help them succeed in the educational system. Therefore, I investigate whether established ties to these more advantaged individuals are associated with more ambitious educational decisions or better school grades.

All in all, the results of this dissertation show that social relationships can mitigate inequality in educational outcomes. Socioeconomically disadvantaged adolescents benefit more from the social capital they access than their more advantaged counterparts, which reduces the gap in educational outcomes between these social groups. This finding can be explained because most socioeconomically advantaged adolescents already have a rather good starting position and better educational prospects. Hence, when the defaults are academically ambitious decisions or rather good school grades, there is little room for improving these outcomes via social capital. Adolescents from less advantaged households, on the other hand, can benefit from their social capital. Social capital may provide them with resources they do not have (at home), such as

information about educational choices, knowledge about the school system, pro-school norms, or help with homework.

However, while social capital seems to be particularly worthwhile for disadvantaged adolescents, results highlight that these students have worse chances of accessing social capital than their advantaged counterparts. This is a common finding in research on social capital: The social capital deficit of disadvantaged social groups, such as individuals with lower socioeconomic status or ethnic minorities, is a well-established finding (Behtoui, 2007, 2016; van Tubergen & Volker, 2015; Verhaeghe et al., 2013, 2015). Moreover, research on social networks and social inequality also shows that the structure of social networks tends to be advantageous to those who are already advantaged (e.g. Calvó-Armengol & Jackson, 2004, 2004; DiMaggio & Garip, 2011, 2012; Zhao & Garip, 2021). Hence, this dissertation supports previous research, which established that social resources are unequally distributed and cluster amongst the already advantaged individuals, and provides evidence for this in the school context. Additionally, this dissertation contributes by more thoroughly investigating the underlying mechanisms for this social capital deficit. As chapters 2 and 3 show, this social capital deficit can be differentiated into different school as well as relationship choices. As a first step, the allocation of students to different schools substantially structures access to social capital due to the considerable extent of school segregation. In the second step, relationship selection between adolescents and their parents produces socially-segregated social networks, which further contribute to the reduced social capital access for socioeconomically disadvantaged adolescents. Moreover, as chapter 4 shows, advantaged adolescents even tend to select higher-achieving peers as friends increasing their stock of social capital. Taken together, this dissertation illustrates that while social capital—once accessed—particularly benefits socioeconomically disadvantaged adolescents, they have a social capital deficit which can be traced back to school as well as relationship choices.

On the other hand, this dissertation's findings on the potential of social relationships (once they are formed) to decrease inequality is inconsistent with the majority of research on social relationships and intergroup inequality. Research on social capital and status attainment largely considered the mediating role of social capital concerning social inequality: inequality is explained via unequal access to valuable network resources (Chen, 2010; Verhaeghe et al., 2015). Only a few studies actually consider differential returns to social capital by considering the moderation between socio-demographic characteristics and social capital (e.g. Behtoui 2007; Behtoui and Neergaard 2010; Raabe 2018) or employing simulations to investigate intergroup inequality (e.g. Zhao and Garip 2021).

Previous social networks research also supports the notion that social networks amplify small initial advantages due to network segregation and the subsequent influence processes (DiMaggio & Garip, 2011; Zhao & Garip, 2021). This research, however, tends to focus on migration decisions or the adoption of beneficial practices (i.e. technological), which are not widespread in the population. This research suggests that socioeconomically advantaged individuals tend to have a higher likelihood of adopting a certain practice in the first place (DiMaggio & Garip, 2012). Due to socially segregated networks, the practice then diffuses much more rapidly amongst socially advantaged individuals increasing the advantage of this group. Overall, networks tend to favour those who are already advantaged. A notable recent exception is Chetty et al. (2022), who identified that relationships with socioeconomically advantaged individuals are one of the strongest predictors of income mobility of disadvantaged individuals.

Regardless, the majority of findings are not in line with the findings of this thesis, which may be explained by conceptually different outcomes. As highlighted, many socioeconomically advantaged students already have rather good educational prospects. Unlike the adoption of a new practice, their educational situation leaves—on average—little room for improvement and there might be a ceiling effect. In this case, social relationships between more and less advantaged individuals may have the potential to decrease inequality—at least once they are established. However, the large extent of social and network segregation must not be neglected, because this systematically restricts access to valuable resources.

With regard to research on social networks and educational inequality, few studies investigated the relevance of social relationships for intergroup educational inequality. For example, Raabe et al., (2019) showed that friendship networks can widen the gender gap in science, technology, engineering, and math (STEM). Moreover, Behtoui (2007) showed that young ethnic minority individuals have a decreased return from their social capital when it comes to their labour market entry. Hence, while some studies exist, more research should be dedicated to the investigation of social relationships and socioeconomic inequality in educational and occupational outcomes. Importantly, more effort should be made to investigate the interaction between socioeconomic status—but also other socio-demographic characteristics—and social capital to assess differential returns to social capital (for a similar call see also DiMaggio & Garrip 2012). Similarly, more effort should be made to assess group-specific outcomes of social network processes.

While this dissertation contributes to this research gap, there are some limitations, which provide a basis for future research. First of all, in all three chapters, this dissertation relies on

complete social networks, such as friendship networks or networks of contacts among parents. These networks contain students (and their parents) of a single school class or school grade. Hence, they do not include individuals, who do not attend the same school class or grade, such as neighbourhood friends or friends from outside school activities (i.e. football training or music classes). While this is common practice in research on adolescents' social networks, this might introduce certain biases because relevant individuals in a person's network might be omitted. For example, neighbourhood friends may also provide useful information with regard to educational decisions. However, research shows that meeting opportunities, such as neighbourhood, clubs, or voluntary associations tend to be socially segregated, too (McPherson, 2004; McPherson & Smith-Lovin, 1986). Therefore, the added information on these social networks might be rather small. Regardless, social networks, which draw the boundary beyond the school to include out-of-school relationships, need to be investigated in further research to assess the relevance of these for educational—but also other—outcomes.

Secondly, since I rely on complete social networks and, in chapter 3, also a longitudinal approach with a larger time horizon, sample attrition and sample composition restrict the generalizability of my findings. Social network research requires that a certain share of participants are included in the sample – the usual cut-offs are 75 or 80 per cent (Huisman & Steglich, 2008). Networks that do not fulfil this condition are usually tossed out. In the case of non-random survey participation, this might lead to a bias in the sample composition. For example, since the participation rate of lower-track students was lower in the SOCIALBOND data, many of the lower-track schools had to be excluded from the sample. To make matters worse, lower-track school grades tend to be smaller than the grades of the other tracks. This lead to more convergence problems in these networks. Taking these aspects together, the sample was biased against lower-track schools: only a few networks of lower-track schools were included in the analysis. Future research should probe the robustness of the results with a larger more comprehensive sample.

Thirdly, research on peer effects and peer influence is often concerned with causality (e.g. Calvó-Armengol et al., 2009; Elwert, 2013; Sacerdote, 2011). While I employed stochastic actor-oriented models to disentangle selection and influence (Chapter 4) or controlled for a variety of confounding variables in combination with a lagged outcome (Chapter 3), I cannot establish causality. While establishing causality in social network studies is notoriously difficult (Mouw, 2006; Shalizi & Thomas, 2011), future studies can improve on this by employing different methods, such as instrumental variable regressions (Bramoullé et al., 2019; Calvó-Armengol et al., 2009; Flashman, 2014), or by experimental approaches (Sacerdote, 2011).

Lastly, on a more conceptual note, the focus of this dissertation is the potential benefit for disadvantaged individuals if they are more connected to more advantaged peers. This focus, however, neglects the potential negative side of social capital (or as Portes (1998) calls it ‘The dark side of social capital’): Connections between different social groups may be harmful to more advantaged individuals. While the simulations used in chapter 4 did not show a substantial negative development of school grades for advantaged students, this might be different for other outcomes, which are correlated with socioeconomic status, such as health (Weyers et al., 2010) or delinquent behaviour (Rekker et al., 2015). Further research should investigate whether positive spillover can also be observed for different outcomes or whether positive spillover in one domain (e.g. education) might be offset by negative behaviour developments in another domain (e.g. health or delinquent behaviour).

Regardless of these limitations, this dissertation provides important insights into the link between social capital and socioeconomic inequality in educational outcomes. The findings presented in this dissertation also suggest policy implications and advice for teachers to remedy these inequalities. Firstly, from a policy perspective, the reduction of social school segregation would systematically increase access to social capital for underprivileged adolescents. Since not only adolescents’ social capital access is connected to the levels of school segregation (e.g. Palardy, 2013; Shen, 2018), desegregation efforts ought to be a central goal of policymakers. However, desegregation is an almost insurmountable task and requires large-scale reforms of the school system. Since, school reforms are complicated and often met by the resistance of students, teachers, and parents alike, initiating substantial changes is difficult.

Secondly, and more realistic because more nuanced, teachers and schools could deliberately try to connect adolescents and parents from different socioeconomic strata. This could be achieved by pairing relevant students in classwork (Boda et al., 2020), changing classroom seating arrangements (Keller & Takács, 2019), or by hosting events for parents where educational pathways are being discussed. In the latter case, highly-educated parents can offer guidance and information about university education (or vice versa) and connections across social groups may be fostered. A caveat to these suggestions is the necessity for teachers and schools to assess the socioeconomic background of adolescents, which may be considered sensitive information. Nevertheless, these efforts might improve educational prospects for socioeconomically underprivileged individuals via social connections to more advantaged individuals.

Chapter 2

Limited opportunities: Adolescents' access to social capital in secondary schools in three European countries*

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Abstract

While previous research indicates that students benefit from their peers' resources, little is known about access to social capital in the school context. Therefore, this chapter examines differential access to social capital – measured by friends' socioeconomic status (SES), the number of books they have at home, and their reading habits – in secondary schools in Germany, the Netherlands, and Sweden. Relying on a large-scale dataset, I investigate the association between socioeconomic status, minority status, and social capital using complete friendship network information. I argue that social capital access is connected to a two-stage process consisting of school sorting and friendship selection. To differentiate between these two processes, I apply within-between random effects (REWB). The models show that friendship selection is much less relevant for access to social capital than school sorting. Results indicate that while high-SES students have better access to social capital across dimensions, access patterns for minority students are more nuanced.

2.1 Introduction

The educational system has always played a central role in research on social inequality. Scholars have not only identified the differences in schools as an important factor contributing to unequal chances in life (Bowles & Gintis, 1977) but have also found that students' immediate peer environment is relevant for educational and labour market outcomes (Carolan, 2018; Carolan & Lardier, 2018; Cherng et al., 2013; Flashman, 2012, 2014; Lomi et al., 2011; Sacerdote, 2011). However, while research indicates that peers' educational resources are associated with educational outcomes, research investigating who actually has access to peers who possess valuable resources remains scarce (Frank et al., 2013; Lorenz et al., 2021).

Following the social capital approach adopted by Lin (1999b, 2001), I identify resources that are accessible through social relationships as social capital. While the importance of social capital for educational and occupational outcomes has been shown many times (Behtoui, 2007; Cook et al., 2007; Crosnoe et al., 2003; Frank et al., 2008; Lin & Erickson, 2008; Roth, 2014b; Verhaeghe et al., 2015), research on differential access to social capital has only recently gained traction (van Tubergen & Volker, 2015; Völker et al., 2008). An important insight of this research stream is that adults from socially disadvantaged groups, such as individuals with minority status or low socioeconomic status (SES), have worse access to social capital. However, considering the relevance of social capital already at an earlier stage in life (Behtoui, 2013; Roth, 2014b; Verhaeghe et al., 2015), it is necessary to investigate how access to social capital is distributed across social groups already at school age. Knowledge of this is important because already small disadvantages can accumulate over time and have the potential to exacerbate inequality between social groups (DiMaggio & Garip, 2012; DiPrete & Eirich, 2006).

Therefore, this chapter examines (1) how *access to social capital* differs between adolescents from different social backgrounds in the school context. In doing this, I respond to the call made by Lin, who emphasised that 'differential access to social capital deserves much greater research attention' (Lin, 2001; van Tubergen & Volker, 2015). Moreover, potential differences in social capital access can be attributed to social segregation of contexts (*between-context*) as well as social network segregation due to *within-context* processes, such as homophily, which is the tendency of similar individuals to associate with one another (McPherson et al., 2001; S. Smith et al., 2016; Wimmer & Lewis, 2010). Therefore, by analysing the distribution of adolescents across schools, as well as their classroom friendship networks, I investigate (2) whether differences in social capital access originate in school segregation and/or the friendship

selection students make within the schools they attend. Hence, I understand social capital access – in the school, but also in other contexts – as a two-stage sorting process. In the first stage, students are sorted along socio-demographic characteristics, such as socioeconomic or minority status, into different schools (resulting in school segregation). These schools then constitute the pool of peers from which students can select their friends in the second stage.

Most studies on adults' social capital focus on the social positions of individuals, indicated by a measure of SES (see Lin & Erickson, 2008). However, as social capital is goal-specific (Flap & Völker, 2001), I will additionally analyse access to specific resources that are relevant in the school context. As shown in the literature on educational stratification, cultural resources are particularly beneficial for educational success (see, for example, DiMaggio, 1982; Jæger, 2009, 2011; Jæger & Breen, 2016). Studies have shown that the availability of *books at home*, as well as *reading habits*, are associated with individual educational success (Evans et al., 2010; Jæger & Breen, 2016). While the bulk of research in this field has examined how students' cultural capital endowment affects their educational success, I extend this line of research using a social capital perspective. Therefore, in addition to the more traditional measurement of social capital by alteri's SES, I investigate cultural resources that students can access through their friends in school, which therefore also constitute social capital in the sense of 'resources that are embedded in social relationships' (Lin, 2001: 81).

Taken together, the study in this chapter advances the literature on social capital and educational stratification in three ways. First, I will analyse *access* to social capital among students by using comparative data on individual characteristics and *complete friendship networks* in 341 schools across three European countries (Germany, the Netherlands, and Sweden). These data from the first wave of the Children of Immigrants Longitudinal Survey in Four European Countries (CILS4EU) project (see Kalter et al., 2017) allow me to investigate the relevance of between-school segregation and within-school processes regarding access to social capital. Second, in addition to the more conventional measure of social capital (i.e. socioeconomic status), I will examine access to *cultural resources* that are relevant in the school context. Third, I will compare access patterns in the school context across three European countries, namely Germany, the Netherlands, and Sweden, each of which have school systems with varying degrees of stratification. By adopting a bird's-eye view of a large number of schools in three countries, I offer one of the first large-scale studies to examine access to social capital in the school context.

The results show that disparities in access to social capital are substantially connected to school segregation in all three countries. School segregation systematically restricts access to

valuable socioeconomic and cultural resources for socioeconomically disadvantaged and ethnic minority students. However, between-school sorting tends to be less relevant in Sweden than in Germany and the Netherlands. Moreover, when comparing school segregation and friendship selection according to socio-demographic characteristics, the latter only play a marginal role regarding access to social capital. Conversely, school composition is the main driver of social capital access.

2.2 Theory and previous research

2.2.1 Social capital and cultural resources

That social networks – and the social capital they provide – can be linked to individual outcomes has been noted by many social scientists (Bourdieu, 1986; Burt, 2005; Coleman, 1988; Granovetter, 1995; Lin, 2001; Portes, 1998). Usage of the term ‘social capital’ has proliferated in academia, but it has also found its way into the everyday language (Portes, 1998). Due to the widespread use of the term, a variety of understandings and definitions of social capital have emerged (Field, 2017; Portes, 2000). While some understand the structure of networks as a form of social capital (Burt, 2005) that can create expectations and help to enforce norms (Coleman, 1988; Portes, 1998), others emphasise that social capital can be understood as resources that are embedded in social networks (Bourdieu, 1984; Lin, 2001). Moreover, while most scholars tend to focus on the positive impact of social capital, Portes (1998) highlights that social capital can also have negative outcomes. Hence, to avoid theoretical and conceptual fuzziness, this diverse set of theoretical lenses requires that I briefly outline the understanding of social capital applied in this chapter.

While Coleman’s social capital approach – focusing on intergenerational closure and dense social networks – is the most widely used in the field of education (Coleman, 1988; Dika & Singh, 2002), I specifically adopt the view of Lin, who defines social capital as ‘resources that are embedded in social relationships’ (Lin, 2001: 81). These resources are not possessed by the individual but can be accessed through their relationships in the pursuit of certain goals (Lin & Erickson, 2008). Although Lin’s (1999, 2001) social capital approach has been largely used to investigate labour market outcomes, I transfer it to the educational context because his approach to social capital has several merits. First of all, he defines the term relatively narrowly, thus making its meaning clear and preventing it from becoming a ‘catch-all, for-all, and cure-all sociological term’ (Lin & Erickson 2008: 1). Moreover, Lin’s theory is specifically concerned with the association between social capital and social inequality (1999, 2001), which is particularly useful in the educational realm. To this end, his theory explicitly distinguishes

between access to and the use of social capital. This not only allows us to investigate inequality with regard to differential returns on social capital but also to determine whether there are differences in social capital access between social groups. As the access to social capital is a prerequisite for its use, investigating inequalities in individuals' access to social capital is of fundamental importance.⁴

While the rich literature on social capital in adolescence highlights its relevance for individuals' educational success (Cook et al., 2007; Crosnoe et al., 2003; Frank et al., 2008; Riegle-Crumb et al., 2006), it tends to neglect the differences in social capital endowment (see, however, Frank et al., 2013). As highlighted, such differences are the focus of research that follows Lin's work on social capital. Studies usually employ the 'position generator' to capture relationships between people from different strata of society (Lin & Dumin, 1986; Lin & Erickson, 2008). A list of occupations across the range of the occupational hierarchy is presented to participants. The participants are then asked to identify those occupations in which someone they know is engaged (Flap & Völker, 2001; Lin & Erickson, 2008; Roth, 2014b; van Tubergen & Volker, 2015). By doing this, researchers can identify the socioeconomic resources (that are associated with certain occupational positions) embedded in individuals' personal networks. These resources are referred to as 'social capital' (see van Tubergen & Volker, 2015). On the one hand, these studies report positive associations of social capital with labour market outcomes (Lin & Erickson 2008). On the other hand, studies employing the 'position generator' were able to identify reduced access to social capital for individuals who occupy lower positions in the labour markets (Behtoui, 2007, 2013, 2016; van Tubergen & Volker, 2015; Verhaeghe et al., 2013, 2015). Moreover, almost all cited studies identify a social capital deficit of immigrants with regard to socioeconomic resources (for an exception see van Tubergen & Volker, 2015). However, studies emphasise that this deficit can often be attributed to the lower SES of migrants.

While the use of the 'position generator' to assess social capital has a long tradition (Lin & Dumin, 1986), it has been criticised because it fails to determine which resources are specifically accessed as it usually relies on the umbrella term of 'socioeconomic resources'. Hence, the nature of the connection between these resources and outcomes often remains unclear (Van Der Gaag & Snijders, 2005). Therefore, I argue that it is additionally important to study resources that are valuable in a *specific field*. Given that the objective of this chapter is to

⁴ It is important to mention that there might also be systematic inequality in the ability to use social capital. Individuals might be more or less successful in mobilising their social capital depending on socio-demographic or other attributes.

analyse social capital in the school context, resources that are beneficial for educational outcomes ought to be analysed. Here, I can draw on a stream of literature that identifies cultural resources as beneficial for academic success (DiMaggio, 1982; Jæger & Breen, 2016).

Bourdieu (1984) conceives of cultural resources as a form of capital. Children from advantaged socioeconomic backgrounds become familiar with this form of capital during their childhood due to parental transmission and exposure. In general, high-SES adolescents tend to have more cultural capital, learn dominant cultural codes, and acquire relevant knowledge, which they can then translate into academic benefits (Bourdieu, 1984; Bourdieu & Passeron, 1990). In his framework, Bourdieu (1986) differentiates between three different forms of cultural capital: institutionalised, objectified, and embodied cultural capital. The institutionalised form of cultural capital pertains to educational credentials and degrees; objectified cultural capital encompasses cultural goods, such as artworks, musical instruments, or books; and embodied cultural capital refers to the knowledge and internalisation of cultural codes, expressed for example by an appreciation for and knowledge of art or literature. Scholars in this field have established a link between students' *individual* stock of cultural capital and their academic success (DiMaggio, 1982; Jæger, 2009, 2011).

However, a growing body of research on adolescents also suggests that resources *possessed by peers* are positively associated with individual educational success (Carolan, 2018; Cherng et al., 2013; Cook et al., 2007; Crosnoe et al., 2003; Flashman, 2012; Kretschmer & Roth, 2020; Lomi et al., 2011; Lorenz et al., 2020; Raabe & Wölfer, 2019). The positive effects of these kinds of resources, when possessed by friends instead of the focal actor, are conceivable, given the increasing amount of time adolescents spend in their peer environment and the intimate relationships close friends can have with one another (Kiuru et al., 2012). Against this background and due to the importance of cultural resources in the educational setting, I argue that it is worth investigating cultural resources that are possessed by peers and to conceive of them as social capital (Cherng et al., 2013). Therefore, in this chapter, 'social capital' not only refers to *socioeconomic* but also to the *cultural* resources that are embedded in students' personal networks.

While a range of cultural indicators has been proposed (for an overview, see Jaeger & Breen, 2016), I chose the number of books at home and adolescents' reading habits, which have both been connected to an individual's educational success (Breznau et al., 2019; Evans et al., 2010; Heppt et al., 2022; Jæger, 2011; Jæger & Breen, 2016; Sieben & Lechner, 2019). These resources capture the objectified (books) as well as embodied (reading) dimensions of cultural capital. Moreover, these factors, unlike grades or aspirations, can be compared across contexts

and countries.⁵ Therefore, in addition to the socioeconomic background of one's friends, this chapter also investigates the number of books in one's friends' households, and their reading habits, as indicators of social capital. This style of analysis, in which multiple indicators are considered, allows for a broader investigation of social capital access.

Particularly in regard to adolescents' books at home, an investigation of other indicators – in this case, socioeconomic status and reading habits – is warranted; indeed, while this indicator has a long tradition in educational research, it has recently come under scrutiny (Engzell, 2019; Sieben & Lechner, 2019). General criticism revolves around the uncertainty of what 'books at home' actually measure, but Engzell (2019) also showed that the association between 'books at home' and educational success is endogenous (i.e. good students acquire more books) and subject to systematic misreporting (lower achievers underreport the number of books at home). This biases the association between 'books at home' and educational success, making it even more important to investigate several different indicators when analysing social capital access. After having outlined my social capital understanding and the investigated resources, the next section provides theoretical arguments for social capital access in the school context.

2.2.2 Access to socioeconomic and cultural resources: Between- and within-school processes

In regard to social capital access in school – but also other – contexts, I argue that a two-stage sorting process can explain socioeconomic and ethnic differences in access to social capital. The first stage is concerned with school sorting (*between-school*), while the second stage pertains to friendship selection (*within-school*). In this section, I provide arguments for *between-* as well as *within-school* processes and how they are linked to differential access to social capital. While these aspects have often been mentioned in social capital research (e.g. Lin, 1999, 2001; Verhaeghe et al., 2015), their separate contributions to social capital access have rarely been explicitly investigated.

Between-school sorting

Between-school sorting concerns the opportunity structure of a context. This refers to the availability of potential relationship partners in a given context; or more specifically, in this

⁵ Although peers' educational expectations or academic achievement occupy a prominent role in the literature, they offer no suitable indicators for my analytic objectives. Most importantly, these factors are heavily structured by the educational system itself (i.e. formal tracking or the expansion of tertiary education) and are therefore highly endogenous. Comparing these factors across countries with different school systems is hardly possible.

case, it refers to school composition. Since personal networks tend to resemble the composition of a context (Blau 1994; Marsden 1990a), the opportunity structure provides a kind of baseline for accessing social capital; that is, a more advantageous pool of individuals is connected to better social capital access. Considering the school context, opportunity structure (i.e. school composition) can differ between schools because a school's allocation of students is connected to their social origin, thus resulting in school segregation (Holmlund & Öckert, 2021; Jenkins et al., 2008). The literature on school allocation processes identifies three mechanisms, which contribute to school segregation (see also Kruse, 2019): parental school choice, residential/neighbourhood segregation, and between-school tracking. Outlining how these processes are connected to school segregation helps us to understand how different school compositions come about and how they, in turn, are connected to differential social capital access.

First of all, research indicates that the composition of schools resembles the surrounding geographical areas because parents tend to select schools for their children that are geographically proximate (Denessen et al., 2005; Kristen, 2008). While levels of residential segregation in Europe are lower than in the US, it is also the case that in European countries residential areas tend to be segregated by socioeconomic status and ethnic background (Andersson et al., 2018). Given that students attend schools that are close-by, schools located in more deprived areas tend to host socially less advantaged students. This results in a social capital deficit for the students attending these schools. Moreover, due to ethnic residential segregation, schools also tend to be ethnically segregated (Kristen, 2008; Kruse, 2019); and so, given that ethnic minority groups tend to have a lower socioeconomic status, they suffer a further social capital deficit due to ethnic school segregation.

However, school segregation is often actually stronger than the segregation of neighbourhoods (e.g. Burgess et al., 2005; Noreisch, 2007). An explanation for this is the set-up of the school system. For example, the Dutch and German educational systems are formally stratified and rely on so-called between-school ability tracking. Adolescents are sorted (at an early age) into different secondary school tracks (often hosted by different/specialised schools) according to their ability at a young age. Students at the age of 10 (Germany) or 12 (the Netherlands) are distributed to different ability tracks. These tracks prepare children for different labour market careers. While nuances between countries exist, in general, lower tracks prepare students for more vocational careers, whereas higher tracks allow students to pursue academic careers. This between-school tracking is linked to school segregation for several reasons. Due to superior family resources, children from socioeconomically advantaged

families tend to demonstrate better academic performance at this early stage in life, making it more likely that they will enter advanced secondary tracks. Moreover, since the secondary school track is strongly connected to occupation prospects, socioeconomically advantaged parents favour advanced school tracks above and beyond prior merit (e.g. Boudon, 1974; Stocké, 2007). Conversely, adolescents with a disadvantaged social background (i.e. low SES) attend lower-track schools (Jenkins et al., 2008).

In addition, (children of) immigrants tend to fare especially poorly in these systems because they, firstly, have – on average – a lower SES, which reduces their success in these systems, and, secondly, because sorting at an early age increases the importance of language skills. Together, all of this produces a situation in which minority students are over-represented in lower tracks, which in turn provides a pool of lower-SES peers (Jenkins et al., 2008; Kristen & Granato, 2007). In Germany and the Netherlands, this between-school ability tracking contributes to segregation between schools.

However, also in the comprehensive Swedish school system, schools are not completely ethnically and socioeconomically desegregated (Holmlund & Öckert, 2021; Karsten, 2010). In Sweden – but also in Germany and the Netherlands – parents have the right to choose the schools their children attend. In general, research shows that especially socioeconomically advantaged and ethnic majority parents make use of this option by avoiding unfavourable schools (Jheng et al., 2022; Renzulli & Evans, 2005). Often this means that parents ‘flee’ schools with a larger share of ethnic minority students (‘white’/‘majority’ flight) (e.g. Renzulli & Evans, 2005). Therefore, parental school choice increases social and ethnic school segregation (Karsten et al., 2003; Kristen, 2008; Kruse, 2019).

Regardless of the explanations behind it, school segregation is connected to unequal pools of peers, students can form friendship relationships with and, eventually, access the social capital embedded in these relationships. This ought to result in a social capital advantage for socioeconomically advantaged and ethnic majority students due to *between-school* sorting.

Within-school processes

After being allocated to schools, students form friendships with each other. Research shows that social networks are segregated according to a variety of characteristics (Goodreau et al., 2009; Lewis & Kaufman, 2018; McPherson et al., 2001; S. Smith et al., 2016; Wimmer & Lewis, 2010). This tendency for network segregation can be explained by ‘homophily’ – the tendency of similar individuals to associate with one another – as well as by structural network effects, such as reciprocity or transitive closure, which can amplify even small levels of

homophily (Kossinets & Watts, 2009). Moreover, when considering within-school processes, different opportunities may lead to socially segregated social networks even after school allocation. For instance, students living close by might share the same bus stop or walk the same way to school (Kruse et al., 2016; Mouw & Entwisle, 2006), which – due to neighbourhood segregation – can contribute to socially segregated networks. Moreover, meeting opportunities provided within schools, such as socially selective extracurricular activities or within-school tracking⁶, can also contribute to network segregation (Frank et al., 2008, 2013; Schaefer et al., 2011). The combination of homophily, different opportunities, and structural network effects thus produces social networks that are segregated by socioeconomic as well as ethnic minority status, and, in turn, provide a social capital advantage for socioeconomically advantaged students and ethnic majority students due to *within-school* sorting.

Considering the outlined within- and between-school processes fostering segregation, I formulate the following research hypotheses:

Hypothesis 1: Higher-SES students tend to have better access to social capital due to school sorting (i.e. between-school segregation) as well as friendship selection (i.e. social network segregation).

Hypothesis 2: Compared to natives, ethnic minority students tend to have reduced access to social capital due to school sorting (i.e. between-school segregation) as well as friendship selection (i.e. social network segregation).

2.2.3 Comparing between-school sorting across countries

Given that personal networks resemble the socio-demographic composition of the context (Blau, 1994; Marsden, 1990a), between-school processes could potentially play a major role in social capital access. Therefore, while I have outlined how, generally speaking, social capital access differs between social groups, it is also worth considering the relevance of between-school processes for social capital access. Due to the assumed association between context composition and social capital access, between-school sorting ought to have relevance when levels of school segregation are higher and vice versa. To investigate this proposition, it is worth

⁶ While within-school tracking might be less relevant in the European school context, there are school types – at least in Germany – that separate students based on their performance (e.g. comprehensive schools).

comparing the level of access to social capital in different countries; in this case the Netherlands, Germany, and Sweden.

While the extent of a country's school segregation can be the result of a complex interplay of historical, cultural, and political factors (Perry et al., 2022), some general patterns explaining country differences in school segregation have been identified by previous research. Most notably, differences in the school system with regard to tracking have been linked to differences in between-school segregation (Strello et al., 2022). As highlighted above, the German and Dutch school systems rely on between-school ability tracking. In Sweden, on the other hand, students stay together until their first transition at the age of 16. Only at that stage do students take different paths through the educational system, which makes the Swedish school system a comprehensive system. This is important because school systems without between-school tracking show – on average – lower levels of socioeconomic and ethnic school segregation (Holmlund & Öckert, 2021; Strello et al., 2022). Accordingly, while between-school tracking might not be the only factor explaining differences in school segregation between the three investigated countries, it has been shown that Swedish schools tend to be less socially segregated than Dutch and German schools (Holmlund & Öckert, 2021; Jenkins et al., 2008; Karsten, 2010). Therefore, I hypothesise the following:

Hypothesis 3: Between-school sorting has a weaker association with social capital access in Sweden than in Germany and the Netherlands.

2.3 Data, Method, and Measures

2.3.1 Data

To investigate the two-stage process, I used the first wave from the Children of Immigrants Longitudinal Survey in Four European Countries (CILS4EU) data, which was collected in the school year 2010/2011 (Kalter et al., 2017). This dataset provides information on individual characteristics, as well as complete classroom networks, for 18,716 adolescents around the age of 14 in 458 schools in England, Germany, the Netherlands, and Sweden (Kruse & Jacob, 2014). Given that a focus of the CILS4EU project is the investigation of immigrants' integration, in the first sampling stage schools with a larger share of minority students were oversampled.⁷

⁷ While survey weights are provided, these led to estimation issues. In particular, weights applied to the Dutch part of the data produced inconsistent results. To avoid bias, then, all analyses control for the sampling stratum on which the sampling of schools was based (see also Dollmann, 2019; Geven &

Afterwards, per school, two classes were randomly selected to participate in the survey. For the analyses, I combined classes from the same school. Students were surveyed within the school and participation rates on the students' level ranged between 80.5% (England) and 91.1% (the Netherlands). In addition to the students, the students' parents also received a questionnaire by mail (participation rates were 36.8% in England, 58.9% in Sweden, 75.7% in the Netherlands, and 78.0% in Germany). In the stratified school systems (Germany and the Netherlands), schools from all ability tracks were sampled.

For the analyses, I excluded several students. First of all, due to issues in the network part during data collection in England, as well as a low parental participation rate in that country (~37%), I excluded England (see also Raabe & Wölfer, 2019). Secondly, because I relied on friendship network information, I excluded classes with a participation rate of under 75% as well as classes with fewer than 15 students (see Smith et al., 2016). To impute missing values, I relied on multiple imputations by taking the multilevel structure of the data into account using the *mice* package in the statistical software R.⁸ I thus imputed ten datasets. Imputed datasets were obtained before assessing network resources (i.e. social capital), meaning that social capital measures were obtained for each imputed dataset separately. The final analysis sample consisted of a combined 12,201 students in 341 schools for Germany, the Netherlands, and Sweden.

2.3.2 Method

In addition to common ordinary least squares regressions, I relied on within-between random effects (REWB) models.⁹ REWB models are appropriate for several reasons. They account for the hierarchical structure of the data (i.e. students nested in schools) and provide unbiased estimates at levels 1 and 2 (Bell et al., 2019; Raudenbush & Bryk, 2002). Moreover, in contrast to regular random effects models, where level 1 and level 2 effects are potentially confounded, the REWB design makes it possible to differentiate between within- and between-effects.¹⁰ This

van Werfhorst, 2020). Separate weighted analyses for the German and Swedish data produced essentially similar results.

⁸ In the *mice* package, I used the imputation method *2l.pmm*. However, regular predictive mean matching (*pmm*) and no imputation (i.e. list-wise deletion) lead to essentially similar results.

⁹ All analyses were executed in the statistical program R (v. 3.5.3) using the *lme4*-package (v. 1.1.21).

¹⁰ A good indication of the merit of this approach is voting behaviour in the United States: while richer states tend to vote for Democratic candidates, richer people in those states tend to favour Republican candidates. In this case, the individual- and state-level effects point in opposite directions, which would lead to a biased estimate if one were to follow the conventional random effects approach (Gelman, 2010).

is crucial in analysing the two-stage process that shapes students' access to social capital through school composition and friendship selection within schools.

In the REWB specification, the predictors at level 1 are group-mean centred, meaning they only account for within-group deviation from the group mean. By including the group mean at level 2, the between-group effect can be additionally estimated. Therefore, this model specification captures unconfounded within-effects and is capable of estimating group-level effects (between-effects).¹¹ The equation used to estimate this REWB model follows this general form:

$$\hat{y}_{ij} = b_0 + b_{1w}(x_{ij} - \bar{x}_j) + b_{2b}\bar{x}_j + (v_j + e_{ij}),$$

where v_j are the random effects for school j – in this case they are assumed to be homogeneous (i.e. a random intercept model) – and e_{ij} are the level 1 residuals assumed to be normally distributed. The variable x_{ij} is split into two parts: by centring x_{ij} around the group mean the within-estimator b_{1w} exclusively estimates the effects of deviation from the respective group mean, hence controlling for all unobserved between-school heterogeneity. The group mean (b_{2b}) solely captures between-group effects. As illustrated in Figure 2.1, b_{2b} captures the differences (for every unit increase) of the intercepts according to the group variable of interest.

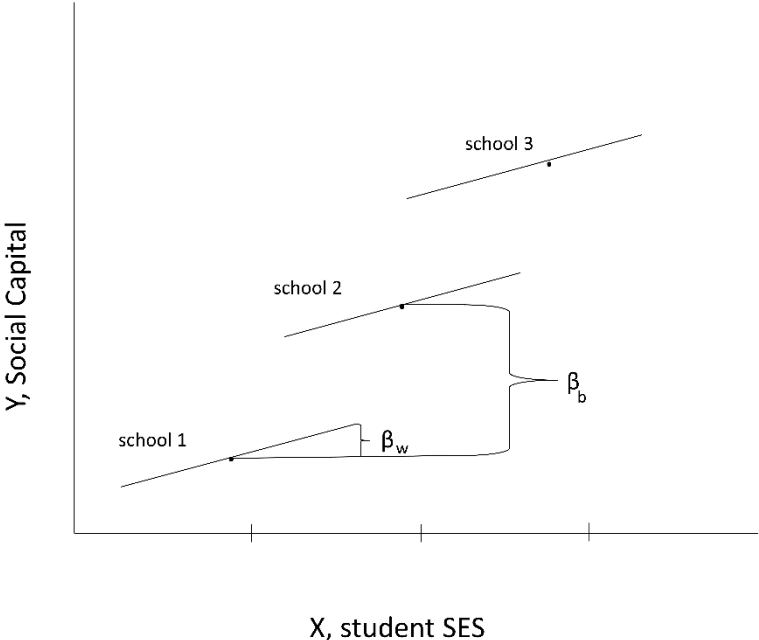


Figure 2.1: REWB model
 Note: Figure adapted from Raudenbush and Bryk (2002).

¹¹ Therefore, this model is also referred to as a 'hybrid' model. However, this term is falling out of favour.

To assess the relevance of between-school sorting, I relied on the intraclass correlation coefficient (ICC). The ICC shows the proportion of variance that can be attributed to differences between observations at the second level (i.e. schools). To compare ICCs between countries, I obtained 95% confidence intervals via a bootstrapped distribution of ICCs using the *bootMer*-function (with 1,000 simulations).

2.3.3 Measures

Outcome variables: Social capital in students' personal network

On the subject of classroom networks, students were asked, 'Who are your best friends?' To answer this, students had to nominate their classmates by writing down a number associated with the respective student. They were allowed to mention up to five friends from their own class, but nominating friends across classroom boundaries or from outside the class context was not permitted. The average number of friends across countries is 3.6.

My dependent variables measure the socioeconomic as well as the (objectified and embodied) cultural resources of the peers that a student nominates as their friends. As a first step, I established complete friendship networks of each classroom. Secondly, I constructed the ego network for every student (i.e. their friends) from students' *outdegrees* to determine which resources they can access.¹² Complete network data allowed me to draw on every student's individual report of their respective resources, thus *avoiding* bias (Marsden, 1990b).

To measure the degree of access to socioeconomic resources in adolescents' personal networks, I used information on the occupational status (ISEI) of friends' parents. The International Socioeconomic Index (ISEI) (Ganzeboom et al., 1992) ranks occupational status according to typical educational and income levels. The index ranges from 11 to 89. To avoid missing values, I assigned the value '10' if both parents are unemployed (Plenty & Mood, 2016). I also made use of parental reports where possible and substituted the students' accounts when parents did not participate in the survey (missing values: Germany: 206 (5.3%); the Netherlands: 107 (2.7%); Sweden: 150 (3.9%)). I rescaled the ISEI score by dividing it by 100. In the first step, every student was assigned the highest ISEI score of their two parents.

¹² I rely on students' outdegree to construct ego networks because this is in line with the 'position generator' approach used in comparable social capital research (Lin, 2001; Lin & Erickson, 2008).

Afterwards, I assessed adolescents' social capital by taking the *mean of their friends' socioeconomic status*.¹³

To capture the degree of access to objectified cultural capital, I obtained information on the books that students' friends have at home. The participants were asked 'About how many books are there in your home?' with the answer categories being as follows: (1) 0–25; (2) 26–100; (3) 101–200; (4) 201–500; (5) more than 500. I then dichotomised this ordinal scale and assigned a '0' to all students with fewer than 100 books at home and a '1' to all students with 100+ books at home (missing values: Germany: 579 (14.8%); the Netherlands: 82 (2.1%); Sweden: 578 (15.1%). Access to friends with books at home is operationalised as the *share of friends with 100+ books at home*.

To capture the degree of embodied cultural capital, I relied on the reading habits of students' friends. Students were asked 'In your spare time, how often do you read a book (not for school)?' with the answer categories being as follows: (1) every day; (2) once or several times a week; (3) once or several times a month; (4) less often; (5) never. I recoded the scale so that high values indicate more regular reading (missing values: Germany: 256 (6.5%); the Netherlands: 86 (2.2%); Sweden: 499 (13.0%)). I took the *mean of friends' reading habits* as the third dependent variable.

Independent variables: Minority status and SES

To examine differential access to social capital along two socio-demographic dimensions – minority and socioeconomic background – I applied the second-generation definition of migration background and thus solely differentiated between natives and migrants. I considered students with a minority status to be those who were either born abroad or who had at least one foreign-born parent (Dollmann et al., 2014). According to this definition, 40% of the sample is classified as minority students (no missing values in any country). In line with the social capital measurement, I also relied on the highest ISEI score of the two parents to capture each student's individual SES. Meanwhile, regarding educational background (missing values: Germany: 191 (4.9%); the Netherlands: 201 (5.1%); Sweden: 585 (15.3%)), I obtained the highest educational degree between both parents, again using parental accounts if available. Given country-specific differences in obtainable degrees, I created a dummy if at least one parent had a university

¹³ The *mean* was suggested by Lin (2001) as one way of measuring social capital. It was chosen because it is also a common approach in longitudinal network models investigating selection and influence processes (i.e. SIENA). Moreover, unlike the total amount of resources in students' networks, it is unbiased by the number of friends. Results using the *maximum* value lead to similar conclusions.

degree. For the REWB models, these individual variables were centred around the respective group mean and addressed within-school friendship selection processes.

With regards to the school composition, which is the result of between-school sorting, I aggregated the above-mentioned variables and focused on the share of minority students in a school, the average ISEI score of a school, and the share of students who had at least one parent who held a tertiary degree. These variables address the association between between-school sorting and social capital access. In the models analysing all three countries jointly, I additionally controlled for the survey countries (i.e. Germany, the Netherlands, and Sweden). Moreover, as indicated in footnote 4, all analyses controlled for the school stratum.

Descriptive statistics of the sample can be found in table 2.1.

Table 2.1: Descriptives

| | min | max | mean | sd |
|--|------------|------------|-------------|-----------|
| Dependent variables | | | | |
| Mean. ISEI/friends | 0 | 0.89 | 0.46 | 0.18 |
| Share of friends with 100+ books at home | 0 | 1 | 0.35 | 0.33 |
| Mean. reading/friends | 0 | 5 | 2.27 | 0.99 |
| Independent variables | | | | |
| Minority status ¹ | 0 | 1 | 0.40 | 0.49 |
| SES ¹ | 0.10 | 0.89 | 0.48 | 0.22 |
| University degree ¹ | 0 | 1 | 0.28 | 0.45 |
| School share minority students | 0 | 1 | 0.40 | 0.27 |
| School SES | 0.18 | 0.74 | 0.48 | 0.11 |
| School share univ. degree | 0 | 0.94 | 0.28 | 0.22 |

Note: (1) For the REWB-analyses, these variables are centred around their respective school mean.

2.4 Result

2.4.1 Linear regressions

In the first step, I show the general access patterns to all three dimensions of social capital by employing linear regressions (see table 2.2). Adolescents with a better socioeconomic background have significantly better access to social capital across dimensions. Moreover, minority status is also associated with reduced access to social capital. However, this deficit is

reduced after including individuals' SES. While the general patterns are consistent across measurements, there are still notable differences between them. Firstly, socio-demographic characteristics – and especially SES – explain access to socioeconomic resources best. On the other hand, access to friends with beneficial reading habits cannot be explained by the chosen predictors particularly well; in fact, only around 4% of the variance in access to this dimension of social capital can be explained.

Table 2.2: Linear regressions with three social capital indicators as dependent variable

| | Friends' SES | | Friends' books at home | | Friends' reading habits | |
|-------------------------|------------------|------------------|------------------------|------------------|-------------------------|------------------|
| | Model 1a | Model 2a | Model 1b | Model 2b | Model 1c | Model 2c |
| <i>Predictors</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> |
| Intercept | 0.487 *** | 0.399 *** | 0.528 *** | 0.403 *** | 2.447 *** | 2.265 *** |
| | (0.004) | (0.006) | (0.009) | (0.011) | (0.026) | (0.035) |
| Min. status (=1) | -0.060 *** | -0.044 *** | -0.091 *** | -0.070 *** | -0.089 *** | -0.058 ** |
| | (0.003) | (0.003) | (0.07) | (0.006) | (0.021) | (0.021) |
| Parental ISEI | | 0.162 *** | | 0.217 *** | | 0.315 *** |
| | | (0.09) | | (0.016) | | (0.048) |
| Parents univ. deg. (=1) | | 0.023 *** | | 0.069 *** | | 0.099 *** |
| | | (0.004) | | (0.008) | | (0.024) |
| Observations | 12201 | 12201 | 12201 | 12201 | 12201 | 12201 |
| R ² | 0.139 | 0.184 | 0.114 | 0.150 | 0.035 | 0.044 |

Note: Controls for country and sampling stratum included, but not shown here. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. Standard errors in brackets.

These findings provide the first evidence for the first two research hypotheses: There seem to be social capital advantages for high-SES and ethnic majority students. However, these analyses do not differentiate between school-sorting and within-school processes. To break this down, then, I turn to REWB models in the next section.

2.4.2 Decomposition of variance

Table 2.3 presents the variance components of the null models for all three social capital dimensions and countries separately. The intra-class coefficients (ICC) indicate substantial between-school variance in all three countries. However, there are considerable differences across countries and social capital measurement. Assessing access to social capital, it becomes apparent that access to friends' socioeconomic resources as well as their objectified cultural capital (i.e. books) is substantially connected to between-school sorting in all three countries. Access to friends with advantageous reading habits is also limited by school sorting to a considerable – albeit much smaller – extent.

As hypothesised, there are substantial differences between countries. Regarding access to the first two analysed dimensions of social capital (i.e. friends' ISEI and friends' books at home), between-school sorting is the most relevant in Germany ($ICC_{ISEI} = 0.38$; $ICC_{Books} = 0.33$) and second most relevant in the Netherlands ($ICC_{ISEI} = 0.33$; $ICC_{Books} = 0.32$). More specifically, in Germany and the Netherlands, between 30% and 40% of the variance lies between schools. Although the between-school variation is smaller, school sorting is also substantially associated with access to social capital in Sweden ($ICC_{ISEI} = 0.15$; $ICC_{Books} = 0.20$).

Meanwhile, in regard to access to friends with beneficial reading habits, between-school sorting seems to be less relevant across countries. However, the results still point towards the notion that school allocation is less relevant in Sweden ($ICC_{Read} = 0.11$) for social capital access than in Germany ($ICC_{Read} = 0.21$) and the Netherlands ($ICC_{Read} = 0.21$). This interpretation is supported by the 95% confidence intervals (CI) of the ICCs. For all three variables, the Swedish CIs do not overlap with the CIs of the German and Dutch results, suggesting that there exist significant differences between the countries. Thus, taken together, these results provide supporting evidence for hypothesis 3: Between-school sorting is less relevant in Sweden compared to Germany and the Netherlands for access to social capital.

In summary, while Sweden generally tends to be most egalitarian in regard to access to social capital determined by school allocation, and Germany least so, it must be stressed that in all countries – even in Sweden, with its comprehensive school system – a considerable amount of variance in access to social capital lies *between* schools. Therefore, in all countries, the school a student attends plays a crucial role.

Table 2.3: Null Models (Variance Decomposition)

| <i>Predictors</i> | Friends' SES | | | Friends' books at home | | | Friends' reading habits | | |
|----------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| | Germany | Netherlands | Sweden | Germany | Netherlands | Sweden | Germany | Netherlands | Sweden |
| | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> |
| Intercept | 0.510*** (0.022) | 0.514*** (0.025) | 0.508*** (0.019) | 0.662*** (0.041) | 0.378*** (0.044) | 0.449*** (0.041) | 2.559*** (0.104) | 2.166*** (0.109) | 2.361*** (0.096) |
| Individual-level variance | 0.014 | 0.020 | 0.031 | 0.059 | 0.063 | 0.084 | 0.681 | 0.644 | 1.049 |
| School-level variance | 0.008 | 0.009 | 0.005 | 0.029 | 0.029 | 0.021 | 0.183 | 0.171 | 0.124 |
| ICC (95% CI) | 0.378 (0.312– 0.423) | 0.327 (0.259– 0.374) | 0.147 (0.110– 0.176) | 0.333 (0.270– 0.376) | 0.317 (0.250– 0.364) | 0.203 (0.157– 0.238) | 0.212 (0.163– 0.247) | 0.210 (0.158– 0.248) | 0.106 (0.076– 0.129) |
| Observations _{schools} | 120 | 98 | 123 | 120 | 98 | 123 | 120 | 98 | 123 |
| Observations _{students} | 4017 | 4057 | 4127 | 4017 | 4057 | 4127 | 4017 | 4057 | 4127 |

Note: Controls for sampling stratum included, but not shown here. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For coefficients, standard errors in brackets. For ICC, 95% confidence intervals in brackets.

2.4.3 Within-Between Models

Tables 2.4 to 2.6 present the multivariate findings on access to social capital. In these models, I first included the individual- and school-level variables on minority status and added the variables capturing socioeconomic background in a second step. This allowed me to show the extent to which ethnic differences in social capital access are linked to socioeconomic disadvantages. Again, by employing REWB models, I can differentiate between friendship selection (within) and school sorting (between).

The key finding here is that, while the explanatory variables at the school level are important and account for between-school variance, the corresponding variables at the student level are much less relevant for explaining access to social capital. This means that socio-demographic characteristics matter for access to social capital predominantly through the school allocation process, which demonstrates the overriding importance of the opportunity structure (i.e. school composition). Once students are together in a school, factors other than socio-demographic characteristics seem to gain importance for selecting friends who may provide social capital.

Figures 2.2 to 2.4 visualise the results by plotting the fitted values of the full models (M2) against the explanatory variables. For these figures, I grouped the 341 schools into quintiles of the respective explanatory variable. While there are, especially for the first two social capital dimensions, considerable distances between the slopes (i.e. between-school effect), the slopes tend to be comparatively flat, indicating negligible within-school associations of SES and minority status. A hypothetical change of schools is much more consequential for an individual's social capital access than a change of position in the within-school socioeconomic hierarchy. However, results and plots indicate important differences between social capital measurements, which will be explored next.

Table 2.4: REWB Model - DV: ISEI/Friends

| | Model 0a | Model 1a | Model 2a |
|----------------------------------|----------------------|-----------------------|-----------------------|
| <i>Predictors</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> |
| Intercept | 0.473 *** (0.014) | 0.514 *** (0.014) | -0.006 (0.015) |
| <i>Within-effects</i> | | | |
| Minority status (= 1) | | -0.036 *** (0.003) | -0.033 *** (0.003) |
| Students' ISEI | | | 0.036 *** (0.008) |
| Students' univ. deg. (= 1) | | | -0.001 (0.004) |
| <i>Between-effects</i> | | | |
| Share minority students (school) | | -0.211 *** (0.029) | -0.019 (0.011) |
| Avg. ISEI (school) | | | 1.000 *** (0.032) |
| Share univ. deg. (school) | | | -0.015 (0.017) |
| Individual-level variance | 0.008 | 0.007 | 0.021 |
| School-level variance | 0.022 | 0.021 | 0.000 |
| ICC | 0.264 | 0.235 | 0.005 |
| Observation _{Schools} | 341 | 341 | 341 |
| Observation _{Students} | 12201 | 12201 | 12201 |
| R ² | 0.118 | 0.158 | 0.343 |

Note: Controls for survey country and sampling stratum included, but not shown here.
 * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$. Standard errors in brackets.

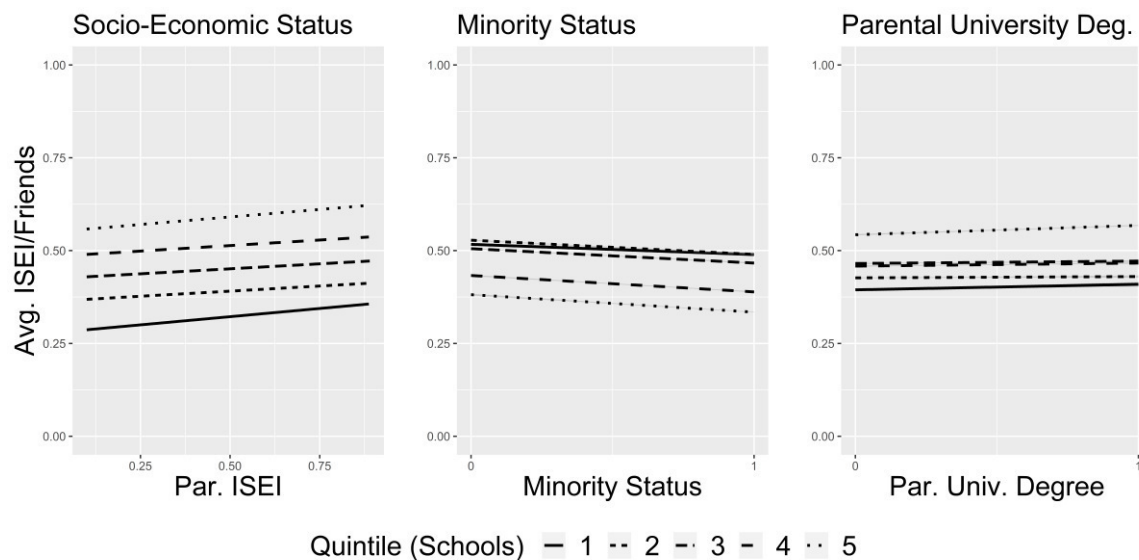


Figure 2.2: Within vs. Between Effect (ISEI/Friends)

Note: The black lines represent quintiles at the school level according to the respective variable.

Table 2.4 presents the results regarding friends’ socioeconomic status. The *within-effects* point to the friendship selection adolescents make within the school setting and the *between-effect* to school sorting.

The results indicate that students’ socioeconomic background is the most relevant for access to socioeconomic resources. However, a comparison of within- and between-effects indicates that the socioeconomic composition of schools is of particular relevance: The better a school’s average SES composition, the better its students’ access to this dimension of social capital ($b = 1.00, p < 0.001$), which is also reflected by the substantial distance between the regression slopes depicted in figure 2.2.

By contrast, within-school processes (with regard to the investigated socio-demographic characteristics) are of comparatively little importance. Indeed, although students’ SES contributes via within-school friendship processes to adolescents’ social capital access, its contribution is substantially smaller ($b = 0.04, p < 0.001$). Moreover, while minority status is also significant, the size of the coefficient points to a negligible relevance ($b = -0.03, p < 0.001$):

To summarise, access to friends’ socioeconomic resources is largely connected to students’ SES, which can be explained by the narrow link between these two indicators. Furthermore, between-school sorting – especially with regard to a school’s average SES – is more important than within-school processes. The relevance of a school’s average SES is emphasised by the fact that between-school variance and ICC drop to zero after accounting for this factor.

These findings support research hypothesis 1: Students with an advantaged socioeconomic background have better access to social capital. Moreover, while ethnic minority students have a social capital deficit – which supports hypothesis 2 – this is largely explained by their lower socioeconomic status.

Table 2.5: REWB Model - DV: Books at home/Friends

| | Model 0b | Model 1b | Model 2b |
|----------------------------------|----------------------|-----------------------|-----------------------|
| <i>Predictors</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> |
| Intercept | 0.522 *** (0.028) | 0.582 *** (0.029) | 0.042 (0.061) |
| <i>Within-effects</i> | | | |
| Minority status (= 1) | | -0.054 *** (0.006) | -0.050 *** (0.006) |
| Students' ISEI | | | 0.051 *** (0.014) |
| Students' univ. deg. (= 1) | | | 0.008 (0.007) |
| <i>Between-effects</i> | | | |
| Share minority students (school) | | -0.316 *** (0.058) | -0.148 *** (0.056) |
| Avg. ISEI (school) | | | 0.850 *** (0.135) |
| Share univ. deg. (school) | | | 0.401 *** (0.070) |
| Individual-level variance | 0.068 | 0.068 | 0.068 |
| School-level variance | 0.039 | 0.027 | 0.011 |
| ICC | 0.299 | 0.281 | 0.142 |
| Observation _{Schools} | 341 | 341 | 341 |
| Observation _{Students} | 12201 | 12201 | 12201 |
| R ² | 0.101 | 0.127 | 0.261 |

Note: Controls for survey country and sampling stratum included, but not shown here.

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$. Standard errors in brackets.

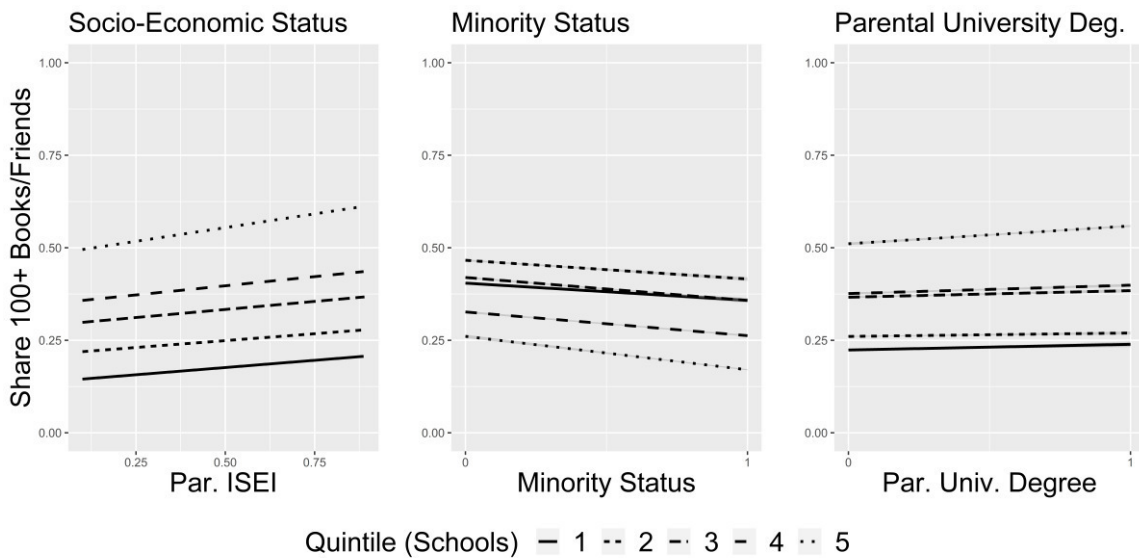


Figure 2.3: Within vs. Between Effect (Books/Friends)

Note: The black lines represent quintiles at the school level according to the respective variable.

Turning to access to friends with more books at home (table 2.5), a similar picture with regards to between-school differences emerges. That is, school sorting also plays a considerable role in access to this dimension of social capital.

Considering within-school processes, the results indicate that adolescents with a better socioeconomic background also select more friends with more books at home ($b = 0.05$, $p < 0.001$). In addition, compared to natives, minority students have a social capital deficit because they select friends with fewer books at home ($b = -0.05$, $p < 0.001$). Hence, given the same SES, minority students have access to less objectified cultural capital in their personal networks than natives. However, it should also be noted that here the regression slopes are relatively flat (see figure 2.3).

Looking at the *between-effects* it can be seen that a larger share of minority students in a school translates into reduced social capital for the students at these schools ($b = -0.15$, $p < 0.001$) and that an advantaged SES composition contributes to much better access to friends with more books at home ($b = 0.85$, $p < 0.001$). Moreover, the share of educated parents in a school substantively increases the stock of this dimension of social capital in a school, thus providing better access opportunities in these schools ($b = 0.40$, $p < 0.001$).

These results provide evidence for research hypotheses 1 and 2. Firstly, socioeconomically advantaged students have better access to friends with more books at home. Secondly, ethnic minority students suffer from a social capital deficit. While both within- and between-school

processes contribute to these differences in social capital access, between-school sorting is much more important than friendship selection processes.

Table 2.6: REWB Model - DV: Reading habits/Friends

| | Model 0c | Model 1c | Model 2c |
|----------------------------------|----------------------|-----------------------|-----------------------|
| <i>Predictors</i> | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> |
| Intercept | 2.423 *** (0.069) | 2.410 *** (0.075) | 1.494 *** (0.200) |
| <i>Within-effects</i> | | | |
| Minority status (= 1) | | -0.104 *** (0.020) | -0.099 *** (0.020) |
| Students' ISEI | | | 0.067 (0.047) |
| Students' univ. deg. (= 1) | | | -0.000 (0.024) |
| <i>Between-effects</i> | | | |
| Share minority students (school) | | 0.067 (0.153) | 0.363 * (0.160) |
| Avg. ISEI (school) | | | 1.504 ** (0.447) |
| Share univ. deg. (school) | | | 0.550 ** (0.242) |
| Individual-level variance | 0.793 | 0.791 | 0.791 |
| School-level variance | 0.171 | 0.171 | 0.133 |
| ICC | 0.277 | 0.178 | 0.144 |
| Observation _{Schools} | 341 | 341 | 341 |
| Observation _{Students} | 12201 | 12201 | 12201 |
| R ² | 0.032 | 0.034 | 0.07 |

Note: Controls for survey country and sampling stratum included, but not shown here.
* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$. Standard errors in brackets.

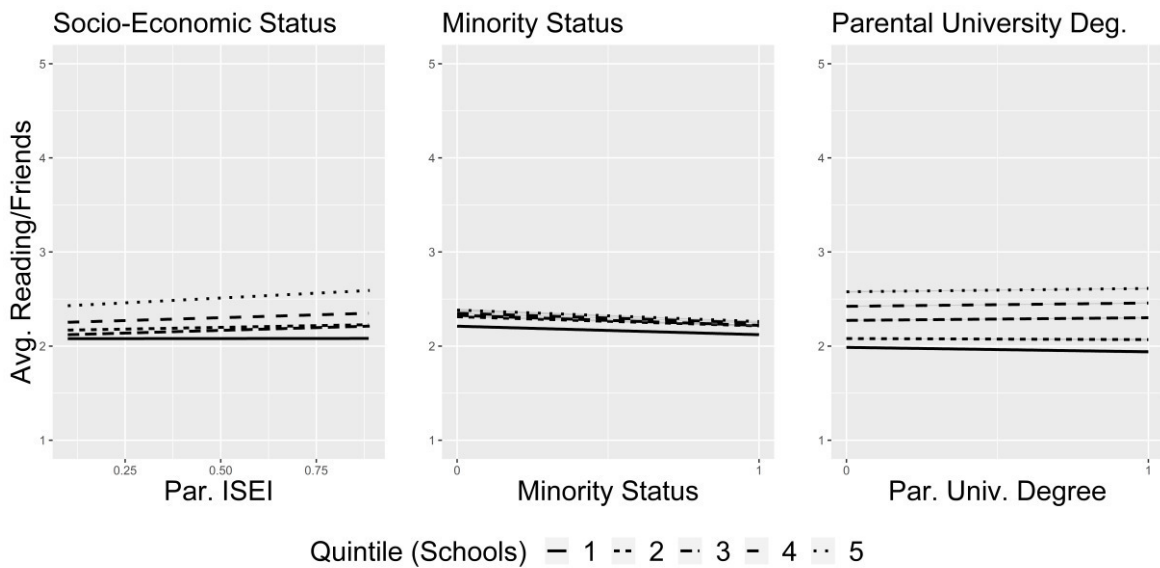


Figure 2.4: Within vs. Between Effect (Reading habits/Friends)

Note: The solid lines represent quintiles at the school level according to the respective variable.

Table 2.6 presents the results regarding access to friends with advantageous reading habits. According to the within-school effects, minority students suffer from a small social capital deficit ($b = -0.10$, $p < 0.001$), but here it also seems to be the case that within-school effects play a relatively small role regarding access to social capital. The flat regression slopes in figure 2.4 highlight these small associations.

At the school level, all three indicators are connected to social capital access. A larger share of minority students ($b = 0.36$, $p < 0.05$), a better socioeconomic composition ($b = 1.50$, $p < 0.01$), and a larger share of university-educated parents ($b = 0.55$, $p < 0.01$) improves adolescents' social capital access.

While these findings support the hypothesis that high-SES students have better access to social capital (hypothesis 1), they actually contradict the second hypothesis: schools' ethnic composition is positively associated with social capital access. After accounting for schools' socioeconomic composition, a larger share of minority students in a school is connected to better social capital access. More specifically, this means that, given two schools with the same socioeconomic composition, an increased share of minority students is beneficial for accessing this form of social capital.

However, contrary to the other two indicators, variables capturing the school composition explain less variance, and the overall R^2 is smaller. This interpretation is supported by the regression slopes presented in figure 2.4, all of which are relatively close together, indicating fewer between-school differences. Overall, the results concerning friends with advantageous

reading habits suggest that socio-demographic characteristics are not strongly associated with access to this dimension of social capital. The possibility of having conversations about books that have been read or the observability of this activity itself might increase the relevance of other micro-level processes, such as ‘reading’ homophily.

2.5 Discussion and Conclusion

This chapter investigated access to social capital in the school system and attempted to determine to what extent access to social capital is associated with individuals’ friendship selection and school sorting according to fundamental socio-demographic characteristics. To this end, three different social capital measurements were analysed: friends’ socioeconomic resources, friends’ books at home, and friends’ reading habits.

The results indicate that while school sorting is substantially associated with social capital, friendship selection (according to the investigated socio-demographic variables) is less relevant for social capital access. Hence, the strong association between between-school processes and social capital access means that socioeconomically disadvantaged and ethnic minority students are structurally restricted from accessing beneficial resources, which may increase social inequality over time (DiMaggio & Garip, 2012).

The estimated REWB models reveal within- and between-discrepancies for all chosen social capital indicators. While socio-demographic characteristics are crucial to structuring adolescents’ opportunities, the same factors seem to be considerably less important for friendship selection processes within schools. This insight suggests that ethnic minority background and socioeconomic status are less salient in the school context and that within-school processes are, therefore, of relatively little importance in relation to social capital access. However, as my birds-eye view of the stratified educational landscapes of three countries reveals, ethnic minority background and socioeconomic status do strongly shape social capital access via the sorting of adolescents across schools.

Regardless, by introducing different dimensions into research into social capital, important differences were discerned. Access to peers who provide socioeconomic resources – the more conventional measurement – is almost completely driven by students’ socioeconomic family background. When it comes to accessing this dimension of social capital, though, the school’s SES composition is the most important factor. While school sorting is similarly important for access to friends with more books at home, here – in addition to the SES composition – the share of minority students in schools also matters. A larger share of minority students results in reduced access to social capital above and beyond SES, highlighting minority students’ reduced

stock of books at home, which may be explained by their (and their parents') relocation during the migration process (Brenzau et al., 2019). Friendship selection based on the investigated sociodemographic characteristics is negligible.

The investigation of access to friends with beneficial reading habits revealed that school sorting and especially friendship selection is much less relevant to this dimension of social capital. Given that reading is an observable behaviour, other processes may be more relevant, such as 'reading' homophily. Moreover, students might influence each other's reading behaviour through observation or conversations about books. Therefore, this resource is potentially less connected to socioeconomic and minority status than the other two indicators.

Nevertheless, these findings highlight the importance of context for differential access to social capital and that socio-demographic variables largely operate through the structuring of opportunities – a finding that is also relevant to research on social capital in the adult population because social contexts, such as voluntary organisations or the overall labour market, tend to be socially segregated too (McPherson, 2004). My results also highlight the need to take the opportunity structure into account when analysing peer effects – peers may matter, but only for those who can access these peers in the first place. Moreover, considering the already established relevance of social capital in adolescence and young adults' labour market trajectories (Roth, 2014b; Verhaeghe et al., 2015), this finding once more highlights the necessity to desegregate social contexts so as to prevent differences in social capital access from exacerbating social inequality. However, it must be acknowledged that this chapter's focus relies on a very specific understanding of social capital, namely that resources are embedded in social relationships (Lin, 1999b, 2001). While my results show that ethnic minority students suffer a social capital deficit, research that applies other social capital understandings also highlights that social capital can be particularly strong in immigrant communities. On the one hand, this can foster educational outcomes (Coleman, 1988; Morgan & Sorensen, 1999) or ethnic businesses (see Portes (1998) for an overview), but on the other hand, it can also have negative consequences, such as downward adjustment of norms or restriction of individual freedom (Portes, 1998). More research might contribute by comparing different social capital concepts for educational, but also other, outcomes. A study could, for instance, specifically compare the relevance of dense social networks versus more specific resources in individuals' personal networks.

Several limitations of my study may serve as the basis for future research. First, I am only able to investigate friendship relationships within a school. Therefore, I cannot make statements regarding relationships with peers who do not attend the same school and the

social capital that these relationships may provide. Second, in terms of reading habits, as previously noted, it must be considered that students can influence one another's reading habits, which in turn could lead to different results compared to a hypothetical analysis immediately after students have entered the school. Moreover, while students report *how often* they read, I am unaware of *what* they read. More information on cultural activities could therefore prove helpful in future research. Here, it would be particularly interesting to establish whether minority students read books written in the host country's language or in their native language, which brings me to the third limitation: While the association between alteri's ISEI and the labour market entry of young adults has been demonstrated (Behtoui, 2016; Roth, 2014b; Verhaeghe et al., 2015), there is no evidence that the chosen *cultural resources* possessed by peers are positively connected to individual educational outcomes yet. The cultural resources were chosen to avoid a stark correlation between the educational system itself and the analysed indicators. While research shows that peers influence each other with regard to educational aspects that are correlated with these cultural resources (Flashman, 2012, 2014; Kretschmer & Roth, 2020; Lorenz et al., 2020; Paloyo, 2020; Rambaran et al., 2017) and that there is cultural taste influence (Lewis et al., 2012; Lewis & Kaufman, 2018), more research is needed that specifically addresses the relevance of the chosen cultural resources of friends for individual educational outcomes. Moreover, besides the mentioned educational outcomes (i.e. school grades or aspirations), the chosen cultural resources may also be a proxy for more flexible 'educational behaviour', such as prioritising homework or exam preparation over leisure time activities. More research concerning educational behaviours' may complement the existing research on cultural resources, educational outcomes, and peer influence.

Furthermore, while research shows that cultural resources are positively associated with educational outcomes (Jæger & Breen, 2016), more evidence regarding the interplay of these resources with delinquent or deviant behaviour is required. This is particularly important since there is more evidence of peer influence with regard to delinquency and deviancy as opposed to academic outcomes (for an overview, see Gallupe et al., 2019; Sacerdote, 2011). Nevertheless, an interesting endeavour could be to analyse the differential associations of these resources when possessed by native versus minority students. The rationale for this would be that natives possess cultural knowledge that is relevant to succeeding in the educational system in the host country, whereas minority students may conceivably possess the 'wrong' cultural knowledge and/or read in their native language, which would not help them, or others, to succeed educationally.

Despite these limitations, this chapter provides important insights into the distribution of educational resources in the school context and highlights that the school system systematically restricts access to these resources for disadvantaged social groups. By differentiating between within- and between-school effects, I have demonstrated how strongly opportunities for friendships are structured. This is a relevant finding for research on social capital in the school context, with further research needed to illuminate micro-level processes as well as longitudinal accounts of educational outcomes.

Chapter 3

Social networks and educational decisions: Who has access to social capital and for whom is it beneficial?*

Co-authored with Mark Wittek, University of Cologne

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Abstract

This chapter investigates students' access to social capital and its role in their educational decisions in the stratified German school system. We measure social capital as the availability of highly educated adults in adolescents' and parents' social networks. Using panel data on complete friendship as well as parental networks and the educational decisions of more than 2,700 students from the CILS4EU-DE dataset, we show that social networks are segregated along socioeconomic differences, which restricts access to social capital for socioeconomically disadvantaged students. A comparison shows that parental networks tend to be substantially more segregated than children's friendship networks. In addition, our results indicate that access to social capital is linked to academically ambitious choices—i.e., entering upper secondary school or enrolling in university. This relationship is especially pronounced for less privileged students.

3.1 Introduction

Many social scientists share the conviction that the reproduction of social inequality is closely linked to education in schools and universities (Bourdieu & Passeron, 1990; Bowles & Gintis, 1977; Hillmert & Jacob, 2005). Within the larger endeavour of understanding the role of these institutions for lasting social inequality, sociologists have argued that educational choices influenced by actors' socioeconomic backgrounds can explain why social inequality persists (Boudon, 1974; M. Jackson & Jonsson, 2013; Stocké, 2007).

In addition, previous research illustrates that social networks, and the social capital they offer, influence educational outcomes (Cherng et al., 2013; Crosnoe et al., 2003; Frank et al., 2008; Raabe et al., 2019; Verhaeghe et al., 2015) and that the structure of networks tends to exacerbate inequalities (Chetty et al., 2022; DiMaggio & Garip, 2012; Jackson, 2021; see Granovetter 1995: 139–177). Social capital can increase intergroup inequalities because chances to access, mobilise and benefit from social capital are unequally distributed between social groups (Behtoui & Neergaard, 2010; Chetty et al., 2022; DiMaggio & Garip, 2012; Lin, 2001).

Against this background, we connect networks to educational decisions to investigate (1) whether multiple types of social networks within schools are segregated along socioeconomic lines and (2) how the social capital embedded in these networks is linked to educational decisions. In particular, we focus on adolescents' friendship networks and contacts between their parents to study the formation of social capital—measured as contacts with highly educated parents—and its relationship to academically ambitious educational choices in the German school system.¹⁴ Therefore, the study in this chapter contributes to the literature on social capital and its role in labour market outcomes and school-to-work transitions (Behtoui, 2007; Roth, 2014b; Verhaeghe et al., 2015). Moreover, the chapter is complementary to research on peer effects in the school setting that suggests the presence of classmates with a high socioeconomic background is beneficial for students' educational outcomes (Helbig & Marczuk, 2021; Legewie & DiPrete, 2012; Zimmermann, 2018) by considering how network mechanisms generate social capital in the first place.

¹⁴ We understand *academically ambitious choices* as the transition from lower track, intermediate track, and comprehensive schools into the academic track, and from upper track schools as well as (for the subset of students who realised the first decision) from intermediate track and comprehensive schools into higher education—as opposed to vocational education or the labour market.

The chapter offers several new insights by comparing segregation according to households' socioeconomic background in parental and student networks and studying the relationship between social capital and educational decisions. In particular, we consider whether preferences for others with similar backgrounds foster segregation along socioeconomic differences above and beyond the opportunity structure for network formation (Wimmer & Lewis, 2010). Previous research demonstrated that the opportunity to meet others with a different socioeconomic background is limited due to a combination of factors, such as segregated neighbourhoods (Denessen et al., 2005), school tracking (Jenkins et al., 2008; Karsten, 2010), and school choices, which are shaped by households' educational backgrounds (Jheng et al., 2022). We add to these studies by investigating whether network segregation along socioeconomic differences is further exacerbated by relationship choices within schools in multiple types of relationships (i.e., we consider friendship networks *and* contacts among parents).

Furthermore, we investigated whether the benefits of social capital for educational decisions are more or less pronounced for adolescents without highly-educated parents. Analysing differential returns to social capital is important to understand under which conditions social relationships contribute to social inequality or have the potential to mitigate it. Therefore, we answer a call by DiMaggio and Garrip (2012), who criticised that the analysis of group-specific network effects is often not investigated or reported (for an exception, see Behtoui and Neergaard 2010).

Empirically, we analysed a longitudinal dataset that contains parental and friendship networks of German students visiting the 9th grade and information on their educational decisions at the end of secondary education. We used the information on students' classroom-level friendships and contacts between their parents to identify whether students have access to highly-educated adults. Recent advances in network analysis (Duxbury, 2021; Lusher et al., 2012) allowed us to investigate whether households' educational backgrounds contribute to the structure of social networks. In particular, these models enabled us to compare whether students' and parents' relationship choices restrict the access to social capital for socioeconomically disadvantaged households net of compositional differences between schools (Jenkins et al. 2008; Wimmer and Lewis 2010). Subsequently, we employed regression techniques to study how social capital relates to long-term educational outcomes. Complete network data—i.e., information on relationships among all parents and students in a classroom—mitigated the limitations typically associated with self-reports of social

relationships, such as a lack of knowledge of others' characteristics or incorrect recollection of them (Killworth & Bernard, 1976; Marsden, 1990b; Paik & Sanchagrin, 2013; Small, 2017).

Our results suggest that students' and parents' networks are segregated by educational background. Consequently, students from disadvantaged households—who already have lower chances to access social capital, e.g., due to neighbourhood segregation—experience a further disadvantage in accessing social capital due to network formation. Results also show that parental networks exhibit more segregation along socioeconomic differences compared to students' friendship networks. Furthermore, our analyses reveal that social capital – especially when accessed through parental networks – plays a substantial role in adolescents' educational decisions. Finally, our findings provide tentative evidence for the notion that social capital is particularly linked to ambitious educational choices when accessed by students from households *without* a university degree.

3.2 Theory and past research

The notion that social networks affect the outcomes of individuals, organisations, and societies is widely shared among social scientists (Bourdieu, 1986; Burt, 2005; Coleman, 1988; Lin, 2001; Putnam, 2007; Small, 2004). In this regard, the concept of social capital proved useful when studying how individuals benefit from their social environment in various domains, such as the labour market (Behtoui, 2016; Burt, 2005; Coleman, 1988; Granovetter, 1995) or educational settings (Cox, 2017; Dika & Singh, 2002; Morgan & Sorensen, 1999). The widespread use of social capital as a conceptual lens has led to diverse definitions of the term (Fuhse, 2021; Portes, 1998). While some highlight that social capital is constituted by information and resources embedded in personal networks (Bourdieu, 1986; Lin, 2001), others understand network structure itself as a form of social capital, e.g. Burt (2005) and Portes (1998) argue that dense networks can facilitate individuals' adherence to social norms (see also Coleman, 1988).

Our study of social capital in the school setting follows a strand of research that studies how information and resources embedded within social relationships can be mobilised by students and parents to realise specific goals, such as school-to-work transitions, college completion, or elevated academic achievement (Behtoui, 2007; Behtoui & Neergaard, 2010; Roth, 2014b, 2018; Verhaeghe et al., 2015).¹⁵

¹⁵ Note that another branch of literature studies how densely connected social networks and intergenerational closure—i.e., when students' parents are acquainted—bolster educational outcomes

3.2.1 Scope conditions for the mobilisation of social capital

Before we derive our theoretical expectations, we would like to point out two qualifications of our conceptualisation of social capital. First, we follow Flap & Völker (2001), who argue that social capital is *goal-specific* because it is not an ‘all-purpose good’ (Flap & Völker, 2001: 302). For instance, actors’ strategic, work-related network ties can help achieve a particular goal, such as getting a promotion at work, but may prove less helpful in realising different outcomes, such as job satisfaction regarding social aspects. Consequently, we study how a particular type of social capital—in our case, contact with highly-educated adults via friendship and parental networks—is related to the specific outcome of academically ambitious educational choices at the end of secondary education (Cherng et al., 2013; Choi et al., 2008; Helbig & Marczuk, 2021).

However, we do not assume that actors’ mobilisation of social capital is necessarily deliberate, rational, or strategic (Lin, 1999a; Small, 2004, 2009). As, for instance, Bourdieu and his collaborators pointed out, perceptual dispositions, transmitted through social interaction or field positions, can reproduce inequality without actors’ deliberate strategizing (Bourdieu, 1986; Bourdieu & Passeron, 1990; Bourdieu & Wacquant, 1992; Fuhse, 2021). In addition, a conversion between different forms of capital, such as economic, cultural, and social capital, takes place in many settings and further complicates studying how social networks affect educational decisions or other life outcomes and vice versa (Bourdieu, 1986; Lewis & Kaufman, 2018; Lizardo, 2006).¹⁶

The second qualification for our conceptualisation of social capital is that network partners must be willing and able to share their resources and information. Previous scholarship suggests this is not always the case, e.g., when societal groups erect physical or symbolic boundaries to exclude others from their accumulated assets (Bourdieu, 1984; Lamont, 1992; Lamont & Molnár, 2002; Tilly, 1998; Wimmer, 2013). Yet, we are confident that students have access to social capital embedded in their network environments because schools usually foster social interaction between students and parents alike. While school choices segregate meeting opportunities for crossing socioeconomic, racial, or ethnic boundaries (S. Smith et al., 2016; Wimmer & Lewis, 2010), we assume that once students are in the same classroom, they at least

(Geven & van de Werfhorst, 2020; Morgan & Sorensen, 1999). Studying both types of social capital would go beyond the scope of our investigation but is an exciting avenue for future research.

¹⁶ While we acknowledge the possible conversion of different forms of capital and control for other types of capital in addition to social capital, such as households’ educational background, in our analyses, modelling conversion dynamics in detail would go beyond the scope of our investigation.

have the possibility of accessing information and resources through their social relationships (Small (2009) made a similar argument for the case of childcare centres). Subsequently, we derive theoretical expectations regarding the formation and usage of social capital in the German school system.

3.2.2 Network segregation along socioeconomic differences

While many studies focus on the effects of social capital on individual outcomes, the question of how the distribution of actors across institutional space and network mechanisms mould the access to social capital for socioeconomically disadvantaged households is seldom addressed (DiMaggio & Garip, 2012). Previous research shows that individuals in high social positions tend to benefit from social capital (Behtoui, 2016; Verhaeghe et al., 2015), but the sources of inequality in access to social capital remain under-investigated. Here, we draw upon network research on segregation in social networks (McPherson, 2004; McPherson et al., 2001) to study whether students' and parents' relationship choices exacerbate segregation along socioeconomic lines.

It is well-known that the socioeconomic composition of schools is shaped by neighbourhood segregation (Denessen et al., 2005), school tracking (Jenkins et al., 2008; Karsten, 2010), and school choices (Jheng et al., 2022). Therefore, we expect opportunities to form social relationships with others from different socioeconomic backgrounds to be restricted due to the distribution of households *between schools*.¹⁷ Relationship choices of students and parents *within schools* carry the potential to further increase segregation. According to the principle of homophily—in which people who are similar have an increased chance of associating with each other—advantaged children and parents tend to form relationships with similarly advantaged others (Malacarne, 2017; McPherson et al., 2001; S. Smith et al., 2016). Sharing the same

¹⁷ The German school system consists of three secondary school tracks, which are hierarchically ordered according to students' prior academic abilities: lower (*Hauptschule*), intermediate (*Realschule*), and upper secondary (*Gymnasium*). Additionally, the school system offers comprehensive schools, which combine these three school tracks and allow students to obtain a certificate that is necessary to go to university. Research shows that the allocation of students is significantly structured by a child's background: children with an advantaged socio-economical background are more likely to attend the higher tracks than socio-economically disadvantaged children (Jenkins et al., 2008; Kristen & Granato, 2007; Solga & Wagner, 2010). Consequently, a higher share of the student body in upper secondary schools comes from advantaged households, as opposed to the other school types. This first step restricts the opportunities for relationships because the composition of a context determines the pool of possible interaction partners (Blau, 1994).

socioeconomic background often provides fertile ground for forming relationships since actors with a similar socioeconomic status tend to share similar tastes, cultural preferences, and attitudes (Bourdieu, 1984; Chan & Goldthorpe, 2007).

Hypothesis 1: Students and parents from similar socioeconomic backgrounds are more likely to form relationships with one another.

While previous research primarily investigated friendship networks, we analyse parental networks as an additional conduit through which information and resources can flow. This extension is fruitful because contact among parents should be more segregated according to socioeconomic differences and is especially consequential for educational decisions. Whereas friendships among students form easily due to shared foci for interaction (Feld, 1981)—e.g., visiting the same classroom or sharing the same way to school—contacts among parents lack such foci for interaction and, thus, require more effort. Therefore, parental networks tend to be sparser and more segregated along socially-relevant traits such as households' migration history (Windzio, 2015; Windzio & Bicer, 2013). Another difference between students' and parents' networks is that friendships among students are characterised by various dimensions such as emotional support, sharing secrets, and helping each other with practical problems such as schoolwork (Kitts & Leal, 2021). In contrast, we assume that most contacts among parents are less multi-faceted and predominantly used to exchange school-related information or coordinating their children's out-of-school activities (Lareau, 2011; Small, 2009). Following these arguments, we expect that parents' networks show stronger tendencies of socioeconomic homophily than students' networks.

Hypothesis 2: Parents show a stronger tendency to form a relationship with others from a similar socioeconomic background than students.

To conclude, we hypothesise that relationship choices among students and parents foster unequal access to social capital due to network segregation and that socioeconomic differences are more important for parents' networks. In the next section, we discuss the potential consequences of unequal access to social capital for educational decisions.

3.2.3 The role of social capital in educational decisions

In Germany, after completing their secondary education, adolescents decide if they will continue schooling and pursue a higher educational degree, start vocational training, or enter the labour market. This choice depends on the type of school students attend: while graduates from upper secondary school can enter tertiary education, students from the lower track, intermediate track, and comprehensive schools are first faced with the decision to enter upper secondary education. Upon completion, these students can also enrol in a university. Therefore, we conceive of enrolment in an upper secondary education (*Gymnasium*) as an academically ambitious educational decision for students from the lower track, intermediate track, and comprehensive schools. In comparison, we define pursuing tertiary education as an academically ambitious educational decision for students who attended upper-track schools (Dollmann, 2017). Accordingly, we rely on the *academic degree* of peers' parents as goal-specific social capital (Cherng et al., 2013; Flap & Völker, 2001; Helbig & Marczuk, 2021). Contact with highly educated households should foster academically ambitious educational decisions for various reasons. As advantaged individuals are equipped with the resources necessary to succeed in the educational system, they can also be helpful to others by providing direct assistance on homework or assignments (Flashman, 2012). Regarding actual educational decisions, highly-educated parents can provide information on educational options (Forster & van de Werfhorst, 2019) and the possibilities that emerge with a better degree (Barone et al., 2018). Furthermore, they can provide reassurance on the feasibility of, and offer information on, the costs of a potential educational decision (Engelhardt & Lörz, 2021; Grodsky & Jones, 2007).

Indirectly, highly educated parents and their children can serve as role models because they tend to have higher educational ambitions and aspirations (Breen & Goldthorpe, 1997; Stocké, 2007), which may spill over to other students, for example, when discussing their academic plans. In a similar vein, they have a habitus that is geared towards the educational system (Bourdieu & Passeron, 1990). Hence, we argue that highly educated parents not only positively affect the educational decisions of their children but are also positively associated with the educational decisions of other students.

Hypothesis 3: Access to social capital increases the chances of making an academically ambitious decision.

While research shows that network effects tend to benefit the already advantaged (DiMaggio & Garip, 2012), we argue that—in the current case—adolescents with less educated parents will benefit from social capital. As educational decisions are linked to resources or information that already circulate among highly educated households, these households should experience diminished benefits of their social contacts (see also Helbig & Marczuk, 2021). Academic expectations are already relatively high among this group, and ambitious choices tend to be the ‘default choice’. Hence, there is little room for improvement through social capital and a ceiling effect might be observed for this group. In comparison, less privileged households lack resources, information, and role models fostering academically ambitious choices. Consequently, social capital should be especially valuable for students from a non-academic background and allow them to *compensate* for their lack of resources (Choi et al., 2008; Sokatch, 2006).

Hypothesis 4: Social capital is especially beneficial for children from a household without academically educated parents.

3.3 Data, measures, and analytical strategy

3.3.1 Data

The data for this chapter was gathered during the CILS4EU project (Kalter et al., 2017) and the CILS4EU-DE extension was conducted as a follow-up study in Germany (Kalter et al., 2019). In the initial CILS4EU project, adolescents visiting the 9th grade were surveyed in four European countries (England, Germany, The Netherlands, and Sweden). The first wave was conducted in 2010/2011 and the original project collected three waves. This chapter relies on the German subset of the data. The survey was administered in a two-level strategy. First, a school sample out of all schools hosting ~14-year-old adolescents was drawn. In this stage, schools with higher proportions of immigrant students were oversampled. Second, usually two classes per school were randomly selected for participation in the survey. In the first wave of the German part of the survey, 5,013 students from 271 classes and 144 schools participated (with response rate of ~80%). In addition to the student surveys, parents also answered a survey in Wave 1 (with response rate of 78%). As an extension to the initial three waves, the German project team continued their efforts and collected five additional waves, amounting to eight

waves in total.¹⁸ This so-called CILS4EU-DE extension dataset recorded the participants' educational and labour market careers.¹⁹

A strength of this dataset is the combination of a panel structure with rich information on adolescents' social networks. Besides regular survey questions, adolescents also reported their and their parents' relationships during the first two waves. These sociometric items were designed to capture social networks at the classroom level, such as friendships or parental contacts.

For our analysis, we included students from lower track schools (*Hauptschule*), intermediate track schools (*Realschule*), comprehensive schools and schools with multiple *tracks* (*Gesamtschule & Schule mit mehreren Bildungsgängen*), and upper track schools (*Gymnasium*). We excluded students from special needs schools and Rudolf Steiner schools because these school types are conceptually different or showed a too-small sample size.

Moreover, as we relied on social network information, we excluded schools with a participation rate of less than 75 %, because a lower participation rate may provide a bias in the social network information (S. Smith et al., 2016).²⁰ Missing values were imputed by predictive mean matching using the *mice* package in the statistical software *R*. We imputed ten datasets and constructed our social capital measure based on each. Our analysis sample consisted of 3,998 participants (see Section 3.2 for details). However, models investigating educational decisions exclude cases with imputed values on the dependent variable, as this may introduce error. Hence, the sample size for these models was 2,749.²¹

¹⁸ The 8th wave was released after finishing the data analysis of this project.

¹⁹ In addition to the original sample, in Wave 6, a refreshment sample of around 3000 individuals was drawn to make up for panel attrition. However, since we connect information from Wave 1 with the later waves, we did not use this refreshment sample.

²⁰ This rule led to the exclusion of around 28% of classes (for a similar sample reduction, see S. Smith et al. 2016).

²¹ Additional analyses do not reveal any substantial bias regarding panel drop-out on relevant variables. However, minor differences can be seen regarding adolescents' educational aspirations and ethnic origin. Students with very high university aspirations and students from the former Soviet Union and Non-Western countries have a higher chance to remain in the sample (see table A3.1 in the appendix).

3.3.2 Methods and analytical strategy

In the first part of our analysis, we investigated how educational background is associated with students' and parents' relationships within schools. We constructed networks from the reports of all participating adolescents in a classroom. Students were asked: 'Who are your best friends in class?' and 'Whose parents do your parents get together with once in a while or call each other on the phone?' Participants could name up to five friends and an unlimited amount of parental contacts (see Kruse & Jacob, 2014).²² These classroom networks formed the basis for studying whether friendship and parental contacts are shaped by students' educational backgrounds. We also derived our measure of social capital from these networks.

The structure of networks

To study how socioeconomic differences structure networks, we employed exponential random graph models (ERGM; Butts, 2008; Lusher et al., 2012).²³ These network models treat the global structure of an observed network as a dependent variable and investigate which local network tendencies—such as reciprocity—account for the network's global structure (for details, see Lusher et al., 2012). For example, ERGMs can tell the analyst whether relationships between same sex students occur more often in the observed network than a random formation of relationships would suggest, given all other network tendencies accounted for by a particular model specification.

An advantage of ERGMs is that they take the opportunity structure according to a given attribute into account (e.g., the share of female students). Therefore, coefficients for homogeneity reflect the tendency to form ties with similar others above and beyond the amount of intra-group relationships we would expect based on meeting opportunities (Wimmer &

²² While we considered the directedness of the friendship network, we treated the parental network as an undirected network. In case researchers conceptualize a network as undirected, they assume that relationships are reciprocal or symmetric and lack directionality. Examples of undirected networks are co-presence ties (i.e., actors spending time together) or communication ties established by two actors engaging in a conversation. In both cases, researchers usually choose an undirected network to represent relations because being co-present or communicating involves both actors automatically. In comparison, directed networks allow researchers to consider relationships that can be one-sided or oriented from one person to another. For instance, friendships can be unreciprocated—if actor A believes B to be their friend, but B does not—and therefore, it is often fruitful to represent them as a directed network (Wasserman & Faust, 1994). The rationale behind this is that the question capturing the parental networks does not indicate directionality. Moreover, we believe some students may not have known about the contacts their parents have, while others did.

²³ We used the *ergm* function of the *statnet* package (v. 2019.6) in R.

Lewis, 2010).²⁴ For instance, a positive and statistically significant coefficient for same-sex ties would indicate that relationships are more likely to form among students of the same sex. We used ERGMs to derive estimates that are closer to students' and parents' genuine preferences in forming relationships with others who share a similar socioeconomic background than descriptive measures (Bojanowski & Corten, 2014). Comparable to regression models, analysts must control for other attributes that structure the network, such as their sex (Goodreau et al., 2009), to obtain estimates for the network patterns of interest and reduce the bias due to omitted variables. In summary, these models helped us test our first hypothesis, that individuals tend to form relationships with others who have the same educational background (*same acad. degree*).

Subsequently, we investigated differences in socioeconomic segregation between friendship and parental networks. Due to their exponential link function, the comparison of estimates between different ERG models is complicated by rescaling issues (Duxbury, 2021; for similar issues with logistic regressions, see Mood, 2010). Hence, to ensure a valid comparison of estimates, we calculated average marginal effects (AMEs) as recently proposed by Duxbury (2021). The advantages of AMEs are that they are robust against rescaling and allow for a substantial interpretation of coefficients. Also, by interpreting AMEs in relation to the density of a network (i.e., the baseline probability of forming a relationship), effect sizes can be compared between models (Kreager et al., 2021). Scaled AMEs can be interpreted as a change of the baseline probability to form a relationship if a network variable increases by one unit. For example, scaled AMEs for the same-sex coefficient will tell us how much the overall probability of forming a friendship increases if two students share the same sex.

Social capital embedded in networks

While ERGMs help us to investigate whether relationships are structured along socioeconomic differences, we now turn to the question of how individuals access social capital through their personal networks. To measure social capital, we first assigned the highest educational background of parents to each student. For this, we mostly relied on the parental questionnaire and substituted missing values with children's reports. We extracted the personal network—i.e., *ego networks*—of each student and parent from the respective classroom-level network. Afterwards, we identified whether students have at least one friend who has a parent with an

²⁴ Other applications of ERGMs also control for endogenous network processes, such as triadic closure (e.g. Wimmer & Lewis 2010). We decided to estimate specifications without higher-order terms because they can complicate the interpretation of coefficients, especially if analysts are interested in the role of node attributes for network structure (see Martin (2020) for a similar line of argumentation).

academic degree (see figures 3.1a and 3.1b). Similarly, we determined whether students' parents have contact with at least one other parent with a university degree. The rationale behind this measurement is that we assume that one person in the network who can provide relevant information is sufficient to foster the observed educational decision.²⁵

Information obtained through complete social network data is considerably less biased because participants do not have to know, remember, or be aware of others' characteristics (Marsden, 1990b); they solely have to report their own relationships. This is particularly useful when investigating adolescents' social networks in combination with parental interviews because previous research shows that adolescents tend to have problems accurately reporting their parents' educational degrees (Engzell & Jonsson, 2015).

In sum, we obtain two binary social capital measures: (1) students have at least one friend who has a parent with a university degree (0/1); (2) students' parents have contact with at least one parent with a university degree (0/1).

²⁵ We also investigated whether the number of contacts or the share of contacts with an academic background provide benefits for educational choices. These results show that the threshold lies between '0' and '1' contacts to individuals with academic background. Our models do not suggest that additional contacts provide additional benefits. A larger share of contacts with an academic background—while estimates point in the same direction—is not statistically significant in most models. Results are available upon request.

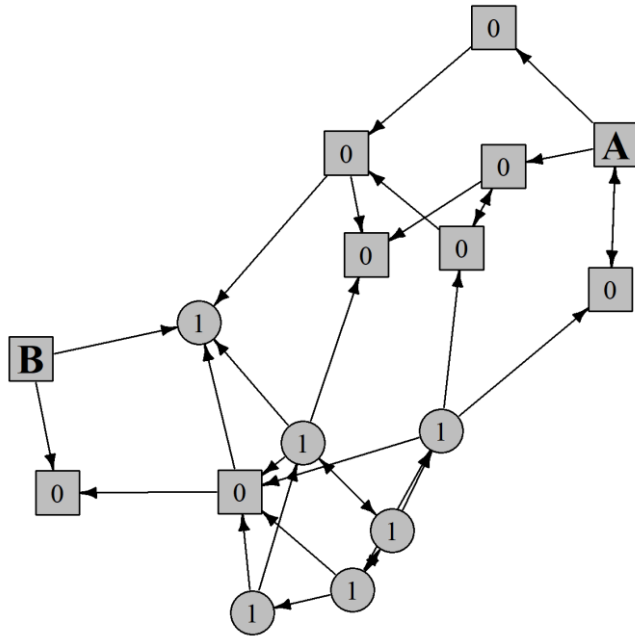


Figure 3.1a: Example ego networks of two students

Note: The figure shows a theoretical example friendship network. Students with a ‘1’ have at least one academically educated parent. While visual inspection suggests that students from highly educated households tend to befriend each other in this network (see bottom-left corner), ERG-models allow us to identify whether this clustering is significantly different from randomness by considering other factors, such as students’ sex. As an example, two students are highlighted: Student A and Student B. Their respective ego networks can be seen in Fig. 3.1b.

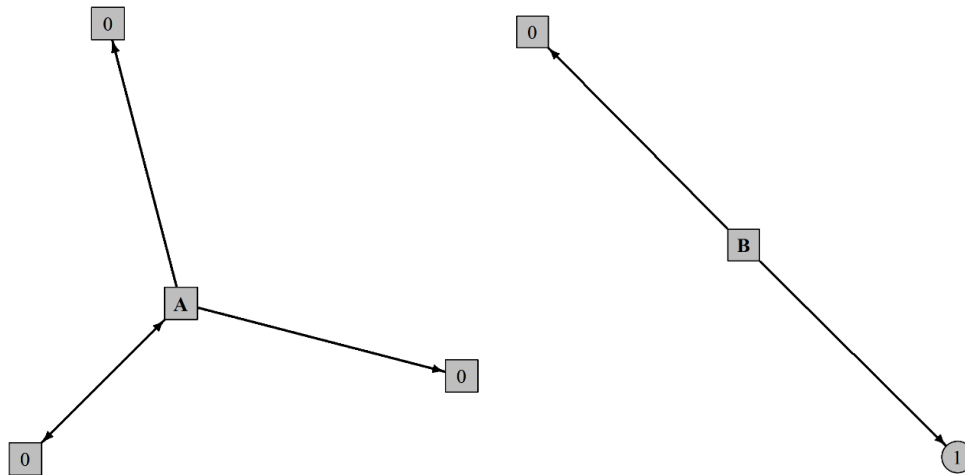


Figure 3.1b: Ego networks of Student A and Student B

Note: The left figure shows the ego network of student A and the right the ego network of student B (see figure. 3.1a). While student A does not have friends with academically-educated parents, student B has one such friend (indicated by ‘1’). Thus, for our purposes, student B has social capital since she has ‘at least one’ friend with academically-educated parents. Student A does not have social capital.

Consequences of social capital: Linear probability models and causality

In the second part of our investigation, we focused on the role of social capital for individual educational decisions, making use of the longitudinal structure of the dataset. We treated students' *academically ambitious choices* as the dependent variable and social capital as the main predictor in a regression framework. We employed *linear probability models* (LPMs) with school class fixed effects and clustered standard errors at the classroom level.

Our aim is to elaborate a connection between social capital and educational decisions that accounts for several sources of potential biases. Yet, we acknowledge that estimating the causal effects of networks on individual attributes is seldom feasible with observational data (for details, see Shalizi & Thomas, 2011).

Researchers encounter several methodological challenges when identifying the causal effects of social capital on educational or labour market outcomes (Mouw, 2006). Unobserved heterogeneity due to the self-selection of individuals into social relationships and reverse causality may inflate estimates of the effect of social capital. Taking all relevant characteristics connected to relationship choices into account can solve the issue of unobserved heterogeneity. However, surveys often cannot provide measurements for all factors shaping networks. Therefore, it is complicated to establish causality (Elwert & Winship, 2014; Mouw, 2006; Shalizi & Thomas, 2011). We addressed this issue by controlling for a variety of confounders and including classroom-level fixed effects to account for unobserved heterogeneity between classrooms.

Another advantage of our analytical strategy is that it did not have the common issue of reversed causality because our social capital measures stemmed from social networks several years before the analysed educational decisions. Hence, while we cannot establish causal effects, our approach improves upon previous studies—especially studies that followed a cross-sectional design (see also Roth & Weißmann, 2022).

3.3.3 Measurements

Dependent variables in regression analyses

We investigated two types of educational decisions depending on the school track students visited (see figure 3.2). First, we assessed the decision to enter the academic track after the 10th grade for students from the lower and intermediate tracks and for comprehensive school students (including schools with several educational tracks, see ED1 in figure 3.2). Second, we considered the decision to enrol in university for students initially attending the academic track

and for intermediate track and comprehensive school students who previously decided to visit the academic track (i.e., ED1, see ED2 in figure 3.2).²⁶

For this purpose, we used the CILS4EU-DE data from Waves 3 to 7. In each wave, participants were asked what they were ‘currently doing’ regarding their educational and labour market situation. The options were ‘School’, ‘Apprenticeship/work-related training’, ‘Studying’, ‘Full-time job’, ‘Internship’, or ‘Something else’. If participants answered that they were currently in ‘School’, they were asked what kind of school they were attending. Based on this information, for ED1, we identified lower-track, intermediate-track, and comprehensive school students who reported that they attended the *Gymnasium* in at least one of the waves. For ED2, we identified academic track students as well as intermediate track and comprehensive school students who reported that they were ‘studying’ in at least one of the waves. The reference category contains all participants who chose the labour market, vocational training, or dropped out. Due to this reference category, we restricted the sample of the non-academic track students in ED2 to those who already realised ED1. Therefore, we excluded students who already made their educational decision towards vocational education or the labour market at an earlier stage which would otherwise inflate the reference category.

We assigned an ambitious choice to students who made an upward decision after having left school, regardless of the timing of that decision. Hence, we included choices that occurred some years after students’ graduation because some students do not follow the usual timeframe due to school year repetition, gap years, or voluntary service (see appendix for a more detailed explanation).

²⁶ For ED2, we decided to drop lower track students because case numbers were relatively small. Few students had social capital in the way we conceptualised it and/or enrolled in universities. While we find a strong positive association between social capital and the decision to enrol in university for lower track students, we do not want to introduce bias due to very small case numbers.

Independent variables in regression analyses

Concerning the LPMs investigating the consequences of social capital, we added a set of control variables, which previous research identified as relevant for relationship choices and educational decisions. We controlled for students' parents with *academic background*. Of the two parents, we obtained the highest educational level and assigned a '1' to students with one parent holding a university degree. While Engzell & Johnson (2015) showed that adolescents have problems accurately reporting their parents' educational background, the CILS4EU project also conducted parental interviews in which parents provided information about their academic degrees. Therefore, when possible, we relied on parental reports to assess their educational background. For 85.49% of our analysis sample, the information provided by parents was available and the missing information was substituted by adolescents' reports (with 15 missing values remaining).

We controlled for socioeconomic status by using the International Socioeconomic Index (ISEI). This index captures the occupational status according to educational and income levels and ranges from 11 to 89. To avoid missing values, we assigned the value '10' if both parents are unemployed (see Plenty & Mood, 2016) and divided the index by 10 so that our final index ranges from 1 to 8.9. Here, we also relied on parental reports when possible and substituted adolescents' reports when necessary (with 102 missing values remaining).

Furthermore, we controlled for students' ethnic group membership and considered several groups based on adolescents' and their parents' countries of origin. We utilised the pre-coded ethnic background variables provided in the CILS4EU dataset to differentiate between the following categories (see Dollmann et al., 2014): Germany, Turkey, Former Soviet Union, Poland, Former Yugoslavia, Italy, Non-Western, Western, and Other (with no missing values).

Regarding educational aspirations, students were asked, 'What is the highest level of education you wish to get?'. The answer categories were (0) 'No degree', (1) 'Degree from lower secondary school (*Hauptschulabschluss*)', (2) 'Degree from intermediate school (*Realschulabschluss*)', (3) 'Degree from upper secondary school (*Abitur*)', and (4) 'University degree'. From this question, we constructed three categories: (0) 'Below upper secondary school degree', (1) 'degree from upper secondary school', and (2) 'university degree'. In our analyses 'below upper secondary school degree' served as the reference category (51 missing values). Similarly, parents were asked, 'What is the highest level of education you wish your child to get?'. We derived a measure for parental aspirations that followed the above-mentioned scheme (36 missing values).

Regarding students' school grades, we used the grades of the subjects 'German', 'Maths', and 'English'. The German grading system ranges from 1 (very good) to 6 (insufficient). To ease interpretation, we recoded the variables ranging from '0' to '5', where higher values reflect better grades. We averaged the grades across the above-mentioned subjects (66 missing values).

Lastly, to account for the opportunity to access social capital, we controlled for the outdegree—that is, the number of friends a student reports or the number of parental contacts, respectively. We derived this information from classroom-level networks of friendships and parental contacts. The construction of networks is described in section 3.3.2.

Independent variables in network models

Concerning the exponential random graph models (ERGM), we focused on the socio-demographic control variables sex, ethnic minority status, and educational background, following previous research on adolescents' social networks (Goodreau et al., 2009; S. Smith et al., 2016). Based on these characteristics, we controlled for the tendency to have same-sex relationships (*same sex*), and whether two individuals with the same migration history are more likely to have a relationship (*same majority/minority*). Moreover, we investigated whether the same educational background increases the chances of forming a relationship (*same acad. background*). In addition, we assessed whether children with highly educated parents are more active in their networks (*activity acad. degree*), or whether they are chosen more often as their network partners (*popularity acad. degree*). Activity refers to the number of nominations a person sends, and popularity refers to the number of nominations a person receives from others. We also included these effects for gender (*activity female* and *popularity female*). Since parents' networks are undirected, we only captured the extent to which university-educated parents and parents of girls have more ties in total.²⁷

3.4 Results

3.4.1 Summary statistics

Tables 3.1 and 3.2 summarise the statistics for both analysis samples. Additionally, we provided statistics differentiated for those with and without an ambitious decision. While just around a quarter of students who finished the 10th grade on another track than the upper track transitioned to the academic track (ED1; table 3.1), almost 70% of adolescents who attended the upper track

²⁷ We estimated additional models only entailing educational background as independent variable. Results remain qualitatively similar in these more basic specifications and are available upon request.

enrolled in a university (ED2; table 3.2). When comparing individuals with and without ambitious decisions, a substantially larger share of those who make an ambitious decision have access to social capital. Especially, when comparing social capital accessed through parental networks, the share is around twice as large. This descriptive overview already points to the relevance of social capital for educational decisions.

Table 3.1: Summary statistics for analysis sample ‘academic track decision’ (ED1)

| | Ambitious choice | | No ambitious choice | | | All | |
|--|------------------|--------|---------------------|--------|------|---------|--|
| | N | % | N | % | N | % | |
| Number of observations (row per cent) | 535 | 23.75% | 1652 | 76.25% | 2187 | 100.00% | |
| Social capital embedded in students’ networks | 239 | 45.07% | 544 | 38.15% | 783 | 39.79% | |
| Social capital embedded in parents’ networks | 107 | 23.78% | 140 | 11.45% | 247 | 14.38% | |
| Academic background | 110 | 20.67% | 176 | 13.03% | 286 | 14.85% | |
| Ethnic status | | | | | | | |
| Germany | 246 | 54.42% | 716 | 61.75% | 962 | 60.35% | |
| Turkey | 83 | 7.97% | 290 | 6.82% | 373 | 7.04% | |
| Former Soviet Union | 35 | 5.32% | 89 | 5.53% | 124 | 5.49% | |
| Poland | 25 | 5.30% | 103 | 5.82% | 128 | 5.72% | |
| Former Yugoslavia | 17 | 1.02% | 82 | 2.44% | 99 | 2.17% | |
| Italy | 19 | 3.65% | 50 | 2.58% | 69 | 2.78% | |
| Non-Western | 57 | 8.36% | 146 | 4.21% | 203 | 5.01% | |
| Western | 42 | 10.74% | 143 | 7.31% | 185 | 7.97% | |
| Other | 11 | 3.21% | 33 | 3.54% | 44 | 3.48% | |
| Adolescents’ educational aspirations | | | | | | | |
| Below upper secondary degree | 48 | 8.86% | 608 | 35.96% | 656 | 29.52% | |
| Upper secondary degree | 275 | 55.00% | 708 | 48.71% | 983 | 50.20% | |
| University degree | 212 | 36.14% | 336 | 15.33% | 548 | 20.28% | |
| Parents’ educational aspirations | | | | | | | |
| Below upper secondary degree | 79 | 21.31% | 765 | 51.34% | 844 | 44.21% | |

| | | | | | | |
|------------------------------------|------|--------|------|--------|------|--------|
| Upper secondary degree | 250 | 46.60% | 544 | 34.30% | 794 | 37.22% |
| University degree | 256 | 31.09% | 343 | 14.36% | 549 | 18.57% |
| | Mean | SD | Mean | SD | Mean | SD |
| Adolescents' outdegree (# friends) | 3.99 | 1.16 | 3.39 | 1.28 | 3.93 | 1.25 |
| Parents' outdegree (# contacts) | 1.23 | 1.37 | 0.92 | 1.19 | 0.99 | 1.24 |
| Average grades | 3.30 | 0.68 | 2.84 | 0.66 | 2.95 | 0.69 |
| ISEI | 4.68 | 2.05 | 4.36 | 1.89 | 4.44 | 1.93 |

Note: Percentages based on design-weighted data. The number of observations is unweighted and shows row percentages. The remaining statistics indicate column-wise percentages.

Table 3.2: Summary statistics for analysis sample 'university decision' (ED2)

| | Ambitious choice | | No ambitious choice | | All | |
|---|------------------|--------|---------------------|--------|-----|---------|
| | N | % | N | % | N | % |
| Number of observations (row per cent) | 623 | 67.28% | 316 | 32.72% | 939 | 100.00% |
| Social capital embedded in students' networks | 456 | 80.21% | 168 | 58.97% | 624 | 73.26% |
| Social capital embedded in parents' networks | 242 | 45.93% | 62 | 23.88% | 304 | 38.72% |
| Academic background | 259 | 45.97% | 68 | 25.10% | 327 | 39.14% |
| Ethnic status | | | | | | |
| Germany | 314 | 58.81% | 166 | 62.77% | 480 | 60.11% |
| Turkey | 66 | 4.03% | 28 | 4.58% | 94 | 4.21% |
| Former Soviet Union | 40 | 5.15% | 23 | 6.59% | 63 | 5.62% |
| Poland | 36 | 7.95% | 22 | 7.53% | 58 | 7.81% |
| Former Italy | 17 | 1.20% | 10 | 2.02% | 27 | 1.47% |
| Non-Western | 71 | 7.63% | 18 | 3.43% | 89 | 6.26% |
| Western | 52 | 9.14% | 27 | 8.64% | 79 | 8.97% |
| Other | 16 | 3.65% | 9 | 3.29% | 25 | 3.54% |
| Adolescents' educational aspirations | | | | | | |
| Below upper secondary degree | 8 | 0.66% | 20 | 6.87% | 28 | 2.69% |

| | | | | | | |
|------------------------------------|------|--------|------|--------|------|--------|
| Upper secondary degree | 180 | 29.63% | 166 | 53.64% | 346 | 37.49% |
| University degree | 435 | 69.71% | 130 | 39.49% | 565 | 59.82% |
| Parents' educational aspirations | | | | | | |
| Below upper secondary degree | 26 | 4.47% | 35 | 14.98% | 61 | 7.91% |
| Upper secondary degree | 229 | 37.07% | 170 | 52.38% | 399 | 42.08% |
| University degree | 368 | 58.45% | 111 | 32.64% | 479 | 50.01% |
| | Mean | SD | Mean | SD | Mean | SD |
| Adolescents' outdegree (# friends) | 4.02 | 1.14 | 3.97 | 1.18 | 4.00 | 1.16 |
| Parents' outdegree (# contacts) | 1.49 | 1.66 | 1.18 | 1.29 | 1.39 | 1.55 |
| Average grades | 3.40 | 0.68 | 3.02 | 0.66 | 3.28 | 0.69 |
| ISEI | 6.06 | 2.00 | 5.21 | 2.00 | 5.78 | 2.04 |

Note: Percentages based on design-weighted data. The number of observations is unweighted and shows row percentages. The remaining statistics indicate column-wise percentages.

Regarding the institutional differences in social capital access, table 3.3 shows the high degree of segregation by educational background between school types. While around 47% of the students in the highest track belong to households with at least one highly educated parent, only about 6% of children in the lower and 14% in the intermediate track have a university-educated parent. These compositional differences also translate into unequal access to social capital across school types. Around 20% of students in the lower track have access to social capital, whereas more than 85% of upper track students have at least one friend with highly educated parents.

In general, parental networks offer less access compared to their children's relationships and upper-track schools allow more students to access social capital. The higher number of highly educated parents in this track may explain this pattern. However, prior work on parental involvement also shows that socioeconomically advantaged parents are more involved in their children's school life (Lareau, 2011), which elevates their chances of accessing social capital.

To conclude, our results illustrate that the distribution of adolescents across school types is closely linked to their access to social capital.

Table 3.3: Distribution of social capital across school types

| | Combined | Lower track schools | Intermediate tracks schools | Comprehensive schools | Upper track schools |
|--|------------|---------------------|-----------------------------|-----------------------|---------------------|
| | Mean share | Mean share | Mean share | Mean share | Mean share |
| Share of academic parents in school type | 24.3% | 6.3% | 13.9% | 19.2% | 46.8% |
| Share of students with social capital embedded in their networks | 53.2% | 19.0% | 38.2% | 49.6% | 85.2% |
| Share of parents with social capital embedded in their networks | 23.5% | 2.2% | 16.1% | 17.4% | 45.2% |

Note: Percentages are based on design-weighted data.

3.4.2 Measuring Segregation with Network Models

In the next step, we performed ERGMs to investigate the relationship patterns among adolescents (table 3.4) and their parents (table 3.5) *within schools*.²⁸ Coefficients indicate whether particular local network structures appear more often than expected by random chance when considering all other parameters in a specification. For instance, the *same-sex* coefficients reflect whether students tended to befriend same-sex peers more often than classmates of the opposite sex.

In support of our theoretical expectations, the results show that adolescents and parents tend to select others with similar educational backgrounds, leading to segregated networks: Relationships between two individuals with the same educational background are more likely than relationships across educational groups. Besides the institutional restrictions to accessing

²⁸ As small and sparse networks (e.g. parents' networks) tend to produce convergence issues, we constructed the respective matrices for each school type separately (for a similar approach combining all classroom-level networks of one school, see Kruse et al., 2016).

social capital (i.e., between school type differences), relationship patterns restrict access even further for those without a university background above and beyond the opportunity structure.

Moreover, highly educated parents are better connected in parental networks, which aligns with our descriptive findings. However, friendship and parents' networks in lower-track schools are exceptions to these patterns. Here, students did not show a preference for those similar to them regarding educational background.

Scaled AMEs in tables 3.4 and 3.5 allow us to compare the extent of network segregation in friendship and parental networks. When comparing the scaled AMEs, we find support for our second hypothesis: Parental networks tend to be substantially more segregated by educational background than friendship networks. In all school types, except for lower track schools, the chances for two parents forming a relationship are around twice as high as for two adolescents with academically-educated parents. For example, in higher-track schools, the baseline probability to form a friendship increases by 26%. In comparison, this probability increases by 192% for same-sex adolescents and by 45% for two minority (or majority) adolescents. Hence, the extent of socioeconomic segregation is smaller than ethnic segregation or sex segregation. Nevertheless, socioeconomic network segregation results in a social capital deficit for households without a university education, especially concerning social capital accessed through parental networks.

Table 3.4: Average marginal effects (AMEs) of full exponential random graph models (ERGMs) for friendship networks

| | Lower track schools | | Intermediate track schools | | Comprehensive schools | | Upper track schools | |
|--|-----------------------|-------------|----------------------------|-------------|-----------------------|-------------|-----------------------|-------------|
| | AMEs | Scaled AMEs | AMEs | Scaled AMEs | AMEs | Scaled AMEs | AMEs | Scaled AMEs |
| Same acad. background | 0.0001 (0.0004) | 2.79 | 0.0062* (0.0002) | 19.19 | 0.0024*** (0.0002) | 59.11 | 0.0012*** (0.0002) | 26.34 |
| Activity acad. background | -0.0004 (0.0004) | -12.74 | 0.0004* (0.0002) | 12.53 | 0.0015*** (0.0002) | 36.51 | -0.0001 (0.0001) | -2.87 |
| Popularity acad. background | -0.0001 (0.0004) | -4.01 | 0.0005* (0.0002) | 15.22 | 0.0012*** (0.0002) | 29.87 | -0.0002 (0.0002) | -4.87 |
| Same-sex | 0.0063*** (0.0002) | 182.99 | 0.0068*** (0.0002) | 210.68 | 0.0091*** (0.0002) | 217.05 | 0.0091*** (0.0002) | 192.61 |
| Activity girls | 0.0005 (0.0001) | 14.50 | (0.0001) (0.0002) | 1.89 | -0.0008** (0.0002) | -19.53 | -0.0008* (0.0002) | -16.55 |
| Popularity girls | -0.0003 (0.0001) | -7.43 | -0.0003 (0.0001) | -8.99 | 0.0004* (0.0002) | 11.43 | -0.0002 (0.0002) | 5.15 |
| Same majority/ minority background | 0.0021*** (0.0001) | 59.70 | 0.0023*** (0.0001) | 71.53 | 0.0031*** (0.0002) | 75.24 | 0.0022*** (0.0002) | 45.49 |

Note: *** p < 0.001; ** p < 0.01; * p < 0.05. Controls for class and density not shown.

Table 3.5: Average marginal effects (AMEs) of full exponential random graph models (ERGMs) for parents' networks

| | Lower track schools | | Intermediate track schools | | Comprehensive schools | | Upper track schools | |
|-----------------------------------|-----------------------|-------------|----------------------------|-------------|-----------------------|-------------|------------------------|-------------|
| | AMEs | Scaled AMEs | AMEs | Scaled AMEs | AMEs | Scaled AMEs | AMEs | Scaled AMEs |
| Same acad. background | 0.0003 (0.0002) | 46.98 | 0.0003*** (0.0001) | 52.65 | 0.0009*** (0.0001) | 97.97 | 0.0008*** (0.0001) | 45.67 |
| Main effect acad. background | -0.0001 (0.0002) | -18.19 | 0.0005*** (0.0001) | 72.27 | 0.0010*** (0.0001) | 101.81 | 0.0003*** (0.0001) | 15.56 |
| Same sex | 0.0006*** (0.0000) | 98.55 | 0.0014*** (0.0001) | 192.97 | 0.0018*** (0.0001) | 182.10 | 0.0020*** (0.0001) | 119.13 |
| Main effect girls | 0.0001*** (0.0000) | 15.82 | 0.0002*** (0.0000) | 22.81 | -0.0001 (0.0001) | -6.34 | -0.0002*** (0.0001) | -14.08 |
| Same majority/minority background | 0.0006*** (0.000) | 108.29 | 0.0011*** (0.0001) | 147.51 | 0.0019*** (0.0001) | 199.97 | 0.0010*** (0.0001) | 59.28 |

Note: *** p < 0.001; ** p < 0.01; * p < 0.05. Controls for class and density not shown.

Taken together, these findings suggest that access to social capital is not only restricted by differences in the opportunity structure across schools—as highly educated families tend to cluster in the upper track—but also due to the formation of social relationships within schools. Moreover, parents tend to segregate more according to their academic backgrounds than their children.

3.4.3 Social capital and ambitious choices

This section investigates whether adolescents’ academically ambitious choices are associated with their social capital. We present the results for two different decisions: (1) the decision to enter the academic track in table 3.6 (i.e., ED1 in figure 3.2) and (2) the decision to enrol in a university in table 3.7 (i.e., ED2 in figure 3.2).

Table 3.6: Educational decisions ‘academic track’ (friendship and parents’ networks)

| Predictors | Model 1a | Model 2a | Model 3a |
|---|---------------------|---------------------|-------------------|
| | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> |
| Intercept | -0.43 *** (0.09) | -0.38 *** (0.10) | -0.41 + (0.24) |
| Social capital embedded in students’ networks | 0.00 (0.04) | -0.00 (0.06) | -0.15 (0.11) |
| Students’ outdegree (# friends) | 0.02 (0.02) | 0.03 (0.04) | 0.11 (0.07) |
| Social capital embedded in parents’ networks | 0.09 (0.06) | 0.14 * (0.07) | -0.16 (0.15) |
| Parents’ outdegree (# contacts) | 0.00 (0.01) | -0.00 (0.02) | 0.04 * (0.02) |
| Academic background | 0.03 (0.04) | | |
| Parents’ occupational status (ISEI) | 0.00 (0.01) | | |
| Ethnic background (ref. native German) | | | |
| Turkey | -0.00 (0.04) | 0.01 (0.04) | -0.17 (0.19) |
| Former Soviet Union | 0.03 (0.05) | 0.01 (0.07) | -0.03 (0.27) |
| Poland | -0.03 (0.07) | -0.01 (0.07) | 0.03 (0.12) |
| Former Yugoslavia | -0.02 (0.05) | -0.04 (0.06) | 0.02 (0.34) |

| | | | |
|---|--------------------|--------------------|--------------------|
| Italy | 0.03 (0.14) | 0.03 (0.13) | -0.32 (0.32) |
| Non-Western | 0.07 (0.06) | 0.08 (0.08) | -0.05 (0.12) |
| Western | -0.06 (0.05) | -0.06 (0.06) | -0.04 (0.10) |
| Other | 0.02 (0.08) | 0.06 (0.09) | -0.32 (0.28) |
| Average grades | 0.12 *** (0.02) | 0.12 *** (0.03) | 0.09 (0.08) |
| Students' educational aspirations (ref.: Degree below upper secondary school or lower) | | | |
| Degree from upper secondary school | 0.10 *** (0.02) | 0.10 *** (0.03) | -0.05 (0.09) |
| University degree | 0.20 *** (0.04) | 0.19 *** (0.05) | 0.05 (0.12) |
| Parents' educational aspirations (ref.: Degree below upper secondary school or lower) | | | |
| Degree from upper secondary school | 0.08 ** (0.03) | 0.06 + (0.03) | 0.43 ** (0.16) |
| University degree | 0.15 *** (0.05) | 0.11 * (0.05) | 0.50 *** (0.14) |
| R2 | 0.27 | 0.25 | 0.61 |
| Observations | 2187 | 1903 | 284 |

Note: The dependent variable captures whether adolescents went to the upper track after attending lower track, intermediate track or comprehensive schools. Model 2 shows results for adolescents without academic family background. Model 3 shows results for adolescents with academic family background. Class dummies included, not shown. Results are design-weighted.

*** p < 0.001; ** p < 0.01; * p < 0.05; + p < 0.10. Standard errors in brackets.

Table 3.7: Educational decision ‘university’ (friendship and parents' networks)

| | Model 1b | Model 2b | Model 3b |
|---|--------------------|-------------------|-------------------|
| Predictors | <i>Estimates</i> | <i>Estimates</i> | <i>Estimates</i> |
| Intercept | -0.24 (0.19) | -0.66 * (0.30) | 0.07 (0.64) |
| Social capital embedded in students' networks | 0.13 * (0.05) | 0.14 + (0.07) | 0.13 (0.09) |
| Students' outdegree (# friends) | -0.02 (0.02) | -0.02 (0.03) | -0.02 (0.02) |
| Social capital embedded in parents' networks | 0.11 ** (0.04) | 0.11 + (0.06) | -0.00 (0.06) |
| Parents' outdegree (# contacts) | 0.01 (0.01) | 0.01 (0.01) | 0.02 (0.02) |
| Academic background | 0.08 * (0.04) | | |
| Parents' occupational status (ISEI) | -0.00 (0.01) | | |
| Ethnic background (ref. native German) | | | |
| Turkey | 0.05 (0.09) | 0.06 (0.11) | -0.07 (0.16) |
| Former Soviet Union | 0.07 (0.10) | 0.12 (0.10) | 0.02 (0.16) |
| Poland | 0.05 (0.10) | 0.10 (0.11) | -0.01 (0.15) |
| Former Yugoslavia | -0.14 (0.17) | -0.26 (0.20) | 0.38 * (0.17) |
| Italy | 0.16 (0.13) | 0.21 (0.24) | 0.13 * (0.06) |
| Non-Western | 0.14 * (0.07) | 0.18 (0.13) | 0.13 ** (0.05) |
| Western | -0.00 (0.05) | 0.08 (0.09) | -0.11 (0.12) |
| Other | 0.06 (0.11) | 0.16 (0.10) | -0.01 (0.19) |
| Average grades | 0.15 *** (0.03) | 0.12 ** (0.05) | 0.19 ** (0.06) |
| Students' educational aspirations (ref.: Degree below upper secondary school or lower) | | | |
| Degree from upper secondary school | 0.05 | 0.02 | -0.05 |

| | | | |
|--|--------|--------|--------|
| | (0.10) | (0.12) | (0.07) |
| University degree | 0.10 | 0.10 | -0.02 |
| | (0.11) | (0.13) | (0.06) |
| Parents' educational aspirations (ref.: Degree below upper secondary school or lower) | | | |
| Degree from upper secondary school | 0.10 | 0.13 | -0.15 |
| | (0.09) | (0.11) | (0.58) |
| University degree | 0.24 * | 0.27 * | -0.12 |
| | (0.09) | (0.11) | (0.57) |
| R ² | 0.36 | 0.42 | 0.37 |
| Observations | 939 | 613 | 326 |

Note: The dependent variable captures whether adolescents went to university after attending the upper track. Model 2 shows results for adolescents without academic family background. Model 3 shows results for adolescents with academic family background. Class dummies included, not shown. Results are design-weighted.

*** p < 0.001; ** p < 0.01; * p < 0.05; + p < 0.10. Standard errors in brackets.

Our results indicate that social capital is associated with both educational decisions, which aligns with the third hypothesis. There are, however, slight differences between the investigated decisions. Considering the decision to go to university (table 3.7), social capital embedded in friendship ($b = 0.13$, $p < 0.05$) as well as parental networks ($b = 0.11$, $p < 0.01$) shows a significant association. The magnitude of the association is comparable to other established factors associated with ambitious choices, such as academic background ($b = 0.09$, $p < 0.01$).

Regarding the decision to enter the academic track (table 3.6), only social capital embedded in parental networks shows a significant association ($b = 0.10$, $p > 0.10$). Moreover, this association is only marginally significant, but in a similar magnitude as students' ($b = 0.1$, $p > 0.001$) and parents' ($b = 0.1$, $p > 0.01$) aspirations to obtain a degree from upper secondary school.²⁹ Nevertheless, taken together, these results provide evidence for the third hypothesis which states that social capital is beneficial for academically ambitious educational decisions.

In the next step, we investigate how social capital is related to educational decisions for individuals with and without an academic family background. To this end, we split the sample by academic background. For both educational decisions (tables 3.6 and 3.7), the results suggest that social capital is particularly beneficial for students from households without a university degree, providing evidence for our fourth hypothesis.

²⁹ Academic family background does not remain significant after controlling for school grades and educational aspirations in this model.

Model 2a in table 3.6 shows that social capital embedded in parental networks of families without university degree increases the chances of entering the academic track by 15% ($b = 0.15$, $p < 0.05$), making social capital comparable to an improvement of one school grade ($b = 0.12$, $p < 0.001$). Table 3.7 shows a similar picture. For non-academic families (Model 2b), social capital accessed by students ($b = 0.15$, $p < 0.1$) and their parents ($b = 0.1$, $p < 0.1$) is associated with entering university.

On the other hand, the results for social capital embedded in networks of families with tertiary education provide less evidence for either educational decision. To avoid overinterpretation of our results, we point out that social capital accessed by students from households with a university degree (table 3.7, Model 3b) is almost statistically significant at the 10%-level and may, therefore, also play a role in adolescents' educational careers ($b = 0.14$, $p > 0.1$). Nevertheless, taking all the results together, we find indicative evidence for our fourth hypothesis that social capital is beneficial for households without academically educated parents, especially when embedded in parental networks.

To summarise, our models reveal that social capital provides various benefits regarding adolescents' educational decisions. Social capital embedded in adolescents and parental networks seems to play a distinct role in students' decisions to enrol in universities. In comparison, social capital embedded in parental networks appears to be more relevant for adolescents' decision to enter upper-track schools after finishing the 10th grade on a different school track. Additionally, our results provide tentative evidence that social capital seems to be particularly useful when accessed by households without academically educated parents. For these families, social capital might substitute for a lack of resources at home.

3.5 Discussion

This chapter addressed the interplay between socioeconomic background, social networks, and educational decisions in the German school system. We analysed the networks and educational decisions of over 2,700 students with network models and regression techniques to investigate the formation of social capital and its link with academically ambitious educational choices. In general, the analyses supported our theoretical expectations and highlight the importance of social capital in the academic setting.

Our results revealed that students and parents tend to form relationships with others who share the same educational background. However, parents tend to form relationships based on socioeconomic differences more often compared to their children. This difference might be explained by better opportunities in adolescents' school life to connect with their peers (Feld,

1981). However, it might also be explained by parents' higher selectivity for relationship partners (Windzio & Bicer, 2013).

In addition, the findings indicate that social capital embedded in students' friendships and parental networks fosters academically ambitious choices. We find that parents' social capital is beneficial for both educational decisions studied, which again highlights the relevance of parents in their children's educational careers (Hoenig, 2019; Roth, 2018; Roth & Weißmann, 2022). In comparison, social capital accessed through students' friendship networks only shows a clear link with the decision to visit university. A possible explanation for this difference could be that adolescents' agency regarding their educational careers increases as students grow older, which may also increase the relevance of the networks in which they are embedded.

Moreover, at a younger age, children's friendships might be less reliable circuits for social capital than parental contacts. Even if friends come from highly educated households, it is unclear whether further conditions for accessing social capital – such as visiting these households – are fulfilled. If friendships with peers from advantaged households are restricted to the school setting, social capital might show diminished benefits for ambitious academic decisions.

The more substantial role of social capital accessed through relationships among parents may also be explained by differences in relationship choices and content at this earlier stage of the educational career. Friendships encompass many aspects, such as mutual expectations, trust, or school advice (Kitts & Leal, 2021), which may evolve during different life stages. Further research is necessary to clarify under which conditions social capital embedded in students' relationships unfolds its positive effects.

We also find tentative evidence for the notion that social capital is particularly beneficial for adolescents from less privileged households. For these families, social capital might substitute for a lack of resources, which provides them with a path toward more advanced schooling and degrees. However, considering our results together, this chapter highlights that the necessary preconditions for such a compensation mechanism are often not fulfilled: school choices, and thereby the opportunity to meet peers from a highly-educated household, are shaped by parents' socioeconomic characteristics. In addition, relationships within schools are segregated according to students' educational backgrounds. Further research should investigate which factors facilitate crossing these boundaries between and within schools to improve access to social capital for those social groups that might benefit most from it.

This chapter contributes to the existing literature in several ways. We used complete networks of multiple types of social relationships (i.e., adolescents' friendships and contacts

between parents), which enabled us to generate novel findings. The analysis of complete networks allowed us to identify patterns indicative of segregation according to socioeconomic differences above and beyond the opportunity structure. In addition, our study highlights that parents' networks are more segregated than friendship networks and reveal the central role of social capital accessed through parental networks for educational outcomes, while many network studies have focused on friendship or advice networks (Cherng et al., 2013; Crosnoe et al., 2003; Raabe et al., 2019; Roth, 2018; Roth & Weißmann, 2022; S. Smith et al., 2016).

Our study investigated group-specific outcomes of social networks and linked them to the greater discourse on social inequality (DiMaggio & Garip, 2012). Complete classroom-level networks allowed us to ensure the robustness of our results regarding potential biases stemming from self-reports and add to the previous literature by highlighting the importance of social capital for educational careers (Behtoui, 2016; Roth, 2014b, 2018; Verhaeghe et al., 2015).

Moreover, as the data used here stems from the highly stratified German school system, we provide a conservative test for the notion that social capital is beneficial, as students are already pre-sorted into different school tracks and educational careers (Buchmann & Dalton, 2002; Roth, 2017). Considering the German school system, however, it is conceivable that social capital might be more relevant after elementary school. First, parents might need to rely more on their social resources due to the variety of educational options at this decisive point in their children's educational careers. Second, providing social capital access to families without academically educated parents—e.g., by reducing the socioeconomic segregation of neighbourhoods or social networks—might be especially beneficial in improving their children's educational prospects. As the social selectivity at this stage of the German school system is particularly high (Ehmke & Siegle, 2005), fostering relationships between less and more educated parents at this early stage might increase the chances of less advantaged children attending higher school tracks due to the provision of information or knowledge of challenges and subsequent steps ahead.

We acknowledge several limitations that should be addressed in future research. First, we did not establish a causal effect of social capital. With the observational data at hand, we could not rule out unobserved latent homophily regarding relationship patterns (Shalizi & Thomas, 2011). However, we took multiple steps to address this issue by employing a longitudinal analytical setup: our measurement of social capital and the educational decisions are a couple of years apart. To account for endogenous selection, we controlled for relevant socio-demographic and other variables associated with the outcome and selection. Moreover, we employed fixed effects at the classroom level: this approach accounts for unobserved and

observed heterogeneity between classes and the selection of students into classrooms. Thus, this procedure rules out alternative explanations at the contextual level, such as class composition, teacher effects, or regional differences. While we were unable to identify a causal effect, our approach took important steps in this direction (Roth & Weißmann, 2022; Verhaeghe et al., 2015).

Second, we relied on nominations within classes. Although adolescents spend an extensive amount of time with their classroom peers, and these relationships can be considered particularly important for their educational development (Legewie & DiPrete, 2012; Zimmermann, 2018), we did not consider how social capital may have been accessed outside the school context. While adolescents have a significant share of friends from their class, omitting parental contacts outside school could lead to potential biases. Parents can access social capital in their neighbourhoods, workplace, or voluntary associations. However, as these social foci tend to be segregated according to socioeconomic status and ethnic background (McPherson, 2004), the chances of socioeconomically disadvantaged parents accessing social capital are potentially reduced – though certainly not impossible.

Moreover, we relied on adolescents' reports of their parents' contacts. Arguably, this is not ideal as adolescents might not be aware of all communication between their parents. It would be preferable to obtain parental contacts directly from parents. Although parental surveys were administered in CILS4EU, this network information was not gathered, likely due to the challenges associated with collecting complete network information. Other research projects conducting complete parental networks followed a similar approach (e.g. Bicer et al., 2014). Future projects may improve the measurement of parental networks by gathering information directly.

Third, we have not answered the question of how social capital is generated to its full extent. More specifically, we did not address the conversion between different forms of capital, especially from cultural capital to social capital (Bottero & Crossley, 2011; Lewis & Kaufman, 2018; Lizardo, 2006, 2016). As cultural capital can be considered particularly relevant in the educational system (Bourdieu & Passeron, 1990; Jæger & Breen, 2016), more research should focus on how advantages in cultural capital may translate into social network advantages in schools.

Despite these limitations, we believe that our findings provide a fertile ground for future research on the role of social capital through different sources for educational decisions and intergenerational mobility more broadly.

3.6 Appendix

Academically ambitious choices

The information on whether participants realized a positive choice stems from the datasets that cover Wave 3 to 7. To code our dependent variable, we split the sample in two. The first part encompasses participants who attended the upper-track and comprehensive schools and the second part contains students who attended the intermediate track.

In each wave, participants were asked what they were ‘currently doing’ regarding their educational and labour market situation. The options were ‘School’, ‘Apprenticeship/work-related training’, ‘Studying’, ‘Full-time job’, ‘Internship’, or ‘Something else’. If participants answered that they were currently in ‘School’, they were asked what kind of school they were attending. Due to the complexity of the German system, the survey provided a variety of schooling choices besides the *Gymnasium* as potential answers for students from the lower, intermediate track, and comprehensive schools.

We coded academically ambitious decisions for upper-track and comprehensive school students if they reported that they were ‘studying’ in at least one of the waves. For the intermediate-track and comprehensive school students, we identified participants who attended *Gymnasium* in at least one of the waves. In both cases, the reference category contains the participants who graduated and either chose a different school, the labour market, a vocational programme, or who dropped out of education. These cases were coded as those who *did not* realize an academically ambitious choice (‘0’).

In addition to the information from the individual waves, we also made use of life history calendar (LHC) assessed in Wave 6. In this module, participants reviewed their educational trajectory up until the survey date, as well as their current situation in Wave 6. As Wave 6 does not include a regular question on respondents’ current status, we had to rely on the information provided in the LHC for the educational decision that occurred between Wave 5 and Wave 6. Moreover, for some participants, the accounts of previous waves do not match the reports of the LHC concerning their educational choices. This means that in the respective year (i.e., Wave 3, Wave 4, or Wave 5), students *did not* indicate that they made a choice but *did* report an ambitious choice in the LHC. In these cases, we used the reports given in the LHC.

Since students who are in the upper-school track usually graduate after 12 or 13 years of schooling, information on their university enrolment comes from the later waves (Wave 4 to Wave 7). However, also for students in the lower-, intermediate-school track, and comprehensive schools, we relied on the information on their educational decisions from later

waves. We decided to also include choices that occurred some years after students' graduation because there are students who do not follow the usual timeframe due to school year repetition, gap years, or voluntary service. Therefore, ambitious choices are not restricted to the exact year after students' graduation. We assigned an ambitious choice to *all* students who make an upward decision after having left school, regardless of the timing of that decision. We assigned missing values to participants who provided their last information while still in the initial school. These students dropped out of the sample before making an educational choice, and we do not know which educational path they chose.

Table A3.1: Attrition analyses (DV: Who remains in the sample?)

| Model 1 | |
|---|--------------------|
| Predictors | <i>Estimates</i> |
| Intercept | 0.28 *** (0.06) |
| Social capital embedded in students' networks | -0.01 (0.03) |
| Students' outdegree (# friends) | 0.00 (0.01) |
| Social capital embedded in parents' networks | 0.03 (0.03) |
| Parents' outdegree (# contacts) | -0.00 (0.01) |
| Academic background | -0.01 (0.03) |
| Parents' occupational status (ISEI) | 0.00 (0.01) |
| Ethnic minority background (ref. native German) | -0.03 (0.04) |
| Turkey | 0.04 (0.04) |
| Former Soviet Union | 0.10 + (0.05) |
| Poland | 0.00 (0.06) |
| Former Yugoslavia | 0.04 (0.05) |
| Italy | -0.05 (0.05) |

| | |
|---|--------|
| Non-Western | 0.08 * |
| | (0.04) |
| Western | -0.02 |
| | (0.05) |
| Other | 0.00 |
| | (0.01) |
| Average grades | 0.02 |
| | (0.02) |
| Students' educational aspirations (ref.: Degree below upper secondary school or lower) | |
| Degree from upper secondary school | 0.05 |
| | (0.03) |
| University degree | 0.09 * |
| | (0.04) |
| Parents' educational aspirations (ref.: Degree below upper secondary school or lower) | |
| Degree from upper secondary school | 0.01 |
| | (0.02) |
| University degree | 0.01 |
| | (0.04) |
| R2 | 0.18 |
| Observations | 4063 |

Note: The dependent variable captures who remains in the sample as opposed to dropping out before making the investigated educational decision. Class dummies included, not shown. Results are design-weighted.

*** p < 0.001; ** p < 0.01; * p < 0.05; + p < 0.10. Standard errors in brackets.

Chapter 4

Social networks, cultural capital, and educational inequality: Investigating network mechanisms and differences in academic achievement*

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Abstract

Students with more cultural capital fare better in the educational system. However, while research shows the link between cultural capital and academic success, it largely neglects the role of friends in the school grade advantage of culturally-endowed students. Therefore, since peer processes are relevant for students' school grades and social networks can amplify social inequality, this study examines (1) whether friendship relationships differ for students with a low vs. high amount of cultural capital and (2) whether friendship networks are connected to the school grade gap between students with a different cultural capital endowment. To this end, I analyze longitudinal social networks of around 1400 adolescents in 18 German secondary schools with stochastic actor-oriented models and employ simulations. Results show that adolescents with more cultural capital tend to select higher-achieving peers as friends and that adolescents tend to influence each other's school grades. However, simulations, which help to explore alternative scenarios, suggest that peer influence can work in favour of culturally-disadvantaged students. This counterintuitive finding can be explained because culturally-advantaged adolescents select higher-achieving peers *compared to* their schoolmates, but *compared to their own grades* they have slightly lower-achieving friends and vice versa. Accordingly, simulations suggest that social networks can decrease educational inequality under the right circumstances.

4.1 Introduction

Students with more cultural capital fare better in the educational system. Since cultural capital is more predominant in socioeconomically advantaged families, cultural capital plays a central role in the reproduction of social inequality (Bourdieu, 1986; Bourdieu & Passeron, 1990; Calarco, 2011; Jæger & Breen, 2016; Lareau, 2011). However, while this research shows the relevance of an individual's cultural capital endowment for success in school, it largely neglects the role of friends and peers in students' educational careers. This aspect is highly important, since social relationships may contribute to inequalities between social groups (DiMaggio & Garip, 2012). Therefore, this chapter investigates the joint role of friendship relationships and cultural capital in educational inequality with regard to school grades.

From a social network perspective, cultural capital may relate to educational inequality, because (1) friendship relationships tend to be socially segregated (McPherson et al., 2001; S. Smith et al., 2016) and (2) friends influence each other (Brechtwald & Prinstein, 2011). Importantly, students select their friends and influence each other not only with regard to school grades (Flashman, 2012; Gremmen et al., 2017; Kretschmer et al., 2018; Kretschmer & Roth, 2020; Lorenz et al., 2020; Raabe et al., 2019; Rambaran et al., 2017; Stark et al., 2017), but research also shows that cultural dispositions and tastes shape individual's network composition (Edelmann & Vaisey, 2014; Lewis et al., 2012; Lewis & Kaufman, 2018; Lizardo, 2006; Vaisey & Lizardo, 2010).

Since cultural capital is associated with better school grades, friendship choices according to these aspects may lead to a network advantage for students with more cultural capital. Moreover, due to their 'habitus' which is geared towards the educational system (Calarco, 2011; Gaddis, 2013), it is also conceivable that adolescents with more cultural capital prefer having friends with better school grades, further increasing their network advantage. Since better school grades cluster among the already advantaged individuals, peer influence may impact the initial school grade gap and contribute to educational inequality between adolescents with a different cultural capital endowment (Calvó-Armengol et al., 2009; DiMaggio & Garip, 2012; Sacerdote, 2011). Hence, the combination of an advantaged friendship composition and friendship influence may relate to the school grade gap between adolescents with different cultural capital amounts.

Conversely, in the educational system, it is also conceivable that less advantaged students particularly benefit from social networks reducing inequality. While school grades of culturally-endowed students tend to be above average leaving little room for further improvement,

disadvantaged individuals – being at the lower end of the school grade spectrum – might benefit from their friends through social influence (Burgess & Umaña-Aponte, 2011; Sokatch, 2006; Wohn et al., 2013).

Hence, taking these considerations together, the purpose of this chapter is to investigate different friendship choices and peer influence processes of adolescents with different cultural capital endowment and their relation with school grades over time. The guiding research questions are:

- (1) Do students with more cultural capital have a network advantage concerning school grades compared to their schoolmates?
- (2) To what extent do selection and influence processes contribute to school grade differences of students with different amounts of cultural capital over time?

To this end, I, firstly, investigate complete longitudinal friendship network data from 1400 German secondary students. I employ stochastic actor-oriented models (SAOMs) to establish whether students with more cultural capital have a network advantage with regard to school grades. Secondly, I use simulations to assess whether selection and influence contribute to the school grade gap of students with a different cultural capital endowment.

This advances the field in several ways: Firstly, I combine research on cultural capital in the educational field with research on adolescents' social networks. Secondly, I provide additional evidence on the growing research of group-specific network mechanisms (e.g. Kretschmer et al., 2018; Kruse & Kroneberg, 2022; Lorenz et al., 2020). Thirdly, by employing simulations, I explore alternative scenarios, which allow me to put the empirical results into perspective leading to novel insights regarding network mechanisms and the school grade gap between adolescents with a different cultural capital endowment.

Results show that adolescents with more cultural capital select higher-achieving peers as friends compared to students with less cultural capital. However, simulations reveal that peer influence can favour adolescents with *less* cultural capital. This can be explained by the finding that adolescents with less cultural capital have worse initial school grades and tend to select friends with slightly better school grades than their own. Adolescents with more cultural capital, on the other hand, select peers as friends with slightly worse grades compared to their own grades. Hence, while adolescents with more cultural capital tend to select higher-achieving peers as friends *compared to their schoolmates*, *compared to their own grades* they have slightly lower-achieving friends. This suggests that fostering peer influence can improve the

school grades of adolescents with less cultural capital, decreasing educational inequality under the right circumstances.

4.2 Theoretical background

4.2.1 Cultural capital

Bourdieu's social reproduction theory is one of the most common theories in the explanation of educational and social inequality and its persistent reproduction over time (Bourdieu, 1984; Bourdieu & Passeron, 1990; DiMaggio, 1982; Jæger & Breen, 2016). He argues that socioeconomically advantaged families transmit their cultural knowledge (i.e. the 'dominant' culture) to their children (Lareau, 2011), which can be regarded as a form of capital—namely cultural capital (Bourdieu, 1986). Cultural capital 'emphasizes micro-interactional processes whereby individuals' strategic use of knowledge, skills, and competence comes into contact with institutional standards of evaluation. These specialized skills are transmissible across generations, are subject to monopoly, and may yield advantages or 'profits' (Lareau and Weininger, 2003: 569), see also Calarco, 2011). Following this definition, adolescents make use of their acquired cultural capital—in the form of academic competence and knowledge of the educational system—in everyday interactions to obtain better grades, which results in better school grades, educational degrees and, eventually, higher socioeconomic status (DiMaggio, 1982; Jæger, 2011; Jæger & Breen, 2016).

However, the joint connection of cultural capital and friendships with academic achievement has not been investigated yet, although research not only shows that friends and peers are relevant for educational outcomes (Flashman, 2012; Gremmen et al., 2017; Kretschmer et al., 2018) but also that cultural dispositions and tastes shape social networks (Lewis & Kaufman, 2018; Lizardo, 2006, 2016; Vaisey & Lizardo, 2010). Since cultural capital and academic achievement are correlated, it is conceivable that adolescents with different cultural capital endowments have different network compositions by selecting peers with better school grades as friends. Importantly, considering that friends potentially influence each other's grades, differences in network compositions between adolescents with less vs. more cultural capital may change the school grade gap over time. Arguments for differences in network composition and the development of school grades over time will be explored in the next two subsections.

4.2.2 Selection

Considering the school grades of friends, the more advantageous friendship composition of adolescents with more cultural capital can be explained in several ways. First and foremost, due to their better school grades, the network advantage can be explained by ‘homophily’ – that is similar individuals tend to associate with one another (McPherson et al., 2001). Homophily is a prevailing social force structuring social relationships not only with regard to ethnic background, religion, or sex (Goodreau et al., 2009; McPherson et al., 2001; S. Smith et al., 2016) but has also been shown for adolescents’ academic achievement (Flashman, 2012; Gremmen et al., 2017; Kretschmer et al., 2018).

Besides school grade homophily, research on culture and networks shows that cultural tastes and dispositions – or what Bourdieu calls ‘habitus’ – shape network composition (Edelmann & Vaisey, 2014; Lewis & Kaufman, 2018; Lizardo, 2006; Vaisey & Lizardo, 2010). While Bourdieu himself did refrain from theorizing actual social interactions between individuals and rather focused on ‘objective relations’ between social positions, it has been proposed that his theoretical account of the convergence of lifestyles of distinct social positions requires the presence of social relationships (Bottero, 2009; Bottero & Crossley, 2011). At the centre of this argument is – again – the association of individuals with similar tastes and cultural practices (i.e. ‘homophily’). Therefore, cultural dispositions, the consumption of cultural goods and the conversation about them shape social networks and the access to relevant resources in them (Edelmann & Vaisey, 2014; Lewis & Kaufman, 2018; Lizardo, 2006; Vaisey & Lizardo, 2010). Following these accounts, adolescents’ similarity in cultural capital increases their chance of forming a friendship. Hence, having already established that culturally-advantaged individuals also tend to have better school grades, an academically-favourable social network composition can come as a by-product of cultural capital homophily.

In a similar vein, an increased amount of cultural capital might come with better opportunities to select higher achievers as friends. Cultural capital is – on average – higher in socioeconomically advantaged families (Xie & Ma, 2019). Due to neighbourhood segregation, adolescents with more cultural capital tend to live closer to other socioeconomically- and culturally-advantaged peers. Since a shared neighbourhood increases the chance of friendship formation (Kruse et al., 2016; Mouw, 2006), shared foci may explain the advantaged friendship composition of these adolescents (Feld, 1981).

However, besides these arguments, it is conceivable that culturally-endowed adolescents select more advantageous friendship relationships in addition to homophily and better

opportunities. I argue that the connection between Bourdieu's theoretical framework and social network analysis can be extended beyond homophily considerations. Due to the process of cultural capital transmission, culturally-advantaged adolescents have, as Bourdieu (1986) argues, more knowledge of and familiarity with the educational system, which is, in turn, rewarded by peers and teachers (Jæger, 2009). In addition to a different knowledge of the 'rules of the game', adolescents with more cultural capital tend to have a more positive disposition (i.e. 'habitus') towards education and the educational system (Dumais, 2002; Gaddis, 2013). Against this background, I argue that these students are more inclined to select higher performers as friends above and beyond the effects of school grades and cultural homophily as well as shared foci. As friends provide a source of social capital (Crosnoe et al., 2003; Frank et al., 2008; Lorenz et al., 2021), culturally-advantaged adolescents might be willing to purposefully invest in these relationships to potentially benefit at a later point in time whereas adolescents who are less familiar with the educational system might not see the importance of this. However, even without this strategic investment in social relationships, higher-achieving peers might be more attractive to adolescents with more cultural capital. Their educational habitus, which is geared towards the educational system, increases the attractiveness of higher-achieving peers for them and makes them more likely to interact and form friendship relationships with higher-achievers. Taken together, as a combination of shared foci, homophily, and habitus, I hypothesize:

Hypothesis 1: Students with more cultural capital tend to select peers with better school grades as friends compared to students with less cultural capital.

4.2.3 Peer influence and intergroup inequality

Since, from a network perspective, the presence of social influence is required for altering the extent of intergroup inequality, I briefly outline the theoretical arguments for adolescents influencing each other's academic achievement. Theoretically, influence with regard to academic achievement can be explained by social and normative learning theories. Friends may not only set educational norms, discuss the importance of school or provide a supportive environment (Brechwald & Prinstein, 2011), but they can also exchange information, support each other by providing educational resources, or help with homework (Brechwald & Prinstein, 2011; Flashman, 2012; Frank et al., 2008). The peer environment and support (or the distraction from school-related tasks) may lead to an adaption of school grades over time. Against this theoretical background, research on social networks and education shows that friends influence

each other's academic performance (Flashman, 2012; Fortuin et al., 2016; Gremmen et al., 2017; Kretschmer et al., 2018; Rambaran et al., 2017; Stark et al., 2017).

Social network scholars are increasingly interested in how relationships relate to intergroup inequality (for an overview see DiMaggio and Garip, 2012). Social relationships have the potential to contribute to inequality via two successive steps: first selection and then influence. Research persistently shows that these social network processes tend to favour already advantaged individuals as their starting advantage helps them to select into more advantageous social networks (DiMaggio & Garip, 2011; Lin, 2001; Manzo, 2013). Due to social influence, (already small) initial group differences can be exacerbated over time (DiMaggio & Garip, 2012). As outlined the social network advantage of culturally-endowed adolescents, can be found in different opportunities, homophily, and students' habitus. Since the most often investigated driver of network advantage is 'homophily' (DiMaggio & Garip, 2011, 2012; Manzo, 2013; Zhao & Garip, 2021), I will focus on the relevance of different levels of homophily with regard to intergroup achievement inequality.

Research shows that more homophily on relevant resources or characteristics, which are correlated with these, tends to increase intergroup inequality (DiMaggio & Garip, 2011). Under conditions with more homophily, desirable resources tend to cluster in already advantaged groups, which can subsequently benefit from them due to social influence (or, conversely, disadvantaged groups do not have access to these resources and are left at a disadvantage) (DiMaggio & Garip, 2011). Since adolescents with more cultural capital tend to have better school grades, this network advantage can be the result of homophily with regard to cultural capital as well as school grades. Therefore, I hypothesize:

Hypothesis 2: More homophily with regards to cultural capital or school grade homophily increases the school grade gap between students with different amounts of cultural capital.

Besides segregated networks, the extent of peer influence also relates to intergroup inequality as, from a social network perspective, intergroup differences would not change without influence. Previous research shows that influence favours advantaged social groups: Influence explains or exacerbates intergroup inequality (DiMaggio & Garip, 2011; Garip, 2008; Manzo, 2013; Pampel et al., 2010). This research often focuses on the adoption of innovation, practices, or migration decisions, which are not widespread in the population. However, I argue that educational outcomes are different from these outcomes. Since, advantaged students already possess skills and knowledge, which help them succeed in school (Boudon, 1974; Bourdieu & Passeron, 1990), their school grades are above average, which leaves little room

for improving their grades via their social relationships. Disadvantaged students, on the other hand, may benefit from having advantaged friends, because these can increase motivation, provide pro-school norms, or help with homework (Choi et al., 2008; Forster & van de Werfhorst, 2019; Helbig & Marczuk, 2021). Accordingly, while some studies in the educational context show that group inequalities increase due to network processes (Calvó-Armengol et al., 2009; Sacerdote, 2011), the few studies which specifically investigate the difference between socially less/more advantaged groups show that peer influence favours disadvantaged groups (Burgess & Umaña-Aponte, 2011; Sokatch, 2006; Wohn et al., 2013). Hence, I argue, that peer influence can be beneficial for disadvantaged groups and improve their school grades, thus reducing the school grade gap:

Hypothesis 3: More peer influence decreases the school grade gap between students with different amounts of cultural capital.

4.3 Data, measurements, method, and analytical strategy

4.3.1 Data

The data for this chapter come from the ERC-funded project ‘Social Boundary Making in Adolescence’ (SOCIALBOND). In this project, panel network data was collected in 37 schools in the German federal state North-Rhine Westfalia between 2018 and 2021.

Due to the COVID-19 pandemic, the collection of the third wave had to be moved online, which resulted in a substantial reduction of participants. Hence, for this project, I solely relied on the first two waves, which have been collected within the school setting. The in-school survey took place in the autumn/winter of 2018 and 2019 in the early phase of the school year.

Schools were contacted several months before the first wave and assured participation for all three waves. Around three weeks before the students’ interviews, teachers, parents and students received information material and parents needed to provide a consent form. Only students with parental consent were allowed to participate in the survey. The participation rate in the first wave was around 76 per cent and in the second wave around 80 per cent. However, parental consent varied across schools (and school types). Especially in the lower-track schools (*Hauptschulen*) consent was substantially lower than in the other tracks. To ensure reliable results, I only included schools with a participation rate of at least 75 per cent in both waves (e.g. Kruse & Kroneberg, 2022). This left 19 schools. One more school had to be dropped because students did not receive school grades in the 7th grade. Students who only participated in one of the waves were excluded from the sample since they do not contribute to the estimation

process of the employed statistical method. 18 schools and 1422 students remained in the analyses.

4.3.2 Measurements

To capture adolescents' *friendship networks* on the grade level, adolescents were asked '*Who are your best friends in your school grade?*'. Students could nominate up to 10 peers from a list of peers provided during the survey.

Regarding adolescents' *cultural capital*, I relied on two indicators: *books at home* and *theatre/opera/museum attendance*. Regarding their *books at home*, adolescents were asked 'How many books do you have at home?' Answer categories were (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. I created a binary variable of these comparing those students who have fewer than (0) and those who have more than 100 books at home (1). To assess students' *opera/theatre/museum attendance*, they were asked 'Do you visit the theatre, the opera or the museum with your parents or relatives?' Answer categories were: (0) Never, (1) maximum once a year, (2) yes, several times a year, and (3) yes, several times a month. Since only a few students indicated that they go 'several times a month', I combined categories 2 and 3.

To measure students' school grades, I relied on their self-reported grades in the subjects German, English, and Math and took the average across subjects. In the German school system, the grading system ranges from 1 (very good) to 6 (failed). Due to the sparseness of the two worst school grades, I combined grades '5' and '6' into one category and reversed the scale, which then ranged from 1 (bad) to 5 (good).

To account for different meeting opportunities (i.e. social foci), I considered whether students indicated that they live in the same neighbourhood ('*Who from your grade lives within a 5-minute walk from your home?*'), whether they knew each other before going to the current school ('*Whom from your grade did you know already before going to this school?*'), and whether they attend the same classroom.

With regards to socio-demographic characteristics, I included adolescents' self-reported sex and their ethnic majority/minority status, which is based on their own as well as their parent's country of birth. To identify ethnic minority students, I relied on the 2nd generation definition and classified those students as an ethnic minority who themselves or, at least one of their parents, were not born in Germany (see also Dollmann et al., 2014).

4.3.3 Method: Stochastic actor-oriented models

To investigate the dynamic development of social networks over time, I relied on stochastic actor-oriented models (SAOM). SAOMs were estimated using the RSiena package (v. 1.2-27) in the statistical programme R (version 4.02).

SAOMs allow modelling of the co-evolution of networks and behaviour to disentangle these different network processes (Snijders et al., 2010; Steglich et al., 2010). They model the interrelated change of network and behaviour in so-called micro-steps over time, thereby teasing selection and influence mechanisms apart. Selection and influence with regard to the behaviour of interest can be separated because these network processes are modelled simultaneously. ‘Behavior’ can be understood as a broad term capturing actor characteristics (here: school grades), which can change over time. At the heart of the modelling process lies the ‘objective function’, which is specified by the researcher and includes theoretically-relevant processes, such as processes capturing network formation or actor-attribute effects explaining the network structure or behaviour (i.e. school grades). Missing values due to item or unit non-response were imputed using RSiena’s pre-defined options: Missing values are imputed for the estimation process, but do not contribute to the estimated parameters.

In addition to obtaining parameters, which explain the observed networks, the simulation algorithm for SAOMs can also be used to model alternative scenarios by manipulating parameter estimates (adams & Schaefer, 2016; Schaefer et al., 2013; Snijders & Steglich, 2015). This helps to explore the realm of alternative scenarios in complex systems and allows the researcher to bridge the micro-macro link because simulations can capture macro-phenomena that are emergent from interdependent micro-level processes. In this way, SAOMs are a form of Agent-Based Model (ABM), which are frequently used when it comes to modelling complex systems (Bruch & Atwell, 2015).

While ABMs provide a lot of flexibility to test theorized mechanisms, they, at times, tend to lack a solid empirical foundation (Snijders & Steglich, 2015). Here, SAOMs represent a worthwhile contribution. As their main purpose is to model parameters to explain observed networks, they are already empirically-calibrated. In the research process, after obtaining parameter estimates from the SAOMs, researchers can manipulate specific parameters while keeping others at the empirical value. With these manipulated parameter values, new models can be simulated, which then allows for assessing the network structure or behaviour under alternative scenarios.

4.3.4 SAOM model specification

Regarding effects explaining the structure of the network, *outdegree* and *reciprocity* are considered. While the first captures the general tendency of tie formation, the second models the reciprocation of incoming ties. With regards to the in- and outdegrees of students, I incorporated *indegree-popularity*, *outdegree-activity*, and *outdegree-popularity*. To model the tendency to befriend friends of friends, I add *3-cycles*, *geometrically weighted edgewise shared partners (GWESP)*, and also included an interaction between GWESP and reciprocity (Block, 2015).

Considering actor attributes, which may contribute to the formation of the network, I focused on students' sex, whether they have a majority/minority background, their cultural capital, and their school grades. I included the *ego*, *alter* and *same sex* and the *same majority/minority* effect. With regard to cultural capital, I also included *ego* and *alter-effects*. For books at home, I included the *same-effect* capturing whether students with more than 100 books at home have an increased chance of forming a friendship tie with each other as opposed to the students with fewer books at home (and vice versa). With regards to theatre/opera/museum attendance, I included the *similarity* effect in addition to *ego* and *alter* effects. To capture different opportunities to establish friendships, I added *same classroom*, *same neighbourhood*, and whether the students know each other already before going to the current school (*prior acquaintance*).

Regarding relational mechanisms connected to adolescents' school grades, I relied on the recently proposed model specification including quadratic terms with four effects (Snijders & Lomi, 2019): grades ego (*egoX*), grades alter (*alterX*), grades alter squared (*altSqX*) and grades ego minus alter squared (*diffSqX*). To address the first research hypothesis, I included an interaction between the *ego* effect of the respective cultural capital measure and the *alter* effect of GPA (*egoX*alterX*).

Turning to the behaviour part of the model, besides the *linear* and *quadratic* functions, which capture the basic behaviour tendencies, I included the total similarity (*totSim*) effect to model peer influence.³⁰ Additionally, I controlled for the effect of *sex*, *ethnic minority status* and *cultural capital* on academic achievement (*effFrom*).

³⁰ An alternative specification with average similarity (*avSim*) provided convergence issue for many networks (9 networks converged), but simulations with these nine networks lead to the same conclusion.

4.3.5 Analytical plan

I address my research hypotheses in two separate analytical steps. In the first step, I estimated the stochastic actor-oriented models for each school separately and combined the obtained results in a fixed-effect multivariate meta-analysis (An, 2015). All models included in the meta-analyses achieved the usual convergence criteria and goodness of fit indices (Ripley et al., 2021). Schools that did not meet the sufficient criteria or did not converge were dropped from the respective meta-analysis. For each cultural capital indicator, I specified two models: (1) a baseline model covering selection and influence, and (2) a model including the interaction between ego's cultural capital and school grades of alteri addressing H1 (*differential selection*).

In the second step, building on the obtained parameter estimates of the baseline model, I employ simulations. This procedure addresses H2 and H3 by assessing the contribution of selection and influence mechanisms on school grades of adolescents with a different cultural capital endowment. As stated above, simulations allow the investigation of outcomes that came about under alternative scenarios. In the current case, the outcome of interest are the school grades of adolescents in the second wave. I differentiated between the school grades of adolescents with different amounts of cultural capital and investigated their school grades separately. This allowed me to address whether, and for whom, network mechanisms matter concerning school grades. Simulations were conducted for all schools separately and they were based on the estimates of the meta-analysis (see Kruse et al., 2016). Results are presented for all schools combined.

Concerning the manipulated parameters, the researcher has to specify a range of reasonably realistic values to assess the contribution of different network processes. To explore different network mechanisms, I ran three sets of simulations with different parameter manipulations: (1) manipulation of *school grade homophily* while keeping other parameters at the empirical value, (2) manipulation of *cultural capital homophily* while keeping other parameters at the empirical value, (3) manipulation of *peer influence* while keeping other parameters at empirical value. (1) and (2) address H2, and (3) addresses H3.

Manipulated values help to explore the realm of alternative scenarios, which necessitates specifying a range of values. In the current case, the chosen parameter values of the simulations are guided by the estimates from the meta-analysis. Regarding the *homophily* manipulation in (1) and (2), the manipulated values were evenly spread out and ranged from twice the negative of the estimated value to three times the estimated value (e.g. -0.02 to 0.03 in steps of 0.01). This ensures that the zero was covered indicating no homophily as well as the situation that

adolescents would choose dissimilar others – a situation, which might be strategically fostered by teachers or the school administration.

Regarding the manipulation of *peer influence* (3), I followed a similar approach, without specifying negative values as most influence studies do not report negative influence (see also Schaefer et al. 2013). Here, I specified values starting from zero (indicating no peer influence) and increased the parameter in steps of 0.3 (e.g. 0 to 1.5 in steps of 0.3).

4.4 Results

4.4.1 Descriptive results

Table 4.1 reports the sample and network statistics. 49.6% of the analysis sample are girls and 52.3% of the sample have an ethnic minority background. Friendship network sizes range between 34 students to 145 students with an average of 79. In Wave 1, students nominated on average 5.95 and in wave 2, 5.61 friends. Jaccard indices, indicating the stability of the network, ranged between 0.30 and 0.56 with an average of 0.42, which are common values for friendship networks (e.g. Kretschmer et al., 2018; Lorenz et al., 2020; Rambaran et al., 2017).

Table 4.1: Summary statistics

| Analyzed sample (N schools = 18; N students = 1422) | | |
|--|------|--------|
| <i>Sample composition</i> | n | % |
| Girls | 706 | 49.64% |
| Ethnic minority students | 743 | 52.66% |
| <i>Networks statistics</i> | Mean | Sd |
| Size | 79 | 24.87 |
| Jaccard index | 0.42 | 0.06 |
| Avg. outdegree W1 | 5.95 | 2.45 |
| Avg. outdegree W2 | 5.61 | 2.49 |
| Density W1 | 0.08 | 0.03 |
| Density W2 | 0.08 | 0.02 |

The number of friendship nominations does not differ systematically according to students' cultural capital (see table 4.2). But, as expected, adolescents with more cultural capital have substantially better school grades. The discrepancy in achievement can also be seen in the social network composition of these groups. On average, friends of adolescents with more cultural

capital also have better school grades. However, when comparing school grades and friends' grades within a group, culturally-advantaged students tend to have friends with slightly worse school grades and vice versa. For example, while in wave 1 the average school grade of students with more than 100 books at home is 3.63, their friends' average grade is 3.59. Students with fewer than 100 books, on the other hand, have an average grade of 3.25 and their friends' average grade is 3.34. To further investigate the patterns of these descriptive findings, I turn to SAOMs in the next section and, eventually, to simulations.

Table 4.2: Overview of cultural capital, school grades and friends' grades

| | | Avg. nominations | | | | Avg. grades | | | | Friends avg. grades | | | |
|--|-----|------------------|------|--------|------|-------------|------|--------|------|---------------------|------|--------|------|
| | | Wave 1 | | Wave 2 | | Wave 1 | | Wave 2 | | Wave 1 | | Wave 2 | |
| | | mean | sd | mean | sd | mean | sd | mean | Sd | mean | sd | mean | Sd |
| <i>Books at home</i> | | | | | | | | | | | | | |
| Fewer than 100 books at home | 738 | 5.93 | 2.45 | 5.50 | 2.53 | 3.25 | 0.84 | 3.15 | 0.80 | 3.34 | 0.50 | 3.26 | 0.48 |
| 100+ books at home | 672 | 5.98 | 2.45 | 5.72 | 2.45 | 3.63 | 0.81 | 3.56 | 0.80 | 3.59 | 0.44 | 3.51 | 0.47 |
| <i>Opera/theatre/museum attendance</i> | | | | | | | | | | | | | |
| 1 | 447 | 5.83 | 2.51 | 5.43 | 2.57 | 3.24 | 0.86 | 3.11 | 0.80 | 3.30 | 0.50 | 3.21 | 0.48 |
| 2 | 538 | 6.12 | 2.43 | 5.68 | 2.49 | 3.45 | 0.83 | 3.40 | 0.81 | 3.49 | 0.48 | 3.39 | 0.49 |
| 3 | 435 | 5.88 | 2.41 | 5.71 | 2.40 | 3.61 | 0.81 | 3.53 | 0.82 | 3.58 | 0.45 | 3.52 | 0.46 |

4.4.2 Meta-analysis of networks

Tables 4.3 and 4.4 show the results of the stochastic actor-oriented models (SAOM) for the two cultural capital indicators. Each table contains two models: (1) baseline model and (2) *differential selection* model. The second model refers to the first hypothesis. As results tend to be largely consistent across cultural capital indicators, I describe them together only stressing differences in case of deviations.

Before I describe the effects of interest, I report the findings of the structural network mechanisms and other basic effects. As expected, general network tendencies play a role in the formation of the network, such as reciprocity or transitivity (see estimates of outdegree, reciprocity, GWESP, and activity/popularity effects in each set of models).

With regards to general meeting opportunities, I find significant effects of students going to the same school class and living in the same neighbourhood across models. Additionally, knowing a schoolmate from before going to the current school also tends to increase the chances of being friends.

Moreover, there is homophily with respect to adolescents' sex and their ethnic majority/minority status. Additionally, the negative sign of *Grades diff squared* indicates that there is homophily with regard to students' school grades. While there is little evidence for homophily with regards to adolescents' books at home (see table 4.3), a similar extent of opera/theatre/museum visits increases the chances of forming friendship relationships (see table 4.4).

Regarding the behaviour part of the model, I find that girls tend to have better grades than boys. Moreover, ethnic majority students have better school grades than minority students – albeit insignificantly. Adolescents with cultural capital also have better school grades. Finally, there is evidence that adolescents influence each other's school grades indicated by the positive *total similarity* estimates across models: Over time adolescents adjust their grades towards the grades of their friends.

Turning to the effects of interest in the second model, we see in M1a and M2a a positive interaction effect between ego's cultural capital and their friends' school grades across cultural capital measures indicating that adolescents with more cultural capital tend to select higher-achieving peers as friends compared to their schoolmates with less cultural capital. Across models, the inclusion of this interaction term reduces the statistical power of school grades homophily and the fact that students were acquainted before the current school. Moreover, *opera/theatre/museum similarity* ceases to be significant in model M2b. This indicates that at

least part of a school grade network advantage can be attributed to school grades and cultural homophily.

Figure 4.1 depicts the contribution to the selection function and illustrates the tendency of adolescents with more books at home to select higher-achieving friends. The figure allows a more nuanced interpretation than the effect sizes: Adolescents with more books at home tend to avoid selecting students from the lower end of the grade spectrum. This seems to be especially important for students with worse grades. For these students, cultural capital seems to compensate for their bad school grades. At the upper end of the grade spectrum, cultural capital seems to be less relevant.

Regardless, this provides evidence for the first research hypothesis: Culturally-advantaged adolescents tend to choose peers with better school grades as friends—especially at the lower end of the school grade spectrum. Hence, these results suggest that network mechanisms favour adolescents with more cultural capital. In the next step, I turn to simulations to investigate the relevance of network mechanisms for school grades of adolescents with a differential cultural capital endowment.

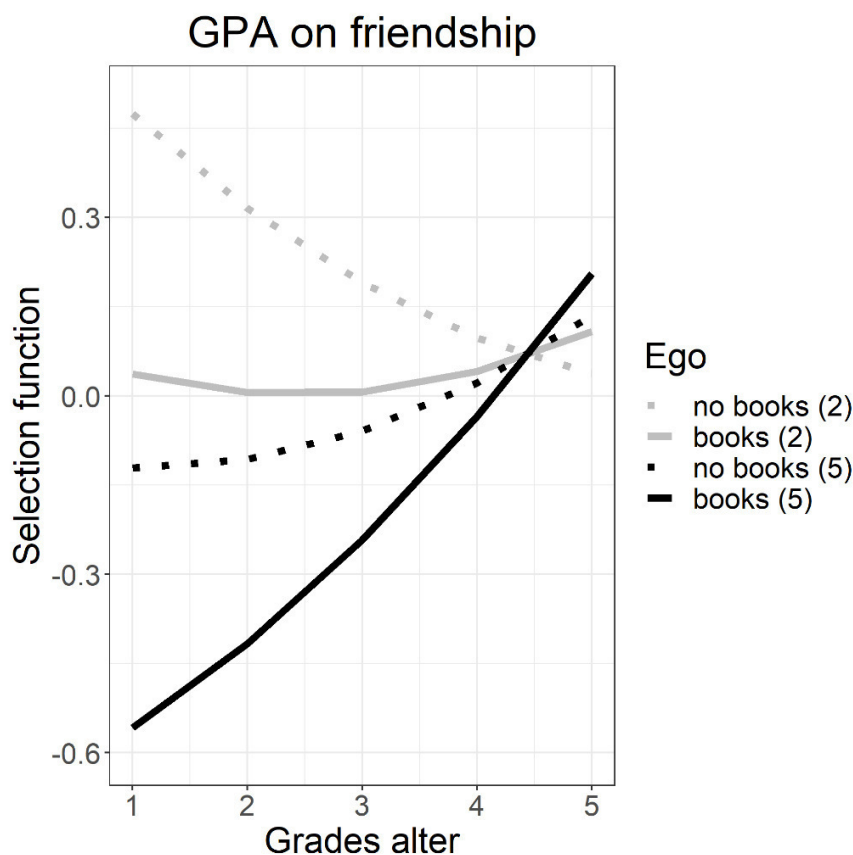


Figure 4.1: Selection effects regarding school grades of students with different amounts of books at home

Note: Plotted predictions rely on meta-analysis estimates from model M1b. Black lines refer to students with the best grade ('5'). Grey lines refer to students with a bad grade ('2').

Table 4.3: SAOMs – Friendship, books at home and GPA (fixed-effects meta analysis)

| | M1a | | | M1b | | |
|---------------------------|-------|------|------|-------|------|------|
| | theta | s.e. | Sig. | theta | s.e. | Sig. |
| <i>Selection function</i> | | | | | | |
| Rate | 11.90 | 0.24 | *** | 11.92 | 0.23 | *** |
| Density | -2.34 | 0.07 | *** | -2.39 | 0.07 | *** |
| Reciprocity | 2.47 | 0.07 | *** | 2.45 | 0.07 | *** |
| 3-cycles | 0.02 | 0.02 | | 0.01 | 0.02 | |
| GWESP | 1.56 | 0.04 | *** | 1.56 | 0.04 | *** |
| Reciprocity x GWESP | -0.79 | 0.06 | *** | -0.81 | 0.06 | *** |
| Indegree popularity | 0.04 | 0.01 | *** | 0.03 | 0.01 | *** |
| Outdegree popularity | -0.16 | 0.01 | *** | -0.15 | 0.01 | *** |
| Outdegree activity | -0.03 | 0.00 | *** | -0.03 | 0.00 | *** |
| Same school class | 0.25 | 0.03 | *** | 0.29 | 0.03 | *** |
| Prior acquaintance | 0.11 | 0.05 | * | 0.08 | 0.05 | |
| Same neighbourhood | 0.28 | 0.04 | *** | 0.31 | 0.04 | *** |
| Girl alter | 0.04 | 0.03 | | 0.03 | 0.03 | |
| Girl ego | -0.05 | 0.03 | | -0.07 | 0.03 | * |
| Same sex | 0.17 | 0.03 | *** | 0.18 | 0.03 | *** |
| Same native/minority | 0.09 | 0.03 | *** | 0.08 | 0.02 | *** |
| Books at home alter | 0.02 | 0.03 | | 0.00 | 0.03 | |
| Books at home ego | 0.01 | 0.03 | | 0.00 | 0.03 | |
| Books at home same | 0.01 | 0.02 | | 0.00 | 0.02 | |

| | | | | | | |
|----------------------------------|-------|------|-----|-------|------|-----|
| Grades alter | -0.01 | 0.02 | | -0.01 | 0.02 | |
| Grades alter squared | 0.04 | 0.03 | | 0.05 | 0.03 | + |
| Grades ego | -0.07 | 0.02 | ** | -0.05 | 0.02 | * |
| Grades diff squared | -0.03 | 0.02 | * | -0.03 | 0.02 | + |
| Books at home ego * Grades alter | | | | 0.13 | 0.05 | * |
| <i>Behaviour function</i> | | | | | | |
| Rate | 1.04 | 0.05 | *** | 1.03 | 0.05 | *** |
| Linear shape | -0.09 | 0.06 | | -0.10 | 0.06 | |
| Quadratic shape | -0.32 | 0.09 | *** | -0.28 | 0.09 | ** |
| Total similarity | 0.27 | 0.13 | * | 0.34 | 0.13 | ** |
| Effect from girl | 0.27 | 0.13 | * | 0.12 | 0.12 | |
| Effect from ethnic minority | 0.09 | 0.14 | | 0.18 | 0.13 | |
| Effect from Books at home ego | 0.29 | 0.13 | * | 0.33 | 0.13 | * |
| N(schools) | | 15 | | | 16 | |

NOTE. * p < .05; ** p < .01; *** p < .001 (two-tailed tests).

Table 4.4: SAOMs – Friendship, opera/theatre/museum attendance and GPA (fixed-effects meta analysis)

| | M2a | | | M2b | | |
|---------------------------------|-------|------|------|-------|------|------|
| | theta | s.e. | Sig. | theta | s.e. | Sig. |
| <i>Selection function</i> | | | | | | |
| Rate | 11.83 | 0.22 | *** | 12.11 | 0.23 | *** |
| Density | -2.32 | 0.07 | *** | -2.34 | 0.07 | *** |
| Reciprocity | 2.48 | 0.07 | *** | 2.51 | 0.07 | *** |
| 3-cycles | 0.03 | 0.02 | | 0.01 | 0.02 | |
| GWESP | 1.53 | 0.04 | *** | 1.56 | 0.04 | *** |
| Reciprocity x GWESP | -0.88 | 0.06 | *** | -0.88 | 0.06 | *** |
| Indegree popularity | 0.03 | 0.01 | *** | 0.03 | 0.01 | *** |
| Outdegree popularity | -0.14 | 0.01 | *** | -0.15 | 0.01 | *** |
| Outdegree activity | -0.03 | 0.00 | *** | -0.03 | 0.00 | *** |
| Same school class | 0.26 | 0.04 | *** | 0.25 | 0.04 | *** |
| Prior acquaintance | 0.11 | 0.05 | * | 0.09 | 0.05 | + |
| Same neighbourhood | 0.31 | 0.03 | *** | 0.32 | 0.03 | *** |
| Girl alter | 0.01 | 0.03 | | -0.01 | 0.03 | |
| Girl ego | -0.06 | 0.03 | + | -0.04 | 0.03 | |
| Same sex | 0.18 | 0.03 | *** | 0.17 | 0.03 | *** |
| Same native/minority | 0.10 | 0.02 | *** | 0.09 | 0.02 | *** |
| Opera/theatre/museum alter | 0.01 | 0.02 | | 0.01 | 0.02 | |
| Opera/theatre/museum ego | 0.00 | 0.02 | | -0.01 | 0.02 | |
| Opera/theatre/museum similarity | 0.06 | 0.03 | + | 0.02 | 0.04 | |

| | | | | | | |
|---|-------|------|-----|-------|------|-----|
| Grades alter | 0.02 | 0.02 | | 0.02 | 0.02 | |
| Grades alter squared | 0.01 | 0.03 | | 0.04 | 0.03 | |
| Grades ego | -0.05 | 0.02 | * | -0.08 | 0.02 | *** |
| Grades diff squared | -0.02 | 0.01 | + | -0.02 | 0.01 | |
| Opera/theatre/museum ego * Grades alter | | | | 0.10 | 0.03 | *** |
| <i>Behaviour function</i> | | | | | | |
| Rate | 0.99 | 0.05 | *** | 0.98 | 0.05 | *** |
| Linear shape | -0.15 | 0.06 | * | -0.18 | 0.06 | ** |
| Quadratic shape | -0.26 | 0.09 | ** | -0.21 | 0.09 | * |
| Total similarity | 0.29 | 0.13 | * | 0.36 | 0.13 | ** |
| Effect from girl | 0.20 | 0.12 | | 0.27 | 0.12 | * |
| Effect from ethnic majority | -0.02 | 0.13 | | 0.19 | 0.13 | |
| Effect from opera/theatre/museum | 0.14 | 0.08 | + | 0.14 | 0.08 | + |
| N(schools) | | 16 | | | 16 | |

NOTE. * p < .05; ** p < .01; *** p < .001 (two-tailed tests).

4.4.3 Simulations

Figures 4.2 to 4.4 show the simulations with regard to students' books at home and their school grades in the second wave. Simulations are based on the results of the school-specific SAOMs. Results for the other cultural capital indicator (i.e. *opera/theatre/museum attendance*) show largely similar patterns and are, therefore, not discussed here (see figures A4.1-A4.3 in the appendix). I simulated 250 networks for each alternative scenario and retrieved for each simulated network the average grades in wave 2 for each cultural capital value separately. The means from the simulations are depicted in boxplots reflecting the distribution of simulated wave 2 school grade group averages. For each manipulated value two boxplots are shown: the left boxplot is for adolescents with fewer than 100 books at home, and the right boxplot shows adolescents with 100+ books at home. The horizontal line highlights wave 2 school grades according to the empirical results. As expected, culturally-endowed adolescents have better school grades across scenarios. However, the gap between adolescents with a low vs high amount of cultural capital differs between certain scenarios.

The first two sets of simulations show the simulated results with manipulated *homophily* values (see figures 4.2 and 4.3). Across simulated scenarios, very little change happens. These simulations indicate that school grade or cultural capital homophily does not substantially change the school grade gap. These results do not support my second research hypothesis. I discuss possible explanations for this in the concluding section.

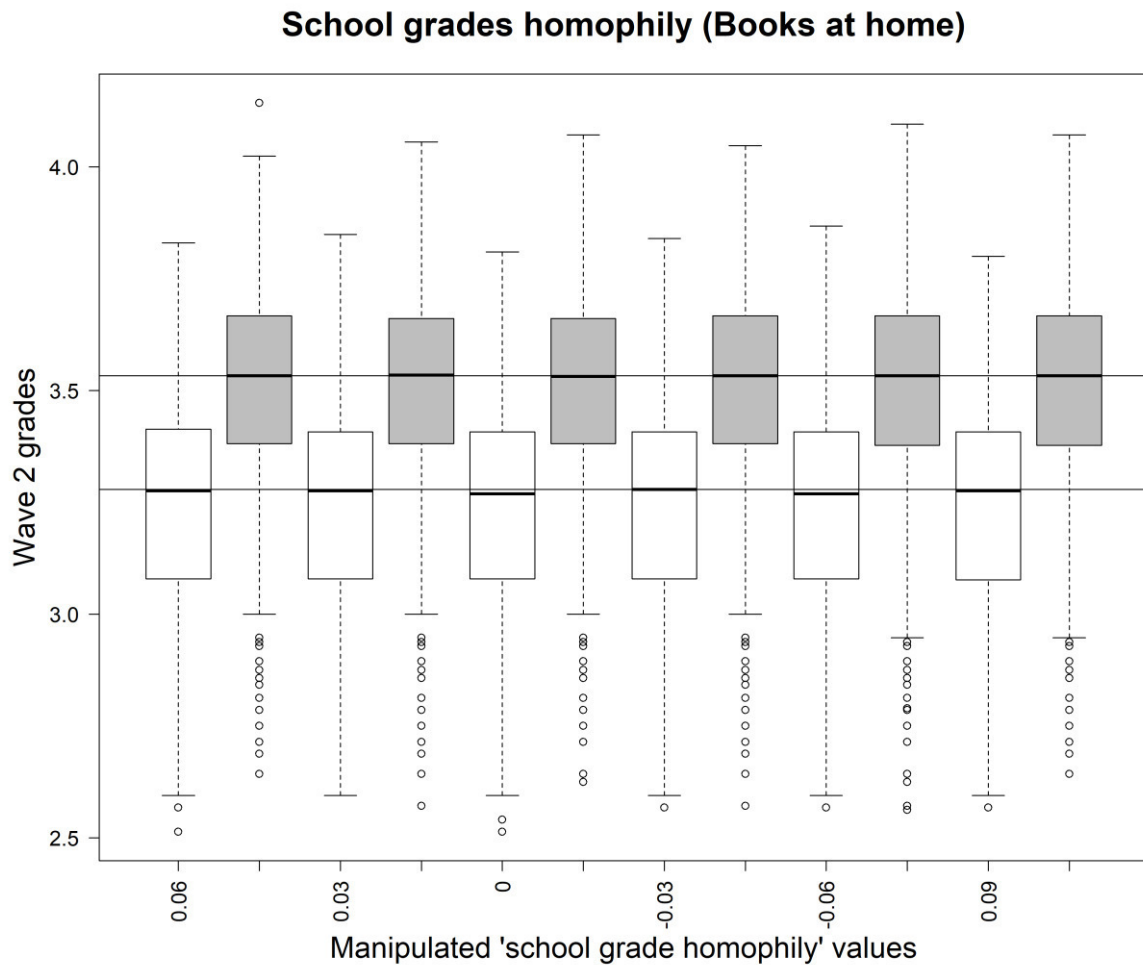


Figure 4.2: Simulations (books at home) with manipulated GPA homophily

Note: Simulations relied on the estimate from Table 4.3 M1a (books at home). The school grade homophily (*Grades diff squared*) parameter was manipulated across scenarios (see x-axis for values). 250 simulations were run for each alternative scenario. The target statistic is school grades in wave 2. For each simulation, grades for adolescents with less than 100 books at home and adolescents with 100+ books at home were extracted separately and the average was calculated. For each scenario, two boxplots (less than 100 books/100+ books at home) are shown representing the distribution of group-specific means.

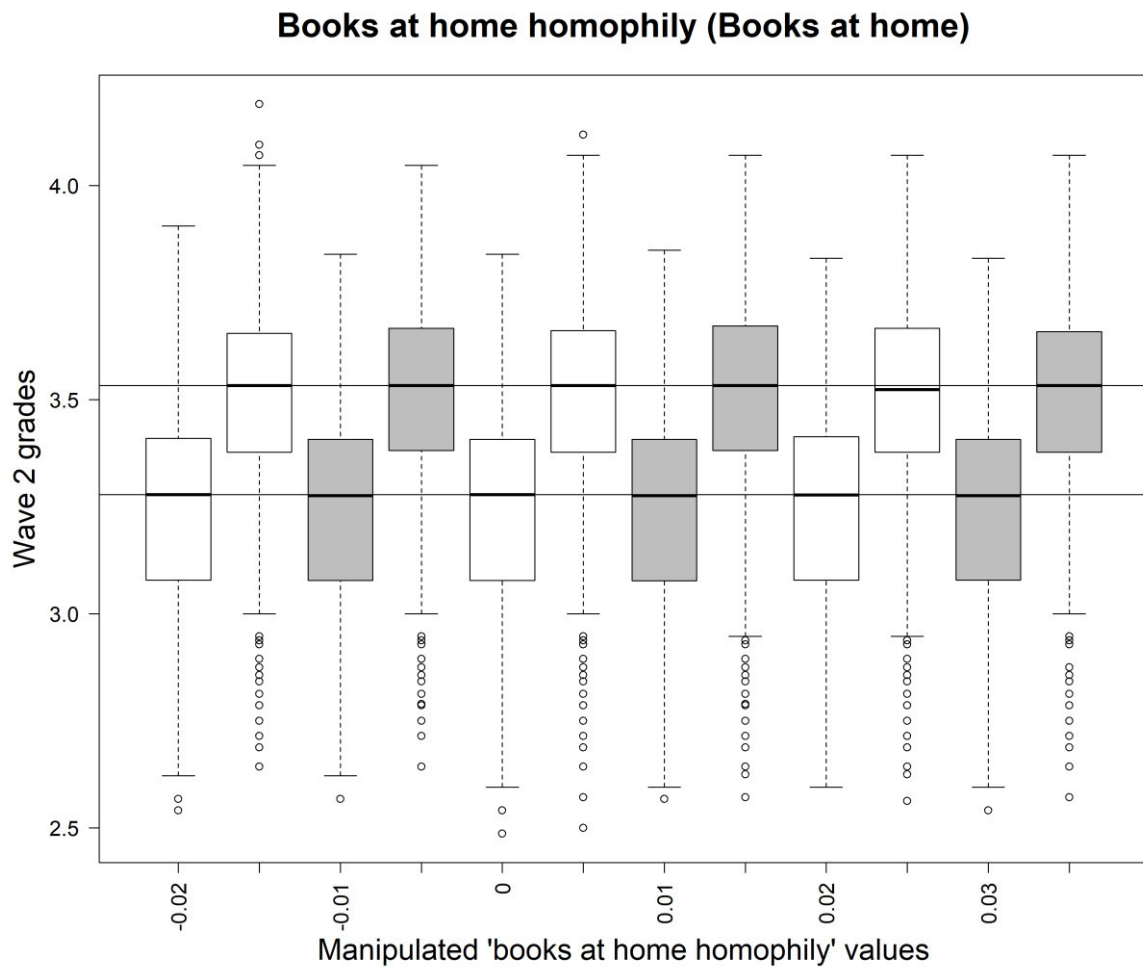


Figure 4.3: Simulations (books at home) with manipulated ‘books at home’-homophily values

Note: Simulations relied on the estimate from Table 4.3 M1a (books at home). The books homophily (*books at home same*) parameter was manipulated across scenarios (see x-axis for values). 250 simulations were run for each alternative scenario. The target statistic is school grades in wave 2. For each simulation, grades for adolescents with less than 100 books at home and adolescents with 100+ books at home were extracted separately and the average was calculated. For each scenario, two boxplots (less than 100 books/100+ books at home) are shown representing the distribution of group-specific means.

The third set deals with manipulated *peer influence* values. Figure 4.4 shows that *peer influence* favours adolescents with a low amount of cultural capital. In cases where no peer influence would have been present, they would have *worse* grades compared to the empirical scenario. For adolescents with less cultural capital, the larger the peer influence estimates, the better their school grades in wave 2 become. While absolute changes are small, it is worthwhile to consider the gap between the two groups: Compared to the first scenario (i.e. no influence scenario), the

grade gap is decreased by roughly 15 per cent in the second scenario (i.e. empirical influence value), and by around 19 per cent in the third scenario (i.e. twice the empirical influence). This gap reduction is driven by improved school grades for culturally-disadvantaged students.³¹

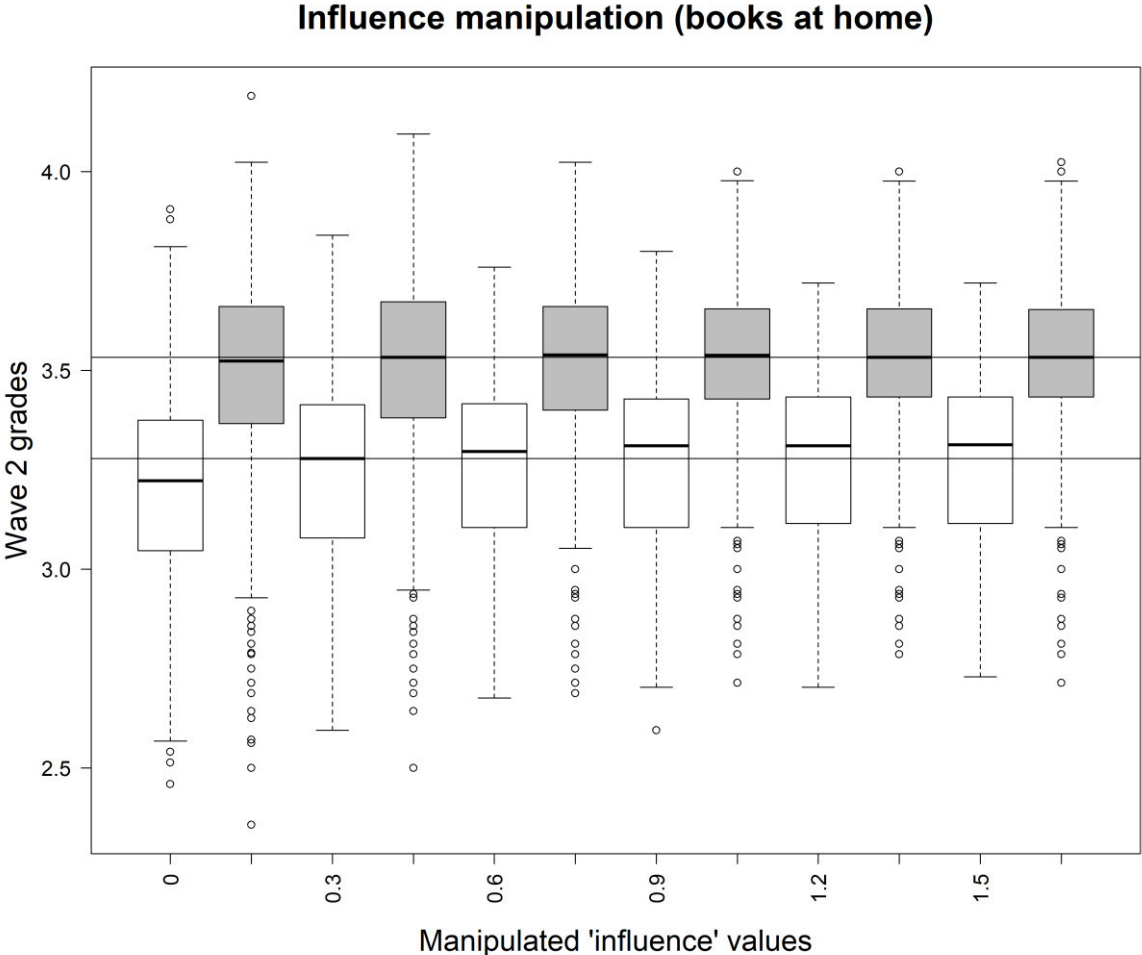


Figure 4.4: Simulations (books at home) with manipulated influence values
 Note: Simulations relied on the estimate from Table 4.3 M1a (books at home). The peer influence (*totSim*) parameter was manipulated across scenarios (see x-axis for values). 250 simulations were run for each alternative scenario. The target statistic is school grades in wave 2. For each simulation, grades for adolescents with less than 100 books at home and adolescents with 100+ books at home were extracted separately and the average was calculated. For each scenario, two boxplots (less than 100 books/100+ books at home) are shown representing the distribution of group-specific means.

³¹ While figure A4.3 (in the appendix) shows that larger peer influence values are also connected to better school grades for adolescents with more cultural capital, the results are consistent with the interpretation that more peer influence would be particularly beneficial for culturally-less endowed adolescents.

Taken together, these simulations show that empirically-observed social network processes can favour culturally-disadvantaged students, although at face value the empirical results suggest an advantage for culturally-advantaged students.

These results may be explained by the fact that culturally-advantaged students tend to select higher achieving peers as friends *compared* to their schoolmates (as the SAOM results suggest),³² but *compared to their own grades* they select friends with slightly worse grades as shown in table 2 in the section on descriptive results.³³ The initially rather good grades make it complicated for students with more cultural capital to select higher-achieving friends (and vice versa). In these hypothetical scenarios, more peer influence would then decrease the school grade gap between students with different cultural capital amounts.

4.5 Discussion and Conclusion

This chapter aimed to investigate whether students with a cultural capital advantage also have a social network advantage with regard to their friends' school grades. Moreover, it sought to address whether social network mechanisms are related to the school grade gap between students with a different cultural capital endowment, potentially altering educational inequality. To this end, I used data from around 1400 adolescents in 18 German secondary schools and applied stochastic actor-oriented models (SAOM) as well as simulations.

SAOM results showed that—compared to students with less cultural capital—adolescents with more cultural capital tend to establish friendships with those who have better school grades. This seems to be especially the case for students at the lower end of the school grades spectrum. Here, cultural capital seems to compensate for bad school grades.

Concerning the school grade gap between students with different cultural capital amounts, simulations reveal that network mechanisms can favour adolescents with less cultural capital: Peer influence can decrease the school gap in certain scenarios. Thus, in light of the SAOM results, the counterintuitive finding can be explained because adolescents with more cultural capital tend to have friends with better grades *compared to their schoolmates*, but their friends have slightly worse grades *compared to their own grades*. Conversely, culturally-disadvantaged students do have worse grades, but their friends have slightly better grades than themselves. This provides them with the chance to benefit from their friends. These selection patterns may be explained by the situation that culturally-advantaged students tend to be at the top of the

³² This can also be understood as an (average) *between-student* effect.

³³ This can also be understood as an (average) *within-student* effect.

school grade distribution and have, therefore, fewer chances to select similar or higher-achieving peers as friends. While I provide theoretical arguments for the underlying mechanisms, this chapter does not investigate how different homophiles (i.e. school grades or cultural) or meeting opportunities constitute the network composition regarding friends' school grades.

However, contrary to expectations, simulations show that more school grade or cultural capital homophily would not increase the school grade gap. This may be explained in two ways. Firstly, homophily, even in the scenarios at the extreme end, may still be too small to make a substantial difference. Secondly, while students with more cultural capital have better school grades, the association between these two indicators is still too weak to increase the school grade gap. Zhao and Garip (2021) show that only in cases where relevant indicators are 'consolidated' (Blau, 1977, 1994), an increase in homophily exacerbates intergroup inequality. They also report that a mere homophily increase without consolidated parameters does not impact intergroup inequality. Future research might address this by investigating networks in which these indicators are more or less consolidated to shed light on whether and why processes differ between schools (see also Adams & Schaefer, 2016).

Taken together, the simulations suggest that social networks may reduce educational inequality under specific circumstances. However, even in the most extreme scenarios, the school grade gap between groups is still rather wide. Starting differences between adolescents with different family backgrounds are and remain more important. In addition to these network effects, it has to be remembered that adolescents' family backgrounds already play a role in the school-choice (Jheng et al., 2022; Kruse, 2019), which is of substantial importance for individuals' educational trajectories. Therefore, the findings of this chapter have to be assessed in light of the bigger picture of educational (and social) stratification.

While the study in this chapter produced novel insights, some limitations may serve as a starting point for future research. First of all, the analysis sample is biased towards schools with a higher socioeconomic status. Especially lower-track schools (*Hauptschulen*), which tend to host socioeconomically disadvantaged and ethnic minority students, are under-represented. The reason for this is two-fold: The response rate of students in these schools was substantially lower than in the other schools, leading to an exclusion from the analysis sample. In addition to that, these schools tend to be somewhat smaller and the overall amount of cultural capital is lower in these schools. This led to more issues with non-convergence in these schools. Future studies might address this issue by drawing on a sample with more lower-track schools to investigate whether the observed patterns can also be found there.

Secondly, I relied on adolescents' books at home and their theatre/opera/museum attendance to assess their cultural capital and inferred their habitus from these. Since research shows that habitus might act as a mediator between cultural capital and academic achievement, future research using a more precise measurement to fill this gap is needed (Gaddis, 2013). Moreover, although the indicator 'books at home' is a common indicator, it has come under scrutiny more recently (see, for example, Engzell, 2019; Sieben & Lechner, 2019). Using different cultural capital indicators may, therefore, prove to be a fruitful extension.

Thirdly, these results are based on simulations, it is not clear how this translates into the real world and it is unclear whether the other processes play out similarly if values were truly different.

Despite these limitations, this chapter advances social network studies in empirical and conceptual ways. It is one of the few studies which investigates network mechanisms for different groups and, to my knowledge, the first study, which investigates behaviour outcomes as a result of network processes for different social groups. This approach leads to novel insights and may provide a foundation for future studies contributing to our understanding of group-specific network processes and their outcomes.

4.6 Appendix

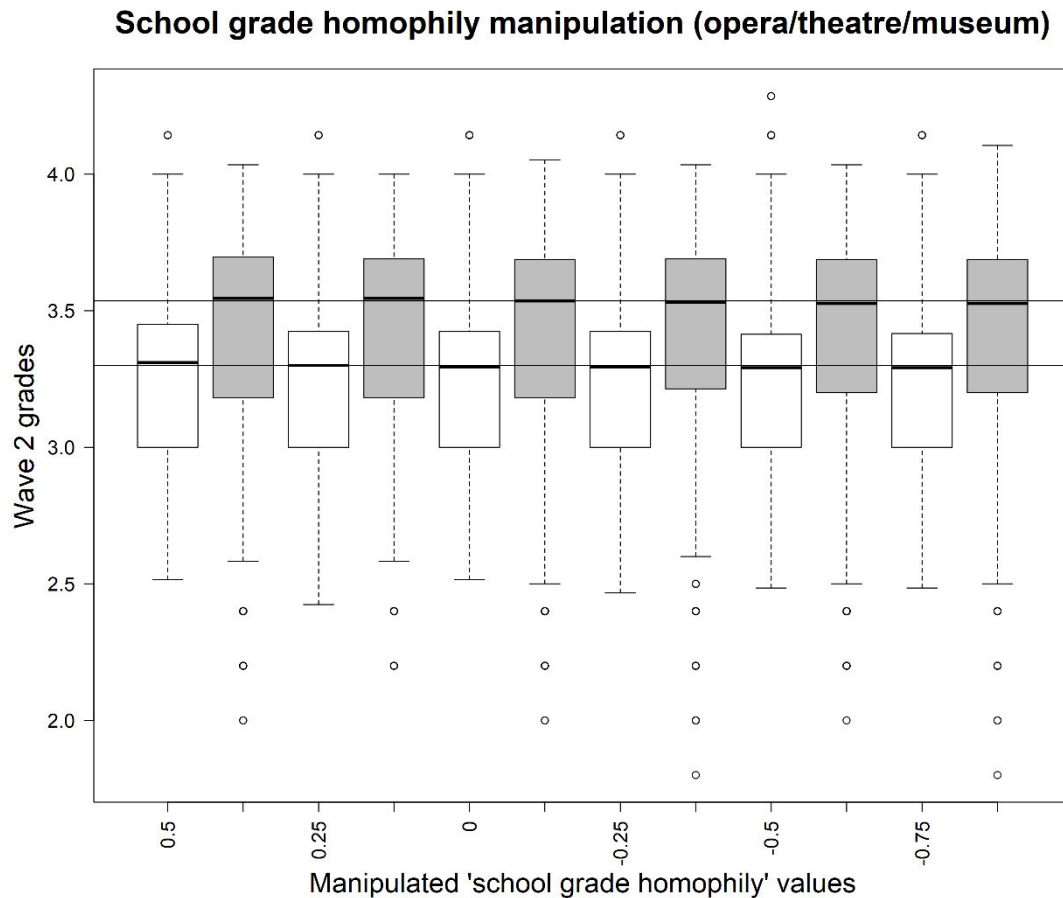


Figure A4.1: Simulations (opera/theatre/museum attendance) with manipulated GPA homophily

Note: Simulations relied on the estimate from Table 4.4 M2a (opera/theatre/museum attendance). The school grade homophily (*Grades diff squared*) parameter was manipulated across scenarios (see x-axis for values). 250 simulations were run for each alternative scenario. The target statistic is school grades in wave 2. For each simulation, grades for adolescents who did not visit the theatre/opera (0) and for adolescents who went at least ‘several times a year’ (2) were extracted separately and the average was calculated. For each scenario, two boxplots (no visit/several times a year) are shown representing the distribution of group-specific means.

Opera/theatre/museum homophily manipulation (opera/theatre/museum)

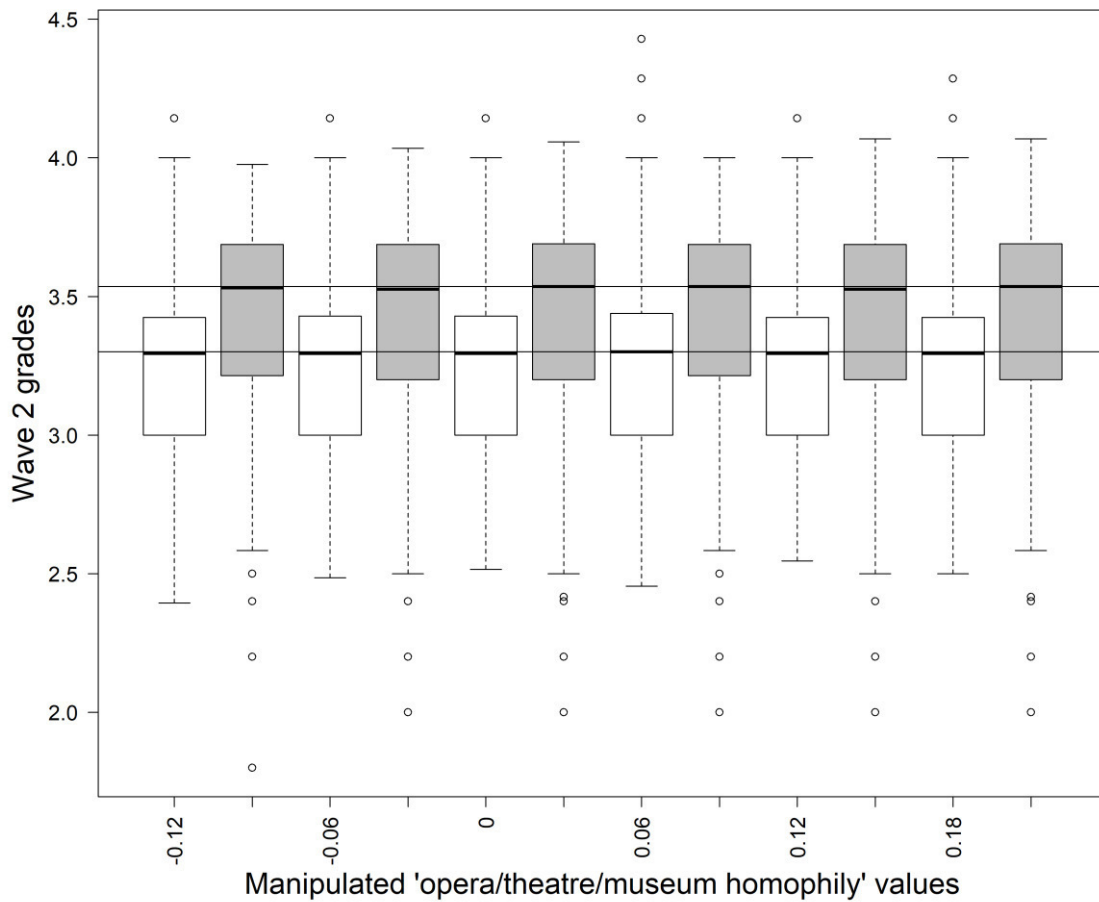


Figure A4.2: Simulations (opera/theatre/museum attendance) with manipulated ‘opera/theatre/museum attendance’-homophily values

Note: Simulations relied on the estimate from Table 4.4 M2a (opera/theatre/museum attendance). The opera/theatre/museum attendance homophily (*opera/theatre/museum attendance similarity*) parameter was manipulated across scenarios (see x-axis for values). 250 simulations were run for each alternative scenario. The target statistic is school grades in wave 2. For each simulation, grades for adolescents who did not visit the theatre/opera (0) and for adolescents who went at least ‘several times a year’ (2) were extracted separately and the average was calculated. For each scenario, two boxplots (no visit/several times a year) are shown representing the distribution of group-specific means.

Influence manipulation (opera/theatre/museum)

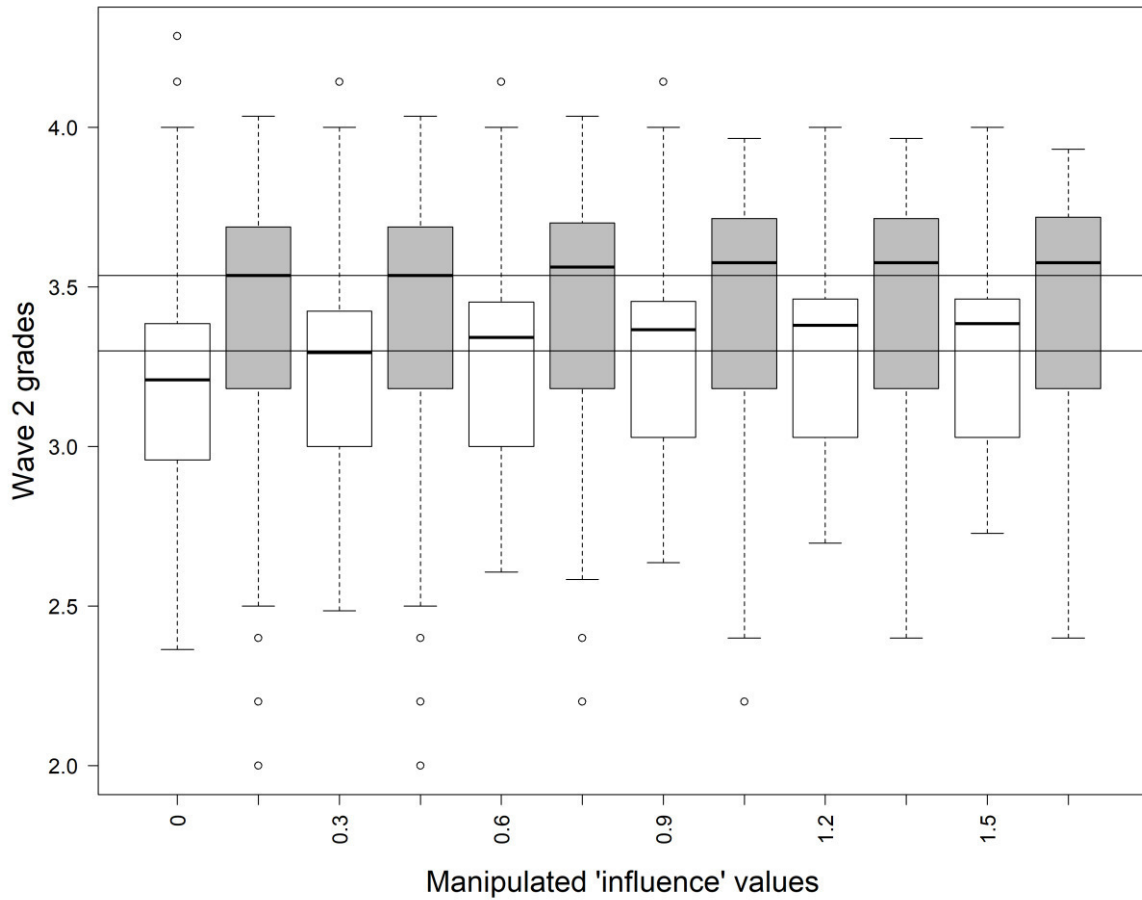


Figure A4.3: Simulations (opera/theatre/museum attendance) with manipulated influence values

Note: Simulations relied on the estimate from Table 4.4 M2a (opera/theatre/museum attendance). The peer influence (*totSim*) parameter was manipulated across scenarios (see x-axis for values). 250 simulations were run for each alternative scenario. The target statistic is school grades in wave 2. For each simulation, grades for adolescents who did not visit the theatre/opera (0) and for adolescents who went at least ‘several times a year’ (2) were extracted separately and the average was calculated. For each scenario, two boxplots (no visit/several times a year) are shown representing the distribution of group-specific means.

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