


Effects of School Segregation on Educational Achievement Along the Educational Trajectory in Germany

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Point of Departure

Excerpt from the Coleman-Report:

“[C]hildren from a given family background, when put in schools of different social composition, will achieve at quite different levels. This effect is again less for white pupils than for any minority group other than Orientals.”

Coleman et al., 1966: 22

Ample Research on School Segregation

- Generally: Higher achievement gains in high-SES schools
- Mixed evidence on the relationship between achievement and school composition by ethnicity or migration status
- Reviews
 - *Van Ewijk & Slegers, 2010; Reardon & Owens, 2014; Holzberger et al., 2020; Perry & Lubienski, 2022*
- Methodological criticism
 - *Koedel et al., 2015; Timmermans & Thomas, 2015; Marks, 2017; Spaiser et al., 2018; Sciffer et al., 2020*

Two Prominent Mechanisms

Instructional Quality

- Teachers adapt their instructional level based on perceptions of students' abilities and learning needs
 - Teachers have (unjustifiably) low expectations of classrooms composed of many low-SES and immigrant students
- *Rosenthal & Jacobson, 1968; Beckerman & Good, 1981; Jussim et al. 1996; Harker & Tymms, 2004; van den Bergh et al., 2010; Agirdag et al., 2013*

Peer Interaction

- Through norms and social contagion, students influence each other's achievement and motivation making them more similar
 - In disadvantaged schools, this contributes to an adverse learning climate
- *Erbring & Young, 1979; Thrupp et al., 2002; Martin & Dowson, 2009; Goldsmith, 2011; Agirdag et al., 2012*

Recent Evidence from Germany

- Lower achievement in socioeconomically disadvantaged lower secondary schools, composition by migration status less relevant
 - *Rjosk et al., 2014; Dollmann & Rudolphi, 2020; Seuring et al, 2021*
- Share of dual language learners is not predictive of vocabulary development in ECEC
 - *Willard et al., 2019; Kohl et al., 2019; Kohl et al., 2022*
- Interdependence of tracking, school composition and competence development
 - *Lenz et al., 2019; Esser & Seuring, 2020; Traini et al., 2021; Becker et al., 2022*

Research Questions

How does school composition affect students' competence development at different educational stages in the German education system?

- If at all, is school composition related to students' competence development?
- Does school composition affect students' learning consistently?
- Or is school composition more important during a specific stage?
- Are there differences by subject? Or by type of school composition?

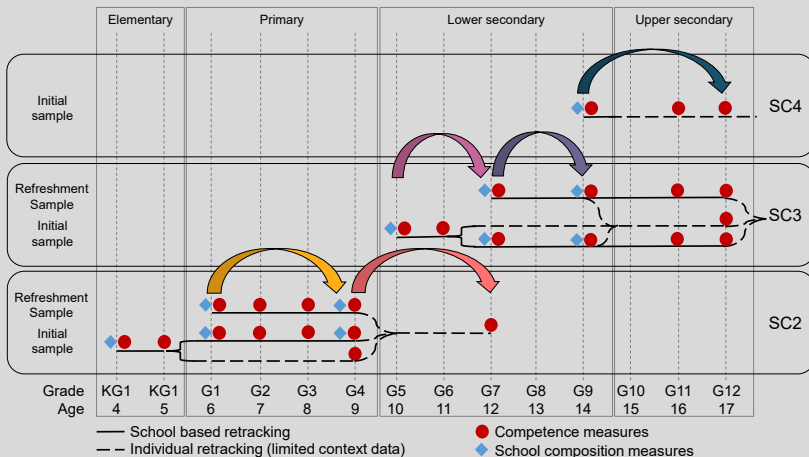
Data

National Educational Panel Study (NEPS)

- Longitudinal data on educational processes and competence development in Germany
 - NEPS Network 2020, 2021a, 2021b
- Information provided by students, parents, educators and principals
- Partition cohorts into grade-specific subsamples:

Source	Subsample	$N_{students}$	$N_{schools}$
SC2	Grade 1 -> Grade 4	4'603	356
SC2	Grade 4 -> Grade 7	1'564	329
SC3	Grade 5 -> Grade 7	3'434	198
SC3	Grade 7 -> Grade 9	4'182	263
SC4	Grade 9 -> Grade 12	5'277	294

Study Design



Operationalisation

Dependent Variables

- Scores from standardised competence tests in mathematics and German (vocabulary and reading)
- Longitudinally linked weighted likelihood estimates (WLE)

School Composition

- By socioeconomic background:
Share of students within the first SES quintile (%)
- By migration status:
Share of first- and second-generation migrants (%)
- Aggregated at the school level

Methods

Linear Mixed-Effects Regression Models

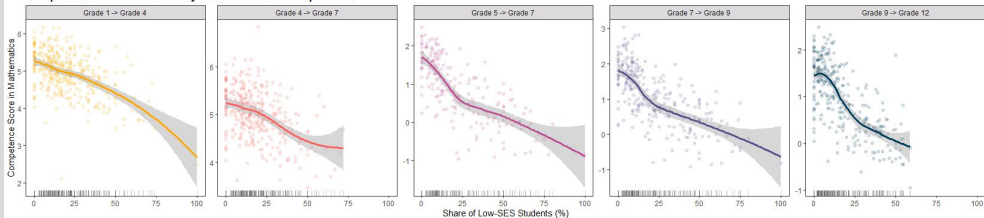
$$Score_{ijt+1} = \gamma_{00} + \gamma_{p0}Score_{ijt} + \gamma_{01}Comp_{jt} + \sum_{p=1}^P \gamma_{p0}X_{pijt} + \sum_{q=1}^Q \gamma_{0q}Z_{qjt} + \delta_{0jt} + \epsilon_{ijt}$$

Score = Competence score; *Comp* = School composition; *i* Students in *j* schools at time *t*; *P* Level-1 controls; *Q* Level-2 controls

- “Lagged score value-added model” / “Residualised change model”
- Restricted maximum likelihood estimation
- Control variables:
 - Student-level: SES, migration background, sex, academic self-concept
 - School-level: mean prior achievement, achievement heterogeneity, track and federal state

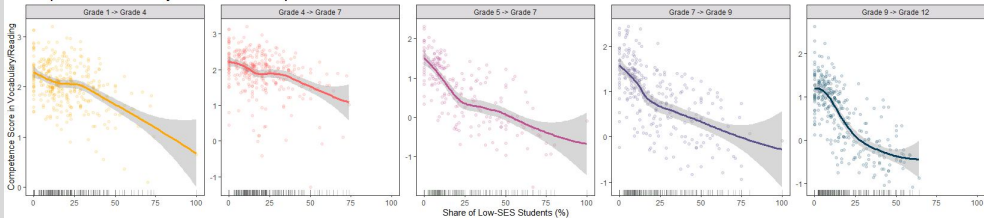
Socioeconomic Composition and Competences

Competences in Mathematics by Socioeconomic Composition



Data: NEPS SC2, SC3, SC4, N = 19'057 students in 1'440 schools. LOESS based on own calculations.

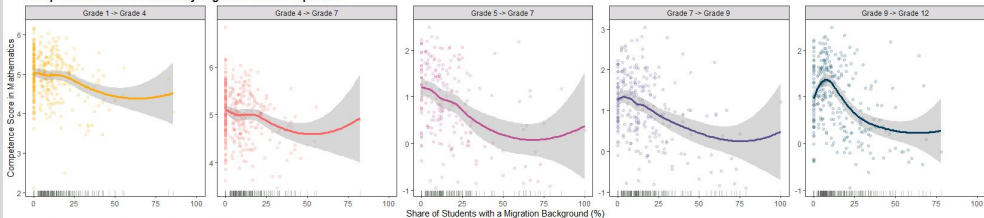
Competences in German by Socioeconomic Composition



Data: NEPS SC2, SC3, SC4, N = 18'410 students in 1'413 schools. LOESS based on own calculations.

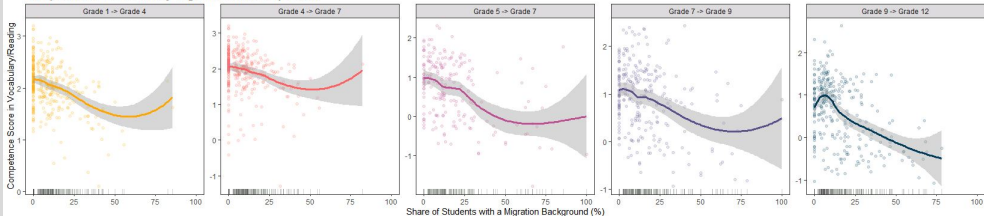
Migrant Status Composition and Competences

Competences in Mathematics by Migrant Status Composition



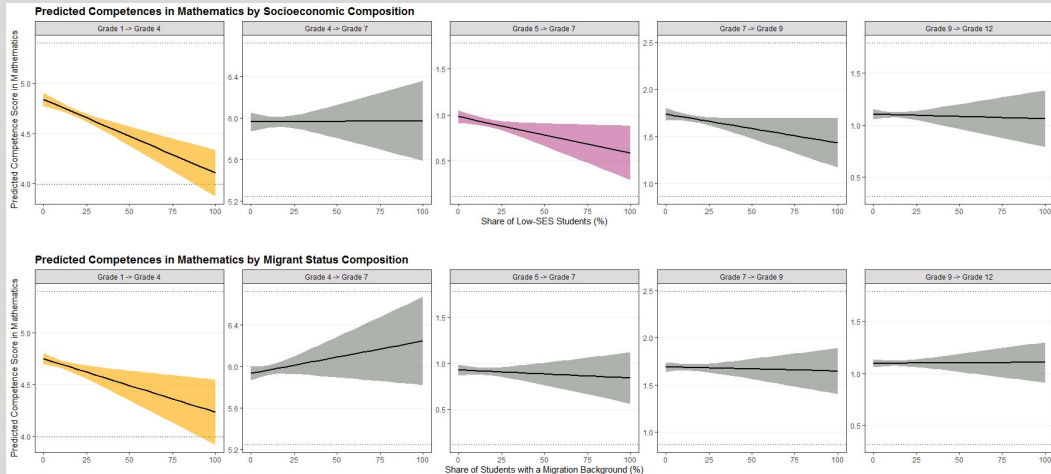
Data: NEPS SC2, SC3, SC4, N = 19'057 students in 1'440 schools. LOESS based on own calculations.

Competences in German by Migrant Status Composition



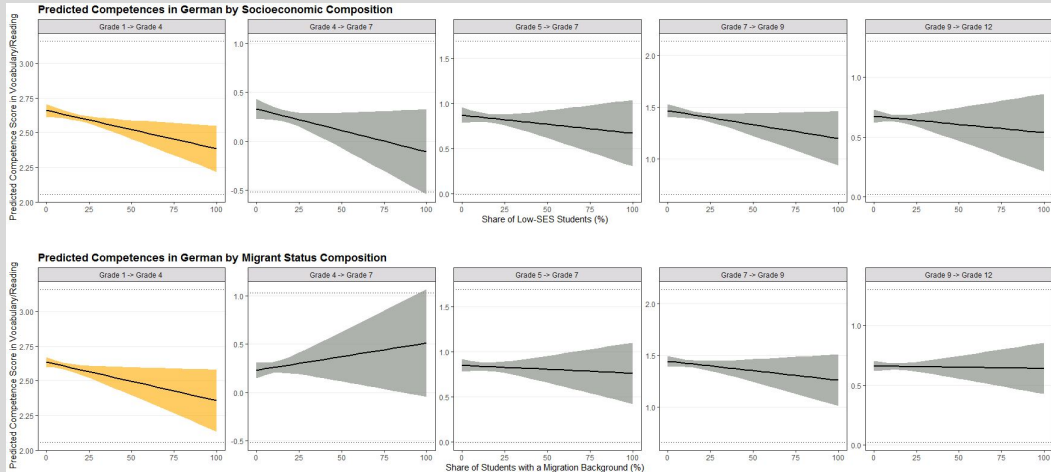
Data: NEPS SC2, SC3, SC4, N = 18'410 students in 1'413 schools. LOESS based on own calculations.

Effect of Composition on Math Competences



Data: NEPS SC2, SC3, SC4, N = 19'057 students in 1'440 schools
Dotted lines indicate upper and lower bounds of IQR. Linear predictions of mixed-effects models based on own calculations.

Effect of Composition on German Competences



Data: NEPS SC2, SC3, SC4, N = 18'410 students in 1'413 schools.
Dotted lines indicate upper and lower bounds of 95% CI. Linear predictions of mixed-effects models based on own calculations.

SES or Migration Status Composition?

	Math 1	Math 2	Math 3	Vocab 1	Vocab 2	Vocab 3
Share Low-SES (%)	-0.007*** [-0.010,-0.005]		-0.007*** [-0.010,-0.004]	-0.003** [-0.005,-0.001]		-0.002* [-0.004,-0.000]
Share Migration Background (%)		-0.005** [-0.009,-0.002]	-0.002 [-0.006,0.001]		-0.003* [-0.005,-0.000]	-0.002 [-0.005,0.000]
Prior Achievement	0.535*** [0.509,0.562]	0.533*** [0.506,0.559]	0.536*** [0.509,0.562]	0.783*** [0.756,0.809]	0.782*** [0.756,0.808]	0.784*** [0.758,0.810]
SES	0.177*** [0.148,0.206]	0.191*** [0.162,0.219]	0.177*** [0.148,0.207]	0.111*** [0.091,0.132]	0.117*** [0.097,0.137]	0.112*** [0.091,0.132]
Migration Background	-0.009 [-0.097,0.079]	0.011 [-0.080,0.102]	0.005 [-0.085,0.096]	-0.154*** [-0.217,-0.092]	-0.138*** [-0.202,-0.073]	-0.140*** [-0.204,-0.075]
Female	-0.043 [-0.094,0.008]	-0.041 [-0.092,0.009]	-0.043 [-0.093,0.008]	-0.03 [-0.064,0.005]	-0.029 [-0.064,0.006]	-0.029 [-0.064,0.005]
Readiness for Exertion	0.182*** [0.135,0.229]	0.180*** [0.133,0.227]	0.182*** [0.135,0.229]	-0.015 [-0.046,0.017]	-0.015 [-0.047,0.017]	-0.015 [-0.046,0.017]
Mean(Prior Achievement)	-0.209*** [-0.292,-0.125]	-0.145*** [-0.225,-0.065]	-0.214*** [-0.298,-0.130]	-0.091* [-0.174,-0.009]	-0.069 [-0.146,0.009]	-0.113* [-0.200,-0.027]
SD(Prior Achievement)	-0.059** [-0.094,-0.024]	-0.041* [-0.076,-0.006]	-0.061*** [-0.096,-0.026]	0.053 [-0.089,0.195]	0.068 [-0.076,0.212]	0.071 [-0.073,0.214]
Intercept	3.966*** [3.741,4.191]	3.762*** [3.554,3.970]	3.994*** [3.765,4.222]	1.553*** [1.364,1.741]	1.491*** [1.317,1.665]	1.588*** [1.395,1.780]
SD(Intercept)	0.239*** [0.203,0.280]	0.252*** [0.217,0.293]	0.238*** [0.203,0.279]	0.142*** [0.118,0.171]	0.144*** [0.120,0.173]	0.142*** [0.118,0.171]
SD(Residual)	0.843*** [0.825,0.861]	0.843*** [0.825,0.861]	0.843*** [0.825,0.861]	0.572*** [0.560,0.584]	0.572*** [0.559,0.584]	0.572*** [0.560,0.584]
Students	4603	4603	4603	4429	4429	4429
Schools	356	356	356	336	336	336
AIC	11853.484	11869.61	11864.566	7945.768	7947.511	7956.321
BIC	12020.78	12036.906	12038.296	8112.062	8113.805	8129.011

Conclusion & Outlook

- When prior competences and schools' average achievement are accounted for...
 - ...negative effects of disadvantaged school composition vanish in secondary education
 - ...negative effects of disadvantaged school composition persist in primary education
- In light of potential long-term implications, school segregation in primary school deserves closer attention
- Extensions to this analysis include:
 - Mid-term effects
 - Cross-level interactions
 - Non-linear effects

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