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Pioneering policies and practices tackling educational inequalities in Europe

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Content

1 An introduction to the consequences of school segregation on educational achievement and attainment

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Highlights

- School segregation refers to an uneven distribution of specific groups of students across schools, limiting their exposure to other groups.
- School segregation is a complex phenomenon caused by multiple contextual, institutional, and psycho-social factors and which operates through different mechanisms.
- Empirical research on school segregation has brought many insights, but has left some aspects underexplored.
- There is an ongoing debate about methodological issues when researching the consequences of school segregation.
- All studies collected within this deliverable provide evidence for substantial yet varying amounts of school segregation. Generally speaking, students in schools with more disadvantaged students do worse than in other schools.

Introduction

School segregation – i.e. the degree to which children and adolescents from different socioeconomic, ethnic, migration, or cultural backgrounds are unevenly distributed across different schools – is an enduring and growing area of education research. Research on school segregation poses the question of whether who they attend school with matters for students' learning outcomes. Particularly in the United States, in light of the *Brown v. Board of Education* ruling from 1954 outlawing *de jure* racial segregation in public schools, the implications of the social composition of schools have received sustained interest in social science research. The influential *Coleman Report* (Coleman *et al.* 1966) first brought into the spotlight that students from a given background achieve at different levels depending on the social composition of the school they attend. International research has studied the consequences of school segregation ever since and illuminated the topic from various angles, condensing findings from previous research and enabling a more profound understanding of how school segregation may be

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associated with educational inequality (for an overview, see: van Ewijk and Sleegers 2010, Reardon and Owens 2014, Holzberger *et al.* 2020).

Analysing the consequences of school segregation directs attention to the role of educational institutions, most prominently schools. Unlike mere student-level or country-level approaches, the focus on schools and classrooms emphasises the specific learning environments in which students develop on a daily basis. What are considered manifestations of educational inequality evolve in precisely these learning environments that mediate between students' inputs and institutional and societal opportunity structures. In light of this, the question arises whether and to what extent the social composition of these learning environments contributes to the emergence of educational inequality.

This report presents original findings from PIONEERED countries on the consequences of school segregation on educational achievement and attainment. As a collection of country-specific studies drawing on national education surveys, the present report provides novel insights into how school segregation relates to inequality in educational outcomes across different European education systems. Based on the *MILC approach* established in Work Package 2 of the PIONEERED project (PIONEERED 2021a), this report investigates intersectional inequalities across the entire school trajectory and during crucial transitions. MILC is a heuristic framework that integrates Multilevel, Intersectional, and Life-Course approaches. While the Multilevel aspect acknowledges that young learners, their parents, their teachers, and other relevant actors are embedded in a specific meso-context (e.g. a school) and macro-context (e.g. the education system), the Intersectional approach highlights the complexity of educational inequality along different axes (e.g. social origin, gender, ethnicity) as well as their intersections. The Life-Course perspective underlines the crucial importance of critical phases in the life course of the educational trajectory (e.g. transitions), and the potentially cumulative nature of educational inequality. All three aspects apply to various educational settings, both within and outside the formal education system, as well as their interactions. Against this backdrop, MILC serves as a frame of reference for both carrying out data analysis and inductively exploring aspects of educational inequality that go beyond common practices in the field of educational research.

To introduce the present report on the consequences of school segregation on educational achievement and attainment, this chapter provides an overview of the state of research. To this end, a brief overview is presented to understand the causes of school segregation. In a second step, this chapter outlines several theoretical mechanisms to illustrate through which channels school segregation relates to educational outcomes. Third, findings from some of the most common research angles on school segregation are described. This chapter concludes with an outlook on the country-specific empirical studies in the present report and outlines the policy relevance.

Research on school segregation

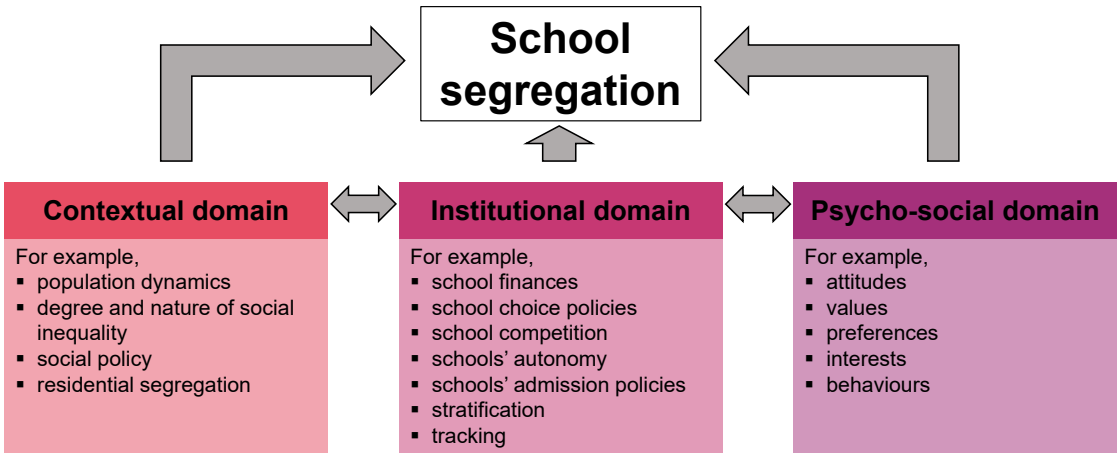
The concept of school segregation

At a general level, segregation refers to the degree to which two or more groups are separated from each other in a given area. In the school context, segregation refers to the distribution of specific groups of students across schools. Following the contextual work of Massey and Denton (1988), schools are segregated if specific groups of students are unevenly distributed across schools, such that they are overrepresented in some schools and underrepresented in others. Moreover, the uneven distribution of specific groups of students across schools limits their exposure to other groups within the school context. While early studies on school segregation – such as the aforementioned *Coleman Report* (Coleman *et al.* 1966) – focused mainly on school segregation based on students' racial or ethnic background, studies increasingly examine school segregation by socioeconomic background (e.g. Rumberger and Palardy 2005, Sciffer *et al.* 2022) or migration status (e.g. Cebolla-Boado and Garrido Medina 2011, Rjosk *et al.* 2017). While the relevant characteristics that define school segregation may vary between education systems, schools are regarded as segregated when they are predominantly composed of educationally (dis)advantaged students (Allen and Vignoles 2007, Reardon and Owens 2014, Perry *et al.* 2022).

Causes of school segregation

The factors that give rise to school segregation are manifold and may be deeply rooted in a country's history. To obtain a broad picture of the causes of school segregation, one may think of school segregation as a corollary of three separate yet inherently interrelated domains (Reardon and Owens 2014, Perry *et al.* 2022, see Figure 1).

Figure 1: *Domains of school segregation*



The first domain comprises contextual and societal factors. Since school segregation refers to an uneven distribution of students of specific groups across schools, this first domain defines along which characteristics the student population is stratified from disadvantaged to privileged. In addition to population dynamics, this includes the degree and nature of inequality based on

socioeconomic status (SES), ethnicity, migration background, gender, and disability, as well as policy efforts to reduce (or increase) these social inequalities. For instance, educational disadvantages might unfold differently in countries with predominantly low-skilled immigrants compared to countries with predominantly high-skilled immigrants (e.g. Dustmann *et al.* 2012, Borgna and Contini 2014, Teltemann and Schunck 2016). In addition, the way members of different societal groups are spatially distributed in a country has far-reaching implications for school segregation. It is plausible that the degree of residential segregation translates into school segregation, particularly when school attendance is determined by geographical catchment areas (e.g. Bygren and Szulkin 2010, Fleischmann *et al.* 2012, Böhlmark *et al.* 2016).

The second domain comprises the institutional features of education systems. A large body of research has investigated the effects of institutional features and educational policy on school segregation. The extent to which school segregation can unfold varies considerably depending on how education systems are organised. Many of these institutional features relate to the marketisation of the education system. Among other things, this includes funding, school choice policies, the degree of competition between schools, schools' autonomy, and schools' admission policies (e.g. Kristen 2008, Valenzuela *et al.* 2014, Monarrez *et al.* 2022). Furthermore, the degree of educational stratification, as well as the extent and timing of educational tracking, have been found to impact school segregation (e.g. Burger 2019, Sciffer *et al.* 2022, Strello *et al.* 2022).

Third, the psycho-social domain comprises the specific attitudes, preferences and values that explain why particular groups of students – when given a choice – may systematically favour entering one school over another. On the one hand, this relates to the social positioning of students and their parents. Since education is a prime vehicle for social mobility, students from different backgrounds invest differently in education and, thus, engage in school choice to a different extent (e.g. Kosunen *et al.* 2020, Jheng *et al.* 2022). On the other hand, research has identified behavioural biases and preferences related to students of specific backgrounds self-selecting into specific schools. Among other things, this includes vocational interests, valuation of education, and competitiveness (e.g. Burgess *et al.* 2015, Becker and Glauser 2018).

This heuristic and simplified depiction of the different causes of school segregation underlines two significant issues: the interrelatedness of various factors and, in turn, the complexity thereof. The extent of school segregation in a specific context cannot be reduced to a single cause. Instead, it is likely that several potential causes of school segregation coexist and interact. School segregation may have different origins due to the diversity of educational contexts and societal structures. Consequently, analysing and interpreting research on school segregation requires in-depth consideration of the conditions in a given context.

Mechanisms of school segregation

The research on school segregation points to several mechanisms through which a disadvantaged classroom composition adversely affects students' learning outcomes. Again, it

is likely that these mechanisms are interrelated and simultaneously affect educational outcomes.

The social interaction explanation emphasises the role of peer interactions that give rise to adverse learning outcomes in schools with a disadvantaged student body. In segregated schools, it is assumed that students influence each other's motivation and learning outcomes so that they become more alike – both positively and negatively. This is traced back to both the processes of social contagion and specific norms being set in these schools. Based on these two channels, the social interaction explanation states that students in disadvantaged schools contribute to an adverse learning climate, which negatively affects their learning outcomes (Erbring and Young 1979, Thrupp *et al.* 2002, Goldsmith 2011).

Another explanation identifies disparities in instructional quality as the mechanism that contributes to lower learning outcomes in segregated schools. This explanation states that the quality of instruction is lower in disadvantaged schools, thereby reducing learning outcomes. While teachers are assumed to adapt their instructional quality to the average level of their students (Rosenthal and Jacobson 1968, Beckerman and Good 1981, Harker and Tymms 2004), there is evidence suggesting that teachers have unjustifiably low expectations of classrooms composed of many disadvantaged students (Jussim *et al.* 1996, Agirdag *et al.* 2013).

An alternative explanation for the relationship between school segregation and students' learning outcomes concerns school resources. The school resources explanation states that various organisational and structural features of schools – such as teaching materials, classroom equipment or the qualifications of teachers and principals – may affect a school's learning environment. Lacking sufficient and adequate resources contributes to a learning environment that adversely affects students' learning outcomes (e.g. Rumberger and Palardy 2005, Cebolla-Boado and Garrido Medina 2011, Teltemann and Schunck 2016). Schools with a disadvantaged student composition often lack sufficient resources to adequately cater to their students' needs. In addition, research repeatedly suggests that schools with an underprivileged student body fail to recruit high-skilled and effective teaching personnel (e.g. Hanushek and Rivkin 2012, OECD 2018).

Previous research on the consequences of school segregation

Previous research consistently suggests that school segregation is related to adverse learning outcomes for students in disadvantaged schools. A broad range of studies across different education systems provides evidence that students' achievement levels are lower in schools and classrooms composed of many students from low-SES households. Some research suggests that this association is more pronounced among low-SES students, whereas high-SES students have more resources at hand to avoid the negative consequences of attending a school with a socioeconomically disadvantaged composition (e.g. van Ewijk and Sleegers 2010, Rjosk *et al.* 2014, Belfi *et al.* 2016, Armor *et al.* 2018). The consequences of socioeconomic school segregation are also apparent in terms of educational attainment. Several studies show that

students in socioeconomically underprivileged schools are less likely to complete secondary education successfully or enter tertiary education (e.g. Owens 2010, Palardy 2013, Gorard 2022). While most studies focus on the consequences of school segregation in secondary education, evidence on pre-primary education, primary education, and tertiary education remains scarce and mixed.

In contrast, research concerning the implications of school segregation and compositional effects by ethnic or migration background yields inconclusive results. Previous studies have found negative associations between school segregation by ethnic or migration background and educational achievement (e.g. Cebolla-Boado and Garrido Medina 2011, Rjosk *et al.* 2017). On average, students in classrooms with a high proportion of ethnic minority or migrant classmates reach lower achievement levels than those with fewer ethnic minority or migrant classmates. However, findings from other studies challenge the relevance of ethnic or migrant background composition effects. Some studies find that this negative association is reduced or even disappears when prior achievement or socioeconomic composition is accounted for (e.g. Fekjaer and Birkelund 2007, Fleischmann *et al.* 2012, Hardoy *et al.* 2018).

Overall, a broad range of research exists on school segregation and classroom composition by social origin, (ethnic) minority status, or migration background. In addition, several studies focus on school segregation by other characteristics, such as gender (e.g. Legewie and DiPrete 2012, Fabes *et al.* 2015) and disability (e.g. Szumski *et al.* 2017, Scharenberg *et al.* 2019). So far, there is limited evidence on the specific educational inequalities that emerge at the intersections of different ascriptive characteristics in segregated schools.

A diverse strand of research aims to illuminate and disentangle the mechanisms that drive the consequences of school segregation. Among other things, several studies focus on the nexus of ability sorting, achievement composition, and school segregation. While there is broad consensus that sorting students into different educational programmes according to their abilities contributes to school segregation (e.g. Burger 2019, Sciffer *et al.* 2022, Strello *et al.* 2022), several scholars stress that the resulting achievement-based segregation may undermine the consequences that are (often) attributed to the social composition of schools and classrooms (e.g. Harker and Tymms 2004, Dicke *et al.* 2018, Becker *et al.* 2022). Furthermore, as residential segregation is found to translate into school segregation, some studies try to isolate the consequences of these dimensions for students' learning outcomes. There are findings within this line of research suggesting that both school and neighbourhood composition are associated with students' learning outcomes, over and above a range of individual determinants of educational achievement (e.g. Brännström 2008, Kauppinen 2008, Goldsmith 2009, Owens 2010). Another line of research analyses factors that mediate the relationship between school or classroom composition and learning outcomes. In this regard, the literature repeatedly identifies the mediating role of perceptions held by teachers and school climate (e.g. Agirdag 2018, Granvik Saminathen *et al.* 2018, Holzberger and Schiepe-Tiska 2021, Dewulf *et al.* 2022).

A plethora of empirical research conducted over recent decades stresses the manifold – and frequently complex and ambiguous – ways in which school segregation and classroom composition are associated with students' learning outcomes. A separate body of literature also provides evidence that school segregation is related to factors other than achievement and attainment. For instance, some studies provide evidence of diverse implications of school and classroom composition on students' motivation and well-being (e.g. Hornstra *et al.* 2015, Rjosk *et al.* 2017, Van den Broeck *et al.* 2020). Moreover, the literature identifies potential links between adolescents' health (behaviours) (e.g. DuPont-Reyes and Villatoro 2019) and juvenile crime (e.g. Billings *et al.* 2014).

Methodological considerations

Despite the enduring tradition of research on the consequences of school segregation on educational outcomes, this strand of research frequently faces methodological criticism. In this respect, three points of criticism stand out: the measurement of school segregation, the statistical approach to analysing the effects of school segregation, and the inherent threat of endogeneity.

Against the background that school segregation is often the result of complex nonlinear dynamics, exactly how to properly measure the extent to which a school is segregated is a contentious issue. Several ways of measuring school segregation have been proposed in the literature (for an overview, see: Allen and Vignoles 2007, Frankel and Volij 2011). These include proportions of specific groups of students (e.g. the share of low-SES students), measures of exposure between two or more groups (e.g. entropy measures such as the M index or H index), and measures of the unevenness to which students are distributed across schools (e.g. dissimilarity index or Gorard's index). Although these measures are mostly highly correlated, they do not convey the same meaning and may even lead to different results, which obstructs the generalisability of findings. In addition, concerns have been raised about whether the implications of school segregation resemble a linear relationship or whether the effects of school segregation are driven by – potentially dynamic and context-specific – tipping points (Schelling 1971, Spaiser *et al.* 2018).

The adequate way to analyse the consequences of school segregation statistically is another ongoing controversy. The most common approach is to estimate the effects of school segregation on educational outcomes in a multilevel regression framework since this – to some degree – allows idiosyncratic differences between schools to be accounted for. In light of a potential overestimation of these effects due to ecological fallacy (i.e. that residual differences between schools are mistakenly interpreted as social processes), several scholars (e.g. Hanushek *et al.* 2009, Reardon and Raudenbush 2009, Timmermans and Thomas 2015, Marks 2017) have proposed so-called value-added models that account for students' prior learning outcomes as well. However, while these value-added models prove successful in debunking "phantom effects" (Harker and Tymms 2004, p. 181) of school segregation, the consistency of these models

is threatened by various methodological issues (e.g. measurement error, temporal variation), which may induce bias when estimating the effects of school segregation.

Fundamental concerns have been raised regarding the underlying endogeneity of the effects of school segregation on students' learning outcomes. On the one hand, it is often difficult to disentangle effects due to the self-selection of students into specific schools from effects that stem from specific features of a school (i.e. its social composition). For instance, when high-ability, high-SES students deliberately enter schools with few low-achieving, low-SES students, it remains unclear whether the educational outcomes in said school are attributable to the social composition or the specific educational prerequisites of its students. On the other hand, two major methodological problems obstruct the identification of causal effects. First, students in a given school are exposed to the same (potentially unobserved) school-level factors that can affect their learning outcomes (e.g. school climate, teachers). If these factors cannot be accounted for in statistical analyses, the estimates will likely be biased to an unknown extent. Consequently, empirical research on school segregation poses high demands on the data. Second, effects due to a school's social composition suffer from the "reflection problem" outlined by Manski (1993). Especially if processes of social interaction mainly drive the effects of school segregation, it is impossible to distinguish the effect of the school environment on a student's learning outcomes from the effect of said student on the school environment – because both are determined simultaneously.

Overall, methodological issues deriving from the measurement of school segregation, the statistical approach, and the inherent threats of endogeneity limit the extent to which the effects of school segregation can be interpreted in causal terms. Furthermore, given the likelihood and unknown direction of bias, it remains unclear whether findings on the consequences of school segregation warrant a policy response. Nonetheless, research on school segregation fulfils the essential function of identifying school contexts that deserve special attention when engineering and implementing policies and practices intended to mitigate educational inequality.

Overview of studies in this report

The present report is designed to provide an in-depth view of the consequences of school segregation on educational achievement and attainment in several European countries. Following a call for papers among consortium members of the PIONEERED project, seven empirical contributions provide novel insights into the consequences of school segregation. Based on the MILC methodology and drawing on country-specific data sets, these studies shed light on specific aspects of school segregation and how these relate to students' learning outcomes.

The first contribution, authored by *Benz, Seiler, and Erzinger* (Chapter 2), examines how socioeconomic school segregation relates to students' competence development across different educational stages in Germany. The results suggest that attending a school with many

socioeconomically disadvantaged students is associated with lower competence gains in mathematics in the early phases of primary and lower secondary education. During kindergarten and in later phases of secondary education, the extent of socioeconomic school segregation does not contribute to competence development when other factors are accounted for.

The study conducted by *Torabian, Hadjar, Ottenbacher, Kroezen, de Moll, Alieva, Pit-ten Cate, and Fischbach* (Chapter 3) investigates the persisting impact of school composition in primary education on educational outcomes in secondary education in Luxembourg. The analyses reveal that students who attended a school with a disadvantaged student composition in third grade show lower achievement scores in mathematics and reading in ninth grade. Moreover, the study finds that children attending primary schools with a higher concentration of socioeconomically disadvantaged students are less likely to be directed to the most prestigious track in secondary education.

Hermann and Kisfalusi (Chapter 4) provide novel evidence on the implications of school segregation in Hungary, drawing on linked administrative panel data. There is considerable school segregation by social status in Hungary, which relates to students' learning outcomes. Not only do students in socioeconomically disadvantaged schools perform lower in reading, but these students are also less likely to complete secondary school and obtain a secondary school leaving certificate.

In a comparative study between Germany and Switzerland, *Glauser, Busse, and Scharenberg* (Chapter 5) examine the consequences of ethnic and social segregation on attainment at the upper secondary level. In both countries, the social structure of students in lower secondary education varies considerably between educational tracks. While attainment at the upper secondary level is largely pre-empted by initial track placement, segregation contributes to attainment only to a limited extent. Instead, the study reveals that students' social background is a more relevant factor for attainment.

The analyses by *Smyth and Darmody* (Chapter 6) focus on the interplay between school and neighbourhood social mix and how this relates to upper secondary performance in Ireland. Active school choice in the Irish education system allows for disentangling the effects of schools and place of residence on educational outcomes. The results suggest that both schools and neighbourhoods matter for educational performance, with schools having a more substantial effect. The findings imply that policies and practices aiming to reduce educational inequalities should not be limited to learning processes happening in formal education.

Next, the contribution authored by *Dunajeva, Kroezen, and Skubiejūtė* (Chapter 7) studies a peculiarity of the Lithuanian education system, namely the coexistence of Lithuanian-speaking schools and separated schools for linguistic and cultural minority groups. Contrasting the learning outcomes in Lithuanian-speaking and Russian-speaking minority schools, the study reveals novel insights. Children who attend Russian-speaking schools achieve higher in math and science than their counterparts in Lithuanian-speaking schools. These differences are primarily

driven by the urbanity of many Russian-speaking schools and the beneficial resource and staff allocation in these urban environments.

The literature review by *Kleemola, Hyytinen, Tuononen, and Toom* (Chapter 8) complements the deliverable by providing an in-depth overview of the many facets of school segregation in Finland. Despite the Finnish education system being renowned for equity, research identifies various aspects that are fostering segregation.

General conclusions and considerations

Substantial overall association between school segregation and educational outcomes

All studies presented in this report provide evidence for substantial yet varying amounts of school segregation. At the same time, they show a significant overall association between school segregation and educational outcomes. Generally speaking, students in schools with more disadvantaged students do worse than in other schools. From a policy perspective, this means that schools where disadvantaged students cluster should receive special attention in terms of the distribution of resources. At the same time, there is also a large amount of variation left between schools with similarly disadvantaged compositions. This variation shows that some schools can deal better with the challenges posed by a disadvantaged composition. The first message from this finding is that practices matter: how teachers and schools teach and operate and how they treat students is relevant. While the empirical studies collected in this report do not investigate potential pioneering practices in this respect, prior research (e.g., Agirdag *et al.* 2012, Van den Broeck *et al.* 2020, Dewulf *et al.* 2022) points to promising ways teachers and school administrators can counteract the disadvantages students face in segregated schools. The second message based on this variation is that identifying schools doing well against the odds could be a promising strategy for learning more about pioneering practices. This means that we can learn from schools whose students have favourable outcomes despite their school having a disadvantaged composition.

Tight link between educational stratification and school segregation

This report takes a country-specific approach to studying the consequences of school segregation to better account for the peculiarities of national education systems. As other reports from PIONEERED (2021b, 2022) have highlighted, tracking – or the degree of stratification of the education system – is one of the key characteristics in this respect. Tracking is closely linked to school segregation: tracking is intended to stream groups of similar academic abilities into the various tracks. However, the allocation to a track is also highly dependent on a student's social background and other ascribed characteristics (Van de Werfhorst and Mijs 2010, Hadjar and Gross 2016, PIONEERED 2021b), meaning that tracks are socially segregated. This tight link between tracking and school composition is reflected in all the studies in this report focused on countries with extensive tracking. For example, the results from Germany and Switzerland explicitly highlight the distinct social composition of the tracks in both countries, while the results from Luxembourg and Hungary suggest that social composition is related to

later track placement that reinforces the segregation of these later tracks. To some extent, similar patterns have even been found for Finland with its comprehensive educational system, where institutional features such as *emphasised classes* foster both segregation and differences in learning outcomes. Finally, both the Irish – with the specially supported *DEIS* schools on the one side and the substantial number of fee-paying schools on the other side – and the Lithuanian case with special minority schools focus on the segregation between types of schooling. In all these cases, types of schooling (e.g. tracks, minority schools) coincide with both marked social compositions and differential educational outcomes.

On the one hand, this coincidence makes it difficult to assess the consequences of the social composition *per se*, as schools differ not only by social composition but also by curricula and resources. On the other hand, such institutionalised forms of segregation often foster the fact that socially disadvantaged students are grouped in schools with low educational prospects – a social issue *per se*, and one that threatens the educational and social participation of disadvantaged students and increases the risk of social divide.

Some evidence for school segregation as a driver of educational inequality

The literature reviewed in this introductory chapter and the results presented in the following chapters suggest that segregation is likely a driver of educational inequality. Students enrolled in a school with a high share of disadvantaged students tend to do worse than those attending other, more privileged schools – even when the students' socioeconomic characteristics and other relevant aspects are considered. In contexts where this is the case, disadvantaged students are confronted with even more challenges since the negative consequences of school segregation add to their existing disadvantages.

However, it remains to be shown that school composition *per se* is the cause of this association. Proving this causal relationship would require data that makes it possible to completely isolate the effect of composition from other relevant factors, such as student characteristics, teaching styles, school resources, parents' involvement, and so forth. Currently, such data is rare. Moreover, existing studies trying to isolate the effects of school composition find them to be relatively modest.

From a policy point of view, this means that school enrolment policies should be designed to limit the amount of school segregation. For example, free school choice policies in combination with selective admission criteria should be avoided, as they can create a vicious circle driving disadvantaged students out of good schools and increasing the burden on the remaining schools. At the same time, the existing evidence does not provide ground for substantive and large-scale interventions. Rather, smaller-scale, carefully designed, and randomly controlled interventions are needed to provide new insights into the consequences of school segregation and help mitigate educational inequalities.

References

Agirdag, O., 2018. The impact of school SES composition on science achievement and achievement growth: mediating role of teachers' teachability culture. *Educational Research and Evaluation*, 24 (3–5), 264–276.

Agirdag, O., Van Avermaet, P., and Van Houtte, M., 2013. School Segregation and Math Achievement: A Mixed-Method Study on the Role of Self-Fulfilling Prophecies. *Teachers College Record*, 115 (3), 1–50.

Agirdag, O., Van Houtte, M., and Van Avermaet, P., 2012. Why Does the Ethnic and Socio-economic Composition of Schools Influence Math Achievement? The Role of Sense of Futility and Futility Culture. *European Sociological Review*, 28 (3), 366–378.

Allen, R. and Vignoles, A., 2007. What should an index of school segregation measure? *Oxford Review of Education*, 33 (5), 643–668.

Armor, D.J., Marks, G.N., and Malatinszky, A., 2018. The Impact of School SES on Student Achievement: Evidence From U.S. Statewide Achievement Data. *Educational Evaluation and Policy Analysis*, 40 (4), 613–630.

Becker, M., Kocaj, A., Jansen, M., Dumont, H., and Lüdtke, O., 2022. Class-average achievement and individual achievement development: Testing achievement composition and peer spillover effects using five German longitudinal studies. *Journal of Educational Psychology*, 114 (1), 177–197.

Becker, R. and Glauser, D., 2018. Vocational Education and Training, Vocational Baccalaureate or Academic High School? An Empirical Analysis of Social Selective Transitions to Upper Secondary Education in the German-Speaking Part of Switzerland. *Swiss Journal of Sociology*, 44 (1), 9–33.

Beckerman, T.M. and Good, T.L., 1981. The Classroom Ratio of High- and Low-aptitude Students and Its Effect on Achievement. *American Educational Research Journal*, 18 (3), 317–327.

Belfi, B., Haelermans, C., and De Fraine, B., 2016. The long-term differential achievement effects of school socioeconomic composition in primary education: A propensity score matching approach. *British Journal of Educational Psychology*, 86 (4), 501–525.

Billings, S.B., Deming, D.J., and Rockoff, J., 2014. School Segregation, Educational Attainment, and Crime: Evidence from the End of Busing in Charlotte-Mecklenburg *. *The Quarterly Journal of Economics*, 129 (1), 435–476.

Böhlmark, A., Holmlund, H., and Lindahl, M., 2016. Parental choice, neighbourhood segregation or cream skimming? An analysis of school segregation after a generalized choice reform. *Journal of Population Economics*, 29 (4), 1155–1190.

Borgna, C. and Contini, D., 2014. Migrant Achievement Penalties in Western Europe: Do Educational Systems Matter? *European Sociological Review*, 30 (5), 670–683.

Brännström, L., 2008. Making Their Mark: The Effects of Neighbourhood and Upper Secondary School on Educational Achievement. *European Sociological Review*, 24 (4), 463–478.

Burger, K., 2019. The socio-spatial dimension of educational inequality: A comparative European analysis. *Studies in Educational Evaluation*, 62, 171–186.

Burgess, S., Greaves, E., Vignoles, A., and Wilson, D., 2015. What Parents Want: School Preferences and School Choice. *The Economic Journal*, 125 (587), 1262–1289.

Bygren, M. and Szulkin, R., 2010. Ethnic Environment During Childhood and the Educational Attainment of Immigrant Children in Sweden. *Social Forces*, 88 (3), 1305–1329.

Cebolla-Boado, H. and Garrido Medina, L., 2011. The Impact of Immigrant Concentration in Spanish Schools: School, Class, and Composition Effects. *European Sociological Review*, 27 (5), 606–623.

Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfeld, F.D., and York, R.L., 1966. *Equality of educational opportunity*. Washington, D.C.: U.S. Department of Health, Education, and Welfare. Office of Education.

Dewulf, L., van Braak, J., and Van Houtte, M., 2022. Examining reading comprehension in disadvantaged segregated classes. The role of class composition, teacher trust, and teaching learning strategies. *Research Papers in Education*, 37 (5), 686–706.

Dicke, T., Marsh, H.W., Parker, P.D., Pekrun, R., Guo, J., and Televantou, I., 2018. Effects of school-average achievement on individual self-concept and achievement: Unmasking phantom effects masquerading as true compositional effects. *Journal of Educational Psychology*, 110 (8), 1112–1126.

DuPont-Reyes, M.J. and Villatoro, A.P., 2019. The role of school race/ethnic composition in mental health outcomes: A systematic literature review. *Journal of Adolescence*, 74, 71–82.

Dustmann, C., Frattini, T., and Lanzara, G., 2012. Educational achievement of second-generation immigrants: an international comparison*. *Economic Policy*, 27 (69), 143–185.

Erbring, L. and Young, A.A., 1979. Individuals and Social Structure: Contextual Effects as Endogenous Feedback. *Sociological Methods & Research*, 7 (4), 396–430.

van Ewijk, R. and Sleegers, P., 2010. The effect of peer socioeconomic status on student achievement: A meta-analysis. *Educational Research Review*, 5 (2), 134–150.

Fabes, R.A., Martin, C.L., Hanish, L.D., Galligan, K., and Pahlke, E., 2015. Gender-Segregated Schooling: A Problem Disguised as a Solution. *Educational Policy*, 29 (3), 431–447.

Fekjaer, S.N. and Birkelund, G.E., 2007. Does the Ethnic Composition of Upper Secondary Schools Influence Educational Achievement and Attainment? A Multilevel Analysis of the Norwegian Case. *European Sociological Review*, 23 (3), 309–323.

Fleischmann, F., Phalet, K., Deboosere, P., and Neels, K., 2012. Comparing Concepts of Ethnicity in Ethnic Composition Measures: Local Community Contexts and the Educational Attainment of the Second Generation in Belgium. *Journal of Ethnic and Migration Studies*, 38 (10), 1513–1531.

Frankel, D.M. and Volij, O., 2011. Measuring school segregation. *Journal of Economic Theory*, 146 (1), 1–38.

Goldsmith, P.R., 2009. Schools or Neighborhoods or Both? Race and Ethnic Segregation and Educational Attainment. *Social Forces*, 87 (4), 1913–1941.

Goldsmith, P.R., 2011. Coleman Revisited: School Segregation, Peers, and Frog Ponds. *American Educational Research Journal*, 48 (3), 508–535.

Gorard, S., 2022. Segregation and the attainment gap for permanently disadvantaged pupils in England. *Educational Review*, 0 (0), 1–24.

Granvik Saminathen, M., Brolin Låftman, S., Almquist, Y.B., and Modin, B., 2018. Effective schools, school segregation, and the link with school achievement. *School Effectiveness and School Improvement*, 29 (3), 464–484.

Hanushek, E.A., Kain, J.F., and Rivkin, S.G., 2009. New Evidence about Brown v. Board of Education: The Complex Effects of School Racial Composition on Achievement. *Journal of Labor Economics*, 27 (3), 349–383.

Hanushek, E.A. and Rivkin, S.G., 2012. The Distribution of Teacher Quality and Implications for Policy. *Annual Review of Economics*, 4 (1), 131–157.

Hardoy, I., Mastekaasa, A., and Schøne, P., 2018. Immigrant concentration and student outcomes in upper secondary schools: Norwegian evidence. *European Societies*, 20 (2), 301–321.

Harker, R. and Tymms, P., 2004. The Effects of Student Composition on School Outcomes. *School Effectiveness and School Improvement*, 15 (2), 177–199.

Holzberger, D., Reinhold, S., Lüdtke, O., and Seidel, T., 2020. A meta-analysis on the relationship between school characteristics and student outcomes in science and maths – evidence from large-scale studies. *Studies in Science Education*, 56 (1), 1–34.

Holzberger, D. and Schiepe-Tiska, A., 2021. Is the school context associated with instructional quality? The effects of social composition, leadership, teacher collaboration, and school climate. *School Effectiveness and School Improvement*, 32 (3), 465–485.

Hornstra, L., van der Veen, I., Peetsma, T., and Volman, M., 2015. Does classroom composition make a difference: effects on developments in motivation, sense of classroom belonging, and achievement in upper primary school. *School Effectiveness and School Improvement*, 26 (2), 125–152.

Jheng, Y., Lin, C., Chang, J.C., and Liao, Y., 2022. Who is able to choose? A meta-analysis and systematic review of the effects of family socioeconomic status on school choice. *International Journal of Educational Research*, 112, 101943.

Jussim, L., Eccles, J., and Madon, S., 1996. Social perception, social stereotypes, and teacher expectations: Accuracy and the quest for the powerful self-fulfilling prophecy. *In*: *Advances in experimental social psychology, Vol. 28*. San Diego, CA, US: Academic Press, 281–388.

Kauppinen, T.M., 2008. Schools as Mediators of Neighbourhood Effects on Choice Between Vocational and Academic Tracks of Secondary Education in Helsinki. *European Sociological Review*, 24 (3), 379–391.

Kosunen, S., Bernelius, V., Seppänen, P., and Porkka, M., 2020. School Choice to Lower Secondary Schools and Mechanisms of Segregation in Urban Finland. *Urban Education*, 55 (10), 1461–1488.

Kristen, C., 2008. Primary School Choice and Ethnic School Segregation in German Elementary Schools. *European Sociological Review*, 24 (4), 495–510.

Legewie, J. and DiPrete, T.A., 2012. School Context and the Gender Gap in Educational Achievement. *American Sociological Review*, 77 (3), 463–485.

Manski, C.F., 1993. Identification of Endogenous Social Effects: The Reflection Problem. *The Review of Economic Studies*, 60 (3), 531–542.

Marks, G.N., 2017. Is adjusting for prior achievement sufficient for school effectiveness studies? *Educational Research and Evaluation*, 23 (5–6), 148–162.

Massey, D.S. and Denton, N.A., 1988. The Dimensions of Residential Segregation. *Social Forces*, 67 (2), 281–315.

Monarrez, T., Kisida, B., and Chingos, M., 2022. The Effect of Charter Schools on School Segregation. *American Economic Journal: Economic Policy*, 14 (1), 301–340.

OECD, 2018. *Effective Teacher Policies: Insights from PISA*. OECD.

Owens, A., 2010. Neighborhoods and Schools as Competing and Reinforcing Contexts for Educational Attainment. *Sociology of Education*, 83 (4), 287–311.

Palardy, G.J., 2013. High School Socioeconomic Segregation and Student Attainment. *American Educational Research Journal*, 50 (4), 714–754.

Perry, L.B., Rowe, E., and Lubienski, C., 2022. School segregation: theoretical insights and future directions. *Comparative Education*, 58 (1), 1–15.

PIONEERED, 2021a. *Methodological guidelines: MILC framework for measuring inequalities and their intersectionalities: Conceptual and methodological approach to answer the research questions (information to be integrated into the triangulation matrix in WP6)*. [Authored by Andrea B. Erzinger, Jessica Herzing, Joakim Jensen, Simon Seiler and Jan Skrobanek]. Bern: University of Bern.

PIONEERED, 2021b. *State of research report – definitions, conceptual approaches, empirical findings*. [Authored by Robin Benz, Andrea B. Erzinger and Simon Seiler]. Bern: University of Bern.

PIONEERED, 2022. *Working paper (scientific). Existing programme- and non-programme-related pioneering practices tackling/reducing educational inequalities from a comparative perspective*. [Authored by Solvejg Jobst, Joakim Jensen, Jan Skrobanek and Daniel Strand]. Bergen: Høgskulen på Vestlandet and Universitetet i Bergen.

Reardon, S.F. and Owens, A., 2014. 60 Years After *Brown* : Trends and Consequences of School Segregation. *Annual Review of Sociology*, 40 (1), 199–218.

Reardon, S.F. and Raudenbush, S.W., 2009. Assumptions of Value-Added Models for Estimating School Effects. *Education Finance and Policy*, 4 (4), 492–519.

Rjosk, C., Richter, D., Hochweber, J., Lüdtke, O., Klieme, E., and Stanat, P., 2014. Socioeconomic and language minority classroom composition and individual reading achievement: The mediating role of instructional quality. *Learning and Instruction*, 32, 63–72.

Rjosk, C., Richter, D., Lüdtke, O., and Eccles, J.S., 2017. Ethnic composition and heterogeneity in the classroom: Their measurement and relationship with student outcomes. *Journal of Educational Psychology*, 109 (8), 1188–1204.

Rosenthal, R. and Jacobson, L., 1968. Pygmalion in the classroom. *The Urban Review*, 3 (1), 16–20.

Rumberger, R.W. and Palardy, G.J., 2005. Does Segregation Still Matter? The Impact of Student Composition on Academic Achievement in High School. *Teachers College Record*, 107 (9), 1999–2045.

Scharenberg, K., Rollett, W., and Bos, W., 2019. Do differences in classroom composition provide unequal opportunities for academic learning and social participation of SEN students in inclusive classes in primary school? *School Effectiveness and School Improvement*, 30 (3), 309–327.

Schelling, T.C., 1971. Dynamic models of segregation. *The Journal of Mathematical Sociology*, 1 (2), 143–186.

Sciffer, M.G., Perry, L.B., and McConney, A., 2022. Does school socioeconomic composition matter more in some countries than others, and if so, why? *Comparative Education*, 58 (1), 37–51.

Spaiser, V., Hedström, P., Ranganathan, S., Jansson, K., Nordvik, M.K., and Sumpter, D.J.T., 2018. Identifying Complex Dynamics in Social Systems: A New Methodological Approach Applied to Study School Segregation. *Sociological Methods & Research*, 47 (2), 103–135.

Strello, A., Strietholt, R., and Steinmann, I., 2022. Does tracking increase segregation? International evidence on the effects of between-school tracking on social segregation across schools. *Research in Social Stratification and Mobility*, 78, 100689.

Szumski, G., Smogorzewska, J., and Karwowski, M., 2017. Academic achievement of students without special educational needs in inclusive classrooms: A meta-analysis. *Educational Research Review*, 21, 33–54.

Teltemann, J. and Schunck, R., 2016. Education systems, school segregation, and second-generation immigrants' educational success: Evidence from a country-fixed effects approach using three waves of PISA. *International Journal of Comparative Sociology*, 57 (6), 401–424.

Thrupp, M., Lauder, H., and Robinson, T., 2002. School composition and peer effects. *International Journal of Educational Research*, 37 (5), 483–504.

Timmermans, A.C. and Thomas, S.M., 2015. The impact of student composition on schools' value-added performance: a comparison of seven empirical studies. *School Effectiveness and School Improvement*, 26 (3), 487–498.

Valenzuela, J.P., Bellei, C., and Ríos, D. de los, 2014. Socioeconomic school segregation in a market-oriented educational system. The case of Chile. *Journal of Education Policy*, 29 (2), 217–241.

Van den Broeck, L., Demanet, J., and Van Houtte, M., 2020. The forgotten role of teachers in students' educational aspirations. School composition effects and the buffering capacity of teachers' expectations culture. *Teaching and Teacher Education*, 90, 103015.

2 Effects of school segregation on educational achievement along the educational trajectory in Germany

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Highlights

- The socioeconomic composition in schools varies considerably in the German education system.
- Across different phases along the educational trajectory, bivariate analyses reveal that students in socioeconomically disadvantaged schools attain lower competences in mathematics.
- The negative relationship between a school's socioeconomic composition and students' competence development is reduced or even disappears when other factors are accounted for.
- Gaps in learning outcomes can be attributed to socioeconomic school composition in the early phases of primary and secondary education – but not thereafter.
- In these phases, extensive school segregation might contribute to educational inequality unless alleviated by educational policy or practices.

Background

With whom children and adolescents go to school and how various characteristics of the student body relate to students' learning outcomes is an enduring area of research on education. Questions regarding how the socioeconomic composition in schools and classrooms affects learning were popularised by the *Coleman Report* (Coleman *et al.* 1966) and have received great interest ever since. Yet the research on the effects of socioeconomic school segregation on educational achievement remains inconclusive. Although the socioeconomic composition in schools has repeatedly been shown to affect students' academic performance (for an overview, see: van Ewijk and Sleegers 2010, Holzberger *et al.* 2020), an increasing number of scholars doubt the validity of these findings amid methodological concerns (e.g., Reardon and Raudenbush 2009, Timmermans and Thomas 2015, Marks 2017).

Despite this strand of literature's long-standing tradition and the vast amount of research conducted, the theoretical attempts to explain how the social composition within schools affects

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students' learning are still contentious non-trivial. In the literature, two mechanisms are frequently put forward: instructional quality and peer interaction. The instructional quality argument states that the overall learning conditions in socioeconomically disadvantaged schools are inferior to schools with predominantly privileged student intake. Based on their perceptions of students' abilities and learning needs, teachers adapt instruction levels to the student body's demands (Rosenthal and Jacobson 1968, Beckerman and Good 1981, Harker and Tymms 2004). However, as teachers may have unjustifiably low expectations of socioeconomically disadvantaged classrooms, this adds to an overall lower instructional quality (e.g. Jussim *et al.* 1996, van den Bergh *et al.* 2010, Agirdag *et al.* 2013). The peer interaction argument states that through norms and processes of social contagion, students influence each other's achievement and motivation – both positively and negatively – leading them to become more alike (Erbring and Young 1979, Thrupp *et al.* 2002, Goldsmith 2011). Particularly in socioeconomically disadvantaged schools, this may give rise to an adverse learning climate (Martin and Dowson 2009, Agirdag *et al.* 2012).

Over recent years, educational research employing a life-course perspective (Elder 1995, Mayer 2009, Bernardi *et al.* 2019) has emphasised the role of temporality and the accumulation of educational (dis)advantage. Related findings suggest that social inequalities in educational outcomes emerge during early childhood and may consolidate throughout students' educational careers (e.g. von Hippel *et al.* 2018, Gil-Hernández 2019, Skopek and Passaretta 2021). Against this background, the question arises as to how socioeconomic school composition relates to achievement inequality from a life-course perspective. If at all, does socioeconomic school composition affect students' learning consistently across different phases of the educational trajectory, or is socioeconomic school composition more important during specific phases?

This research question is examined using longitudinal data from Germany (NEPS Network 2020, 2021a, 2021b). The German education system is an interesting case for studying the effects of socioeconomic school composition. The German education report notes substantial socioeconomic segregation between schools (Autor:innengruppe Bildungsberichterstattung 2018, 2022). During kindergarten and primary education, socioeconomic segregation between educational institutions primarily reflects residential segregation (e.g. Parade and Heinzel 2020). Segregation tends to be reinforced in regions with free school choice policies (e.g. Kristen 2008, Makles *et al.* 2019). In secondary education, the particularly rigid and stratified tracking system[4] contributes to the emergence of distinctly socially composed learning environments, with more demanding tracks being composed of fewer socioeconomically disadvantaged students (e.g. Baumert *et al.* 2006, Lenz *et al.* 2021).

Previous research approached the relationship between socioeconomic school segregation and educational achievement in the German context differently. Most recent studies find that students perform better in schools and classrooms with higher shares of socioeconomically advantaged students (e.g. Rjosk *et al.* 2014, Dollmann and Rudolphi 2020, Seuring *et al.* 2021).

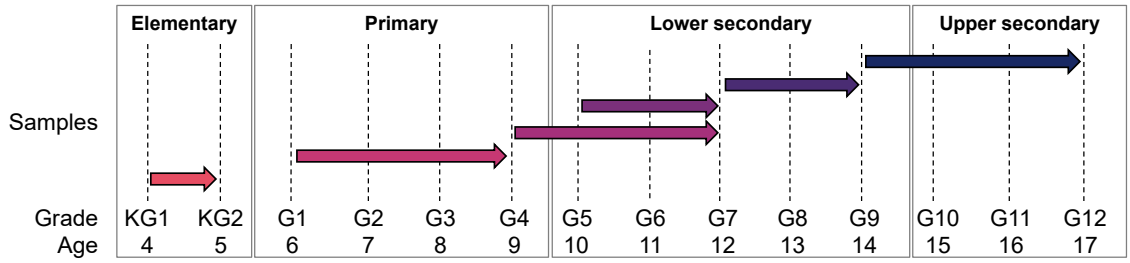
[4] See KMK (2021), Eurydice (2022), and Figure A1 in Appendix 5 for an overview of the German education system.

While most studies focus on secondary education, only limited and inconclusive evidence exists on (pre-)primary education (e.g. Kohl *et al.* 2019, Willard *et al.* 2019). Furthermore, some research suggests that average achievement in schools and classes is substantially more predictive of later educational achievement than socioeconomic composition (e.g. Scharenberg 2014, Becker *et al.* 2022). Particularly during secondary education, achievement segregation between schools seems to confound the direct effects of socioeconomic composition (e.g. Esser and Seuring 2020, Traini *et al.* 2021).

Results

The present analysis of the effects of socioeconomic school composition on educational achievement draws on longitudinal data from the German National Educational Panel Study (NEPS) (NEPS Network 2020, 2021a, 2021b). The data is split into six grade-specific subsamples that make it possible to analyse the consequences of school segregation from kindergarten to the end of upper secondary education (see Figure 1). Educational achievement is analysed for each subsample using school composition, prior achievement, student, and school characteristics measured one to three years earlier as predictors. To assess the predictors' role in educational achievement, the predictors were measured one to three years prior to educational achievement. Educational achievement is measured in terms of competence scores in mathematics, whereas the percentage of students from low-SES households serves as the measure of schools' socioeconomic composition (see "Methodological notes" at the end of the article).

***Figure 1**: Study design*



***Note**: This figure depicts the six grade-specific subsamples based on data from the NEPS. For example, the arrow in the bottom left indicates the subsample for analysing competences in mathematics in the second year of kindergarten (KG2) using the socioeconomic composition and pupil characteristics measures in the first year of kindergarten (KG1) as predictors. Students enter a track with different academic requirements, usually as of fifth grade (G5). See KMK (2021), Eurydice (2022), and Figure A1 in Appendix Chapter 5 for more information on the German education system.*

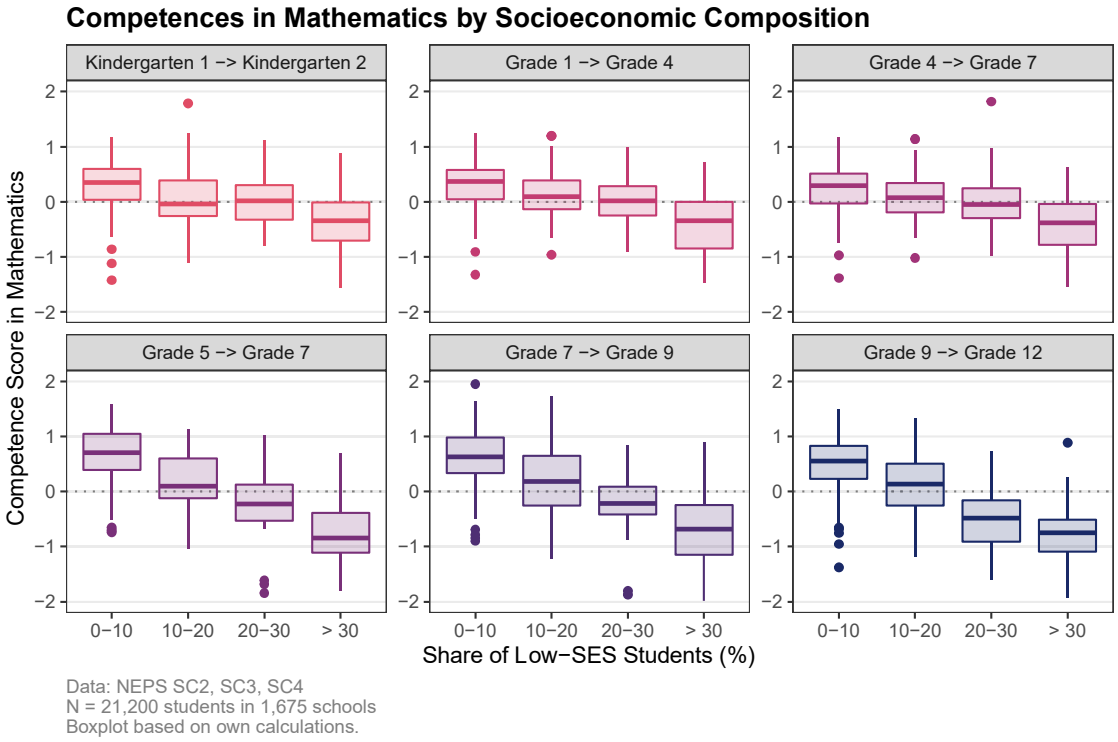
Description of school segregation and its bivariate association with educational achievement

Across different educational stages in Germany, the average share of low-SES students per school ranges from 13.0% in ninth grade to 19.8% in kindergarten. There is, however, considerable variation in schools' socioeconomic composition, both within grade levels and between regions of Germany. Across the entire sample of 21,200 observations, 43.3% attended

schools with fewer than 10% low-SES students. In contrast, one in five observations attended schools with a share of low-SES students above 30%. After primary education, which usually ends after fourth grade, sorting students into different tracks according to their academic abilities amplifies the extent of socioeconomic segregation between schools. In grade 7, for instance, the average share of low-SES students amounts to 7.8% (SD: 6.3 Pp.) in schools with the most demanding academic programme (*Gymnasium*) and to 43.2% (SD: 18.2 Pp.) in schools with the least demanding academic programme (*Hauptschule*).

On a purely descriptive level, NEPS shows lower average mathematics achievement of pupils in schools with higher shares of low-SES students. To illustrate this, Figure 2 depicts for each grade-specific sample mean competence scores in mathematics in relation to the percentage of low-SES students in schools.

***Figure 2**: Bivariate relationship between schools' mean competences in mathematics and socioeconomic composition by grade*



***Note**: This figure depicts boxplots of schools' mean competence scores in mathematics by the share of low-SES students measured one to three years prior, depending on the subsample. Each box comprises the middle 50 per cent of schools' (the interquartile range, IQR) mean competence scores by socioeconomic composition. The bold horizontal line within each box indicates the mean competence score right in the middle of the distribution. The whiskers extending from the box vertically indicate the lower and upper bounds of the distribution, with the dots expressing outliers. Competence scores are scaled so that the average competence level within each subsample has a value of zero. For example, the mean competence scores of the middle 50 per cent of kindergartens with fewer than ten per cent of children from low-SES households lie above the average of all kindergartens.*

Across all grade-specific samples considered, the boxplots depicted in Figure 2 indicate a clear negative relationship between the share of low-SES students in schools and competences in mathematics. The majority of schools with fewer than ten per cent of low-SES students show higher mean competence scores than the overall grade-specific mean. In contrast, the majority of schools with a disadvantaged socioeconomic composition (> 30%) have a below-average mean competence score. This bivariate depiction suggests a linear relationship with the two categories of schools situated between these two extremes. Notably, the gap between schools with a privileged student intake and those with a socioeconomically disadvantaged student intake is particularly pronounced in the three lower panels showing the subsamples in secondary education. While the boxplots show considerable differences between the groups of schools, they also show a substantial variation within these groups. In other words, while the mean competences in mathematics are lower in groups with higher shares of low-SES students than in those with lower shares of low-SES students, the graph also shows that there are high performing schools with high shares of low-SES students as well as low performing schools with only very few disadvantaged students.

Estimated effects of school composition using linear mixed-effects regression models

Moreover, while the bivariate results show that higher shares of low-SES students are associated with lower competence scores, this does not necessarily mean that these lower competences are consequences of school segregation. The most apparent reason why the shown relationship could be spurious is that high-SES students usually perform better (e.g. OECD 2018) and that such high-SES students are more frequent in schools with low shares of low-SES students. In other words, the above relationship could merely reflect the effect of a student's own SES on achievement. When analysing the consequences of school segregation, the starting conditions of students in schools with high shares of low-SES students should be as similar as possible to those students in schools with low percentages of low-SES students.

Given the multitude of factors simultaneously affecting students' achievement in mathematics, an approach is needed to isolate the effect of socioeconomic school composition from confounding factors. To this end, linear mixed-effects regression models (e.g. Snijders and Bosker 2012, Hox *et al.* 2017) are estimated controlling for a variety of factors – both at the student and school level – frequently identified as determinants of school achievement. These models (see Table A1 in Appendix) allow more nuanced insights into how socioeconomic school composition relates to mathematics achievement across different grade levels in the German education system.

Focusing on student characteristics, the regression models unsurprisingly indicate that across all considered grade levels, the level of achieved competences in mathematics is strongly determined by initial competences. The higher students achieve at the first point of measurement, the higher mathematical competences they attain later on. At the same time, students' sociodemographic characteristics influence mathematics competences beyond prior achievement. In line with the pertinent literature, a student's socioeconomic background plays

a vital role in their mathematics achievement. Across all grade-specific subsamples considered in this analysis and holding other predictors constant, results suggest that students from high-SES families achieve higher mathematical competence than students from low-SES families. The results further convincingly support the notion that female students perform lower in mathematics than their male counterparts. In contrast, the results do not indicate that migration status consistently adds to the effects of prior achievement along different educational stages in Germany. Additional analyses (not shown here) reveal that there are no indications of specific groups of students being affected differently by schools' socioeconomic composition. Neither do these models imply that distinct disadvantages arise at the intersections of different axes of inequality.

Moreover, achievement-related characteristics of the school that students attend independently add to the effects of individual factors. From fifth grade onwards, students in schools with a high average competence level in mathematics achieve higher competence scores later. This, however, is not the case in (pre-)primary education: schools' average achievement level is unrelated to students' later achievement in kindergarten and fourth grade, whereas schools' mathematics achievement level in first grade even dampens later competence scores in mathematics.[5] In secondary education (starting from fifth grade in Germany), students are sorted according to their abilities into educational tracks with differing cognitive demands. This strongly affects the extent to which students can increase their competences in mathematics. Even when controlling for prior achievement and the average competence level of a school, the models suggest that students in the track with the highest ability requirements, *Gymnasium*, are expected to achieve significantly higher competences compared to their peers in the less demanding tracks of *Realschule* and *Hauptschule*, and – although to a lesser extent – also other educational programmes such as comprehensive schools. In sum, there is consistent evidence of sociodemographic characteristics and achievement-related factors contributing to the development of competences in mathematics along different stages of the educational trajectory in Germany. Having identified influential individual and school-level predictors, the question remains whether schools' socioeconomic composition is related to mathematical competences beyond these effects.

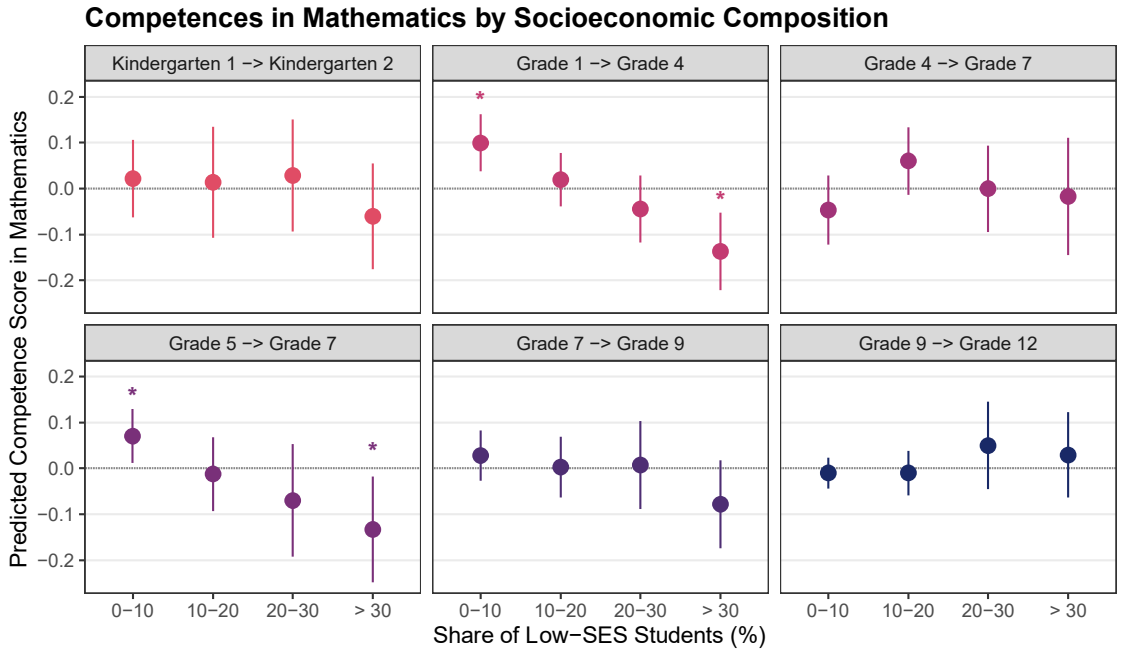
The analyses reveal distinct effects across different educational stages. While the share of low-SES students in kindergartens is unrelated to later competences in mathematics, the multivariate analyses show a significant negative effect for first graders. Conversely, schools' socioeconomic composition is no longer predictive of fourth graders' later mathematics achievement. As soon as students enter lower secondary education, in fifth grade, the

[5] A complete explanation of this variation is outside the scope of this article since the average competence level primarily acts as a control variable. From a theoretical point of view, two adverse processes stand out. The first is the peer interaction argument, which argues for a positive association between average competence level and individual achievement. By contrast, frame of reference models such as the big-fish–little-pond effect (e.g. Marsh and Parker 1984, Marsh 1987) postulate the opposite. According to this model, being in a less capable group might have a positive effect on a student's academic self-concept. Therefore, a speculative explanation for the found differences between educational stages could be that the frame of relevance is of higher importance in (pre-)primary education than in secondary education, whereas processes of peer interaction might be more important in secondary education.

statistically significant negative relationship between the share of low-SES students in schools and later mathematics achievement reappears. As secondary education progresses, in seventh and ninth grade, regression results suggest that schools' socioeconomic composition does not significantly affect students' learning trajectories in mathematics anymore. Thus, the share of low-SES students in a given school appears to induce learning differentials at the beginning of both primary and secondary education, but these differentials do not accumulate after that.

To illustrate these findings, Figure 3 depicts predicted later competences by the share of low-SES students while adjusting for all other covariates. The results are contextualised by indicating the deviations from the mean predicted competence score for each grade-specific subsample.

***Figure 3**: Adjusted predicted competences in mathematics by socioeconomic composition and grade*



Data: NEPS SC2, SC3, SC4
N = 21,200 Students in 1,675 schools
Dotted line indicates grand mean. Star indicates significant (p<0.05) difference from grand mean.
Linear predictions of mixed−effects models based on own calculations.

***Note**: The figure above presents predicted competence scores in mathematics along with 95% confidence intervals for different shares of low-SES students in schools. The presented results are based on linear mixed-effects regression models, which means they are adjusted for individual and school-level predictors. The competence scores are scaled so that the average of predicted competences within each subsample has a value of zero. Thus, the depicted values directly correspond to the values in Figure 2. For example, first-grade students in schools with fewer than ten per cent low-SES students are predicted to achieve 0.1 points above average three years later, which represents a significant difference from the mean of all first graders.*

The two panels in Figure 3 showing the effects for first and fifth graders suggest that students in schools with a disadvantaged socioeconomic composition (i.e. with 30 per cent or more low-SES students) attain significantly lower competences in mathematics. The opposite is true for students in schools with fewer than ten per cent low-SES students, who are predicted to attain

higher competences. Concerning the other four subsamples, there is no statistical relationship between a school's share of low-SES students and later competences net of all other covariates. Thus, for these subsamples, the clear negative relationship established in Figure 2 does not prove robust when other determinants of students' competence development are controlled for. In other words, the analyses provide some evidence for consequences of school segregation at the beginning of primary and secondary education. However, no evidence has been found for a widening gap between schools with low and high shares of low-SES students over the further course of these educational stages.

Conclusion

Despite ample research suggesting that schools' socioeconomic composition is related to student achievement, it remains underexplored during which phases of the educational trajectory these effects occur. The present analysis aims to shed light on this temporal dimension using longitudinal data from Germany. Focusing on competences in mathematics, the results suggest that schools' socioeconomic composition only adds to differences in students' learning outcomes at the beginning of both primary and lower secondary education. During these phases, students in socioeconomically disadvantaged schools experience reduced competence gains in mathematics compared to students in socioeconomically advantaged schools. However, results further suggest that these effects are relatively minor.

The findings underline the susceptibility to inequalities of the early phases following educational transitions – be it from kindergarten to primary school or from primary to secondary school. Students are challenged to adapt to a new learning environment during these phases. As the analyses in this study suggest, the socioeconomic composition of these learning environments may impede learning progress independently of other factors. Unless alleviated by policies or educational practices that aim to compensate for the unequal starting conditions, extensive school segregation might contribute to the emergence of educational inequalities. In the German educational setting, in particular, where the time window for counterbalancing early educational inequalities is limited and where initial track placement has the potential to consolidate these inequalities, practitioners, policymakers, and researchers alike are called upon to find ways to ensure equitable conditions for all students.

However, the present analysis cannot provide practical guidance on how the potentially inequality-inducing effects of schools' socioeconomic composition can be mitigated, as the data neither allows for a causal interpretation nor informs about long-term implications. Instead, the study provides insights into which educational phases compositional effects are likely to affect students' learning outcomes. In doing so, the present analysis helps to identify educational phases where special attention is needed when designing policies or implementing practices.

Methodological notes

This paper uses data from the National Educational Panel Study (NEPS; see Blossfeld and Roßbach 2019). The NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi, Germany) in cooperation with a nationwide network. As of 2010, the NEPS collects panel data from different age-specific starting cohorts with regular refreshment samples on educational processes and competence development. The present study draws on data from Starting Cohort 2 (NEPS Network 2020) for kindergartners, and first and fourth graders, Starting Cohort 3 (NEPS Network 2021a) for fifth and seventh graders, and Starting Cohort 4 (NEPS Network 2021b) for ninth graders.

In this study, competences in mathematics are measured by weighted maximum likelihood estimates of scores in standardised competence tests (Pohl and Carstensen 2012, Fischer *et al.* 2016). While providing an internally consistent measure of achievement, these competence scores are not interpretable in substantive terms. The socioeconomic school composition is operationalised as the percentage of students in the first quintile of the composite SES measure, an index derived from parental education, the highest parental ISEI-08 score, and the number of books at home. The models for grade 5, grade 7, and grade 9 include a variable indicating the educational track. This variable contrasts students in the higher track (*Gymnasium*), the intermediate track (*Realschule*), the lower track (*Hauptschule*), and other schools, including comprehensive schools (*Gesamtschule*). The regression models include fixed-effects for federal states to account for differences in educational and population structures.

Analyses were conducted by estimating linear mixed-effects models (e.g. Snijders and Bosker 2012, Hox *et al.* 2017) with students nested in schools. From grade 5 onwards, track-specific clusters are differentiated within schools to disentangle tracking effects from school effects. The hierarchical linear models are estimated using a value-added specification. That is, the models condition on students' prior achievement to isolate the effects of school composition (Reardon and Raudenbush 2009, Koedel *et al.* 2015, Timmermans and Thomas 2015, Marks 2017). Following the approach of Snijders and Bosker (2012) and controlling for the most relevant factors the survey weights are based on, the application of survey weights was renounced. Missing values that do not stem from panel attrition or selective participation in the competence tests are treated via a list-wise deletion approach.

While this study implements the latest methodological recommendations for the analysis of compositional effects, the presented estimates are not exempt from bias and should, therefore, be generalised only with reservations. One potential source of bias concerns the limited number of students observed in each school and the accompanying possibility of measurement error in the compositional measures. Using the school as the level of aggregation, it is further impossible to capture – potentially detrimental – compositional processes that happen within the classrooms of a school. As neither school composition nor the presumed mechanisms driving the effect of school composition on achievement are determined exogenously, (unknown) bias due to endogeneity is plausible. In addition, there is no way to account for potential bias that arises from the "reflection problem" outlined by Manski (1993).

References

Agirdag, O., Van Avermaet, P., and Van Houtte, M., 2013. School Segregation and Math Achievement: A Mixed-Method Study on the Role of Self-Fulfilling Prophecies. *Teachers College Record*, 115 (3), 1–50.

Agirdag, O., Van Houtte, M., and Van Avermaet, P., 2012. Why Does the Ethnic and Socio-economic Composition of Schools Influence Math Achievement? The Role of Sense of Futility and Futility Culture. *European Sociological Review*, 28 (3), 366–378.

Autor:innengruppe Bildungsberichterstattung, 2018. *Bildung in Deutschland 2018* [Education in Germany 2018]. DE: wbv Media.

Autor:innengruppe Bildungsberichterstattung, 2022. *Bildung in Deutschland 2022* [Education in Germany 2022]. DE: wbv Media.

Baumert, J., Stanat, P., and Watermann, R., eds., 2006. *Herkunftsbedingte Disparitäten im Bildungswesen: differenzielle Bildungsprozesse und Probleme der Verteilungsgerechtigkeit: vertiefende Analysen im Rahmen von PISA 2000* [Educational Inequalities by Social Origin: Differential Educational Processes and Problems of Distributive Justice: Analyses on PISA 2000]. 1. Aufl. Wiesbaden: VS Verlag für Sozialwissenschaften.

Becker, M., Kocaj, A., Jansen, M., Dumont, H., and Lüdtke, O., 2022. Class-average achievement and individual achievement development: Testing achievement composition and peer spillover effects using five German longitudinal studies. *Journal of Educational Psychology*, 114 (1), 177–197.

Beckerman, T.M. and Good, T.L., 1981. The Classroom Ratio of High- and Low-aptitude Students and Its Effect on Achievement. *American Educational Research Journal*, 18 (3), 317–327.

van den Bergh, L., Denessen, E., Hornstra, L., Voeten, M., and Holland, R.W., 2010. The Implicit Prejudiced Attitudes of Teachers: Relations to Teacher Expectations and the Ethnic Achievement Gap. *American Educational Research Journal*, 47 (2), 497–527.

Bernardi, L., Huinink, J., and Settersten, R.A., 2019. The life course cube: A tool for studying lives. *Advances in Life Course Research*, 41, 100258.

Blossfeld, H.-P. and Roßbach, H.-G., 2019. *Education as a Llifelong Process. The German National Educational Panel Study (NEPS). Second Edition*. Wiesbaden: Springer VS.

Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfeld, F.D., and York, R.L., 1966. *Equality of educational opportunity*. Washington, D.C.: U.S. Department of Health, Education, and Welfare. Office of Education.

Dollmann, J. and Rudolphi, F., 2020. Classroom composition and language skills: the role of school class and friend characteristics. *British Journal of Sociology of Education*, 41 (8), 1200–1217.

Elder, G.H., 1995. The life course paradigm: Social change and individual development. *In*: P. Moen, G.H. Elder, and K. Lüscher, eds. *Examining lives in context: Perspectives on the ecology of human development.* Washington: American Psychological Association, 101–139.

Erbring, L. and Young, A.A., 1979. Individuals and Social Structure: Contextual Effects as Endogenous Feedback. *Sociological Methods & Research*, 7 (4), 396–430.

Esser, H. and Seuring, J., 2020. Kognitive Homogenisierung, schulische Leistungen und soziale Bildungsungleichheit: Theoretische Modellierung und empirische Analyse der Effekte einer strikten Differenzierung nach den kognitiven Fähigkeiten auf die Leistungen in der Sekundarstufe und den Einfluss der sozialen Herkunft in den deutschen Bundesländern mit den Daten der „National Educational Panel Study“ (NEPS) [Cognitive Homogenization, Educational]. *Zeitschrift für Soziologie*, 49 (5–6), 277–301.

Eurydice, 2022. *Germany - Overview | Eurydice* [online]. Available from: https://eurydice.eacea.ec.europa.eu/national-education-systems/germany/germany-overview [Accessed 29 Sep 2022].

van Ewijk, R. and Sleegers, P., 2010. The effect of peer socioeconomic status on student achievement: A meta-analysis. *Educational Research Review*, 5 (2), 134–150.

Fischer, L., Rohm, T., Gnambs, T., and Carstensen, C.H., 2016. *Linking the Data of the Competence Tests (NEPS Survey Paper No. 1)*. Bamberg: Leibniz Institute for Educational Trajectories, National Educational Panel Study.

Gil-Hernández, C.J., 2019. Do Well-off Families Compensate for Low Cognitive Ability? Evidence on Social Inequality in Early Schooling from a Twin Study. *Sociology of Education*, 92 (2), 150–175.

Goldsmith, P.R., 2011. Coleman Revisited: School Segregation, Peers, and Frog Ponds. *American Educational Research Journal*, 48 (3), 508–535.

Harker, R. and Tymms, P., 2004. The Effects of Student Composition on School Outcomes. *School Effectiveness and School Improvement*, 15 (2), 177–199.

von Hippel, P.T., Workman, J., and Downey, D.B., 2018. Inequality in Reading and Math Skills Forms Mainly before Kindergarten: A Replication, and Partial Correction, of "Are Schools the Great Equalizer?" *Sociology of Education*, 91 (4), 323–357.

Holzberger, D., Reinhold, S., Lüdtke, O., and Seidel, T., 2020. A meta-analysis on the relationship between school characteristics and student outcomes in science and maths – evidence from large-scale studies. *Studies in Science Education*, 56 (1), 1–34.

Hox, J.J., Moerbeek, M., and Schoot, R. van de, 2017. *Multilevel analysis: techniques and applications*. Third edition. New York, NY: Routledge.

Jussim, L., Eccles, J., and Madon, S., 1996. Social perception, social stereotypes, and teacher expectations: Accuracy and the quest for the powerful self-fulfilling prophecy. *In*: *Advances in experimental social psychology, Vol. 28*. San Diego, CA, US: Academic Press, 281–388.

KMK, 2021. *The Education System in the Federal Republic of Germany 2018/2019. A description of the responsibilities, structures and developments in education policy for the exchange of information in Europe*. Secretariat of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK).

Koedel, C., Mihaly, K., and Rockoff, J.E., 2015. Value-added modeling: A review. *Economics of Education Review*, 47, 180–195.

Kohl, K., Willard, J.A., Agache, A., Bihler, L.-M., and Leyendecker, B., 2019. Classroom Quality, Classroom Composition, and Age at Entry: Experiences in Early Childhood Education and Care and Single and Dual Language Learners' German Vocabulary. *AERA Open*, 5 (1), 2332858419832513.

Kristen, C., 2008. Primary School Choice and Ethnic School Segregation in German Elementary Schools. *European Sociological Review*, 24 (4), 495–510.

Lenz, S., Rjosk, C., Lorenz, G., and Stanat, P., 2021. Ethnische Segregation zwischen Schularten in mehrgliedrigen Schulsystemen und im „Zwei-Wege-Modell" [Ethnic Segregation Between School Types in Multi-tiered School Systems and Two-tiered Systems]. *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 73 (1), 59–84.

Makles, A.M., Schneider, K., and Terlinden, B., 2019. Schulische Segregation und Schulwahl. Eine Analyse mit den Daten der Bremer Schülerindividualstatistik. Münster: Waxmann Verlag, 176–196.

Manski, C.F., 1993. Identification of Endogenous Social Effects: The Reflection Problem. *The Review of Economic Studies*, 60 (3), 531–542.

Marks, G.N., 2017. Is adjusting for prior achievement sufficient for school effectiveness studies? *Educational Research and Evaluation*, 23 (5–6), 148–162.

Marsh, H.W., 1987. The big-fish-little-pond effect on academic self-concept. *Journal of Educational Psychology*, 79 (3), 280–295.

Marsh, H.W. and Parker, J.W., 1984. Determinants of student self-concept: Is it better to be a relatively large fish in a small pond even if you don't learn to swim as well? *Journal of Personality and Social Psychology*, 47 (1), 213–231.

Martin, A.J. and Dowson, M., 2009. Interpersonal Relationships, Motivation, Engagement, and Achievement: Yields for Theory, Current Issues, and Educational Practice. *Review of Educational Research*, 79 (1), 327–365.

Mayer, K.U., 2009. New Directions in Life Course Research. *Annual Review of Sociology*, 35 (1), 413–433.

NEPS Network, 2020. *National Educational Panel Study, Scientific Use File of Starting Cohort Kindergarten*. Bamberg: Leibniz Institute for Educational Trajectories (LIfBi).

NEPS Network, 2021a. *National Educational Panel Study, Scientific Use File of Starting Cohort Grade 5*. Bamberg: Leibniz Institute for Educational Trajectories (LIfBi).

NEPS Network, 2021b. *National Educational Panel Study, Scientific Use File of Starting Cohort Grade 9*. Bamberg: Leibniz Institute for Educational Trajectories (LIfBi).

OECD, 2018. *Equity in Education: Breaking Down Barriers to Social Mobility*. OECD.

Parade, R. and Heinzel, F., 2020. Sozialräumliche Segregation und Bildungsungleichheiten in der Grundschule – eine Bestandsaufnahme [Socio-spatial segregation and educational inequalities in primary school - a review]. *Zeitschrift für Grundschulforschung*, 13 (2), 193–207.

Pohl, S. and Carstensen, C.H., 2012. *Scaling the Data of the Competence Tests (NEPS Working Paper No. 14)*. Bamberg: Leibniz Institute for Educational Trajectories, National Educational Panel Study.

Reardon, S.F. and Raudenbush, S.W., 2009. Assumptions of Value-Added Models for Estimating School Effects. *Education Finance and Policy*, 4 (4), 492–519.

Rjosk, C., Richter, D., Hochweber, J., Lüdtke, O., Klieme, E., and Stanat, P., 2014. Socioeconomic and language minority classroom composition and individual reading achievement: The mediating role of instructional quality. *Learning and Instruction*, 32, 63–72.

Rosenthal, R. and Jacobson, L., 1968. Pygmalion in the classroom. *The Urban Review*, 3 (1), 16–20.

Scharenberg, K., 2014. Schule und Schulklasse als soziale Kontexte der Entwicklung im Jugendalter. *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 66 (1), 317–348.

Seuring, J., Rjosk, C., and Stanat, P., 2021. Ethnic Classroom Composition and Minority Language Use among Classmates: Do Peers Matter for Students' Language Achievement? *European Sociological Review*, 36 (6), 920–936.

Skopek, J. and Passaretta, G., 2021. Socioeconomic Inequality in Children's Achievement from Infancy to Adolescence: The Case of Germany. *Social Forces*, 100 (1), 86–112.

Snijders, T.A.B. and Bosker, R.J., 2012. *Multilevel analysis: an introduction to basic and advanced multilevel modeling*. 2nd ed. Los Angeles: Sage.

Thrupp, M., Lauder, H., and Robinson, T., 2002. School composition and peer effects. *International Journal of Educational Research*, 37 (5), 483–504.

Timmermans, A.C. and Thomas, S.M., 2015. The impact of student composition on schools' value-added performance: a comparison of seven empirical studies. *School Effectiveness and School Improvement*, 26 (3), 487–498.

Traini, C., Kleinert, C., and Bittmann, F., 2021. How does exposure to a different school track influence learning progress? Explaining scissor effects by track in Germany. *Research in Social Stratification and Mobility*, 76, 100625.

Willard, J.A., Agache, A., and Leyendecker, B., 2019. Classroom composition, classroom quality and German skills of very young dual language learners and German-only learners. *Early Childhood Research Quarterly*, 49, 269–281.

3 The impact of school composition on students achievement in Luxembourg: a longitudinal perspective

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Highlights

- Luxembourg is a small country with the highest migrant population in Europe (47.35%)[9] and stark socio-economic stratification (the top 10% share of wealth stagnates at 59.3%)[10].
- Educational inequalities, well-documented in previous studies, persist due to students' socio-economic and migration heterogeneity and the country's systemic early tracking and multilingual education system.
- This study depicts a strong correlation between school composition and math and German reading comprehension, even after accounting for important individual determinants.
- It draws on the longitudinal dataset (2013-21) from Luxembourg School Monitoring Programme ÉpStan (Épreuves Standardisées) including 3585 students from Grade 3 matched later to the same student cohort in Grade 9.
- School composition is measured in Grade 3: a) as a percentage of student with low socio-economic background and b) as a percentage of 1st generation migrant students.
- Outcomes of the study reveal persisting impact of primary school composition – particularly its socio-economic character – on achievement and track placement in Grade 9 – controlling for student's individual background and prior educational achievement.

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Background

Educational inequality in Luxembourg has been a systematic recurring challenge. As early as 1968, the first large-scale psycho-social study in Luxembourg called MAGRIP[11] found that educational paths of students were strongly affected by their social backgrounds. The same trend has been detected in the recent two decades of international and national studies (Hadjar & Backes, 2021; Hornung et al, 2021; Sonnleitner et al, 2021; ONQS, 2020; OECD, 2018; and Fusco et al, 2013). Across these studies, educational inequalities are observed at the intersection of *individual* characteristics of students- including their gender, social, linguistic, and migration background- and the *institutional* features of the education system in Luxembourg, i.e., its multilingualism and early tracking (see, Hadjar et al., 2018; Hauret, 2017; Martin et al., 2016; and Klieme et al., 2010).

While several studies have depicted the relation between school tracking and students' achievement (Klapproth et al, 2013 & Schaltz & Klapproth, 2014) research on school composition- per se- and students' achievement has been missing in Luxembourg. Elsewhere though, studies have shown a high correlation between school composition and achievement, e.g., in Germany (Riedel et al., 2010), Spain (Cebolla-Boado & Medina, 2011), in Belgium (Van Houtte & Stevens, 2010), and in Australia (Perry & Mc Conney, 2012).

The current study builds on this strand of research on educational inequality and fills an existing contextual knowledge gap on the relationship between *school composition* and *students' track and achievement* in math and reading in Luxembourg. To this end, it seeks to answer the following research questions (RQs):

RQ1: *To what extent primary schools' socio-economic and migrant composition affect track placement in secondary school in Luxembourg?* This will help understanding the *long-term effect* of schools' composition in Grade 3 on the probability of students being placed in a high (classic), middle (general), or low (preparatory) tracks[12] in Grade 9.

RQ2: *To what extent schools' characteristics measured in Grade 3 affect students' achievement in math and German reading comprehension in Grade 9?* By controlling for key variables, this allows a) understanding the *long-term effects* of schools' composition on students' achievement in secondary school and b) examining the impact of school composition on students' performance prior to track placement.

[11] See a summary in Appendix I

[12] See Appendices II & III for an overview of education system including VET in Luxembourg

To answer these research questions, we have adapted an innovative approach as briefly explained below:

- We examine the effect of primary school composition on *several outcomes* in secondary school including math and German reading comprehension scores and track placement of students (classical, general, or preparatory). This provides new evidence of the importance of school composition on educational achievement in Luxembourg.

- Empirical evidence in this study focuses on the *long-term effect* of school composition on students' performance. We analyse the longitudinal data gathered as part of Luxembourg School Monitoring Programme Épreuves Standardisées (ÉpStan; Ugen et al., 2014) with school composition – measured in Grade 3 – being among key predictors of students' educational outcomes six years later when the same cohort are around age 15 and attending secondary school. Our results support – indirectly – the theoretical underpinnings of an early accumulation of socio-economic disadvantage over [part of] life-course.

- Our analyses account for key background information of individual students as well as their prior academic achievement in Grade 3. As such, the reported effects of primary school composition on achievement in math and German in Grade 9 are their *net effects*.

- Research traditionally focuses on the socio-economic composition of schools. In a similar vein, we calculate such a measure by aggregating individual data on parents' educational backgrounds at each level of students' schooling. Given the substantial share of migrant population, continuous arrival of newcomers from various parts of the globe and the multilingual education system in Luxembourg, we added a second measure of school composition and calculated the percentage of first-generation students in each school in our sample.

In both empirical parts of our analyses, we draw on multilevel modelling where Grade 3 students (N=3585) are nested schools (N=146). To analyse track placement, we use multilevel logistic regression with random intercepts and compare the likelihood of placement in one of two given tracks (e.g., classical vs. general; classical vs. preparatory; general vs. preparatory).[13] For the analysis of math and reading achievement, we use multilevel linear regression models with random intercepts (see "Methodological notes").

Results

Findings of this study affirm but also add valuable insights to both the existing body of research on educational inequalities in Luxembourg and those studies conducted elsewhere on school composition and students' achievement. More specifically, our study reveals:

[13] Multinomial regression models have been tested, as a part of robustness check and results are consistent with the results of logistic regression.

A. While our aim is primarily to explore the impact of school composition on students' achievement, our results reconfirm persisting social stratification in Luxembourg – inherent in its inequality-prone stratified education system and the conservative-corporatist welfare state-regime – and their reproduction (Bourdieu, 1970; Bourdieu & Passeron, 1977) in the public education system.[14]

B. As expected, our analyses are in line with other studies that report *strong* association between the *socio-economic* background of students at primary level and their *track placement* at a later stage of their secondary schooling. In effect, in the "classical vs. general" model children with highly educated parents and better prior results in math and German reading are significantly and consistently more likely to be enrolled in the highest (classical) track. Factors that decrease those odds include, *student's gender* (male students are less likely to be placed in the highest track), *migration background* (being either the 1st or 2nd generation student), and previously reported *grade repetition*.

   Somewhat similar results- to the above- are observed in the "classical vs. preparatory" model[15] while the "general vs. preparatory" results are different. In the latter, *gender* and *prior school achievement* are the only characteristics that seem to affect students' track placement. That is, male students are more likely to be directed to the lowest (preparatory) track while students with better results in math and German reading have higher chances to be in the middle (general) track. Students – male and female – with *grade repetitions* are more likely to attend middle track, too. However, we remain cautious in our interpretation as there exist different paths to preparatory track including, for instance early transition to the lower track to avoid multiple grade repetitions in primary school.

   Overall, we conclude that *track placement* based on students' individual characteristics means that social stratification is continuously reproduced in the Luxembourgish education system. In effect, 60% of students with migration backgrounds in Luxembourg – compared to an average of 46% in other OECD countries – are enrolled in lower and middle tracks including in the Technical and Vocational Education (VET), according to the OECD report (2016).

   Analysing school composition, we find statistically significant and robust effect of the *socio-economic school composition in Grade 3* in the "classical vs. general" track placement model- but not in others. The share of 1st generation immigrant children in Grade 3 does not seem to have any effect in any of the three variants of track placement.[16]

[14] However, these findings will not be substantially discussed in this contribution given the length limitations.

[15] Given the small sample size of students in preparatory track (N=165), we are cautious with the interpretation of results.

[16] We check for a potential multicollinearity between two measures of school composition, and this does not seem to be the case (r=0.297).

C. Regarding math performance in Grade 9, our results reiterate international study findings and reveal that male students outperform female students in math. Male advantage remains constant after controlling for individual background and prior results in Grade 3. First generation students and those who have repeated a grade in the past tend to have lower results in math. As expected, the effect of track is substantial and consistent across all models reflecting an anticipated direction: students in the classical track outperform – by far – students in the two other tracks. School composition analysis depicts some interesting results. One the one hand, and as anticipated, students who attended Grade 3 in the more socio-economic disadvantaged schools tend to perform worse in Grade 9- even after controlling for several key variables such as gender, individual socio-economic background, migration background and language spoken at home. On the other hand, students attending schools with a higher percentage of 1st generation students in Grade 3 tend to have better math results by Grade 9 and these results remain consistent across all tested models.

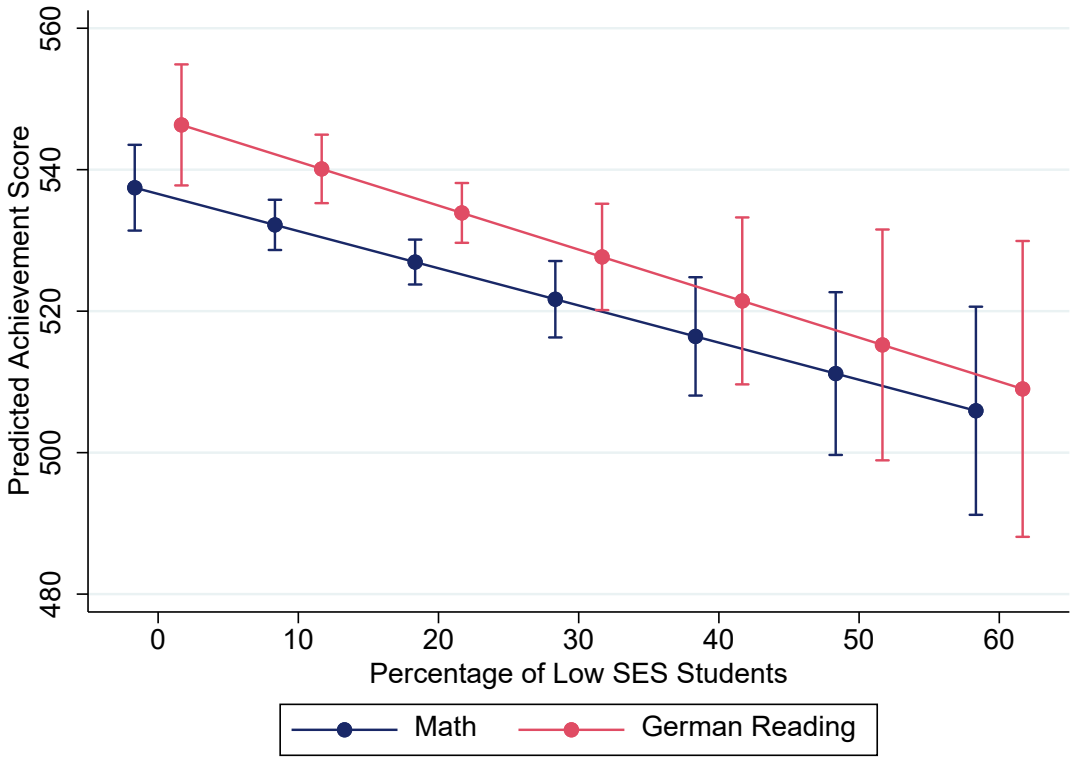
D. Results in German reading comprehension are equally interesting. In accordance with other studies, female students outperform their male classmates in reading comprehension. In contrast to math performance analysis, language spoken at home has a substantial impact on reading outcome. This means, students speaking other language than German or Luxembourgish – including French and Portuguese – perform worse in their Grade 9 tests- controlling for performance in Grade 3. These findings as well as the substantial differences between the three school tracks have previously been reported in earlier studies as mentioned in the background section of this article.

With regards to school composition, the socio-economic school population intake in Grade 3 has a statistically significant negative effect, while migration composition is not a significant factor. This entails that the higher the percentage of low SES students, the lower the achievement level.

To summarise, this study shows that primary *schools' socio-economic composition* is a prominent predictor of educational achievement of students at later stages of their schooling and acts independently from other forms of educational inequalities in Luxembourg, e.g., tracking. This is while student's socio-economic, migratory, and linguistic backgrounds together with prior academic results remain important factors predicting track placement and students' achievement in general.

More precisely, and to answer the RQs of this study, we found that primary school children attending schools with a higher concentration of socio-economic disadvantaged are less likely to be directed to an academic (highest) track in secondary school – after controlling for their background and performance **(RQ1).** The long-lasting impact of primary school composition on outcomes during secondary education is an important evidence – both for further academic research and for policy and practice design. The impact of primary school socio-economic composition in Grade 3 on academic results in math and German reading comprehension in Grade 9 is also consistently confirmed in Luxembourg context **(RQ2)** – see also the Figure 1 below.

***Figure 1**: Predicted math and German reading scores in Grade 9 by school composition in Grade 3*



***Note**: The graph displays a linear prediction (fixed portion) of math and German reading scores at different levels of the school percentage of low SES students, with their 95% confidence intervals. Math and German reading scores are scaled to have a mean of 500 and standard deviation of 100.*

The graph shows a higher percentage of socio-economically vulnerable students in primary school will negatively affect students' academic performance in secondary school and the effect appears to be somewhat steeper for German reading results. Additionally, subject-specific performance demonstrates that school composition – even after controlling for student's educational track – does have an impact. Early tracking that takes place in Luxembourg after Grade 6 directly manifest its impact both, and especially, through academic curriculum and the respective school compositions between the tracks. This entails that students from lower socio-economic backgrounds are overrepresented in the lower and middle tracks (usually VET fields) and those with higher socio-economic status in the academically oriented higher tracks.

There are two intriguing findings in our study that require further research. One is the long-lasting impact of primary school composition on educational performance at secondary level knowing that time interval between the two stages is approximately 6 years and that between Grades 7-9 students follow different track-specific curriculum content. Another observation is the positive effect of migrant school composition (1st generation) in primary school on students' math competencies in Grade 9. While the exact mechanism requires future research, some descriptive analysis with our own data revealed that 74% of the 1st generation students in our

cohort reported high level of interest in math (compared to 65% among the native students). Such an avid interest in subject may hypothetically result from high educational aspirations of the 1st generation – and in specific of their parents – as also reported elsewhere and known as "immigrant optimism" paradox in education (Kao and Tienda 2012; Cebolla-Boado et al. 2021). High aspirations of these students may very well have a positive spill over effect on fellow schoolmates. Another hypothesis is that math – as a subject – is to a certain extent language-neutral compared to German reading comprehension class – especially for non-German/ Luxembourgish speaking students. It may hence potentially generate more enthusiasm and interest among students. These, we reckon, require further scrutiny.

Conclusion

Academic literature on schools' socio-economic composition and segregation has long reported their detrimental impact on students' achievement while also repeatedly demonstrating improved educational achievement when school segregation has diminished (Benito et al.2014; Granvik Saminathen, et al., 2018). School segregation disrupts social cohesion of the society at large (Molina, 2021) while also affecting – and negatively too – teachers' perceptions, attitudes, and pedagogies (Rosenthal & Jacobson, 1968; Timmermans et al., 2018; Doyle et al, 2022) as well as students' self-appraisal of their identity, learning, and future personal and professional success and integration (Marsh, 1987; Crenshaw, 1991; Steele, 1997; Harter, 2003; Becker & Neumann, 2016). In short, school segregation consistently bears negative effect on teaching, learning, and assessment processes and requires ongoing academic and policy efforts to offset its direct impacts and externalities. Our study, too, is a reaffirmation of the negative effect of disadvantaged socio-economic composition of schools on students' achievement

We drew on the longitudinal data from the Luxembourg school monitoring programme (ÉpStan). This facilitated demonstrating the long-term impact of primary school composition (together with the previous educational achievement and socio-economic background) on students' achievement at later stages of their schooling in Grade 9. Indeed, a multilevel reproduction of disadvantages in Luxembourg is observed as students' individual characteristics (micro-level) and the school composition (meso-level) perpetuate educational inequalities for the already socially disadvantaged student population. However, we didn't run subsamples and interaction effects.

Realising the life course and multilevel nature of educational inequalities, national educational policies (macro-level) in recent years have been formulated to reduce social and educational inequalities. A particular noteworthy policy tool has been created in Luxembourg during the 2009 reform of primary education that had foreseen provision of extra-curricular support lessons based on the socio-economic index, class size, and the needs of students at the primary level located in municipalities with a higher proportion of socio-economically and linguistically disadvantaged population. Political awareness of the fact that educational disadvantage start accumulating from early stages in life of a child has led to several measures, such as childcare

service voucher system for ECEC in 2009, introduction of Luxembourgish language in creches since 2017, and free use of after-school care services since 2022, free books, and vouchers to buy school material. These are all witness to a holistic life course approach to policy formulation in Luxembourg while many challenges persist.

Finally, outcomes of this study reiterate the necessity of adapting inclusive, equitable, high quality, and sustainable approaches to provision and delivery of education and creating "enabling learning environments" for all students regardless of their gender, socio-economic, migration, and linguistic backgrounds. This study can serve as a reference to tailor evidence-based policies and teaching pedagogies towards undoing the negative impact of school composition on students' achievement. That is halting the reproduction of social inequalities through and by education hence realising sustainability and social cohesion as envisioned in the overarching 2030 Luxembourg framework[17] of Luxembourg.

Methodological notes

- **Sample:** 3585 students – one cohort followed from 3rd to 9th grade,
- **Data:** the Luxembourg School Monitoring Programme (ÉpStan) collected between Nov 2013 and November 2017-2021,
- **Method:** multilevel logistic and linear regression analysis including Model 1: random effects estimation on the probability of placement in high (classical secondary education), middle (general secondary education – guidance route) or lowest (general secondary education – preparatory route) education tracks; and Model 2: multilevel random effects linear regression analysis tracing educational achievement of Grade 9th students controlling for previous achievement, socio-demographic characteristics, tracking, and school composition,
- **Aim:** to investigate the effect of school composition (based on the percentage of students from lower socio-economic and migration backgrounds) on a) track placement and b) math, German reading outcomes.

[17] https://www.tradeandinvest.lu/news/2030-agenda-sustainable-development/

References

Becker, M; & Neumann, M. (2016). Context-related changes in academic self-concept development. On the long-term persistence of big-fish-little-pond effects. In Learning and Instuction, (2016) 45, S. 31-49. Accessible at: https://www.sciencedirect.com/science/article/abs/pii/S0959475216300603

Benito, R., Alegre, M. À., & Gonzàlez-Balletbò, I. (2014). School Segregation and Its Effects on Educational Equality and Efficiency in 16 OECD Comprehensive School Systems. Comparative Education Review, 58(1), 104–134. https://doi.org/10.1086/672011

Cebolla-Boado, H., & Garrido Medina, L. (2011). The Impact of Immigrant Concentration in Spanish Schools: School, Class, and Composition Effects. *European Sociological Review*, *27*(5), 606–623. https://doi.org/10.1093/esr/jcq024

Cebolla-Boado, H., González Ferrer, A. & Soysal, Y.N. (2021) It is all about "Hope": evidence on the immigrant optimism paradox. *Ethnic and Racial Studies*, 44(2), 252-271, DOI: 10.1080/01419870.2020.1745254

Crenshaw, K.W. (1991). Mapping the margins: intersectionality, identity politics, and violence against women of color. Stanford Law Review 43(6), 1241-99.

Doyle, L., Easterbrook, M. J., & Harris, P. R. (2022). Roles of socio-economic status, ethnicity and teacher beliefs in academic grading. *British Journal of Educational Psychology*. https://doi.org/10.1111/bjep.12541

Fusco, A.; & Van Kerm, P.; Alieva, A.; Bellani, L.; Fanny, R.; Guio, A. C.; Kyzyma, I.; Leduc, K.; Liégeois, P.; Noel, M.; Pi Alperin, M.; Reinstadler, A.; Sierminska, E.; Sologon, D.; Thill, P.; Valentova, M.; Voicu, B. (2013). Growing Inequalities and Their Impact in Luxembourg. https://www.researchgate.net/publication/260551489_Growing_Inequalities_and_Their_Impact_in_Luxembourg

Granvik Saminathen, Maria, Sara Brolin Låftman, Ylva B. Almquist & Bitte Modin (2018) Effective schools, school segregation, and the link with school achievement, School Effectiveness and School Improvement, 29:3, 464-484, DOI: 10.1080/09243453.2018.1470988

Hadjar, A. & Backes, S. (2021). Bildungsungleichheiten am Übergang in die Sekundarschule. In LUCET and SCRIPT (Eds.) *Nationaler Bildungsbericht Luxemburg 2021 [National Education Report Luxembourg 2021]* (pp. 86-93). Université du Luxembourg.

Hadjar, A; Backes, S (2017): Educational trajectories through secondary education in Luxembourg: how does permeability affect educational inequalities? - In: Schweizerische Zeitschrift für Bildungswissenschaften 39 (2017) 3, S. 437-460 - URN: urn:nbn:de:0111-pedocs-166597. Available at : https://www.pedocs.de/volltexte/2019/16659/pdf/SZBW_17_3_Backes_Hadjar_Educational_trajectories.pdf

Hadjar, A,; Fischbach,A.; Backes, S. (2018). Bildungsungleichheiten im luxemburgischen Sekundarschulsystem aus zeitlicher Perspektive. S. 59-83 in: Université du Luxembourg, LUCET & Ministère de l'Éducation nationale, de l'Enfance et de la Jeunesse, SCRIPT (Hg.), Nationaler Bildungsbericht Luxemburg 2018. Luxembourg

Harter, S. (2003). The development of self-representations during childhood and adolescence. In M. R. Leary & J. P. Tangney (Eds.), Handbook of Self and Identity (pp. 610-642). New York: Guilford Press.

Hauret, L (2017): Study on the link between dropping out of school and NEET status. Luxembourg Institute of Socio-Economic Research (LISER). University of Luxembourg. https://forms.snj.lu/sites/default/files/publications/2017%2007%2020%20rapport%20d%2Bcrochage%20version%20finale_ANGLAIS_version%20finale.pdf

Hornung, C., Wollschläger, R., Keller, U., Esch, P., Muller, C., & Fischbach, A. (2021). Neue längsschnittliche Befunde aus dem nationalen Bildungsmonitoring ÉpStan in der 1. und 3. Klasse: Negativer Trend in der Kompetenzentwicklung und kein Erfolg bei Klassenwiederholungen. In LUCET and SCRIPT (Eds.) *Nationaler Bildungsbericht Luxemburg 2021 [National Education Report Luxembourg 2021]* (pp. 44-55). Université du Luxembourg.

Kaiser, J., Südkamp, A., & Möller, J. (2017). The effects of student characteristics on teachers' judgment accuracy: Disentangling ethnicity, minority status, and achievement. *Journal of Educational Psychology*, *109*(6), 871–888. https://doi.org/10.1037/edu0000156

Kao, G., & Tienda, M. (2012). Optimism and achievement: The educational performance of immigrant youth. In *The new immigration* (pp. 345-358). Routledge.

Klapproth, F., Krolak-Schwerdt, S., Glock, S., Böhmer, M., & Martin, R. (2013). Die prognostische Validität der Sekundarschulempfehlung in Luxemburg. Eine Gegenüberstellung von Verbleibsquoten und Leistungstestdaten. *Schweizerische Zeitschrift Für Bildungswissenschaften*, *35*(2), 319–345 &

Klieme, E., Artelt, C., Hartig, J., Jude, N., Köller, O., Prenzel, M., Schneider, W., & Stanat, P. (2010). PISA 2009. Bilanz nach einem Jahrzehnt [PISA 2009. Balance after one decade]. In *Main*. Waxmann. https://www.pisa.tum.de/fileadmin/w00bgi/www/Berichtsbaende_und_Zusammenfassungungen/DIPF_PISA_Bericht_2009.pdf

Martin, R ; Ugen, S; Fischbach, A (2016). Les inégalités dans les parcours scolaires au Luxembourg [Inequalities in educational pathways in Luxembourg]. https://www.researchgate.net/publication/301230945_Les_inegalites_dans_les_parcours_scolaires_au_Luxembourg_Inequalities_in_educational_pathways_in_Luxembourg

Molina, A. (2021). School segregation and social cohesion in Santiago: Perspectives from the Chilean Experience. In International Study of City Youth Education Series, Springer. Accessible at: School Segregation and Social Cohesion in Santiago | SpringerLink

OECD (2009). Closing the gender gap: differences in PISA scores. Available at: https://www.oecd-ilibrary.org/social-issues-migration-health/closing-the-gender-gap/girls-significantly-outperform-boys-in-reading-but-boys-perform-better-than-girls-in-mathematics_9789264179370-graph22-en

OECD (2014). Are boys and girls equally prepared for life. Available at: https://www.oecd.org/pisa/pisaproducts/PIF-2014-gender-international-version.pdf

OECD (2016): Education policy outlook: Luxembourg. Available at: https://www.oecd.org/luxembourg/Education-Policy-Outlook-Country-Profile-Luxembourg.pdf

ONQS (2020). Le Bilan L'évaluation systématique de l'éducation au Luxembourg. Accessible at : https://men.public.lu/dam-assets/catalogue-publications/statistiques-etudes/themes-transversaux/2102-onqs-bilan-evaluation-education-lux.pdf

Perry, L. B. (2012). Causes and Effects of School Socio-Economic Composition? A Review of the Literature. *Education and Society*, *30*(1), 19–35. https://doi.org/10.7459/es/30.1.03

Riedel, A., Schneider, K., Schuchart, C., & Weishaupt, H. (2010). School choice in German primary schools. How binding are school districts? *Journal of Educational Research Online / Journal Für Bildungsforschung Online*, *2*(1), 94–120. https://doi.org/10.25656/01:4569

Rosenthal, R., & Jacobson, L. (1968). *Pygmalion in the classroom*. Holt, Rinehart, and Winston.

Schaltz, P., & Klapproth, F. (2014). *The effect of ability-based tracking in secondary school on subsequent school achievement : A longitudinal study*. *4*, 440–455.

Sonnleitner; P., Krämer, C., GAmo, S., Reichert, M., Keller, U., & Fischbach, 1. (2021). Neue längsschnittliche Befunde aus dem nationalen Bildungsmonitoring ÉpStan in der 3. Und 9. Klasse: Schlechtere Ergebnisse und wirkungslose Klassenwiederholungen. In LUCET and SCRIPT (Eds.) *Nationaler Bildungsbericht Luxemburg 2021 [National Education Report Luxembourg 2021]* (pp. 109-115). Université du Luxembourg.

Steele, C. M. (1997). A threat in the air. How stereotypes shape intellectual identity and performance. The American Psychologist, 52(6), 613–629. https://doi.org/10.1037/0003-066X.52.6.613

Timmermans, A. C., Rubie-Davies, C. M., & Rjosk, C. (2018). Pygmalion' s 50th anniversary: the state of the art in teacher expectation research. *Educational Research and Evaluation*, *24*, 91–98. https://doi.org/10.1080/13803611.2018.1548785

Ugen, S., Fischbach, A., Reichert, M., Dierendonck, C., & Martin, R. (2014). Épreuves Standardisées: objectifs et méthodologie [Épreuves Standardisées: objectives and methodology]. In R. Martin, S. Ugen, & A. Fischbach (Eds.), *Épreuves Standardisées: Bildungsmonitoring für Luxemburg. Nationaler Bericht 2011 bis 2013 [Épreuves standardisées: School monitoring for Luxembourg. National report 2011 to 2013]* (pp. 7–21). University of Luxembourg, LUCET.

Van Houtte, M., & Stevens, P. A. J. (2010). School ethnic composition and aspirations of immigrant students in Belgium. *British Educational Research Journal*, *36*(2), 209–237. https://doi.org/10.1080/01411920902802180

4 School segregation, student achievement, and educational attainment in Hungary

Zoltán Hermann[1], Dorottya Kisfalusi[2]

Highlights

- School segregation by social status is considerable in Hungary.
- Students attending segregated lower secondary schools have lower reading competences.
- Students in segregated lower secondary schools are less likely to finish upper secondary education.
- Part of these effects seem to be the result of selection bias.

Background

The analysis explores whether attending a segregated lower secondary school goes together with lower academic achievement and lower educational attainment. We investigate the case of Hungary, where school segregation based on social status and Roma ethnicity is among the highest compared to other European countries at both the primary and secondary levels (Csapó *et al.* 2008, Jenkins *et al.* 2008, FRA 2016, Holmlund and Öckert 2021). Administrative data show that segregation has increased in the last decades (Kertesi and Kézdi 2012, Hajdu *et al.* 2021, 2022), and school segregation contributes to large between-school differences in student performance. Moreover, the relationship between students' socio-economic background and performance is particularly strong in Hungary compared to other OECD countries (Schleicher 2019).

Primary and secondary education in Hungary consists of two main stages. General education encompasses the primary and lower secondary levels (Grade 1-8); it is followed by upper secondary education, where students can choose from three different tracks. The most competitive academic track provides general secondary education and prepares students for the secondary school final exam. Students who pass the final exam receive a secondary school leaving certificate. Furthermore, the results of the exam are taken into account in the admission process to higher education. Upper secondary vocational schools prepare students for the final exam and provide vocational training as well. Vocational schools offer vocational training and

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general education with a limited scope, without direct access to tertiary education[3]. Admission to the chosen secondary track depends on a competitive entrance exam and students' academic achievement in general school. Some secondary schools also provide eight- or six-year-long academic tracks, starting in grades 5 and 7. These highly selective tracks attract the highest achieving students from general schools (Schiltz *et al.* 2019). Since academic achievement and social status are strongly related, high-status students are overrepresented in these tracks.

Hungarian general education is characterised by free school choice: parents can select a general school outside the catchment area of their residence. Although general schools are required to enrol all students living in their catchment area, they are free to enrol students from other catchment areas, provided there are free places. Free school choice allows high-status parents to avoid schools with a higher share of low-status or minority students, especially in larger cities where commuting costs are lower (Kertesi and Kézdi 2013). Therefore, school choice is significantly associated with social status: our data show that higher-status students are more likely than lower-status students to attend a different school than the designated one.

In Hungary, policy debates usually focus on the segregation of Roma students. However, socio-economic and ethnic school segregation is closely related. In our sample, the school-level correlation between the share of students with disadvantaged socio-economic background and the share of Roma minority students is 0.79. Although we concentrate on the analysis of segregation based on social status, it is important to note that schools with a high share of low-status students usually also enrol a high share of Roma minority students.

Results

For the analysis, we used linked administrative panel data that covers 50 per cent of the Hungarian population. We carried out the analysis for three cohorts: 8th-grade students in the academic year of 2007-2008 (Cohort 1), 2008-2009 (Cohort 2), and 2009-2010 (Cohort 3). The sample comprised 118'535 students. The overall number of schools in the sample is 2'788.

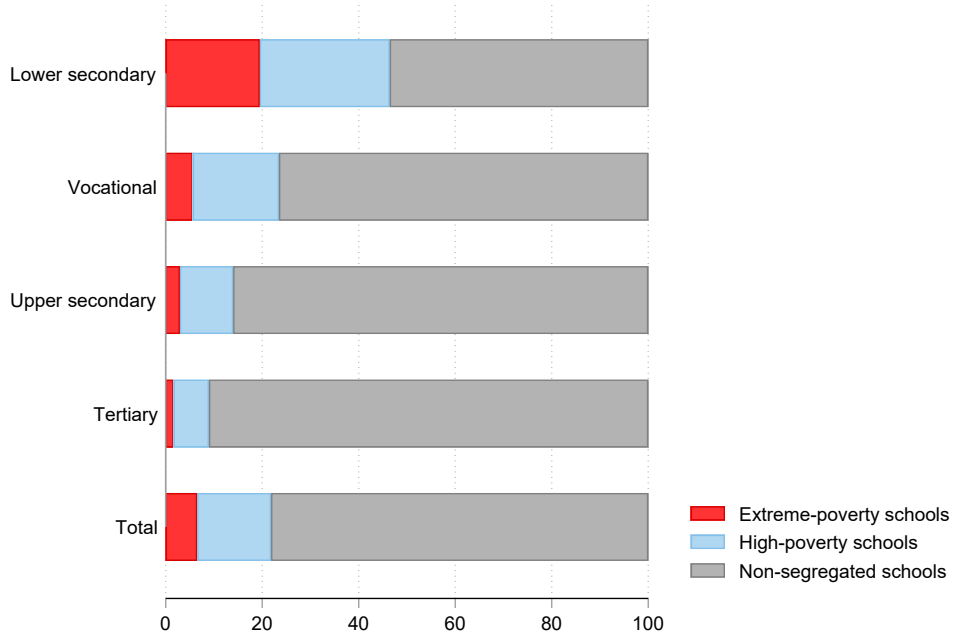
Segregated schools are defined with respect to the share of students with disadvantaged socio-economic background (9.5% of the student population). Socio-economically disadvantaged status is defined by the law: it indicates whether families are entitled to regular child support allowance. Families are entitled to child support allowance if at least two conditions hold from the following ones: 1) low educational level of the caretakers; 2) low employment situation of the caretakers; 3) inadequate living conditions. The number of students classified in this category is available in school statistics each year. Two categories of segregated schools are defined: high-poverty schools and extreme-poverty schools, with 15-35% and 35+% share of disadvantaged students, respectively. These categories are consistent with those used in the

[3] Vocational school students have the possibility to take the final exam after two additional years in school.

literature on Roma segregation (Havas and Liskó 2005). 69% of the schools belong to the non-segregated category, 19% are high-poverty schools, and 12% are extreme-poverty schools.

Figure 1 shows the distribution of students over these categories. Overall, one-fifth of students are studying in segregated schools. However, this share is much larger in the case of students with low-educated mothers; almost one of every two students in this group is enrolled in a segregated school.

***Figure 1**: Distribution of students over non-segregated, high-poverty, and extreme-poverty schools, by mother's education, %*



***Note**: The overall distribution according to the mother's highest education: 18.32% lower secondary, 30.15% vocational, 32.57% upper secondary, 18.97% tertiary.*

The effect of attending a segregated school on achievement and attainment was estimated using a matching method (Imbens 2015, for details, see "Methodological notes"). For each segregated school student, a control student was chosen from a non-segregated school, as closely replicating the observed characteristics of the first student as possible. In the preferred estimation, gender, disadvantaged status, and mother's education are identical, the control student is chosen from the same county, and the differences in other family background characteristics are minimal.

The effect of segregation was estimated for five different outcome variables. Math score and reading score are standardised achievement scores measured in the 8th grade (its mean is 0, standard deviation is 1). Three outcome variables measure educational attainment and progression; these are secondary school completion in any track, obtaining the secondary school leaving certificate, and admission to higher education.

The preferred estimation method revealed no statistically significant association between attending a segregated school and math test scores and admission to higher education, conditioning on a rich set of student characteristics. Regarding the other three outcomes, students attending a segregated school have lower reading scores, a lower probability of secondary school completion, and a lower probability of obtaining the secondary school leaving certificate than similar students attending non-segregated schools.

Figures 2-4 show these associations as the difference between the observed mean in segregated schools and the estimated mean for a comparable control group of students studying in non-segregated schools. The outcome for the control group (with light blue in the figures) represents the best estimate of how students in segregated schools would have performed if they had attended non-segregated schools. As a reference, the figures also depict the overall mean of the outcome variables in non-segregated schools.

Figure 2 shows that attending a high-poverty school incurs modest losses in reading performance. High-poverty school students achieve 0.04 standard deviation lower reading scores, whereas extreme-poverty school students achieve 0.17 standard deviation lower reading scores than comparable control group students in non-segregated schools

Figures 3 and 4 show that attending a high-poverty school is associated with a lower probability of secondary school completion and obtaining the secondary school leaving certificate, respectively. Studying in an extreme-poverty school seems to harm students more. The probability of both completing secondary education and obtaining the secondary school leaving certificate is about 5 percentage points lower than in the control group. This is an economically significant difference.

***Figure 2**: Means of reading scores in segregated schools, comparable control groups, and non-segregated schools*

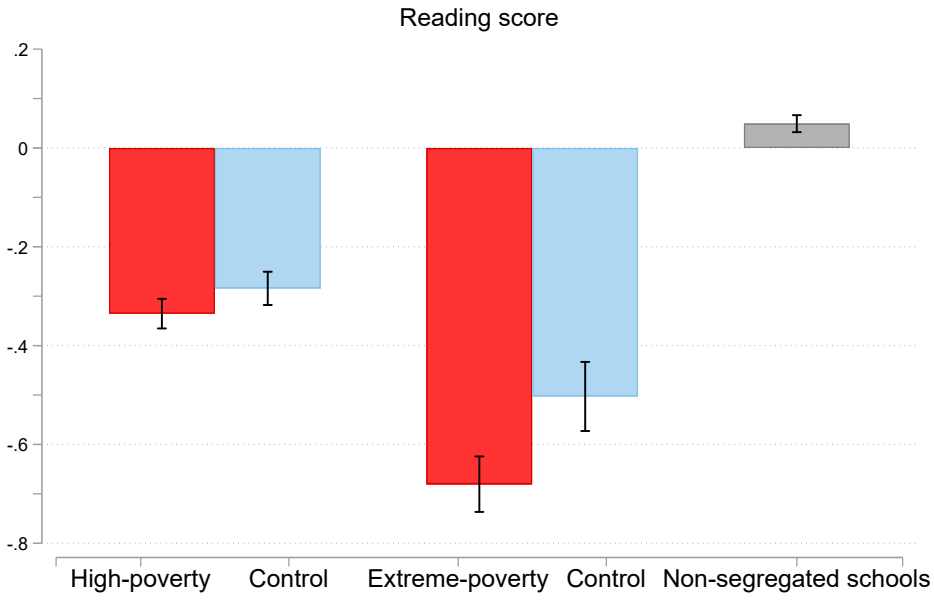


***Figure 3**: Estimated mean probabilities of secondary school completion in segregated schools, comparable control groups, and non-segregated schools*

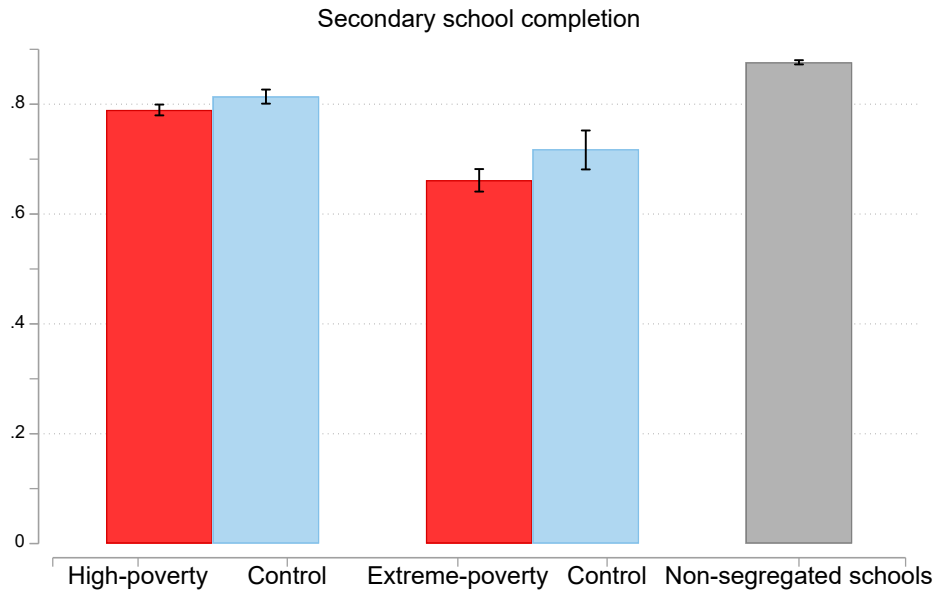
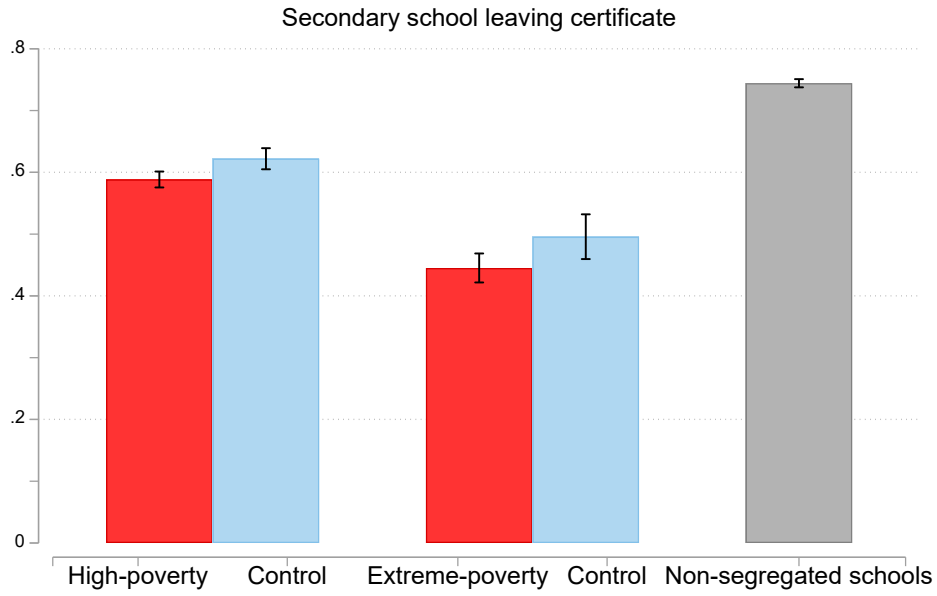


***Figure 4**: Estimated mean probabilities of obtaining the secondary school leaving certificate in segregated schools, comparable control groups, and non-segregated schools*



Next, we assessed the results by subgroups. With regard to gender, differences between students in non-segregated and segregated schools are more pronounced among boys than girls. That is, the estimated negative effects are larger for boys than for girls. With regard to the

type of settlement, the differences are larger in the case of towns than in the case of villages. However, the higher estimates in the case of towns might arise due to the potentially higher selection bias in towns compared to villages. Since more schools are available within a short distance, the costs of commuting to a higher-quality school are lower (Kertesi and Kézdi 2013). Therefore, in towns, students and families with higher academic motivations and aspirations can more easily select another school than the designated one. On the other hand, due to the patterns of residential segregation, the majority of segregated schools are located in villages where commuting costs are higher[4].

Economic studies usually find that educational policies and school practices influence math achievement more than reading competence (Fryer 2014). Reading competence depends more on students' family background. Therefore, the larger estimates for reading than math scores suggest that the estimated differences between students of segregated schools and comparable control groups are larger than the true causal effect of attending a segregated school. Even if segregated school students and control group students are almost identical in terms of observable individual and family background characteristics, different unobserved characteristics in the former group are likely to generate less favourable education outcomes. Thus, our estimates for the effect of attending a segregated school are likely to be upwardly biased.

Conclusion

In a country with a high level of school segregation, we have analysed whether students attending segregated schools have lower educational achievement and disadvantages in educational outcomes compared to students attending non-segregated schools. On the one hand, we find that attending a segregated school is associated with lower reading scores, a lower likelihood of completing secondary education, and a lower likelihood of obtaining the secondary school leaving certificate. On the other hand, attending a segregated school is not significantly associated with lower math scores or a lower likelihood to enrol in higher education.

Since school choice is influenced by student characteristics we cannot observe, measuring the causal effect of attending a segregated school is challenging. Although we have taken into account a rich set of observed student characteristics such as socio-economic background and cultural resources, unobserved factors such as skills, pupils' as well as parents' aspirations, and motivations influence both students' school choices and educational outcomes. This implies that the true causal effects are probably smaller than our estimates. Thus, we interpret the results as an upper bound for the effect of attending a segregated school.

[4] Altogether, two-thirds of the students in segregated schools live in villages. The share of segregated school students in villages and towns are 36 and 12 percent, respectively.

Methodological notes

Data: We used a unique panel of linked administrative data (Admin3) compiled in 2019 by the Databank of the Centre for Economic and Regional Studies that contains anonymised individual-level labour market, education, and health data for the 2003-2017 period and covers 50 per cent of the Hungarian population in 2003 (Sebők 2019). There are three cohorts in the dataset for which both 8th-grade academic achievement data and later educational outcomes are available (N=148 777). We carry out the analysis for these three cohorts, that is, 8th-grade students in the academic year of 2007-2008 (Cohort 1), 2008-2009 (Cohort 2), and 2009-2010 (Cohort 3). Students with missing mathematics and reading test scores, students who have not filled out the background questionnaire, students with special educational needs (SEN), students studying in schools with more than 50% of SEN students, and students attending highly selective six- or eight-year-long secondary schools were left out from the analysis. The final sample comprised 118 535 students.

Methods: The effect of attending a segregated school was estimated using a matching method (Imbens 2015). First, we estimated propensity scores (Rosenbaum and Rubin 1983) that reflect the probabilities of attending a high-poverty and an extreme-poverty school, using logistic regression. Then, for each segregated school student, a control student was chosen from a non-segregated school. We combined exact matching based on gender, disadvantaged status, mother's education, and county and nearest neighbour matching based on the estimated propensity scores. We assigned one nearest neighbour, that is, a single control student to each segregated school student with replacement (if multiple control students had identical covariate and propensity score values, each of these cases was used with weighting). For every outcome, we calculated the average treatment effect on the treated (ATT) that shows to what extent achievement and attainment would change in the case of segregated school students if they were studying in non-segregated schools. As a robustness check, we also estimated multilevel linear models with substantively similar results.

References

Csapó, B., Molnár, G., and Kinyó, L., 2008. Analysis of the Selectiveness of the Hungarian Educational System in International Context.

FRA, 2016. *EU-MIDIS II: Second European Union Minorities and Discrimination Survey*. Luxembourg: European Union Agency for Fundamental Rights.

Fryer, R.G., Jr., 2014. Injecting Charter School Best Practices into Traditional Public Schools: Evidence from Field Experiments *. *The Quarterly Journal of Economics*, 129 (3), 1355–1407.

Hajdu, T., Hermann, Z., Horn, D., Hőnich, H., and Varga, J., 2022. *A közoktatás indikátorrendszere 2021 [The indicator system of the Hungarian public education 2021]*. Budapest: KRTK KTI.

Hajdu, T., Kertesi, G., and Kézdi, G., 2021. Ethnic Segregation and Inter-Ethnic Relationships in Hungarian Schools. *On Education. Journal for Research and Debate*, 4 (11).

Havas, G. and Liskó, I., 2005. *Szegregáció a roma tanulók általános iskolai oktatásában [Segregation in the education of Roma primary school students]*. Budapest: Felsőoktatási Kutatóintézet.

Holmlund, H. and Öckert, B., 2021. Patterns of school segregation in Europe. EENEE Analytical Report No.45.

Imbens, G.W., 2015. Matching Methods in Practice: Three Examples. *Journal of Human Resources*, 50 (2), 373–419.

Jenkins, S.P., Micklewright, J., and Schnepf, S.V., 2008. Social segregation in secondary schools: how does England compare with other countries? *Oxford Review of Education*, 34 (1), 21–37.

Kertesi, G. and Kézdi, G., 2012. Ethnic Segregation Between Hungarian Schools: Long-run Trends and Geographic Distribution. *Hungarian Statistical Review*, 90 (Special number 16.), 18–45.

Kertesi G. and Kézdi G., 2013. *School segregation, school choice, and educational policies in 100 Hungarian towns*. Budapest: Roma Education Fund.

Rosenbaum, P.R. and Rubin, D.B., 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70 (1), 41–55.

Schiltz, F., Mazrekaj, D., Horn, D., and De Witte, K., 2019. Does it matter when your smartest peers leave your class? Evidence from Hungary. *Labour Economics*, 59, 79–91.

Schleicher, A., 2019. *PISA 2018: Insights and Interpretations*. OECD Publishing. OECD Publishing.

Sebők, A., 2019. *The Panel of Linked Administrative Data of CERS Databank*. Budapest: Institute of Economics, Centre for Economic and Regional Studies.

5 Consequences of ethnic and social segregation on educational attainment at upper secondary level in Germany and Switzerland

David Glauser[1], Robin Busse[2], and Katja Scharenberg[3]

Highlights

- In both countries, the social structure of students at lower secondary level differs between tracks.
- Segregation is particularly prevalent regarding social origin and migration background.
- Attainment at upper secondary level depends on the attended school track in compulsory school.
- The association between ethnic or social segregation and upper secondary attainment is weak.
- Students' individual social background is more relevant than ethnic or social segregation at class level.

Background

The aim of this article is to examine whether and how ethnic segregation (i.e., the proportion of migrant students in class) at lower secondary level is associated with inequalities in trajectories to educational tracks at upper secondary level in Germany and German-speaking Switzerland, respectively. The focus of this article is on inequalities regarding a direct transition to certifying upper secondary tracks (vocational and academic tracks) as well as on the propensity to attend an academic track instead of vocational education and training (VET) one year after leaving compulsory education. The outcomes considered reflect disadvantages, which, on the one hand, point to general difficulties in the transition to upper secondary education. On the other hand, attending an academic track at upper secondary level and acquiring a higher education entrance qualification is associated with favourable opportunities in the labour market and throughout the life course (Korber and Oesch, 2019, Rözer and Bol, 2019).

Investigating effects of ethnic composition of the school learning environment in Germany (GER) and German-speaking Switzerland (SUI) may foster the understanding of the extent to which and how the ethnic class composition affects individuals' educational attainment. First, the

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educational systems of both countries share important features, which reduce the possible bias that might result from country-specific structures of the respective educational systems. In Germany as well as in Switzerland, the educational systems are characterised by early tracking in compulsory education[4], and both countries have a highly differentiated VET system providing adolescents with rather smooth transitions to skilled employment (Müller and Shavit, 1998, Blossfeld *et al.*, 2016). Second, in both countries, there are pronounced disadvantages in educational achievements and attainment for students with a migration background and those from socially disadvantaged families (Borgna and Contini, 2014, Laganà *et al.*, 2014, Veerman and Dronkers, 2016, Rözer and van de Werfhorst, 2017, Spörlein and Schlueter, 2018, Kruse and Kroneberg, 2019, Nauck, 2019, Becker and Klein, 2021, Lenz *et al.*, 2021). Taken together, given the similar features of the educational systems and the observed disadvantages of students with migration background, a cross-country comparison will provide valuable insights into whether school composition unfolds different effects on educational attainment in the two countries considered.

Previous research mainly focused on how individual characteristics are associated with the outcomes of interest, while the importance of the context, i.e., the school learning environment, here in particular ethnic segregation at the class level, is often disregarded. However, classrooms are important psychosocial environments for adolescents (Dar and Resh, 1986, Rathmann *et al.*, 2020). Existing research focused largely on the influence of the ethnic classroom composition on educational achievement, while there are only a few studies on the relationship between class composition and educational attainment at different educational levels. The few existing studies on educational attainment so far yield contradictory results (for an overview: Fekjaer and Birkelund, 2007). Thus, the results of our study might contribute to the debate on whether policies to improve educational opportunities should be explicitly tailored to specific migrant groups of students, or whether the disadvantages of migrants should be dealt with as a special case of social inequality (Kalter *et al.*, 2018).

Results

Social structure at lower secondary level

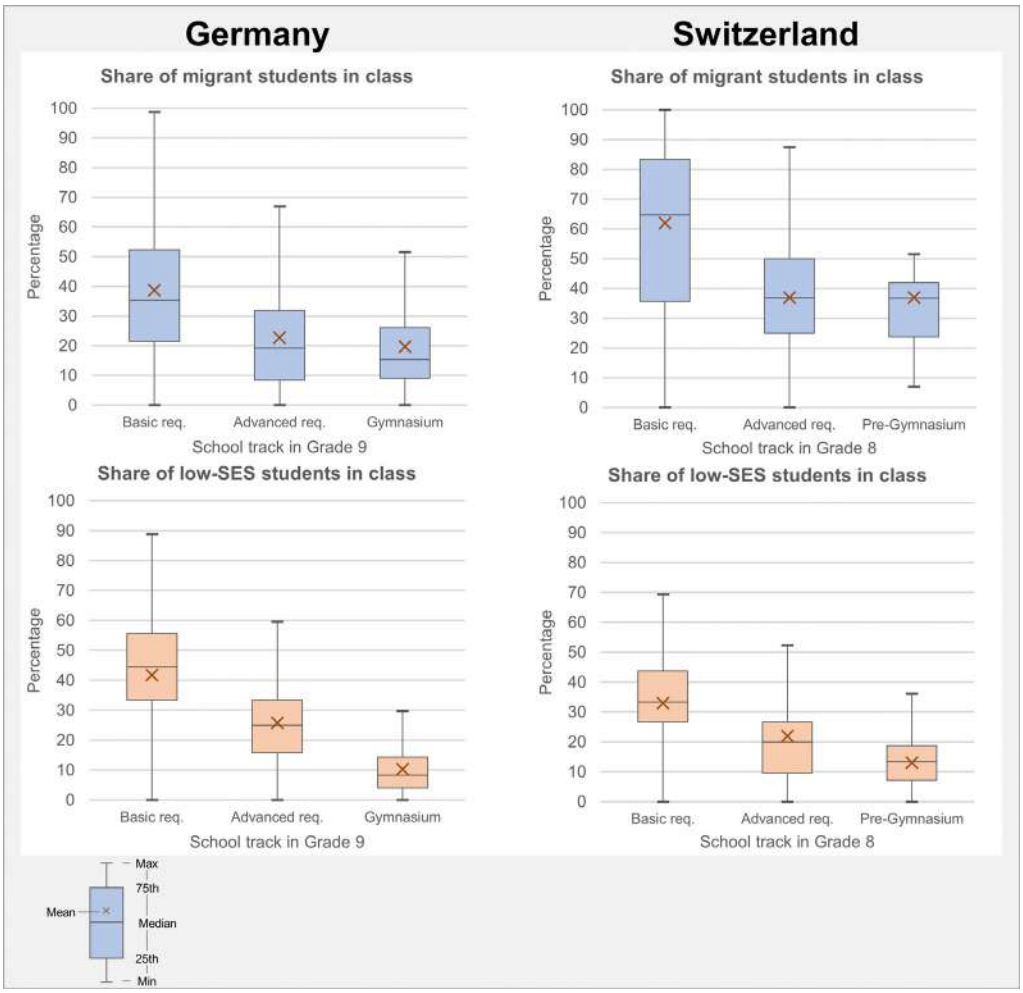
Descriptive findings show that there is a large social and ethnic selectivity regarding the **school track enrolment at lower secondary level**.[5] In both countries, socially disadvantaged students and those with a migration background are under-represented in cognitively more demanding

[4] Germany and Switzerland can be classified as traditional tripartite educational systems, as students are separated into three educational tracks in lower secondary education. In both countries, students attend a comprehensive primary school usually until Grade 4 (Grade 6 in Switzerland). Afterwards, they are channeled into three different educational tracks at lower secondary level. The tracks in lower secondary education are hierarchically ordered according to learning requirements, curricula and attainable school-leaving certificates. See Appendix for a graphical representation of the education systems.

[5] We differentiate between the following tracks at lower secondary level according to their cognitive demands. The Gymnasium (GER) or pre-Gymnasium (SUI), the Realschule (GER) or school type with advanced requirements (SUI), and the Hauptschule (GER) or school type with basic requirements (SUI). For better readability, the English terms are used in the text.

secondary school tracks and over-represented in tracks with the lowest cognitive demands. Consequently, the social and migrant composition differs between secondary school tracks. The highest proportion of **students with a migration background** (i.e., if at least one parent was born abroad) is observed at the school track with basic requirements (Median GER: 39%, Median SUI: 62%; see left side in Figure 1).

***Figure 1**: Social structure at lower secondary level in Germany (NEPS) and Switzerland (DAB)*



This proportion is substantially lower at school tracks with advanced requirements (Median GER: 23%, Median SUI: 37%) as well as in the Gymnasium (Median GER: 20%; Median SUI: 37%). The same applies to the **proportion of students from socially less privileged families**, i.e., if parents belong to the lowest ISEI quartile (GER: ≤ 31.72; SUI: ≤ 30.78). This proportion is highest at the school track with basic requirements (Median GER: 42%, Median SUI: 33%), while it is remarkably lower at the school track with advanced requirements (Median GER: 26%, SUI: 22%) and in the Gymnasium (GER: 10%; SUI: 13%; see right side in Figure 1). Moreover, compared to the other tracks, the variation of migrant and low-SES students is considerably lower in the Gymnasium. These descriptive findings are in line with previous research and point out to a

substantial segregation related to migration background and social origin (SCCRE, 2018: 80, Autorengruppe Bildungsberichterstattung, 2020: 115f.).

For further in-depth **multivariate analyses**, we distinguish different migration groups by parents' country of birth and examine **differences in the attended school track at lower secondary level compared to native students** (see Figures A1 and A2 in the Appendix and "Methodological notes"). Compared to their native peers, a higher propensity to attend a track with basic requirements is observed in Germany for students whose parents were born in Turkey (+18 percentage points [pp]) and in Switzerland for students with parents born in the Balkans, Turkey, or Portugal (+27 pp). In addition, these students have a substantially lower propensity to attend a school track with advanced requirements (GER: -3 pp; SUI: -22 pp) or a Gymnasium (GER: -17 pp; SUI: -4 pp) compared to their native peers. Part of these disadvantages are related to social origin (parental education and ISEI, see right side in Fig. A1 and A2). However, while for Germany, a substantial part of the association between migration background and attended school track is attributable to social background, this only holds for Switzerland regarding students at the Gymnasium. When interpreting these multivariate results, it is important to note that – with the given data sets – it is not possible to disentangle to what extent these associations are related to prior achievement in primary school.

Trajectory to certifying tracks at upper secondary level

In our samples, the majority of the school-leavers commence a certifying upper secondary education, namely VET or academic tracks, directly after compulsory education (GER: 84%; SUI: 84%). A delayed transition to upper secondary education does not necessarily have to be linked to disadvantages in the subsequent educational career. For example, students may attend pre-vocational training to improve their school leaving certificates before they commence a certifying upper secondary education (e.g. VET).[6] However, if a direct transition to certifying upper secondary tracks is related to ethnic or social segregation in class, a lower propensity to directly enter a certifying track is obviously subject to educational inequalities. In the following, we focus on students from school tracks with basic and advanced requirements since students from the (pre-)Gymnasium usually directly pursue a certifying track at upper secondary level (GER: 98%; SUI: 96%).

Due to the strong link between social origin and migration background on the one hand and the attended school track in lower secondary education on the other hand, we analyse compositional effects separately for students from school tracks with basic and advanced requirements (see Figures A3 and A4 in the Appendix). At the ***individual level***, the results indicate no systematic disadvantages for specific ethnic groups (expect for Turkish students in Germany). However, since students with a migration background and those from socially less privileged families are overrepresented in the school track with basic requirements, they still face the greatest disadvantages in the direct transition to certifying education. At the ***class level,***

[6] A delayed transition may occur due to different options (pre-vocational training, bridge year courses, internships, etc.) students opt for before commencing a certifying upper secondary education.

the results show that in both countries, class composition in lower secondary education only matters for students at the school track with advanced requirements. In Germany, a higher share of low-SES students in class is related to a significantly lower probability to enter certifying upper secondary education. In contrast, no association between social class composition and the likelihood of directly starting a certifying education is observed in Switzerland, while the ethnic class composition (i.e., a higher share of migrant students) is associated with a lower probability to directly start a certifying upper secondary education.

Propensity to attend an academic track vs VET at upper secondary level

Finally, the scope is on the propensity that students attend an academic track instead of VET at upper secondary level. The following analyses focus only on students from school tracks with advanced requirements. This sample restriction reflects the fact that students from the (pre-) Gymnasium usually stay in academic tracks after compulsory education while students from school tracks with basic requirements do only infrequently or are not permitted to start an academic track at upper secondary level due to institutional regulations.[7]

Again, and for both countries, the most important ***individual level predictor*** is the school track attended at lower secondary level. Overall, no significant disadvantages for specific ethnic groups are observed. However, when controlling for social origin, the attended school track as well as grades in language and maths, a higher probability to attend an academic track is observed for students whose parents were born in Turkey, Poland or the FSU compared to their native peers in Germany, while in Switzerland this holds for students with parents born in the Balkans, Turkey, or Portugal. These findings are in line with previous research on positive ethnic choice effects (Tjaden and Scharenberg, 2017). The results highlight that students from specific ethnic groups, which face considerable educational disadvantages in compulsory education, show a higher propensity to attend an academic track than natives.

Regarding ***compositional effects*** at the class level, we observe no association between the share of migrant or low-SES students and the propensity to attend an academic track 15 months after leaving compulsory school neither in Germany nor in Switzerland (see Figures A5 and A6 in the Appendix).

Conclusion

Overall, the results point out to substantial ethnic and social segregation at lower secondary level in Germany as well as in German-speaking Switzerland. This segregation is linked to well-documented educational disadvantages for specific migration groups and the offspring from economically less privileged families. Our findings underline that due to early tracking in the

[7] 24 percent of students from this track attend an academic track in Germany, while the share in Switzerland is 25 percent. About 5 percent of the students from the school track with basic requirements in Germany attend an academic track, while in Switzerland the share is lower than 2 percent due to institutional restrictions. In contrast, 93% (73%) percent of students who attended the (Pre-)Gymnasium in compulsory education pursue this track at upper secondary level in Germany (Switzerland).

education systems of both countries, the attended school track at lower secondary level matters with respect to directly starting a certifying upper secondary track (academic track or VET) and also for attending an academic track approximately one year after completing compulsory schooling. In sum, our findings contribute to the well-documented fact that students with migration background are particularly disadvantaged in tracked education systems because they are overrepresented in school tracks with low cognitive demands.

Our analyses, which we conducted separately by school tracks at lower secondary level, indicate that there is only a weak association between ethnic or social segregation at class level and disadvantages in educational attainment at upper secondary level. Moreover, we find no evidence that students of specific ethnic groups show disadvantages regarding the outcomes considered. Our contribution highlights for both countries that the attended school track at lower-secondary level is more important regarding the subsequent educational attainment than the ethnic and social composition at class level. However, and this trajectory cannot be covered with the data used here, educational inequalities at the transition to lower secondary level after primary school are highly relevant in both countries because they are closely related not only to socio-spatial segregation but institutional regulations at community or state level (Bundesland, Canton; see Seibert *et al.*, 2009, Gresch *et al.*, 2010), and have thus a decisive long-term influence on achievement development, later educational opportunities and labour market outcomes (Terrin and Triventi, 2022).

Methodological notes

The analyses are based on data of the Starting Cohort 4 (Grade 9) of the National Education Panel Study (NEPS) for Germany (NEPS Network, 2021)[8] and the DAB Panel Study ("Determinanten der Ausbildungswahl und der Berufsbildungschancen", Becker *et al.*, 2022) for Switzerland. The stratified random samples include information on the transition from compulsory to upper secondary education of the school leaver cohort from 2013 (in Germany 2012/2013). The analysis sample is restricted to students of regular schools with complete information on the attended upper secondary track directly and 15 months after leaving compulsory education. Missing information on control variables was imputed using chained equations (White *et al.*, 2011). The analyses are based on 10 imputed data sets. Weights were used to account for longitudinal designs.

In order to describe the social structure of students at lower secondary level, multinomial logistic regression models were applied. The analysis on the association of ethnic segregation and the educational outcomes at upper secondary level are based on multilevel linear probability models (Breen *et al.*, 2018). Robustness checks show negligible differences between results if multinomial logistic regression and average marginal effects are estimated.

The main dependent variables are operationalised as follows: a) whether students commence a certifying upper secondary track directly after leaving compulsory school (= 1) or not (= 0); b) whether students had attended an academic track (= 1) instead of a vocational education and training (VET, = 0) 15 months after leaving compulsory school.

Ethnic segregation is measured in both data sets on the class level based on information provided by the respondents. The proportion of migrants within class is calculated as relative share of students whose parents [or at least one parent was] were born abroad. The proportion of low SES students in class refers to students whose parents belong to the lowest ISEI quartile. Although the proportions of these two measures at class level could vary within school, we do not expect a systematic bias due to the random sampling of classes within schools.

The following controls were used in the analyses: gender, migrant background operationalised by parents' country of origin (GER: Germany, Turkey (TUR), other labour migrants (OLM), Poland (POL), Former Soviet Union (FSU), Others; SUI: Switzerland, EU15/EFTA, Balkans/Turkey/Portugal (BalTuPor), Others, Switzerland/mixed), social background operationalised by the highest socio-economic status (ISEI) and the highest educational level (ISCED) of the parents. Additionally, the school track (GER: basic requirements *[Hauptschule]*, advanced requirements [*Realschule]*, *Gymnasium*; SUI: basic requirements, advanced requirements, pre-gymnasium) attended in compulsory education (GER: Grade 9; SUI: Grade 8), as well as grade point averages in language and maths, were included in the analysis. We use data from Grade 8 in the Swiss case since in several cantons the pre-gymnasium is provided only from 9th grade onward.

A limitation of the analysis is the fact that measures of social origin (ISEI, ISCED) are based on information provided by students, which might lead to an underestimation of socio-economic disparities (Engzell and Jonsson, 2015).

[8] This paper uses data from the National Educational Panel Study (NEPS; see Blossfeld and Roßbach, 2019). The NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi, Germany) in cooperation with a nationwide network.

References

Autorengruppe Bildungsberichterstattung, 2020. Bildung in Deutschland 2020. Ein indikatorengestützter Bericht mit einer Analyse zu Bildung in einer digitalisierten Welt [Education in Germany 2020. An indicator-based report with an analysis of education in a digitalised world] Bielefeld: wbv Media. https://doi.org/10.3278/6001820gw.

Becker, B. & Klein, O., 2021. The primary effect of ethnic origin – rooted in early childhood? An analysis of the educational disadvantages of Turkish-origin children during the transition to secondary education in Germany. Research in Social Stratification and Mobility, 75. https://doi.org/10.1016/j.rssm.2021.100639.

Becker, R., Glauser, D. & Möser, S., 2022. DAB Panel Study (DAB): W1 - W8 [Dataset, Public-Use-File, Data-Release Version 5.0] Lausanne: Distributed by SWISSUbase. https://doi.org/10.48573/cf4p-6s72.

Blossfeld, H.-P., Buchholz, S., Skopek, J. & Triventi, M. (eds.) (2016) Models of secondary education and social inequality. An international comparison, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing. https://doi.org/10.4337/9781785367267.

Blossfeld, H.-P. & Roßbach, H.-G. (eds.) (2019) Education as a lifelong process: The German National Educational Panel Study (NEPS). Wiesbaden: Springer VS. https://doi.org/10.1007/978-3-658-23162-0.

Borgna, C. & Contini, D., 2014. Migrant achievement penalties in Western Europe. Do educational systems matter? European Sociological Review, 30**,** 670-683. https://doi.org/10.1093/esr/jcu067.

Breen, R., Karlson, K.B. & Holm, A., 2018. Interpreting and understanding logits, probits, and other nonlinear probability models. Annual Review of Sociology, 44**,** 39-54. https://doi.org/10.1146/annurev-soc-073117-041429.

Dar, Y. & Resh, N., 1986. Classroom intellectual composition and academic achievement. American Educational Research Journal, 23**,** 357-374. https://doi.org/10.2307/1163053.

Engzell, P. & Jonsson, J.O., 2015. Estimating social and ethnic inequality in school surveys. Biases from child misreporting and parent nonresponse. European Sociological Review, 31**,** 312-325. https://doi.org/10.1093/esr/jcv005.

Fekjaer, S.N. & Birkelund, G.E., 2007. Does the ethnic composition of upper secondary schools influence educational achievement and attainment? A multilevel analysis of the Norwegian case. European Sociological Review, 23**,** 309-323. https://doi.org/10.1093/esr/jcm003.

Gresch, C., Baumert, J. & Maaz, K., 2010. Empfehlungsstatus, Übergangsempfehlung und der Wechsel in die Sekundarstufe I: Bildungsentscheidungen und soziale Ungleichheit [Recommendation status, transition recommendation and the transition to lower secondary school: Educational decisions and social inequality]. In J. Baumert, K. Maaz & U. Trautwein (eds.) Bildungsentscheidungen. Wiesbaden: VS Verlag für Sozialwissenschaften, 230-256. https://doi.org/10.1007/978-3-531-92216-4_10.

Kalter, F., Jonsson, J.O., Van Tubergen, F. & Heath, A. (eds.) (2018) Growing up in diverse societies: The integration of the children of immigrants in England, Germany, the Netherlands, and Sweden, Oxford: Oxford University Press. https://doi.org/10.5871/bacad/9780197266373.001.0001.

Korber, M. & Oesch, D., 2019. Vocational versus general education: Employment and earnings over the life course in Switzerland. Advances in Life Course Research, 40**,** 1-13. https://doi.org/10.1016/j.alcr.2019.03.003.

Kruse, H. & Kroneberg, C., 2019. More than a sorting machine: Ethnic boundary making in a stratified school system. American Journal of Sociology, 125**,** 431-484. https://doi.org/10.1086/705561.

Laganà, F., Chevillard, J. & Gauthier, J.-A., 2014. Socio-economic background and early post-compulsory education pathways. A comparison between natives and second-generation immigrants in Switzerland. European Sociological Review, 30**,** 18-34. https://doi.org/10.1093/esr/jct019.

Lenz, S., Rjosk, C., Lorenz, G. & Stanat, P., 2021. Ethnische Segregation zwischen Schularten in mehrgliedrigen Schulsystemen und im „Zwei-Wege-Modell“ [Ethnic segregation between school types in multi-tiered school systems and two-tiered systems. Analyses with respect to school structural reforms in Berlin, Bremen, and Hamburg]. KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie, 73**,** 59-84. https://doi.org/10.1007/s11577-021-00739-x.

Müller, W. & Shavit, Y., 1998. The institutional embeddedness of the stratification process. A comparative study of qualifications and occupations in thirteen countries. In Y. Shavit & W. Müller (eds.) From school to work. A comparative study of educational qualifications and occupational destinations. Oxford: Clarendon Press, 1-48.

Nauck, B., 2019. Ethnic inequality in educational attainment. In R. Becker (ed.) Research handbook on the sociology of education. Cheltenham: Edward Elgar, 499-519. https://doi.org/10.4337/9781788110426.00039.

NEPS Network, 2021. National Educational Panel Study, scientific use file of starting cohort Grade 9. Bamberg: Leibniz Institute for Educational Trajectories (LIfBi). https://doi.org/10.5157/NEPS:SC4:12.0.0.

Rathmann, K., Herke, M. & Richter, M., 2020. The role of class-level composition and schools´ contextual characteristics for school-aged children´s life satisfaction: a three-level multilevel analysis. International Journal of Adolescence and Youth, 25**,** 12-24. https://doi.org/10.1080/02673843.2019.1573743.

Rözer, J. & Bol, T., 2019. Labour market effects of general and vocational education over the life-cycle and across time: Accounting for age, period, and cohort effects. European Sociological Review. https://doi.org/10.1093/esr/jcz031.

Rözer, J. & Van De Werfhorst, H., 2017. Inequalities in educational opportunities by socioeconomic and migration background. A comparative assessment across European societies. ISOTIS.

Seibert, H., Hupka-Brunner, S. & Imdorf, C., 2009. Wie Ausbildungssysteme Chancen verteilen. Berufsbildungschancen und ethnische Herkunft in Deutschland und der Schweiz unter Berücksichtigung des regionalen Verhältnisses von betrieblichen und schulischen Ausbildungen [How training systems distribute opportunities. Vocational training opportunities and ethnic origin in Germany and Switzerland, taking into account the regional distribution of company and school-based training]. Kölner Zeitschrift für Soziologie und Sozialpsychologie, 61**,** 595-620.

Spörlein, C. & Schlueter, E., 2018. How education systems shape cross-national ethnic inequality in math competence scores. Moving beyond mean differences. PLoS ONE, 13**,** 1-21. https://doi.org/10.1371/journal.pone.0193738.

Swiss Coordination Centre for Research in Education, 2018. Swiss education report 2018. Aarau: SCCRE. https://www.skbf-csre.ch/en/education-report/education-report/.

Terrin, É. & Triventi, M., 2022. The effect of school tracking on student achievement and inequality: A meta-analysis. Review of Educational Research**,** 003465432211008. https://doi.org/10.3102/00346543221100850.

Tjaden, J.D. & Scharenberg, K., 2017. Ethnic choice effects at the transition into upper-secondary education in Switzerland. Acta Sociologica, 60**,** 309-324. https://doi.org/10.1177/0001699316679491.

Veerman, G.J.M. & Dronkers, J., 2016. Ethnic composition and school performance in the secondary education of Turkish migrant students in seven countries and 19 European educational systems. International Migration Review, 50**,** 537-567. https://doi.org/10.1111/imre.12185.

White, I.R., Royston, P. & Wood, A.M., 2011. Multiple imputation using chained equations: Issues and guidance for practice. Statistics in Medicine, 30**,** 377-399. https://doi.org/10.1002/sim.4067.

6 The impact of school social composition and neighbourhood social mix on upper secondary exam performance in Ireland

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Highlights

- This paper looks at the effect of school and neighbourhood social mix on upper secondary performance using Growing Up in Ireland data.
- Active choice of secondary school in Ireland means we can provide more precise measures of school and neighbourhood effects.
- Both schools and neighbourhoods matter to educational performance, with schools having a stronger effect.
- Policies to tackle educational inequality need to target families, schools *and* communities to make a difference.

Background

Much of the literature to date have explored the causes and consequences of unequal education, as it can be a driver of unequal outcomes between different groups in society and affect social mobility across generations. Unequal outcomes have been associated with socio-economic background, parental education, family structure, migrant status, gender, and having a special educational need (Bukodi and Eibl, 2015; Filsi et al., 2016; Buchmann et al., 2008). These multiple barriers to educational opportunities compound one another in shaping the experiences and outcomes of children. These factors can also intersect with school and neighbourhood effects.

There has been a good deal of debate about whether the social mix of the school and neighbourhood make a difference to educational outcomes like exam performance. Some researchers have argued that what really matters is the profile of young people in a particular school (or neighbourhood) (Thrupp et al. 2002; Marks 2021). Others have maintained that schools (and/or neighbourhoods) have an effect over and above the characteristics of individuals they contain (Palardy et al. 2015; Sciffer et al. 2020). Resolving this issue is extremely important for policymakers as it influences whether we should target supports at young people

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and their families and/or provide additional resources for schools (or neighbourhoods) with a concentration of social disadvantage.

A further debate has taken place about whether schools or neighbourhoods matter more for young people's educational outcomes, in terms of both the level reached and the grades attained within a particular level of education (Sykes and Musterd, 2011, in the Netherlands; Brännström, 2008 in Sweden; Kauppinen, 2008, in Finland). It has often been difficult to unpack the relative effect of these two settings as, in many European countries, young people attend their local school. There is a long-standing debate on the positive and negative aspects of school choice. School choice is a complex process, with decisions made based on parental perceptions of the best 'fit' of the school for their child. The decision-making process is informed by considering different alternatives as well as access to schools (Reay, 1996; Kristen, 2008). Supporters of school choice highlight the right of parents to opt for a school of their choice on the basis of a range of criteria, including the quality of schools, financial considerations, the school's philosophy/mission, and distance from home (OECD, 2017). Across OECD countries, just over half (64%) of the parents surveyed report that they had a choice of at least one other school available to them (OECD, 2017). However, the degree of choice varies markedly between countries and across social groups. Critics, however, note that the availability of choice is likely to lead to greater social and cultural segregation in the school system (OECD, 2017). Research to date has shown that middle-class parents are in better position to exercise such choice, while choice tends to be more constrained for other social groups (Burgess, et al, 2009).

This paper uses data from the Growing Up in Ireland (GUI) study[3] to examine whether the social composition of schools and neighbourhoods influences upper secondary performance, over and above individual social background factors. Ireland is an interesting case-study as there is very active choice of secondary school on the part of families, resulting in variation between schools in the social profile and prior ability levels of their students.[4] This means that adolescents in the same neighbourhood often attend different secondary schools and a particular school may draw on young people from several neighbourhoods, all with different profiles. Furthermore, in Ireland, performance in the high-stakes upper secondary exam affects whether young people go on to tertiary education and their access to employment, making it a key mechanism for the reproduction of inequality.

Results

Upper secondary performance is measured in terms of 'points' which combine the grades young people received across six subjects and the level (higher or ordinary) at which they studied a

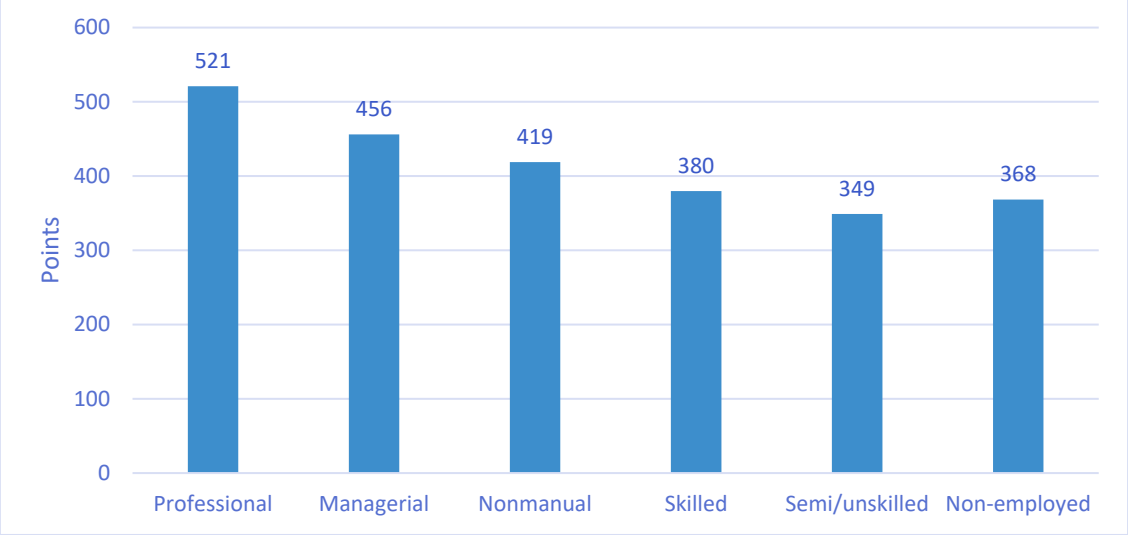
[3] Growing Up in Ireland is a Government-funded study which has followed two cohorts of children. This paper draws on data from Cohort '98, which first surveyed participants at age 9 and followed them up at 13, 17 and (in 2017/18) 20 years of age.

[4] At primary level, children are more likely to attend their local school, but can choose between different types of primary school depending on location.

subject for their Leaving Certificate (see "Methodological notes").[5] Drawing on the GUI data, the analyses are based on a multidimensional approach to understanding educational inequality, looking at social class, mother's education, experience of financial strain (difficulty making ends meet), migrant status, family structure, gender and disability/special educational need.

Using social class as an illustration, we see that there is a strong social gradient in exam grades, with young people from a professional background receiving much higher 'points' than those from semi/unskilled manual or non-employed households (Figure 1). A multivariate model allows us to look at all of these different dimensions of social background simultaneously. We find that social class, mother's education, family structure and financial strain all influence exam results, with the lowest grades found among those in manual or non-employed families, where their mother has a lower secondary (or lower) qualification, where they experience financial strain and where they are living in a lone-parent family (see Figure A1 in Appendix). Mother's education has the largest effect among these family background characteristics. Unlike in many other countries, being from a migrant family in Ireland does not make a significant difference to exam grades once other aspects of family background are taken into account. Lower exam grades are also found among young people with disabilities and, to some extent, among males.

***Figure 2**: Upper secondary grades by household social class*



The analyses adopt a multilevel approach, looking at how young people are clustered within schools and neighbourhoods. Both the individual school attended and the area in which they lived have significant influences on exam grades, but the effect of the school is stronger than that of neighbourhood. We use involvement in a policy intervention, the Delivery of Equality of Opportunity in Schools (DEIS) scheme, as a proxy for school social mix. This scheme targets additional resources and supports towards schools with a concentration of socio-economically

[5] All subjects are examined at higher and ordinary level with foundation level only available in Maths and Irish. The grading is based on 8-point scale within subject levels.

disadvantaged students.[6] Grades are found to be much lower in schools with a concentration of students from socio-economically disadvantaged backgrounds (DEIS schools) than among schools with a more socially mixed profile (Figure 2). The highest grades are found among those in fee-paying (private) schools which represent about 8% of secondary schools in Ireland.

***Figure 2**: Upper secondary grades by secondary school social mix*

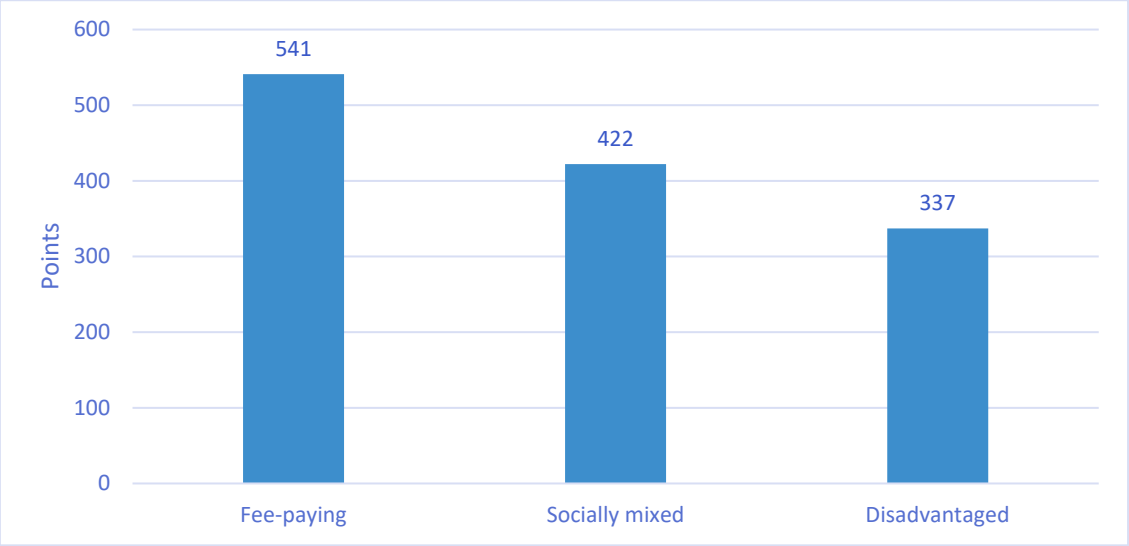


Figure 2 shows the overall differences between schools but we know that these schools vary in the profile of students attending them. When we take account of these background characteristics, the differences by school social mix are not as large but they are still sizeable (see Figure A2 in Appendix). Thus, the social profile of the school acts as a mechanism to produce educational inequality.

Does the profile of the neighbourhood make a difference? We use two sets of measures: objective measures of area-level deprivation from the Census of Population and parental reports of how disorderly/unsafe they see the neighbourhood as (McNamara et al., 2021). We see a clear difference in upper secondary performance between those living in the least disadvantaged neighbourhoods and those living in the most disadvantaged settings (Figure 3). We also see that grades are lower in areas described by parents as disorderly and relatively unsafe (Figure 4).

Figures 3 and 4 do not take account of the profile of young people and families living in these areas or the social mix of the school they attend. When we use allow for the fact that different areas different in the socio-economic profile of families, we see that the size of the differences between different types of areas reduces but it is still substantial (see Figure A3 in Appendix). Thus, young people living in disadvantaged neighbourhoods do worse in their exams than those

[6] Launched in 2005, the scheme takes an integrated approach to tackling educational disadvantage including reduced class size, access to Home School Community Liaison Services (HSCL), School Meals Programme, School Completion Programme, literacy/numeracy support, etc.

living in other settings, even taking account of their own family background and the type of school they attend. Young people living in urban areas also do worse in their exams than those in rural areas.

***Figure 3**: Upper secondary exam grades by level of deprivation in the local area (Census-based scale, divided into quartiles)*

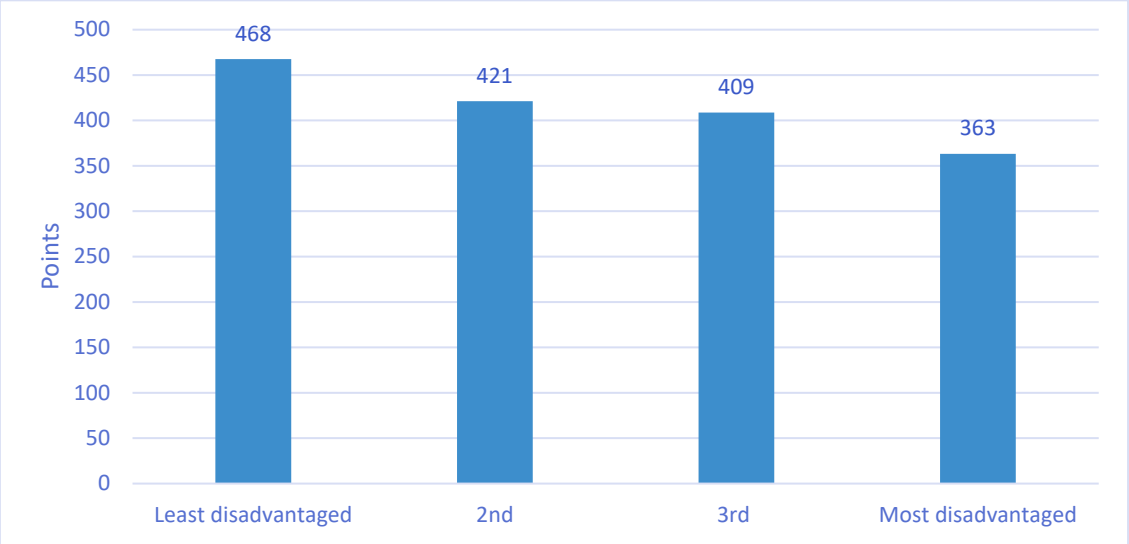
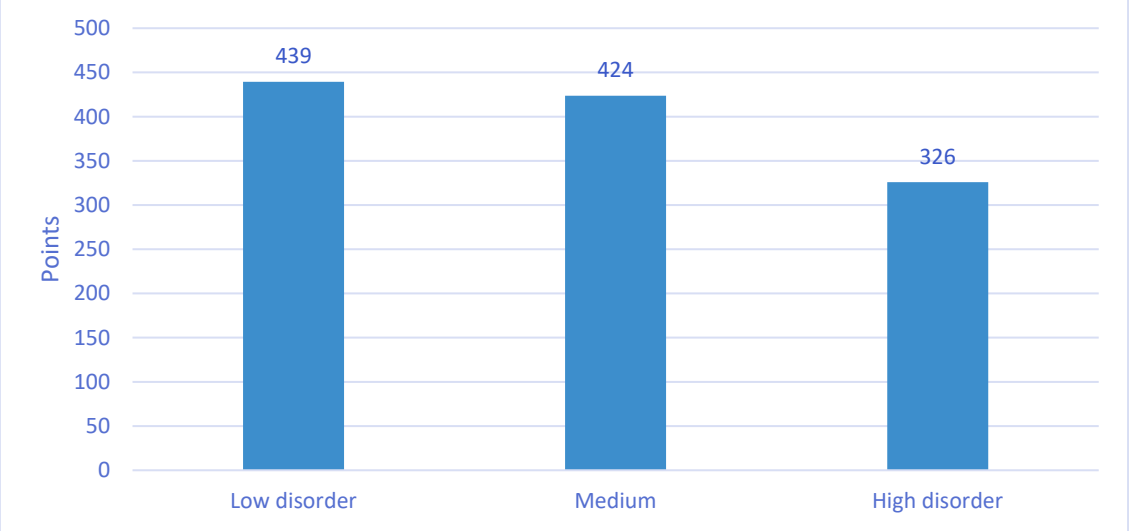


***Figure 3**: Upper secondary exam grades by perceived neighbourhood disorder (parent reports, with the scale divided into tertiles)*



Conclusion

Active choice of secondary school in Ireland makes it a useful case-study in examining whether the social composition of schools and neighbourhoods influences educational outcomes. The results presented here show the value of taking a multidimensional approach and a multilevel perspective to understanding educational inequality. Different dimensions of social background

matter, with mother's education, social class, experience of financial strain and family structure (lone- or two-parent) all making a difference to how young people do academically. The social profile of the school attended also makes a difference, with young people attending schools with a concentration of peers from socio-economically disadvantaged backgrounds receiving lower grades than those in socially mixed or middle-class (fee-paying) schools. The profile of the neighbourhood matters too, with young people living in more deprived or disorderly areas doing worse academically. All of these layers coalesce to produce and reproduce inequality, with some young people experiencing disadvantage through their family, school and local environment.

A contribution of the research is that it can provide precise measures, using an approach called cross-classified multilevel modelling (see "Methodological notes"), of the influence of schools and neighbourhoods. We find that both contexts matter but, perhaps not surprisingly, schools have a stronger effect on educational performance than local areas.

The findings have important implications for policy to tackle educational inequality. At present, schools serving disadvantaged populations in Ireland receive additional resources and supports. The results suggest that these additional resources and supports are not sufficient to bridge the gap in performance between schools with different profiles, highlighting the importance of even more resources for these schools to counter educational inequality. However, individual social background has a strong effect and not all disadvantaged students attend schools receiving additional supports. This would suggest the need for tapered supports across all schools to support students from disadvantaged backgrounds. Area-based interventions could also make a difference by ensuring a better social mix in the placement of social housing and by addressing anti-social behaviour in some communities.

While the findings relate to the Irish context, the issue of whether to target supports at families, schools and/or communities is one that is faced by policymakers across Europe.

Methodological notes

This paper draws on Cohort '98 of the Growing Up in Ireland (GUI) study. First surveyed at nine years of age, this cohort of young people along with their parents were followed up at 13, 17/18 and 20 years of age. Analyses relate to the 4,500 young adults who reported their upper secondary grades at wave four of the survey, conducted in 2017/18. The analyses exclude those who left school early and the small group that took the (non-college-track) Leaving Certificate Applied programme and were assessed using a different grading system. Weights are used to adjust for non-response and attrition.

The outcome variable was upper secondary performance, measured using a 'points' system with points awarded on the basis of the grade received and subject level taken. Family background is measured using household social class, maternal education, financial strain, family structure and migrant status. Analyses also take account of gender and disability/special educational needs. School social mix is measured on the basis of participation in a scheme for schools serving socio-economically disadvantaged populations and on whether the school is fee-paying (private) or not. Neighbourhood social mix is based on a factor scale of the proportion in the electoral division (an administrative area) with lower secondary qualifications, in rented accommodation and unemployed. In addition, parent reports of local disorder/lack of safety are used to capture subjective perceptions of the area.

Cross-classified multilevel models are used to take account of the clustering of young people in schools and neighbourhoods. A series of nested models are presented, with the null model identifying the extent to which grades vary by school and neighbourhood and the progressive inclusion of: family background factors; school social composition; and neighbourhood social composition.

A limitation of the paper is the reliance on proxy measures of school social mix. Larger samples within schools would have facilitated the construction of aggregate measures of school composition. Furthermore, neighbourhood is measured on the basis of electoral division which may not reflect the boundaries of areas as perceived by young people and their families.

References

Brännström, L. 2008. Making their mark: the effects of neighbourhood and upper secondary school on educational achievement. *European Sociological Review*, 24 (4), DOI:10.1093/esr/jcn013.

Buchmann, C., DiPrete, T. A., McDaniel, A. 2008. Gender Inequalities in Education. Annual Review of Sociology. 34:319-337

Bukodi, E. and Eibl, F. 2015. Linking the Macro to the Micro: A Multidimensional Approach to Educational Inequalities in Four European Countries. WORKING PAPER 15-02. Available at: https://www.spi.ox.ac.uk/files/150609barnettpaper15-02pdf

Burgess, S., Greaves, E., Vignoles, A. & Wilson, D. 2009. Parental Choice of Primary School in England: What 'Type' of School do Parents Choose?, CMPO Working Paper Series, no 09/224. The Centre for Market and Public Organization. http://www.ntu.ac.uk/nbs/document_uploads/99207.pdf.

Flisi, S., Meroni, E.C., Vera-Toscano, E. 2016. Educational outcomes and immigrant background.

EUR 28195 EN. doi:10.2791/026577, Available at: file:///C:/Users/mdarmody/Downloads/educational%20outcomes%20and%20immigrant%20background_revisions%20accepted%20sf%20final.pdf

Kauppinen, T. M. 2008. Schools as mediators of neighbourhood effects on choice between vocational and academic tracks of secondary education in Helsinki. *European Sociological Review*, *24*(3), 379-391.

Kristen, C. 2008. Primary School Choice and Ethnic School Segregation in German Elementary Schools. *European Sociological Review*. 24 (4), 495–510.

Marks, G. N. 2021. School socioeconomic-background effects are generally small: a response to Sciffer, Perry, and McConney. *British Journal of Sociology of Education*, *42*(5-6), 616-626.

McNamara, E., O'Reilly, C., Murray, A., O'Mahony, D., Williams, J., Murphy, D., McClintock, R., & Watson, D. 2021. *Growing Up in Ireland: Design, Instrumentation and Procedures for Cohort '98 (Child Cohort) at Wave 4 (20 years of age)*. Dublin: ESRI/TCD/DCEDIY.

OECD 2017. School choice and school vouchers: An OECD perspective. Paris: OECD. Available at: https://www.oecd.org/education/School-choice-and-school-vouchers-an-OECD-perspective.pdf

Reay, D. 1996. Contextualizing Choice: Social Power and Parental Involvement. *British Educational Research Journal*, 22 (5), 581–596.

Sciffer, M. G., Perry, L. B., & McConney, A. 2020. Critiques of socio-economic school compositional effects: are they valid?. *British Journal of Sociology of Education*, *41*(4), 462-475.

Thrupp, M., Lauder, H., & Robinson, T. 2002. School composition and peer effects. *International Journal of Educational Research*, 37(5), 483–504. doi:10.1016/s0883-0355(03)00016-8

7 Equal education and PISA scores: the case of Russian-Medium Schools in Lithuania

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Highlights

- There is no consensus on how minority language-medium schools in Lithuania perform academically, with national assessment suggesting that they perform worse than Lithuanian-medium schools, and international assessment showing mixed results.
- In general, students who live in rural areas, do not speak the state language at home (non-Lithuanian speakers), and come from low socio-economic status backgrounds have lower levels of academic achievement.
- Children who study in Russian-medium schools have higher levels of academic achievement in math and science than those who study in Lithuanian-medium schools after controlling for student's SES, language spoken at home and the location of the school.
- Attending a Russian-medium school partially mitigates the negative impact of speaking Russian at home possibly indicating that studying in the mother tongue helps students perform better academically.
- Russian-medium schools are primarily situated in urban areas, benefiting from a more efficient resource and staff allocation in those areas, and may have a stronger focus on science (rather than humanities).
- Our research emphasised the importance of providing systematic assistance to minority language students, especially in rural areas and in schools where the language of instruction is other than their mother tongue, and pointed out the challenges of academic performance assessment of minority language students.

Background

Although the Lithuanian education system strives to provide equal, inclusive and free access to quality education for all, there are still many vulnerable children who are unable to equally benefit from education, such as children with special educational needs and disabilities, at-risk youth, children in institutional care, children from socio-economically disadvantaged families, children living in rural areas, refugee and returnee children, and children from ethnic and linguistic minority backgrounds (UNICEF 2021; LR Seimas 2022; Bankauskaite and Dunajeva

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2022). This paper focusses on the latter group; considering that it is primarily language minority children who study in minority language schools, we analyse the differences in academic achievement between students of mainstream Lithuanian-language schools and their peers in minority language schools.

After Lithuania re-gained its independence, linguistic and cultural minority groups had the right to be educated—from ECEC until the end of secondary education—in non-Lithuanian medium schools. There is a paucity of research on the quality of education in minority language schools in Lithuania, yet some authors have found that the academic achievement of language minority students is lower than that of their Lithuanian-speaking peers (e.g., Dambrauskas 2020). To this date, there has been no systematic and comprehensive study on the reasons for this underachievement. The two most numerous ethnic minority groups in Lithuania are the Poles and Russians, constituting 6.6 per cent and 5.1 per cent respectively.[4] These groups may choose one of the 27 Russian-medium or one of the 46 Polish-medium schools in the country (ŠVIS 2021). Our research focusses on Russian-medium schools (for reasons explained in "Methodological notes") and aims to:

1) confirm whether there are differences in academic performance among children attending Lithuanian and Russian-medium schools, using PISA data;

2) suggest reasons that may explain any potential differences.

The education of minority language children has been a contentious topic in Lithuania for many years. For instance, the requirement for ethnic and linguistic minority children to pass the same Lithuanian language exams as Lithuanian children introduced in 2011 (then updated in 2020) was immediately met with criticism from the representatives of these minority groups, claiming this requirement was discriminatory (Tracevskis 2011; Radio Poland 2015; Ozdoba 2018; Urbaitytė 2011; Adomavičiūtė 2020; Busygina & Onishchenko 2019; Lietuvos Respublikos švietimo, mokslo ir sporto ministerija 2011; 2020a; LR Seimas 2022). Currently, Lithuanian classes are provided for Russian-speaking children from kindergarten stage.[5] During education in Lithuania, starting with ECEC and until secondary level, Lithuanian language classes are provided for at least 5 hours a week (the same as in Lithuanian-medium schools), while subjects such as citizenship studies, geography and history are taught in Lithuanian language during secondary education (Lithuanian Education plan for 2021-2022, 2022-2023). Yet, many observers have reported that the quality of Lithuanian language teaching and integration into other subjects is insufficient, and hence minority language students are not always properly prepared to take exams in Lithuanian on a par with Lithuanian-speaking students (Dambrauskas 2020; Stacevičius 2020; Dabašinskienė and Kubiliūtė 2021).

[4] Lithuanian statistics portal, 2022. Accessible at: https://osp.stat.gov.lt/statistiniu-rodikliu-analize#/

[5] Note: Public ECEC in Lithuania is divided into two stages: 1) *ikimokyklinis ugdymas* from 1 to 5 year-olds, and 2) *priešmokyklinis ugdymas* from 5 to 7 year-olds (in some exceptions for 5 to 6 year-olds, upon the request of parents if the child is more academically advanced).

Furthermore, the requirement for students in Russian-medium (and Polish-medium) schools to pass the same matura exams (final exams at the end of secondary school) in the Lithuanian language as children who study in mainstream Lithuanian-language schools further put non-Lithuanian speaking students at a disadvantage. It should be noted however, that a transition period of nine years (until 2020) has been agreed upon, when graduates from minority language schools were evaluated less strictly in Lithuanian language exam (National Examination Centre 2017). Nevertheless, the final year exam (VBE) grades of students attending Russian-medium schools are lower than the grades of their peers attending Polish and Lithuanian schools, although their results have improved slightly (NŠA 2022). Among other disadvantages, scholars have pointed out overcrowded classrooms and big class sizes, resulting in high student-teacher ratio, and inadequate resources, such as textbooks (relying on books in Lithuanian due to the lack of Russian language ones), negatively impacting students' academic achievement (Zabulionis 2020). Other challenges include teachers' and principals' lack of experience with working in a bilingual and multiethnic environment (Reingardė, Vasiliauskaitė and Erentaitė 2010; Saugėnienė 2003; Šliavaitė 2019), partly due to insufficient professional training, and lack of access to non-formal education activities organized either by the school or private providers (Nacionalinės mokyklų vertinimo agentūra 2019), which have been demonstrated to greatly contribute to children's academic success, especially among vulnerable groups (Simac and Marcus 2019; Souto-Otero 2015). Indeed, children who study in Russian or Polish schools have less opportunities for non-formal education, while those who study in Lithuanian schools have more options (NŠA 2022).

Studies show that **intersectional disadvantages for children who belong to minority language or ethnic minority groups are particularly pronounced if students attend rural schools**, as the quality of education is unequivocally lower in rural areas and there are less opportunities to engage in non-formal education (UNICEF 2021). More specifically, schools in rural areas often lack educational support specialists, psychologists, well-qualified teachers, access to technology, laboratories, adjusted learning materials (i.e. adapted educational resources, such as special teaching methodologies and tools according to children's needs), up-to-date books and learning methodologies with contemporary teaching and learning approaches (UNICEF 2021). Admittedly, the overwhelming majority (23 schools out of 27) of Russian-speaking schools are situated in urban areas, with only 4 schools in rural areas (NŠA 2022), which indicates that although these schools are able to benefit from a pronounced performance advantage of urban schools (OECD 2016, p.39), yet Russian-speaking children in rural areas must attend non-Russian medium schools. Partly for this reason and partly due to the overall demand for placement in Russian-medium schools exceeding the available number of schools, a growing number of Russian-speakers tend to enrol in Lithuanian-speaking schools, and to a lesser extent in Polish-speaking schools (Zabulionis, 2020). With an increasing number of Russian-speaking children studying in non-Russian-language schools, these students may require additional support to mitigate inequalities.

In addition, studies have demonstrated that some minority students, such as the Russian-speaking students face stigmatization and prejudice in society, and as a result have low self-esteem that affects their education (Zaleskienė and Kvederavičiūtė 2017; Budginaitė and Mašidlauskaitė 2015; Skerytė-Kazlauskienė and Barkauskienė 2010). Admittedly, Russian-speakers are a diverse group that consists of "minority groups such as Poles, Ukrainians and Belorussians or people of mixed ethnic origin, [who] have often adapted Russian as their first language" (Alijeva 2017, 486). Overall, minority students face multiple disadvantages in education, particularly if their parents have low levels of educational attainment; they attend rural schools and come from a low-economic status background (UNICEF 2021). Consequently, Russian-speaking students are less likely to enrol in higher education institutions in Lithuania: in 2020, 60% of Lithuanian-speaking students enrolled in universities after secondary school, compared to 50% of Polish and Russian students (Švietimo, mokslo ir sporto ministerija 2019). Granted, the language of higher education is predominantly Lithuanian, with a growing number of courses offered in English, and many Polish students, for instance, study in universities in Poland.

Considering the various forms of disadvantage faced by Russian-speaking students, there have been some attempts to compare the academic results of minority schools with those in Lithuanian-speaking schools, with mixed results. As a contribution to this ongoing debate, in our model, we compared the academic results of students in Russian-speaking schools with those of students attending Lithuanian-speaking schools based on PISA 2018 results for reading, math and science. It is further discussed in the "Methodological notes" section below.

Results

Based on a linear regression model that included earlier identified variables of importance, such as language spoken at home, school location (rural or urban) and language of instruction, and the socioeconomic status of the family, we found that overall students in Russian-speaking schools outperform those attending Lithuanian-speaking schools in reading, math and science, after controlling for the various above mentioned forms of disadvantage that minority students face in the Lithuanian education system.

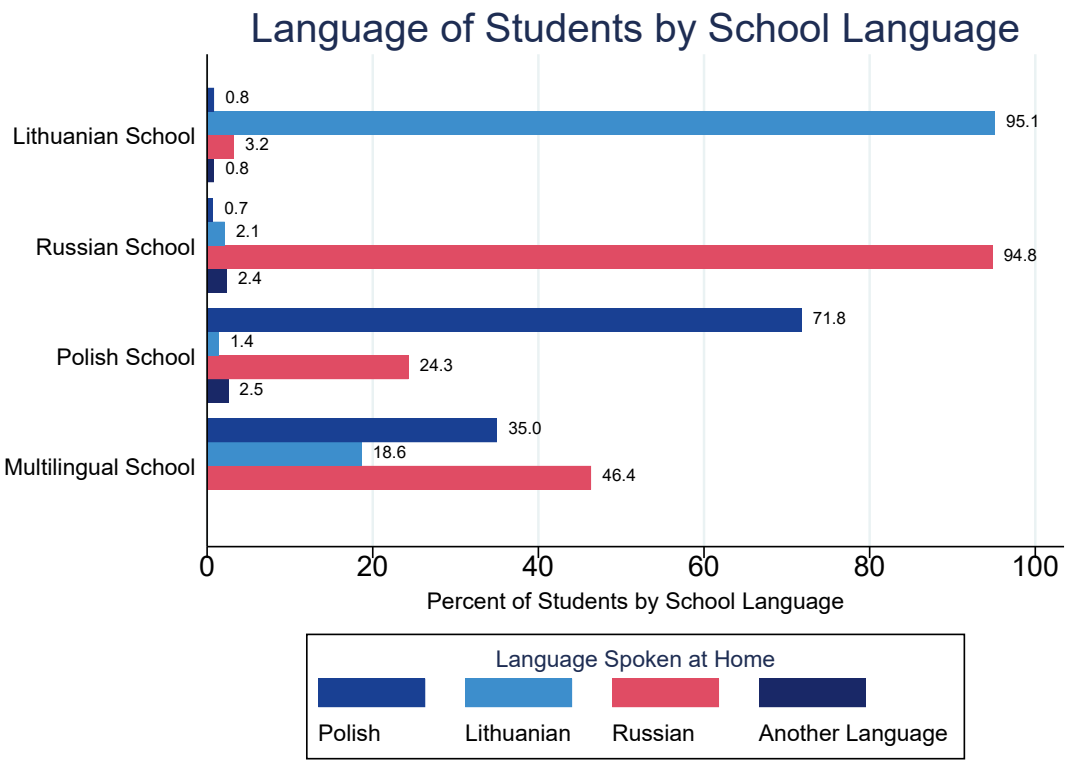
The national exams in Lithuania (the main achievement assessment (PUPP)[6] after grade 10, and national matura exams (VBE),[7] taken after grade 12), reveal that the linguistic minority students are at a disadvantage. In the national PUPP Lithuanian language and literature exams, taken in Lithuanian by all students, minority language students received on average one grade lower scores (on a 10-point scale) than their Lithuanian speaking peers (NŠA 2022). Between 2018 and 2021 PUPP and VBE results of students from ethnic minority schools were slightly improving, most of the improvement was among children attending Polish-medium schools (ibid.). These

[6] Subjects tested: Lithuanian and Mathematics; students from ethnic minority schools can also take their native language exam.
[7] Subjects tested: Lithuanian (mandatory for all students) and one or two high school subjects (chosen by students, one needed for high school graduation and two for enrolling in higher education).

results indicate that in terms of national academic assessment, linguistic minority students or multilinguals whose Lithuanian proficiency lags behind are at a disadvantage.

Regarding PISA reading tests, since 2015 students in Lithuania were able to choose the language of the test: around 50% of Russian-speaking children selected the Russian language as their test language and 41% selected the Lithuanian language, mainly because they were educated in Lithuanian-speaking schools (Zabulionis 2020).[8] Figure 1 below shows that although the majority (95%) of students in Russian-speaking schools speak Russian at home, there are Russian-speakers in Polish schools (24%), Lithuanian schools (3%), and multilingual schools (46%) as well. Multilingual school refer to those where education takes place in various languages, usually a combination of Lithuanian, Russian, and Polish. We found that **in reading, students who took the test in Russian or Polish had lower test scores compared to those who took the test in Lithuanian**. **This was the case with science as well**.

***Figure 1**: Language of students by school language-medium*



Indeed, research from over a decade ago already demonstrated that "there has been a marked rise in the level of Russian-Lithuanian bilingualism amongst the Russian community, prompted by an increasing desire to integrate in the overall population," and hence the number of

[8] Note: We do not consider mixed families in our analysis, the language spoken at home questions in PISA assessment do not allow for such complex answers.

bilinguals among Russian-speakers has sharply increased (Ramonienė and Extra 2011, 65). Academic research has also confirmed that bi- and multilingualism have a significant effect on children's academic achievements, and recent research convincingly argued that bilingualism is associated with several cognitive and academic benefits, such as stronger multitasking skills, creativity, memory, and even reading skills (e.g., Marian and Shook 2012; Bialystok 2017; Tunmer and Myhill 1984).

Despite these findings, in the context of Lithuanian education, minority students who participate in schools with a language of instruction other than the language spoken at their home show lower test scores in all PISA tests by 30-40 points on average (Zabulionis 2020). This is partly due to the late introduction of the Lithuanian language (at the age of 7), inadequate support with language acquisition, the lack of integration of Lithuanian-language subjects into the curriculum of minority schools, and low level of pedagogical competencies among teachers (Zabulionis 2020; Mazolevskienė 2000; Mazolevskienė and Montvilaitė 2007; UNICEF 2021). Minority children attending Lithuanian-medium schools tend to need support in reading, as children who read in languages other than their mother tongue are likely to face additional challenges in terms of pronunciation and comprehension (Cigaitė et al. 2014; Blažienė 2015). **Our analysis showed that attending a Russian-medium school helps to mitigate some of the disadvantages faced by Russian-speaking students in reading** (see Figure 2). Further research is needed to identify the factors that hinder the performance of bi- or multilingual children in the Lithuanian education system.

We also examined achievement in math and science, analyzing the performance of students in different language-medium schools. In particular, socio-economic status, language spoken at home and location of the school had a significant effect on test results (see Figure 3), supporting an earlier hypothesis that there is a *negative correlation between math scores and children whose parents do not have a university degree, study in rural areas and speak Russian at home*. As suggested above, Russian-speaking children who live in rural areas tend to study in Lithuanian, Polish or multilingual schools, resulting in lower performance in math and science. Interestingly, a model **controlling for these variables revealed a positive and significant effect on math assessment scores for children attending Russian-medium schools compared to Lithuanian schools**. **The same observation was true for science scores as well**. The Polish and Multilingual schools both have insignificant effects on math performance.

To further understand the impact of Russian-medium schools it is important to highlight that although attending a Russian-medium school has a positive impact on math achievement, speaking Russian at home has a negative impact on math scores. Since the majority (94.8%) of the population in Russian-medium schools are Russian speakers (see Figure 1), the Russian-medium schools are compensating the disadvantage of speaking Russian. Thus, comparing the average achievement in Lithuanian-medium schools to Russian-medium schools is not enough to uncover the source or disadvantage and the true impact of attending a different language-medium school.

***Figure 2**: Linear regression results for factors influencing reading scores, using the Lithuanian sample of students in PISA 2018 (N=6644)*

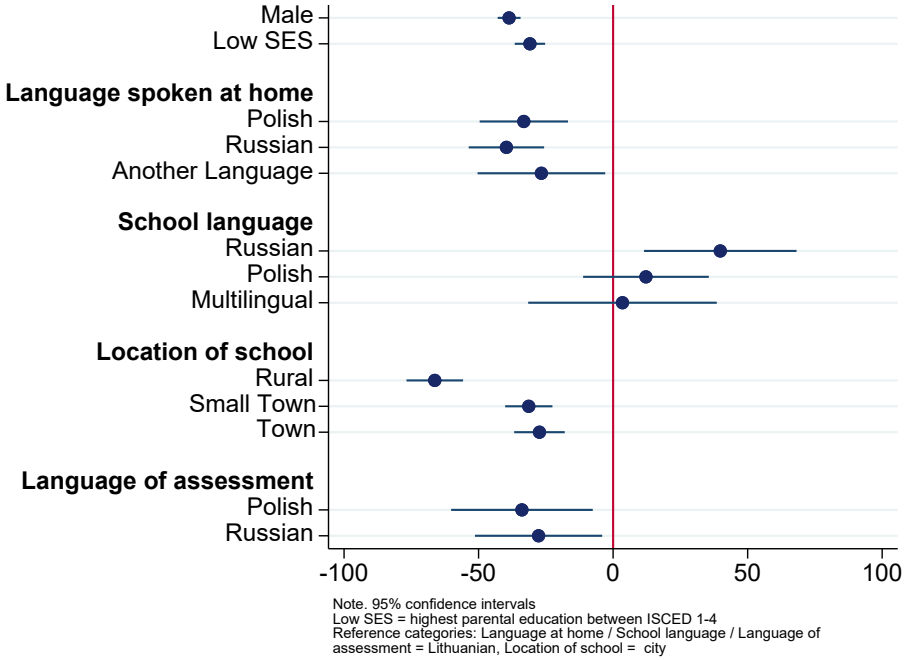
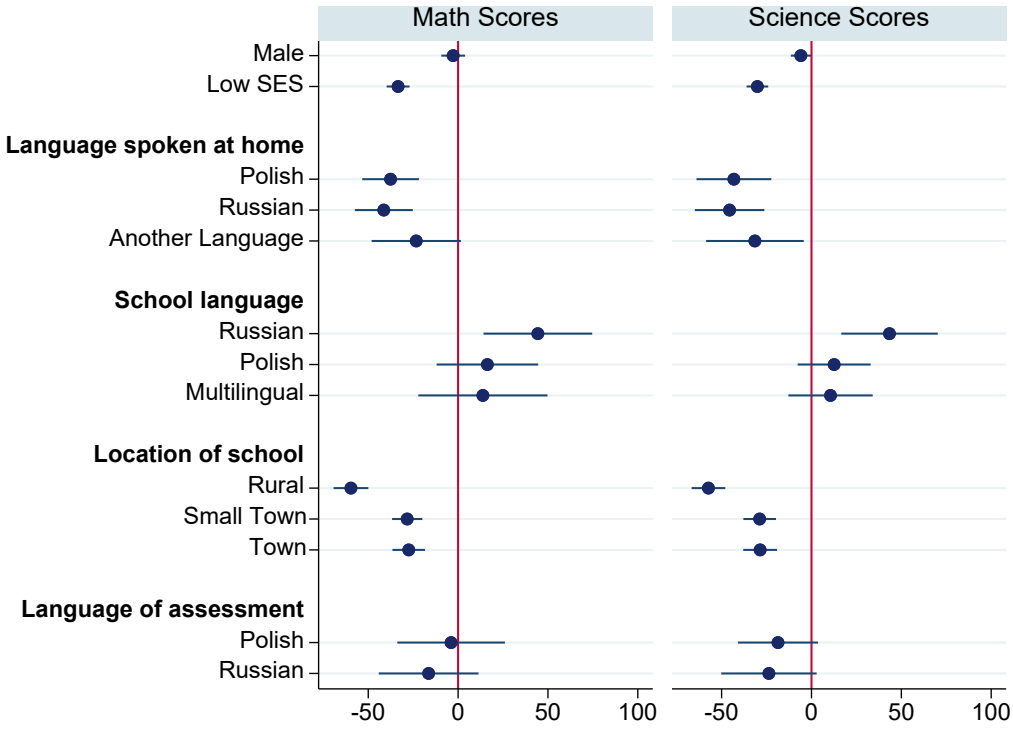


***Figure 3**: Linear regression results for factors influencing math and science scores, using the Lithuanian sample of students in PISA 2018 (N=6644)*

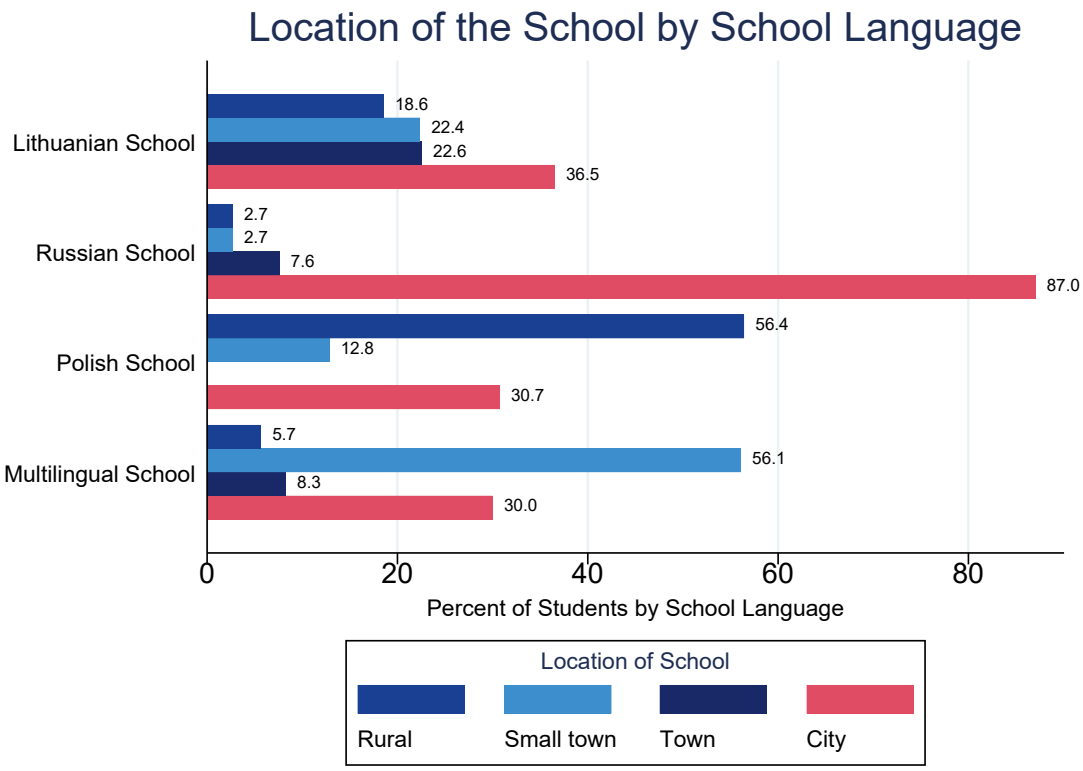


The results of the national assessment data from the same year; based on PUPP scores in 2018, show the average results of students from Russian-speaking schools were higher than those from Polish and Lithuanian schools (5.3 for Russian schools, 5.2 for Polish, and 5 for Lithuanian schools, on a 10-point scale). Further investigations would be required to understand the sources of inequality that lead to the different average achievement in the schools. Recent results for 2021 show that math scores improved for everyone, while in comparison, children attending Lithuanian and Polish schools performed best (6.4 points), while those attending Russian schools received lower scores (6 points) (NŠA 2022). Admittedly, comparing national and international test results may be problematic because 1) national tests are based on the curriculum and reflect a number of factors, including curriculum coverage or the amount of time spent on studying by students, while students cannot prepare for PISA tests in the same way; 2) national exams are predominantly taken in Lithuanian language, while PISA allows for a choice of language. These nuances should be further investigated in a more detailed study.

Overall, our results confirm earlier findings regarding **inequalities in the Lithuanian educational system**, with the most underprivileged schools located in rural areas with predominantly low SES families (UNICEF 2021). Indeed, Lithuanian demographic statistics show that the majority of families who live in rural areas have a lower SES, have lower levels of education, and the quality of education in rural areas is lower compared to that of urban areas (OSP 2022; ŠVIS 2022). While all schools, regardless of the language of instruction, perform worse if located in rural areas, Russian-speaking schools are mostly located in urban areas. Figure 4 shows that among the schools included in our model based on PISA survey, 37% of Lithuanian schools, 31% of Polish schools, 30% of multilingual schools, and 87% of Russian-speaking schools are located in cities (defined as locations with at least 15 000 habitants), making **Russian-medium schools disproportionally benefiting from a more efficient resource and staff allocation in urban environments**, which partially accounts for the overachievement of students in these schools. Indeed, studies demonstrate that compared to rural schools, urban schools are better equipped in terms of IT, and laboratories, and have better qualified and younger teachers and learning support specialists (Lietuvos Respublikos Vyriausybė 2021).

Considering that the majority of Russian-medium schools are located in cities, students are more likely to come from higher socio-economic status groups with highly educated parents—factors that influence academic achievement as well. Indeed, previous research shows that children of parents who have higher levels of education tend to perform better in reading tests (Nalipay, Cai and King 2019). In addition, urban schools in Lithuania have better equipment to support science education; for example, 50% of Russian-speaking schools had scientific laboratories in 2018, compared to only 32.8% of Lithuanian schools and 22.5% of Polish schools, according to the Education Ministry (Švietimo, sporto ir mokslo ministerija 2020). Yet, our models showed that **even when controlling for the urban-rural divide, children attending Russian-medium schools still performed better, although a significant part of the variation was indeed explained by the urban environment**.

***Figure 4**: Location of the school by school language-medium*



It is also important to note that due to the limitations of the regression model, interaction effects were only partially explored, and possibly the interaction between some of the above-described variables may indeed explain the overperformance of Russian-speaking schools. More sophisticated models should be explored to understand how the interaction between urban location, school language, high socio-economic status and parents' education may mitigate educational inequalities associated with speaking a minority language at home.

Another explanation for our findings was suggested by the representative of the National Agency for Education, Eglė Melnikė, who was interviewed for this study. She highlighted, that apart from the location, socio-economic status and education of parents, the culture and traditions of education in Russian-medium schools also have to be taken into consideration. The expert affirmed that Russian-medium schools have a long science and math teaching tradition, which resulted in an emphasis on these subjects, as well as better training of teachers and increased professional attention to these subjects. Accordingly, the prioritisation of mathematical and scientific knowledge in schools may positively affect students' attitudes and consequently their performance. With no scientific research on the topic of Russian-speaking schools' education traditions and students' attitudes, this explanation is hypothetical and requires further systematic investigation.

Conclusion

In summary, our inquiry has led us to several conclusions. First, our investigation highlighted the ambiguities of assessing and comparing minority students' performance in the Lithuanian school system. While national results (based on PUPP and VBE) in general showed that Russian-speaking schools perform worse than Lithuanian schools, and in some cases the Polish schools, some international assessments showed that students attending Russian schools have similar results to students from Lithuanian schools (based on 2019 TIMSS results (NŠA 2022)), while others suggested that Lithuanian schools are performing better than Russian- or Polish-speaking schools (based on 2018 PISA results interpreted by Zabulionis (2022)). Our assessment of 2018 PISA data shows that after controlling for student and school background characteristics, children attending Russian-speaking schools outperform their peers. With no consensus, further research is needed into the assessment methodologies, considering the difficulties of comparing schools with different languages of instruction in Lithuania, given the widely divergent characteristics of these schools.

Second, our research indicated the importance of providing systematic assistance to language minority students, especially when the language of instruction in schools is other than their mother tongue, and when the schools is situated in a rural environment. Lithuanian researchers have concluded that students who speak a different language at home tend to perform worse in school where they have to use a different language, while international assessment has confirmed that there is a pronounced difference in academic achievement between rural and urban schools, with the former showing significant disadvantages.

Third, this study has pointed out the vulnerabilities that minority students face in the Lithuanian education system, under certain conditions, especially in terms of access to education and assessment of educational results. Earlier research has highlighted that differences in language and culture indeed influence how minority students perform in school and on various assessment tests. Further investigation is needed into how minority students in Lithuania are evaluated academically and what forms of disadvantage the language of evaluation might entail.

Finally, an important caveat to minority education in Lithuania as Algirdas Zabulionis argues, is that unlike most Western European countries, where language minorities are mainly children of immigrants and consequently education policy must look for complex solutions to mitigate a range of inequalities, in Lithuania, similarly to other Baltic countries, the share of newly arrived immigrants is low and the majority of Russian-speakers are descendants of Soviet-era migrants; consequently many of the language minorities are those who had lived in the country for generations. As a result, the experience of other countries may not fit the Baltic context and should be applied with caution (Zabulionis 2022).

Methodological notes

The data and sample used in this study were derived from the 2018 PISA survey, our analysis is based on the full sample of Lithuanian students (N=6644); we also conducted one expert interview on August 29, 2022. In this research, we focus on Russian-speaking schools only, considering that PISA regression findings for the Polish-speaking schools were not statistically significant. The method of analysis was linear regression analysis with plausible values. The dependent variables included in the models were standardized tests on math, science and reading with 10 plausible values for each. The main predictor measuring separate education used in regression analysis was language of instruction at school. The control variables included gender, parents' education, language spoken at home, location of school, and language of assessment. During the analysis, the variance-covariance matrix (VCE) was calculated using balanced repeated replications (BRR), using provided weights in PISA. Importantly, this study should be considered as exploratory, considering the limited model used for analysis. Hence, rather than making causal inferences, the authors strove to describe a potential correlation and point out areas where further inquiry is necessary to understand why academic achievements differ between minority language schools and mainstream Lithuanian language schools in the country.

References

Alijeva, L. 2017. “Left Behind? A Critical Study of the Russian-speaking Minority Rights to Citizenship and Language in the Post-Soviet Baltic States. Lessons from Nationalising Language Policies.” *International Journal on Minority and Group Rights*, 24(4), 484–536. https://www.jstor.org/stable/26557930

Adomavičiūtė, L. 2020. “Two mother tongues and post-Soviet transition: Lithuania’s ethnic minorities 30 years later”. *LRT.lt English*. Available at: https://www.lrt.lt/en/news-in-english/19/1180735/two-mother-tongues-and-post-soviet-transition-lithuania-s-ethnic-minorities-30-years-later [Accessed 22 Aug 2022].

Bankauskaite, R. and Dunajeva, K. 2022. “Country report Lithuania on Mapping concepts, definitions and prioritization in policy documents with special focus on educational inequality and tactics to enhance access and uptake of education”. *Vilnius: Public Policy and Management Institute*.

Bialystok, E. 2017. “The Bilingual Adaptation: How Minds Accommodate Experience”. *Author Manuscript, PMC*, No. 143(3), P. 233-262. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5324728/ [Accessed 28 Aug 2022].

Budginaitė, I. and Mašidlauskaitė, R. 2015. “Ar laukiami diasporos vaikai Lietuvoje? Tėvų ir mokytojų patirtys”. *Politologija*, No. 78(2), P. 94–128.

Busygina, I. M. and Onishchenco, A. D. 2019. “The Polish minority in the Republic of Lithuania: internal and external factors”. Politics, No. 1, P. 43-59. Available at: https://cyberleninka.ru/article/n/the-polish-minority-in-the-republic-of-lithuania-internal-and-external-factors [Accessed 22 Aug 2022].

Council of Europe. 1995. *The Framework Convention for the Protection of National Minorities in one of the most comprehensive treaties designed to protect the rights of persons belonging to national minorities*. Strasbourg: Council of Europe.

Dabašinskinė, I. and Kubiliūtė, S. 2021. “Language competence in education: Re-thinking minority issues in Lithuania”. *Estonian Papers in Applied Linguistics*, Vol. 17, P. 29-45. Available at: http://arhiiv.rakenduslingvistika.ee/ajakirjad/index.php/aastaraamat/article/view/ERYa17.02 [Accessed 22 Aug 2022].

Dambrauskas, K. (2020). “Neoliberalios valdysenos įtaka Lietuvos tautinių mažumų švietimo politikai socialinės politikos kontekste”. *Lietuvos Socialinė Raida*, No. 9, P. 28-45. Available at: https://etalpykla.lituanistikadb.lt/object/LT-LDB-0001:J.04~2020~1650308855964/J.04~2020~1650308855964.pdf [Accessed 22 Aug 2022].

Europos žmogaus teisių fondas. 2018. *Suvienodintas Lietuvių kalbos egzaminas kelia sunkumų tautinių mažumų mokyklų mokiniams.* Available at: https://lt.efhr.eu/2018/08/30/suvienodintas-lietuviu-kalbos-egzaminas-kelia-sunkumu-tautiniu-mazumu-mokyklu-mokiniams/ [Accessed 22 Aug 2022].

Lithuanian Education plan for 2021-2022, 2022-2023. Available at https://www.e-tar.lt/portal/lt/legalAct/f0828f70abe911eb8bc8b1cdd5d7f785.

LR Seimas. 2022. *Lietuvos Respublikos tautinių mažumų įstatymas*. Vilnius: Lietuvos Respublikos Aukščiausioji Tatyba.

LR Seimas. 2022. *Dėl Tautinių mažumų švietimo nuostatų*. Vilnius: Lietuvos Respublikos švietimo ir mokslo ministerija.

Lietuvos Respublikos Vyriausybė. 2021. Dėl 2021-2030 metų Lietuvos Respublikos švietimo, mokslo ir sporto ministerijos švietimo plėtros programos patvirtinimo (TAP-21-1595(2); 21-31778(3)). https://e-seimas.lrs.lt/portal/legalAct/lt/TAK/2c7722f151d211ec86bdcb0a6d573b32?positionInSearchResults=0&searchModelUUID=5f52d8d9-edc8-4b05-a550-bbc5f13067ad

National Examination Centre.2017. Available at: http://www.nec.lt/naujienos/734/

Stacevičius, J. 2020. “Lithuania’s minorities consistently fail state language exam – what can be done?”. LRT.lt English. Available at: https://www.lrt.lt/en/news-in-english/19/1273849/lithuania-s-minorities-consistently-fail-state-language-exam-what-can-be-done [Accessed 22 Aug 2022].

Marian, V. and Shook, A. “The Cognitive Benefits of Being Bilingual”. *Cerebrum*. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3583091/ [Accessed 22 Aug 2022].

Murauskaitė, A. 2020. “Tautinių mažumų mokinių sunkumai atvėrė dar vieną dviejų Lietuvų skirtumą: Vilniuje – vienaip, Kaune – kitaip”. *LRT*. Available at: https://www.lrt.lt/naujienos/lietuvoje/2/1251870/tautiniu-mazumu-mokiniu-sunkumai-atvere-dar-viena-dvieju-lietuvu-skirtuma-vilniuje-vienaip-kaune-kitaip [Accessed 22 Aug 2022].

Nacionalinės mokyklų vertinimo agentūra. 2019. “Lietuvos tautinių mažumų švietimo būklės analizė 2018”. *Švietimo aprūpinimo centras*. Available at: https://smsm.lrv.lt/uploads/smsm/documents/files/tyrimai_ir_analizes/2019/Lietuvos%20tautini%C5%B3%20ma%C5%BEum%C5%B3%20%C5%A1vietimo%20b%C5%ABkl%C4%97s%20analiz%C4%97_.pdf [Accessed 22 Aug 2022].

Nacionalinė švietimo agentūra. 2022. “Lietuvos tautinių mažumų švietimo būklės analizė”. *Švietimo, sporto ir mokslo ministerija*. Available at: https://smsm.lrv.lt/uploads/smsm/documents/files/Lietuvos%20tautini%C5%B3%20ma%C5%BEum%C5%B3%20%C5%A1vietimo%20b%C5%ABkl%C4%97s%20analiz%C4%97(2).pdf [Accessed 22 Aug 2022].

Nalipay, M. J. N., Cai, Y. and King, R. B. 2019. “Why do girls do better in reading than boys? How parental emotional contagion explains gender differences in reading achievement”. *Psychology in the Schools*, Vol. 57, No. 2, P. 310-319. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1002/pits.22330 [Accessed 22 Aug 2022].

O’Connell, M. 2019. “Is the impact of SES on educational performance overestimated? Evidence from the PISA survey”. *Intelligence*, Vol. 75, P. 41-47. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0160289618302393 [Accessed 22 Aug 2022].

OECD. 2016. *OECD Reviews of School Resources: Lithuanian 2016*. Available at: https://www.oecd-ilibrary.org/education/oecd-reviews-of-school-resources-lithuania-2016/school-education-in-lithuania_9789264252547-5-en;jsessionid=-WLUpVraiG6FNBLusMGwOMrPGyTwzertSbocTpwB.ip-10-240-5-28 [Accessed 30 Aug 2022].

OSCE. 1996. *The Hague Recommendation Regarding the Education Rights of National Minorities*.

Official Statistics Portal. 2020. *Population and housing censuses*. Available from: https://osp.stat.gov.lt/gyventoju-ir-bustu-surasymai [Accessed 24 Aug 2022].

Ozdoba, P. 2018. “Warsaw-Vilnius Relations as a Common Matter: the Polish Ethnic Minority in Lithuania”. Warsaw Institute. Available at: https://warsawinstitute.org/warsaw-vilnius-relations-common-matter-polish-ethnic-minority-lithuania/ [Accessed 24 Aug 2022].

FactMaps*. 2018. PISA 2018 Worldwide Ranking – average score of mathematics, science and reading*. 2018. Available at: https://factsmaps.com/pisa-2018-worldwide-ranking-average-score-of-mathematics-science-reading/ [Accessed 22 Aug 2022].

Radio Poland. 2015. *Polish schools strike in Lithuania*. Available at: http://archiwum.thenews.pl/1/10/Artykul/219422,Polish-schools-strike-in-Lithuania [Accessed 24 Aug 2022].

Ramonienė, M. and Extra, G. 2011. “Multilingualism in Lithuanian Cities: Aims and outcomes of a home language survey in Vilnius, Kaunas and Klaipėda“. *Kalbotyra*, Vol. 63, No. 3, P. 59-77.

Reingardė, J., Vasiliauskaitė, N., and Erentaitė, R. 2010. “Tolerancija ir multikultūrinis ugdymas bendrojo lavinimo mokyklose”. *University Research Publications*, P. 102. Available at: https://www.vdu.lt/cris/entities/publication/6cea17b6-8cc9-4c0a-b0fb-7922fb172d7b [Accessed 22 Aug 2022].

Saugėnienė, N. 2003, *Lietuvos tautinių mažumų švietimas multikultūriškumo vertybiniame kontekste*, KTU leidykla. Kaunas.

Simac, J. and Marcus, R. 2019. “Does non-formal education have lasting effects?”. *Compare: A Journal of Comparative and International Education*, Vol. 51, No. 5, P. 706-724. Available at: https://www.tandfonline.com/doi/abs/10.1080/03057925.2019.1669011 [Accessed 24 Aug 2022].

Skerytė-Kazlauskienė, M. and Barkauskienė, R. (2010). “Mokymosi negalią turinčių paauglių savęs vertinimas ir suvokta socialinė parama”. *Psichologija*, No. 41, P. 33–49.

Souto-Otero, M. 2015. “Young people's views of the outcomes of non-formal education in youth organisations: its effects on human, social and psychological capital, employability and employment”. *Journal of Youth Studies*, Vol. 19, No. 7, P. 938-956. Available at: https://www.tandfonline.com/doi/abs/10.1080/13676261.2015.1123234 [Accessed 24 Aug 2022].

Šliavaitė, K. 2019. “Kalba, tautinis tapatumas ir lygios galimybės švietime: mokyklų lietuvių, lenkų ir rusų mokomosiomis kalbomis bendruomenių požiūriai”. *Socialinių tyrimų žurnalas*, Vol. 10, No. 2, P. 31-58. Available at: https://etalpykla.lituanistikadb.lt/object/LT-LDB-0001:J.04~2019~1586849852406/J.04~2019~1586849852406.pdf [Accessed 22 Aug 2022].

Švietimo, mokslo ir sporto ministerija. 2019. *Lietuva. Švietimas šalyje ir regionuose: mokinių pasiekimų atotrūkis*. Available at: https://smsm.lrv.lt/uploads/smsm/documents/files/tyrimai_ir_analizes/2019/B%C5%ABkl%C4%97s%20ap%C5%BEvalga%202019_GALUTINIS.pdf [Accessed 22 Aug 2022].

Švietimo, mokslo ir sporto ministerija. 2020a*. Ilgalaikio švietimo strateginio planavimo rezultatai: Valstybinės švietimo 2013–2022 metų strategijos įgyvendinimas per XVII Vyriausybės programa*. Available at: https://smsm.lrv.lt/uploads/smsm/documents/files/tyrimai_ir_analizes/2020/Ilgalaikio%20%C5%A1vietimo%20strateginio%20planavimo%20rezultatai_V%C5%A0S%20%C4%AFgyvendinimas%20per%20XVII%20Vyriausyb%C4%97s%20program%C4%85.pdf [Accessed 22 Aug 2022].

Švietimo, mokslo ir sporto ministerija. 2020. *2021–2030 m. investicijų poreikio į švietimo sistemą žemėlapis.* Available at: https://smsm.lrv.lt/uploads/smsm/documents/files/veikla/es_investicijos/Aktualizuotas%20svietimo%20zemelapis_2020%2008%2024.pdf [Accessed 22 Aug 2022].

Švietimo, mokslo ir sporto ministerija. 2021. *Lietuva. Švietimas šalyje ir regionuose 2021—Nuotolinis mokymas(is*). Available at: https://smsm.lrv.lt/uploads/smsm/documents/files/teisine_informacija/lietuva-svietimas-salyje-ir-regionuose-2021-nuotolinis-mokymas-is.pdf [Accessed 22 Aug 2022].

Švietimo, mokslo ir sporto ministrija. 2021. *2021-2030 m. Plėtros programos valdytojos Lietuvos Respublikos švietimo, mokslo ir sporto ministerijos švietimo plėtros programos pagrindimas*. Available at: https://smsm.lrv.lt/uploads/smsm/documents/files/%C5%A0PP%20pagrindimas.pdf [Accessed 22 Aug 2022].

Švietimo valdymo informacinė sistema. 2022. *Bendrasis ugdymas*. Available at: http://svis.emokykla.lt/bendrasis-ugdymas-2/ [Accessed 22 Aug 2022].

Šutinienė, I. 2003, *Moksleivių vertybių struktūra ir jos pokyčiai*, Socialinių tyrimų institutas, Vilnius, P. 10-16.

ŠVIS (2021), Tautinių mažumų kalbomis veikiančių mokyklų skaičius. Available at: https://view.officeapps.live.com/op/view.aspx?src=http%3A%2F%2Fwww.svis.smm.lt%2Ffile%2Fm[…]ianciu%2520mokyklu%2520skaicius.xlsx&wdOrigin=BROWSELINK

Tracevskis, R. M. 2011. “Poland’s war against Lithuania over education law”. *The Baltic Times*. Available at: https://www.baltictimes.com/news/articles/28383/ [Accessed 24 Aug 2022].

Tunmer, W. E. and Myhill, M. E. 1984. “Metalinguistic Awareness and Bilingualism”. *Metalinguistic Awareness and Bilingualism*, Vol. 15, P. 169-187.

UNICEF. 2021. *Deep Dive into the European Child Guarantee – Lithuania*. Available at: https://www.unicef.org/eca/reports/deep-dive-european-child-guarantee-lithuania [Accessed 22 Aug 2022].

Urbaitytė, K. 2011. “Švietimo įstatymas: Kodėl bruzda tautinės mažumos”. *Bernardinai*. Available at: https://www.bernardinai.lt/2011-09-19-svietimo-istatymas-kodel-bruzda-tautines-mazumos/ [Accessed 22 Aug 2022].

Zabulionis, A. 2022. “Tarptautinio švietimo tyrimo OECD PISA Lietuvos ir kaimyninių šalių duomenų tikslinė antrinė analizė”. *Nacionalinė švietimo agentūra*. Available at: file:///C:/Users/VPVI/Downloads/tarptautinio_svietim_2020_1.pdf [Accessed 22 Aug 2022].

Zaleskienė, I. and Kvederavičiūtė, M. 2017. “Socialinės įtraukties link: Pabėgėlių vaikų ir jaunuolių edukaciniai iššūkiai ir jų įveikos galimybės”. *Socialinis ugdymas*, Vol. 46, No. 2, P. 40–55.

8 A review on literature on school segregation and its consequences in Finland

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Highlights

- Schools' socioeconomic segregation has consequences for students' learning outcomes.
- Choice of track in secondary education effect learning outcomes and transition to higher education.
- School segregation is intertwined with the residential segregation in the Finnish context.
- General upper secondary track and vocational track are segregated.
- Research-intensive universities and universities of applied sciences are segregated.

Background

Even though Finland has traditionally been emphasised educational equality and its educational system with no dead-ends, recent studies have shown that there are some points in the educational path that are causing segregation and differences in opportunities. The present paper reviews seminal research from the last decade in order to show what those problematic phases are and what kind of consequences they have in the Finnish context.

Results

Residential segregation and school segregation

As a base rule, Finnish comprehensive schools admit students from their catchment area meaning that children from certain neighbourhoods go primarily to certain schools. In the metropolitan area, socioeconomic differences between catchment areas have been increasing during the latest decades (Bernelius 2015), and despite the efforts to level out the differences between areas and schools, it seems that the residential segregation has an important role in school segregation (Bernelius 2011) even if they are not always intertwined (Kauppinen 2008). It has been found that some parents make choices on their place of residence based on school

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catchment areas for popular schools, reinforcing the residential segregation (Bernelius and Vilkama 2019).

An additional factor in the segregation between school areas and even classes within schools is the practice of emphasized classes that has become increasingly prevalent in urban areas (Seppänen et al. 2012). Emphasized classes offer supplementary teaching within a public basic education school in subjects such as music, physical education, mathematics, or a foreign language. The emphasized classes are highly selective classes with high grade requirements and specific application procedures, and pupils are applying to these classes regardless of where they live (e.g., Kosunen et al. 2020). Research shows that pupils who have parents with higher socioeconomic background are more likely to apply and be admitted to the emphasized classes (Seppänen et al. 2012, Kosunen 2014, Kosunen et al. 2020), thus leading up to socioeconomically segregated classes even within a school.

Against the tendency for socioeconomic segregation of schools, some parents in Finland interestingly make a conscious decision about avoiding schools with high achieving ethos due to their competitiveness (Ramos Lobato et al. 2018). Such developments could level off the segregation development.

Several studies show that socioeconomic segregation has consequences in learning outcomes, even though in international comparison, differences between schools are small (Metsämuuronen & Nousiainen 2021). The schools with a composition of higher socioeconomic background have higher grades and more positive attitudes towards education (Bernelius 2011). Additionally, parents of pupils that attend these schools, are more satisfied with the school (Tikkanen 2019). Furthermore, the emphasized classes that attract pupils from higher socioeconomic background (E.g. Kosunen et al., 2020), have significantly higher grades compared to other pupils even in same schools (Berisha & Seppänen 2017). However, whether this is a consequence of highly selective admission practices or actual socioeconomic differences is not clear.

School location has also consequences. In urban areas, differences in learning outcomes between schools have grown significantly lately, while in rural areas there's little change (Metsämuuronen & Nousiainen 2021). However, PISA scores of boys are lower in small rural schools compared with larger schools, and in Swedish-speaking schools this applies to all genders (Harju-Luukkanen et al. 2015, Ahonen 2021). The division between rural and urban origin is particularly important in educational attainment, in transition to higher education. Studies show that urban adolescents are more likely to enter in research-intensive universities than their rural peers (Nori 2011, Jokila et al. 2019). One reason to this may be the better supply of preparatory courses in urban areas (Jokila et al. 2019).

Segregation between general and vocation track in the upper secondary school

The educational inequality in Finland is crystallized in the transition to the upper secondary school (Kilpi-Jakonen et al. 2016, Härkönen & Sirniö 2020). It is the first point in educational path

of a Finn where significant choices about different tracks are made, and until very recently (2021), it marked the end of compulsory education where all expenses are covered. Studies show that socioeconomic composition of students in the general track and the vocational track are different: the general track has students with higher socioeconomic status than students in the vocational track (Härkönen & Sirniö 2020). Furthermore, the choice between the tracks has vital consequences to educational attainment, later opportunities and competence development. The influence that the socioeconomic background has on the choice of track has been increasing since late 1980's with the cohorts that were born in early 1970's (Härkönen & Sirniö 2020). However, immigrant background does not predict the choice between the tracks when socioeconomic background and academic achievement are controlled (Kilpi-Jakonen 2011, Kalalahti et al. 2017).

The major consequence in the segregation between the tracks is the educational attainment and future prospects. Students who have completed the vocational track are less likely to enter higher education (Haltia et al. 2022), and thus, their future socioeconomic status is lower (Heiskala, Erola, & McMullin 2021). However, there is no difference in future unemployment between students in each track (Heiskala, Erola, & McMullin 2021). Additionally, there are differences in skills that are needed in future education and in working life. Students who have completed the generic track have stronger generic skills and mathematical skills compared to their peers in the vocational track (Metsämuuronen 2017, Nissinen et al. 2021). Despite all its seeming advantages, it is interesting that students who have chosen the general track are more likely to experience exhaustion than their peers in the vocational track (Salmela-Aro et al. 2008). While cynicism and inadequacy seem to increase in the general track, the opposite happens in the vocational track (Salmela-Aro et al. 2008).

Consequences of attending different tracks are intertwined with the contents of each track and the socioeconomic composition of each track. In other words, it is difficult to confirm direct consequences of socioeconomic segregation of each track. However, the segregation in the choice of track is essential as it leads to very different future opportunities.

Segregation between research-intensive universities and universities of applied sciences

Higher education is stratified in all Nordic countries despite the ethos of educational equality (Isopahkala-Bouret et al. 2018). Some of this originates from the decisive choices that were made during the transition to the upper secondary level. However, in Finland, there is distinct segregation between the two types of higher education institutions, namely research-intensive universities, and universities of applied sciences. Studies show that students with higher socioeconomic background prefer applying to research-intensive universities, and students with lower socioeconomic background prefer applying to universities of applied sciences, regardless of their academic achievement (Heiskala, Erola, & Kilpi-Jakonen 2021). It seems also that students in respective types of institutions have different skillsets. Generic skills are weaker among the students at universities of applied sciences compared with their peers in research-intensive universities, although this difference can in part be explained by higher proportion of

students who have completed the vocational track in the upper secondary school (Nissinen et al. 2021).

Conclusion

Even though the Finnish educational system does not have dead-ends, the segregation still seems to appear in the points where choices are offered. This occurs in transitions. The transition to the lower secondary school offers an opportunity to apply for emphasized classes, and the transitions to the upper secondary education and higher education force a choice between tracks. The consequences of these choices can be far-reaching, and adolescents from different socioeconomic background tend to make different choices.

The emphasized classes in the lower secondary education attract pupils with high socioeconomic status, while pupils with lower socioeconomic status attend primarily the schools in their catchment areas. Overall learning outcomes are stronger in the emphasized classes, making them distinct within their schools but also nationally. The segregation by choice is especially evident in the transition to upper secondary education with general and vocational tracks that provide very different prospects and lead to differences in educational attainment and skills. The decisive factor in segregation of tracks is socioeconomic background, especially parental education to be more exact. The immigrant background seems to have little significance when other factors are controlled for. Students completing vocational secondary education have weaker skills and continue mostly on vocational track, namely the universities of applied sciences, and students completing general upper secondary education and matriculation examination have stronger skills and continue mostly on academic track, namely the research-intensive universities, although it is possible in the Finnish system to change the tracks flexibly. Overall, the socioeconomic background has a cumulative effect in educational attainment: the higher the educational level is, the more prominent is the high socioeconomic background (Kilpi-Jakonen 2011).

In addition to the segregation by choice, research shows that the regional segregation differentiates schools. In urban areas, areas with higher socioeconomic composition have also schools with higher socioeconomic composition and vice versa. The segregation has consequences in learning outcomes: the schools with higher socioeconomic composition outperforming other schools. In rural areas, differences between schools are not as prominent. However, differences between urban and rural schools show in educational attainment.

Overall, it is noteworthy, that study of consequences of school segregation is never straightforward. There are myriads of factors that influence on school choice, educational outcomes and attainment, and causal inferences on the influence of socioeconomic composition of a class, a school or a track are not possible. The reviewed studies gave some indications that intersectional factors could add to school segregation and its consequences, but none of the studies focused on this question. The reasons for this may be various: researchers have not yet focused on this issue systematically, there may be challenges in data collection from minorities

or vulnerable groups, or the effect is still very small. Future research should put more focus on intersectionality and interplay of various single factors instead of only individual factors. More complex research designs are needed in order to capture the consequences of educational segregation.

Methodological notes

A literature search was conducted to identify peer-reviewed articles and relevant government reports. Both English and Finnish articles were searched for. The search was limited to years 2011 to 2022, however, two older, relevant articles were included. Eminent researchers in the field in Finland were identified, and their publications were examined. Publications that were relevant to causes and consequences of school segregation were chosen for closer reading. A few additional articles were identified in the reference lists of chosen articles. Altogether 37 articles or reports were read by the research team, and 26 were included in the final analyses.

References

Ahonen, A.K., 2021. Finland: Success Through Equity—The Trajectories in PISA Performance. *In*: N. Crato, ed. *Improving a Country's Education*. Cham: Springer International Publishing, 121–136.

Berisha, A.-K. and Seppänen, P., 2017. Pupil selection segments urban comprehensive schooling in Finland: composition of school classes in pupils' school performance, gender, and ethnicity. *Scandinavian Journal of Educational Research*, 61 (2), 240–254.

Bernelius, V., 2011. Osoitteenmukaisia oppimistuloksia? Kaupunkikoulujen eriytymisen vaikutus peruskoululaisten oppimistuloksiin Helsingissä. *Yhteiskuntapolitiikka*, 76 (5), 479–493.

Bernelius, V., 2015. Pääkaupunkiseudun koulujen naapurustot – missä erot kasvavat? *Yhteiskuntapolitiikka*, 80 (6).

Bernelius, V. and Vilkama, K., 2019. Pupils on the move: School catchment area segregation and residential mobility of urban families. *Urban Studies*, 56 (15), 3095–3116.

Haltia, N., Isopahkala-Bouret, U., and Jauhiainen, A., 2022. The vocational route to higher education in Finland: Students' backgrounds, choices and study experiences. *European Educational Research Journal*, 21 (3), 541–558.

Harju-Luukkanen, H., Sulkunen, S., and Vettenranta, J., 2015. Enemmän yhtäläisyyksiä kuin eroja: Ruotsinkieliset pienet ja suuret koulut PISA 2009 -tulosten valossa. *Nuorisotutkimus*, 33 (3–4), 59–73.

Härkönen, J. and Sirniö, O., 2020. Educational Transitions and Educational Inequality: A Multiple Pathways Sequential Logit Model Analysis of Finnish Birth Cohorts 1960–1985. *European Sociological Review*, 36 (5), 700–719.

Heiskala, L., Erola, J., and Kilpi-Jakonen, E., 2021. Compensatory and Multiplicative Advantages: Social Origin, School Performance, and Stratified Higher Education Enrolment in Finland. *European Sociological Review*, 37 (2), 171–185.

Heiskala, L., Erola, J., and McMullin, P., 2021. Formal differentiation at upper secondary education in Finland: subject-level choices and stratified pathways to socio-economic status and unemployment. *Longitudinal and Life Course Studies*, 12 (3), 323–343.

Isopahkala-Bouret, U., Börjesson, M., Beach, D., Haltia, N., Jónasson, J.T., Jauhiainen, A., Jauhiainen, A., Kosunen, S., Nori, H., and Vabø, A., 2018. Access and stratification in Nordic higher education. A review of cross-cutting research themes and issues [*]. *Education Inquiry*, 9 (1), 142–154.

Jokila, S., Haltia, N., and Kosunen, S., 2019. Valmennuskurssit ja korkeakoulumarkkinoiden maantiede. *Tiedepolitiikka*, 44 (3), 18–28.

Kalalahti, M., Varjo, J., Zacheus, T., Kivirauma, J., Mäkelä, M.-L., Saarinen, M., and Jahnukainen, M., 2017. Maahanmuuttajataustaisten nuorten toisen asteen koulutusvalinnat. *Yhteiskuntapolitiikka*, (1).

Kauppinen, T.M., 2008. Schools as Mediators of Neighbourhood Effects on Choice Between Vocational and Academic Tracks of Secondary Education in Helsinki. *European Sociological Review*, 24 (3), 379–391.

Kilpi-Jakonen, E., 2011. Continuation to upper secondary education in Finland: Children of immigrants and the majority compared. *Acta Sociologica*, 54 (1), 77–106.

Kilpi-Jakonen, E., Erola, J., and Karhula, A., 2016. Inequalities in the haven of equality? Upper secondary education and entry into tertiary education in Finland. *In*: H.-P. Blossfeld, S. Buchholz, J. Skopek, and M. Triventi, eds. *Models of Secondary Education and Social Inequality*. Edward Elgar Publishing.

Kosunen, S., 2014. Reputation and parental logics of action in local school choice space in Finland. *Journal of Education Policy*, 29 (4), 443–466.

Kosunen, S., Bernelius, V., Seppänen, P., and Porkka, M., 2020. School Choice to Lower Secondary Schools and Mechanisms of Segregation in Urban Finland. *Urban Education*, 55 (10), 1461–1488.

Metsämuuronen, J., 2017. *Oppia ikä kaikki–Matemaattinen osaaminen toisen asteen koulutuksen lopussa 2015.* Kansallinen koulutuksen arviointikeskus.

Metsämuuronen, J. and Nousiainen, S., 2021. *Matematiikkaa COVID-19-pandemian varjossa. Matematiikan osaaminen 9. luokan lopussa keväällä 2021*. Kansallinen koulutuksen arviointikeskus.

Nissinen, K., Ursin, J., Hyytinen, H., and Kleemola, K., 2021. Higher education students' generic skills. *In*: J. Ursin, H. Hyytinen, and K. Silvennoinen, eds. *Assessment of undergraduate students' generic skills in Finland : Findings of the Kappas! project*. Helsinki: Ministry of Education and Culture, 39–82.

Nori, H., 2011. *Keille yliopiston portit avautuvat? Tutkimus suomalaisiin yliopistoihin ja eri tieteenaloille valikoitumisesta 2000-luvun alussa.* University of Turku.

Ramos Lobato, I., Bernelius, V., and Kosunen, S., 2018. Looking for the ordinary? Parental choice and elite school avoidance in Finland and Germany. *Nordic Journal of Studies in Educational Policy*, 4 (3), 156–167.

Salmela-Aro, K., Kiuru, N., and Nurmi, J.-E., 2008. The role of educational track in adolescents' school burnout: A longitudinal study. *British Journal of Educational Psychology*, 78 (4), 663–689.

Seppänen, P., Rinne, R., and Sairanen, V., 2012. Suomalaisen yhtenäiskoulun eriytyvät koulutiet: oppilasvalikointi perusopetuksessa, esimerkkinä Turun koulumarkkinat. *Yhteiskuntapolitiikka*, (1).

Tikkanen, J., 2019. Parental school satisfaction in the context of segregation of basic education in urban Finland. *Nordic Journal of Studies in Educational Policy*, 5 (3), 165–179.

Appendices

Appendix Chapter 2: "Effects of school segregation on educational achievement along the educational trajectory in Germany"

***Table A1**: Results of linear mixed-effects regression models*

Predictors (measured at t_0)	**Kindergarten 1 -> Kindergarten 2**	**Grade 1 -> Grade 3**	**Grade 4 -> Grade 7**	**Grade 5 -> Grade 7**	**Grade 7 -> Grade 9**	**Grade 9 -> Grade 12**
Low-SES Students: 10-20% (Ref. 0-10%)	-0.008 [-0.177,0.160]	-0.080 [-0.181,0.021]	0.107 [-0.020,0.234]	-0.083 [-0.201,0.034]	-0.025 [-0.125,0.075]	0.000 [-0.070,0.070]
Low-SES Students: 20-30% (Ref. 0-10%)	0.007 [-0.163,0.177]	-0.144* [-0.255,-0.034]	0.046 [-0.096,0.188]	-0.140 [-0.301,0.020]	-0.021 [-0.155,0.113]	0.060 [-0.056,0.176]
Low-SES Students: > 30% (Ref. 0-10%)	-0.082 [-0.265,0.101]	-0.237*** [-0.359,-0.115]	0.030 [-0.143,0.203]	-0.204* [-0.366,-0.043]	-0.106 [-0.245,0.033]	0.040 [-0.080,0.159]
Prior Science Achievement	1.437*** [1.002,1.871]					
Prior Vocabulary Achievement	0.491*** [0.444,0.538]					
Prior Math Achievement		0.534*** [0.508,0.561]	0.646*** [0.600,0.691]	0.547*** [0.515,0.578]	0.491*** [0.465,0.517]	0.447*** [0.424,0.470]
SES	0.178*** [0.131,0.225]	0.181*** [0.152,0.210]	0.175*** [0.123,0.227]	0.097*** [0.065,0.128]	0.082*** [0.055,0.109]	0.059*** [0.035,0.082]
Migration Background (Ref. No Migration Background)	0.166* [0.039,0.293]	-0.013 [-0.101,0.076]	0.130 [-0.040,0.300]	-0.068 [-0.152,0.015]	-0.061 [-0.133,0.011]	-0.101** [-0.166,-0.035]
Female (Ref. Male)	-0.133*** [-0.208,-0.057]	-0.042 [-0.093,0.008]	-0.314*** [-0.402,-0.226]	-0.154*** [-0.209,-0.099]	-0.074** [-0.121,-0.027]	-0.255*** [-0.298,-0.212]
Readiness for Exertion		0.182*** [0.135,0.229]	0.159*** [0.075,0.243]			
Academic Self-Concept in Math				0.159*** [0.126,0.192]	0.216*** [0.190,0.241]	0.215*** [0.190,0.240]
Mean (Vocabulary)	-0.036 [-0.182,0.110]					
SD (Vocabulary)	-0.103 [-0.304,0.099]					
Mean (Science)	0.361 [-2.937,3.659]					
SD (Science)	-0.829 [-2.626,0.968]					
Mean (Math)		-0.170*** [-0.254,-0.087]	0.089 [-0.050,0.227]	0.236*** [0.116,0.355]	0.187*** [0.093,0.280]	0.203*** [0.127,0.279]
SD (Math)		-0.047** [-0.082,-0.011]	0.022 [-0.188,0.231]	-0.086 [-0.358,0.185]	0.030 [-0.151,0.211]	-0.072 [-0.229,0.085]
Hauptschule (Ref. Gymnasium)				-0.198 [-0.423,0.028]	-0.260** [-0.455,-0.064]	-0.065 [-0.206,0.075]
Realschule (Ref. Gymnasium)				-0.116 [-0.262,0.030]	-0.293*** [-0.415,-0.171]	-0.077 [-0.182,0.027]
Other (Ref. Gymnasium)				-0.129 [-0.330,0.071]	-0.157* [-0.307,-0.008]	0.009 [-0.114,0.133]
Federal State Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-0.573 [-2.138,0.992]	3.844*** [3.628,4.060]	1.991*** [1.264,2.717]	0.559*** [0.259,0.860]	0.669*** [0.433,0.905]	0.281** [0.108,0.455]
SD(Intercept)	0.278*** [0.226,0.342]	0.248*** [0.212,0.289]	0.182*** [0.120,0.276]	0.191*** [0.153,0.239]	0.188*** [0.156,0.228]	0.117*** [0.089,0.153]
SD(Residuals)	0.865*** [0.838,0.893]	0.843*** [0.825,0.861]	0.842*** [0.811,0.875]	0.762*** [0.744,0.781]	0.729*** [0.713,0.745]	0.741*** [0.726,0.755]
Number of Students	2143	4603	1564	3431	4182	5277
Number of Schools	235	356	329	198	263	294
AIC	5708.950	11868.040	4071.529	8138.430	9542.349	12065.905
BIC	5879.048	12048.205	4221.469	8322.648	9732.505	12269.610

***Note**: Non-standardised coefficients from linear mixed-effects regression models. 95% confidence intervals in brackets. * p < 0.05, ** p < 0.01, *** p < 0.001. Data: NEPS SC2, SC3, SC4 (NEPS Network 2020, 2021a, 2021b), own calculations.*

Appendix Chapter 3: "The impact of school composition on students achievement in Luxembourg: a longitudinal perspective"

MAGRIP:

The acronym "MAGRIP" which has become the emblematic name of this study refers to "lost Gray Matter" (Matière grise perdue) and thereby translates the fundamental research question of the authors of the time, namely to study to what extent the Luxembourg school system is capable or incapable of developing the cognitive potential of each of its students regardless of their social status. In other words, it was about quantifying the loss of potential in terms of educational attainment caused by social inequalities that could negatively influence a student's educational path. The question (of inequalities) was at the centre of the famous MAGRIP study which was launched in 1968 and which was the first large-scale psycho-socio-educational study in Luxembourg (Martin et Al. 2016).

Achievement gap and educational handicap

The figure illustrates the link between the school achievement gap and the proportion of children not reaching proficiency level 2 in the three subjects. The countries in the upper right quadrant show the best performance, as they combine low achievement gaps with a low percentage of students below level 2 in all three subjects. On the contrary, the countries in the lower left quadrant show the worst performance, since they have both large achievement gaps and a high absolute percentage of students below level 2. This graph highlights that the reduction in the achievement gap does not necessarily imply a choice between equality and a good academic level. Sources: (PISA 2012, UNICEF Innocenti 2016).

***Figure A1**: Education system in Luxembourg and its characteristics (Source: MENJE 2020)*

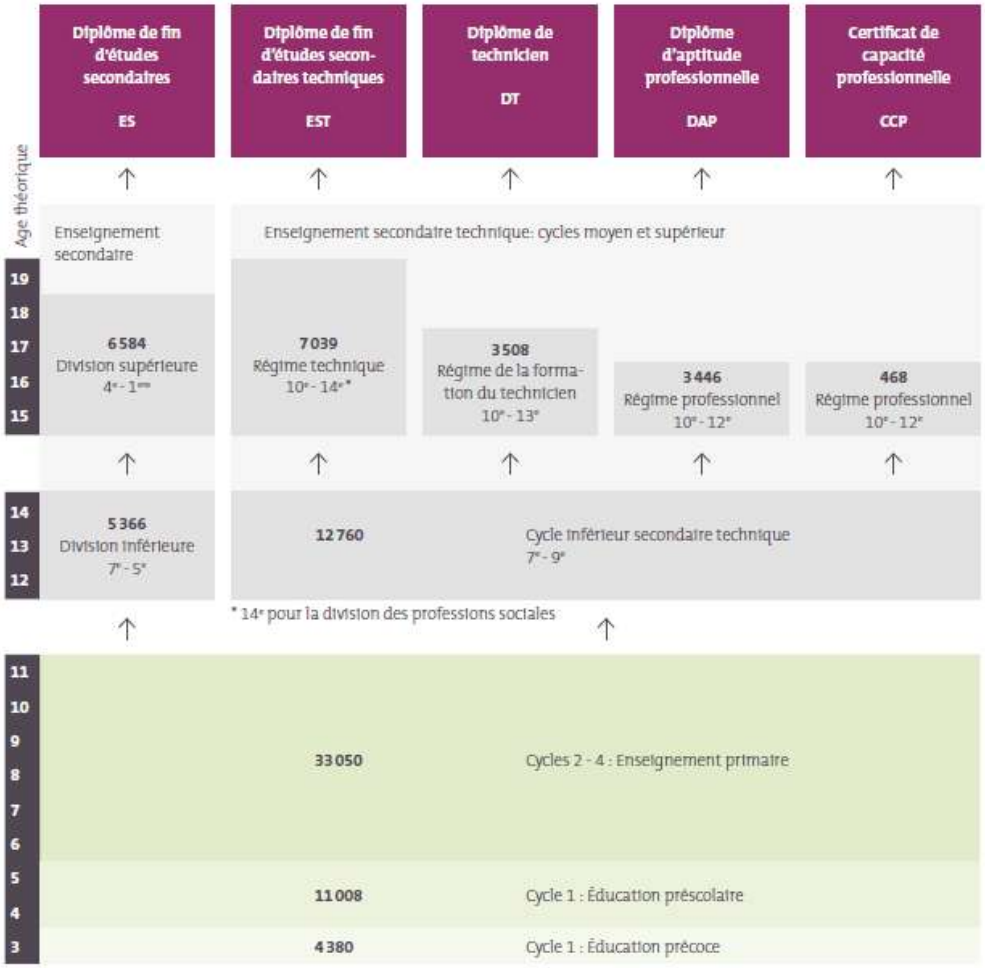
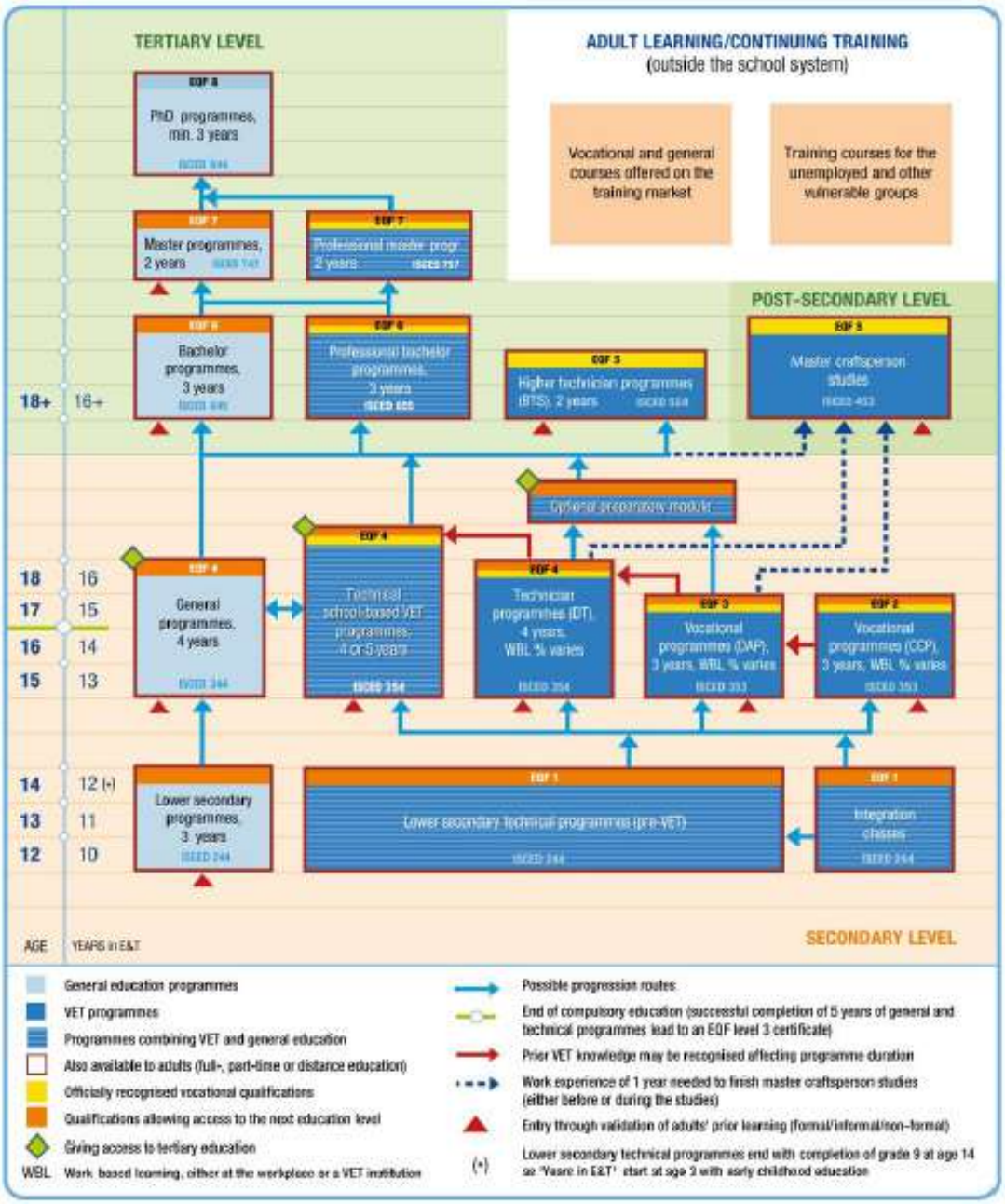


***Figure A2**: Structural characteristics of the education system in Luxembourg (Source: Lambert 2019; INQS 2020)*

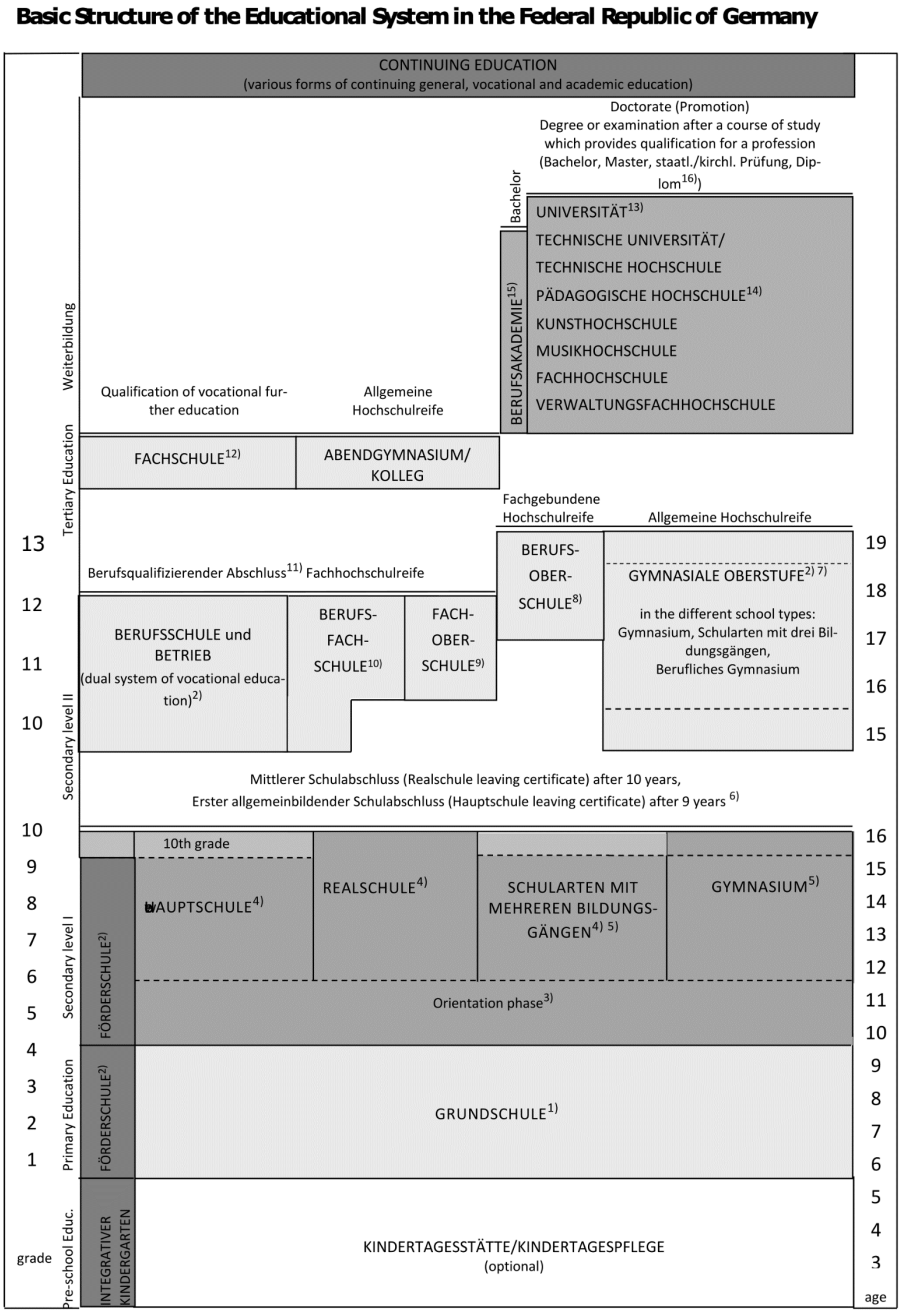
	CARACTÉRISTIQUES STRUCTURELLES						PERFORMANCES			
	Âge sélection	Taux retard scolaire	Indice de ségrégation sociale entre écoles	Indice de ségrégation académique entre écoles	% Élèves dans écoles avec classes de niveau	% Élèves dans écoles avec groupes de niveau	Δ Scores entre élèves quartiles extrêmes ESCS	Score moyen (écart-type)	% Élèves «forts» (≥ niveau 5)	% Élèves «faibles» (≤ niveau 1)
Système éducatif du Luxembourg (LUX)	13,0	30,9	26,1	33,9	72,0	54,0	125,0	483,0 (100,3)	8,3	25,8

***Figure A3**: VET system in Luxembourg (Source: Cedefop; ReferNet Luxembourg)*



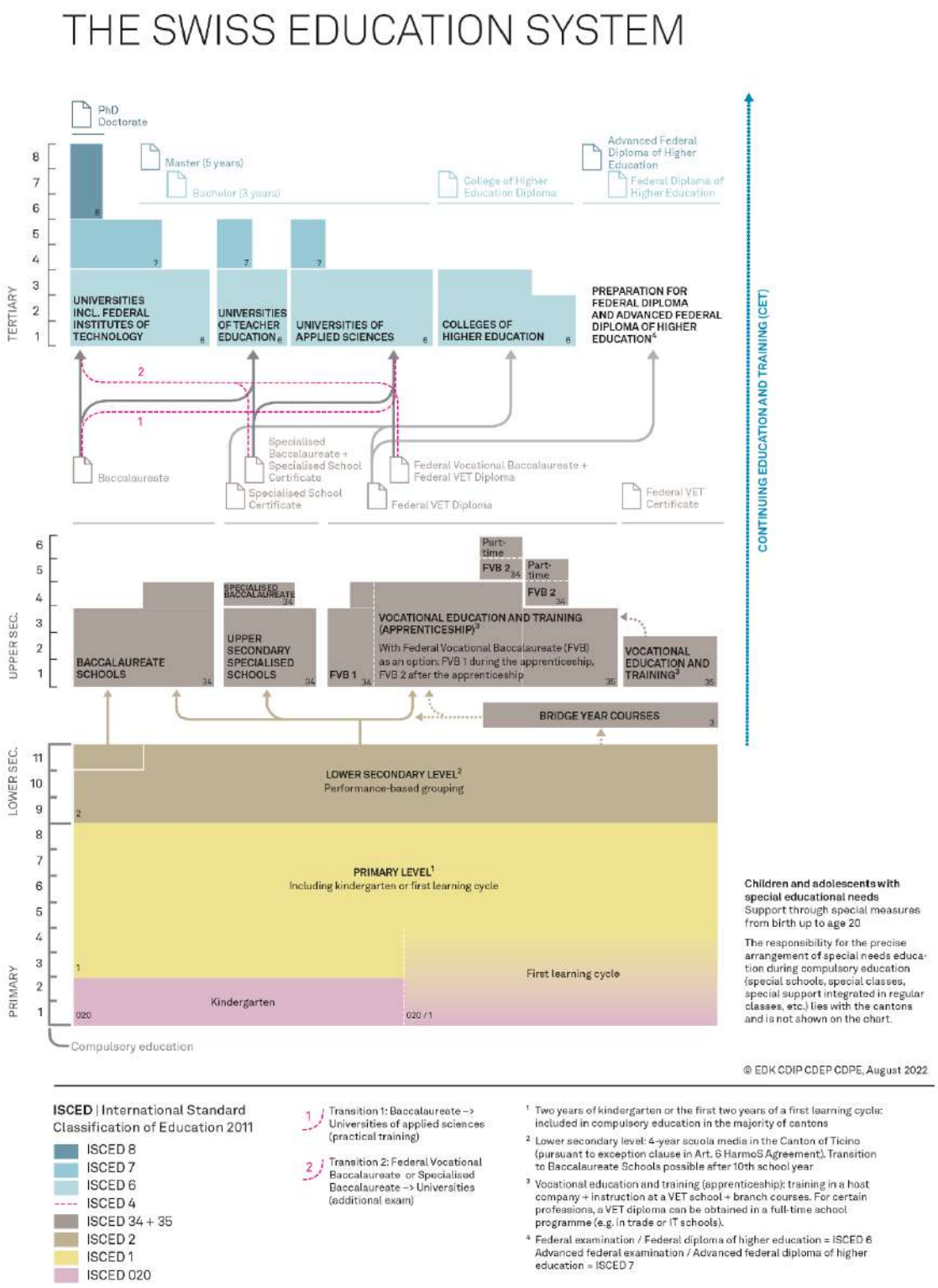
Appendix Chapter 5: "Consequences of ethnic and social segregation on educational attainment at upper secondary level in Germany and Switzerland"

***Figure A1**: Structure of the German education system*



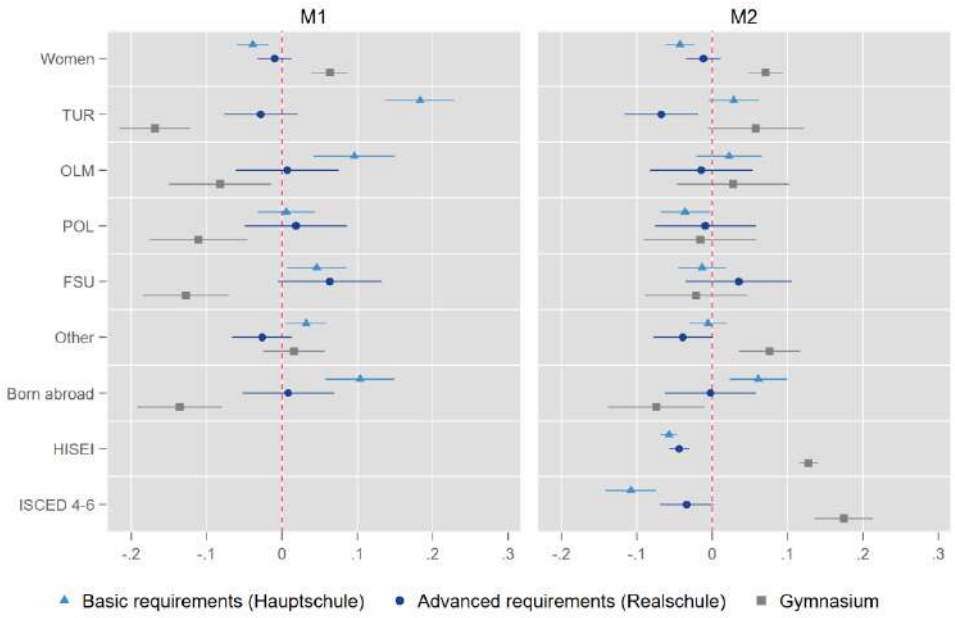
(Source: Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of German; https://www.kmk.org/fileadmin/Dateien/pdf/Eurydice/Bildungswesen-engl-pdfs/dossier_en_ebook.pdf)

***Figure A2**: Structure of the Swiss education system*



(Source: Swiss Conference of Cantonal Ministers of Education; https://www.edk.ch/en/education-system/diagram?set_language=en)

***Figure A3**: Association of migration background and social origin on attended school type at lower secondary level (Germany, NEPS);* Multinomial logistic regression models, average marginal effects. See "Methodological notes" for an overview of abbreviations and reference categories.



***Reading example, model** 1*: The propensity that students, whose parents were born in Turkey (TUR), attend the Hauptschule is 18 percentage points higher compared to students, whose parents were born in Germany. Confidence intervals that to not cross the red dashed vertical line on the x-axis indicate that the association is statistically significant at least the 5 percent level.

***Figure A4**: Association of migration background and social origin on attended school type at lower secondary level (German-speaking Switzerland, DAB);* Multinomial logistic regression models, average marginal effects. See "Methodological notes" for an overview of abbreviations and reference categories.

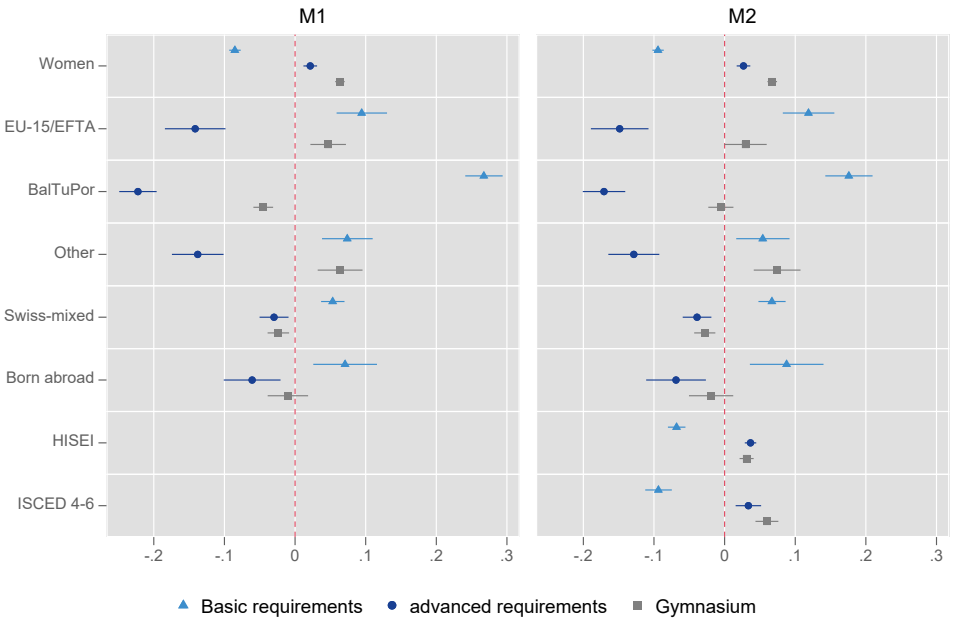


***Figure A5**: Association of migration background and social origin on the direct transition to a certifying track at upper secondary level (Germany, NEPS); Multilevel linear probability regression models.*

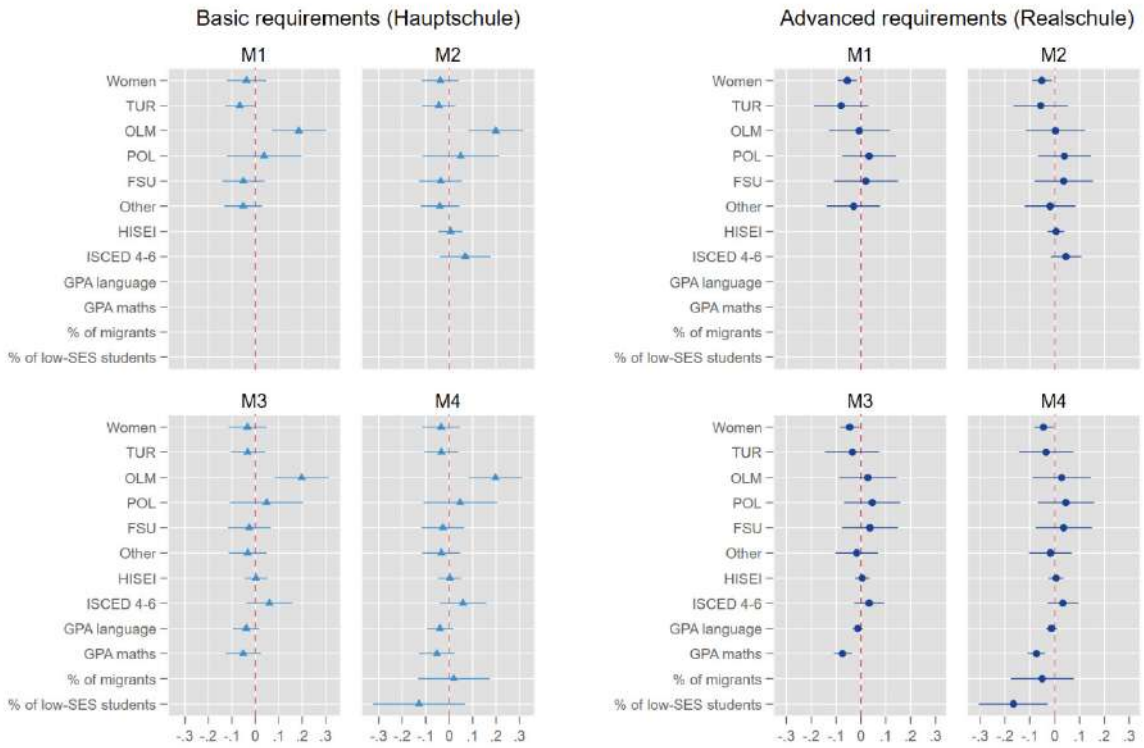


***Figure A6**: Association of migration background and social origins on the direct transition to a certifying track at upper secondary level (German-speaking Switzerland, DAB)*; Multilevel linear probability regression models.

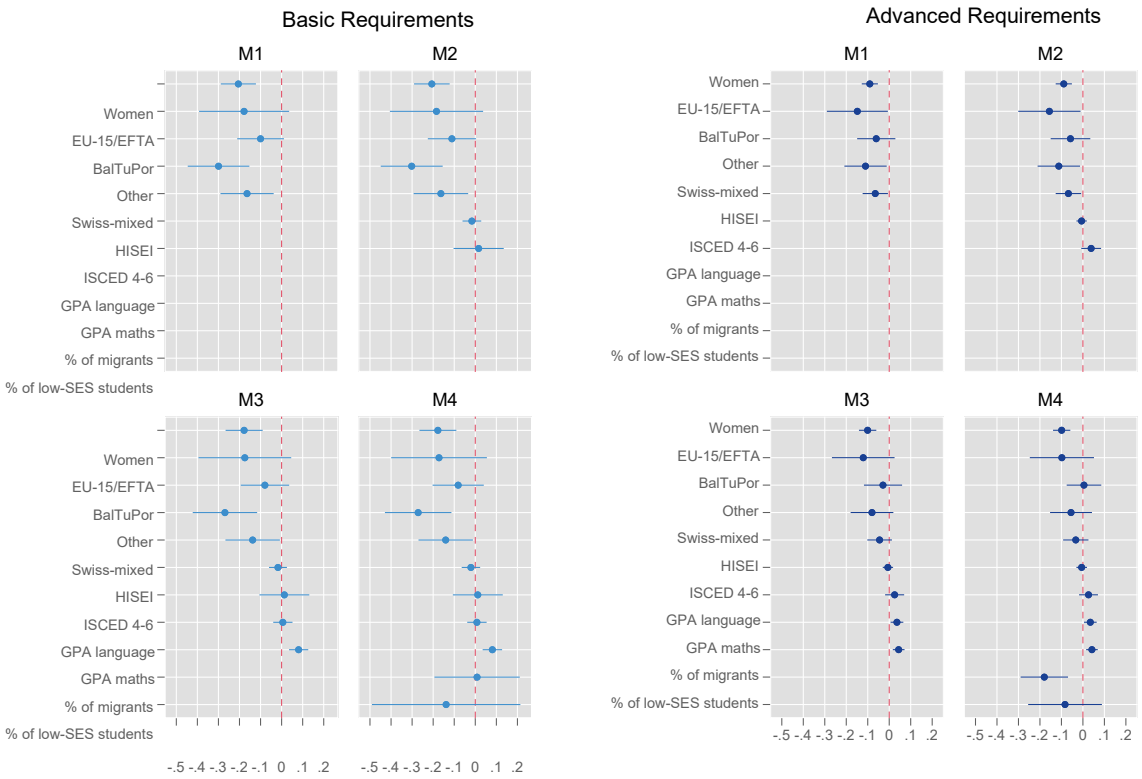


***Figure A7**: Association of migration background and social origin on attending an academic school track instead of VET (Germany, NEPS); Multilevel linear probability regression models.*

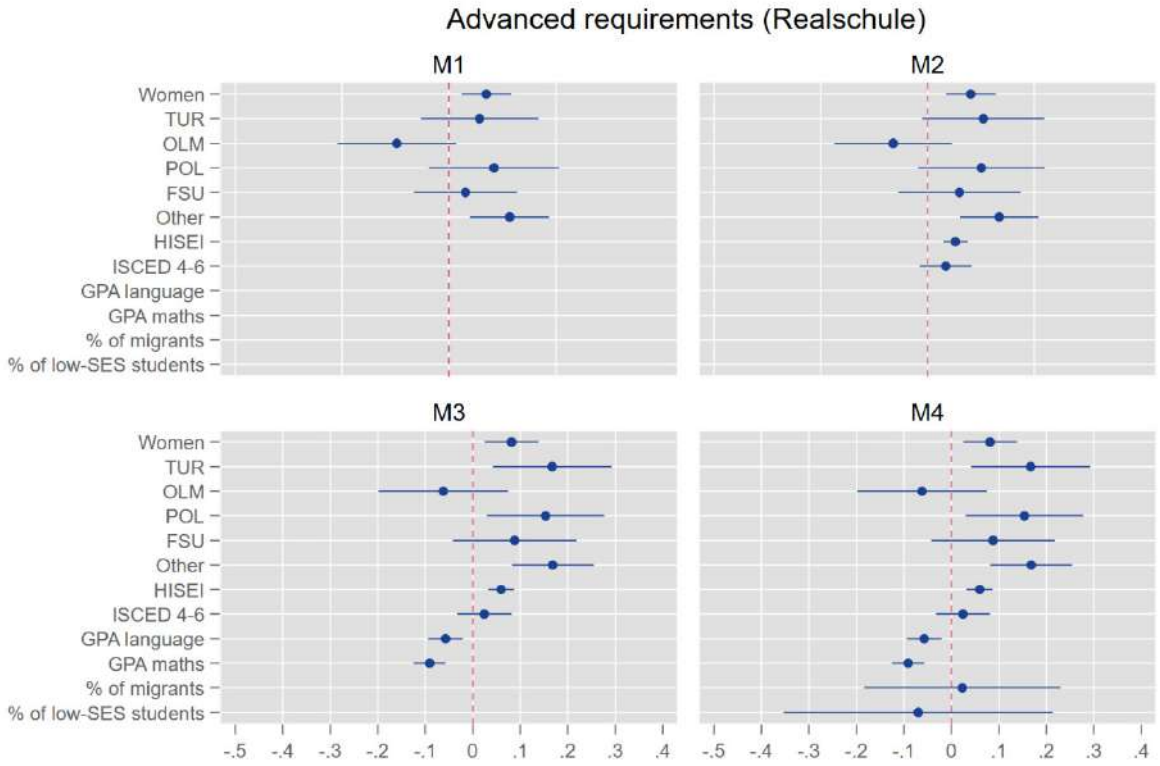
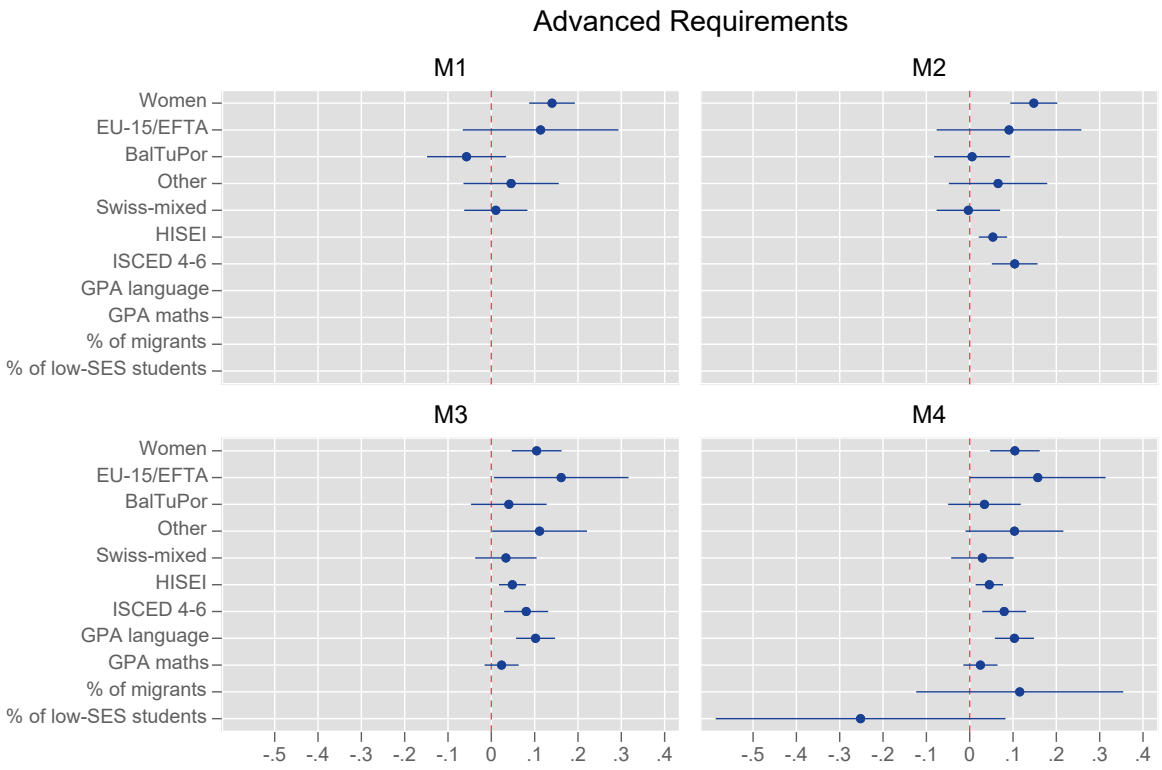


***Figure A8**: Association of migration background and social origin on attending an academic school track instead of VET (German-speaking Switzerland, DAB); Multilevel linear probability regression models.*



Appendix Chapter 6: "The impact of school social composition and neighbourhood social mix on upper secondary exam performance in Ireland"

***Figure A1**: Coefficients from cross-classified multilevel model of the influence of family social background on upper secondary performance*

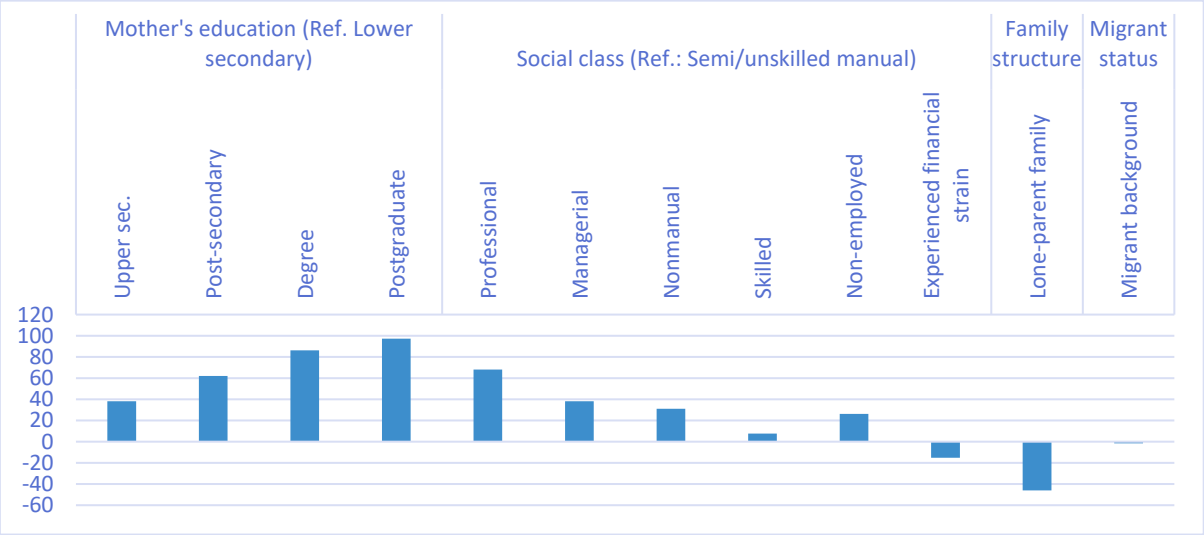


***Figure A2**: Coefficients from cross-classified multilevel model of the influence of school social mix on upper secondary performance (relative to socially mixed schools)*

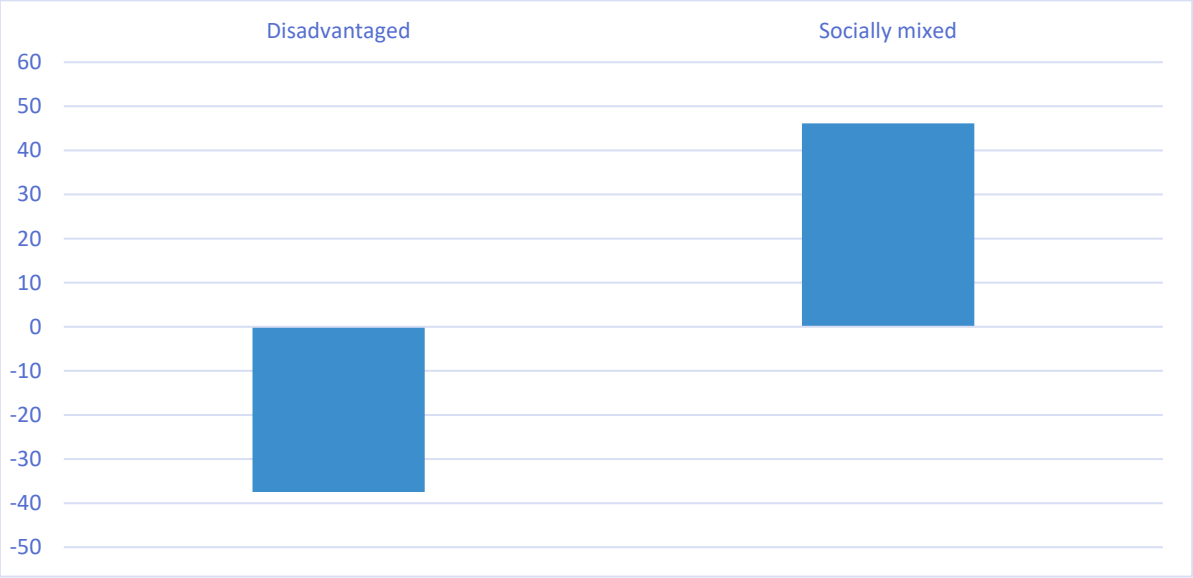
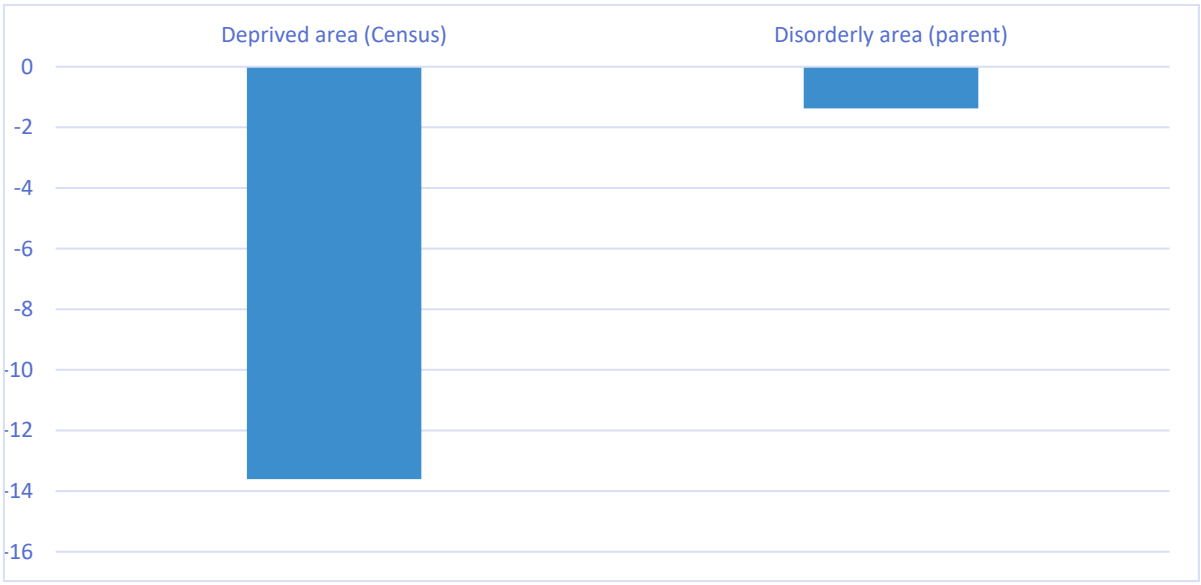


***Figure A3**: Coefficients from cross-classified multilevel model of the influence of neighbourhood social mix on upper secondary performance*



***Note**: These models also control for gender, disability/special educational need, whether the young person attended a disadvantaged primary school, school gender mix, school size and urban/rural location.*

Appendix Chapter 7: "Equal education and PISA scores: the case of Russian-Medium Schools in Lithuania"

***Table A1**: Descriptive statistics*

Individual level variables

Student (Standardized) Gender	Freq.	Percent	Cum.
Female	3281	49.38	49.38
Male	3363	50.62	100.00
Total	6644	100.00	

Parent's Highest Education-Categories	Freq.	Percent	Cum.
Low = ISCED 0-4	1938	29.17	29.17
High = ISCED 5+	4706	70.83	100.00
Total	6644	100.00	

Language at home (3-digit code)	Freq.	Percent	Cum.
Polish	423	6.37	6.37
Lithuanian	5384	81.04	87.41
Russian	773	11.63	99.04
Another language (LTU)	64	0.96	100.00
Total	6644	100.00	

Language of Assessment	Freq.	Percent	Cum.
Polish	457	6.88	6.88
Lithuanian	5689	85.63	92.51
Russian	498	7.50	100.01
Total	6644	100.00	

School-level variables

School Language	Freq.	Percent	Cum.
Lithuanian	5596	84.23	84.23
Russian	416	6.26	90.49
Polish	415	6.25	96.74
Multilingual	217	3.27	100.01
Total	6644	100.00	

Location of school	Freq.	Percent	Cum.
A village, hamlet or rural area	1298	19.54	19.54
A small town	1445	21.75	41.29
A town	1310	19.72	61.01
A city	2591	39.00	100.01
Total	6644	100.00	

***Table A2**: Descriptive sample statistics for the variables in the analyses (restricted sample, N = 6644)*

Variables	Description	Mean	SD	Min	Max	N
Dependant Variables						
Math achievement	*Plausible values in Math (all 10 PVs used in analysis):*					
	Math score PV1	483.32	90.03	175.18	811.09	6,644
	Math score PV2	479.45	89.93	148.33	778.28	6,644
	Math score PV3	480.67	90.65	176.63	815.77	6,644
	Math score PV4	480.75	89.43	145.16	799.21	6,644
	Math score PV5	478.46	90.32	122.79	795.42	6,644
	Math score PV6	480.60	90.63	132.77	865.24	6,644
	Math score PV7	478.60	90.66	169.48	803.45	6,644
	Math score PV8	479.73	90.26	192.32	785.91	6,644
	Math score PV9	478.51	91.06	141.57	864.97	6,644
	Math score PV10	479.24	92.01	147.84	787.71	6,644
Independent Variables						
Male	0 = Female ; 1 = Male	0.51	0.50	0	1	6,644
Parents highest education	0 = High SES (ISCED +5) ; 1 = Low SES (ISCED 0-4)	0.29	0.45	0	1	6,644
Language spoken at home	*Categorical variable:*					
	273 = Polish	0.06	0.24	0	1	6,644
	375 = Lithuanian	0.81	0.39	0	1	6,644
	495 = Russian	0.12	0.32	0	1	6,644
	833 = Another language	0.01	0.10	0	1	6,644
Language of the school	*Categorical variable:*					
	1 = Lithuanian school	0.84	0.36	0	1	6,644
	2 = Russian school	0.06	0.24	0	1	6,644
	3 = Polish school	0.06	0.24	0	1	6,644
	4 = Multilingual school	0.03	0.18	0	1	6,644
Location of the school	*Categorical variable:*					
	1 = Rural	0.20	0.40	0	1	6,644
	2 = Small town	0.22	0.41	0	1	6,644
	3 = Town	0.20	0.40	0	1	6,644
	4 = City	0.39	0.49	0	1	6,644
Language of the assessment	*Categorical variable:*					
	273 = Polish	0.07	0.25	0	1	6,644
	375 = Lithuanian	0.86	0.35	0	1	6,644
	495 = Russian	0.07	0.26	0	1	6,644
Observations						6,644