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Living in the Big Pond: Adding the Neighborhood as a Frame of Reference for Academic Self-Concept Formation

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Research on the big-fish-little-pond effect demonstrates that class-average achievement negatively affects students' academic self-concept via social comparison processes. The neighborhood-effects literature reports positive effects of advantageous socioeconomic neighborhood conditions on students' academic development via collective socialization mechanisms. To investigate how socioeconomic neighborhood conditions affect academic self-concept, we separately and simultaneously analyzed classroom- and neighborhood-level composition effects on students' academic self-concept, using two samples drawn from two grade levels ($N_{Grade5} = 3{,}906$, $N_{Grade9} = 3{,}277$). Analyses of the neighborhood level only indicate that socioeconomic neighborhood conditions negatively predict general, math, and German self-concept in Grade 5. In Grade 9, this holds only for math self-concept. In simultaneous analyses including classrooms and neighborhoods, socioeconomically advantageous neighborhood conditions negatively predicted general and math self-concept in Grade 5.

Keywords: *academic self-concept, big-fish-little-pond effect, classroom composition, neighborhood effects, social comparison, collective socialization*

Introduction

To cope with a rapidly changing world, positive self-beliefs are a central socioemotional skill (Organisation for Economic Co-operation and Development [OECD], 2018). Positive self-beliefs are "a basic psychological need that has a pervasive impact on daily life, cognition, and behavior, across age and culture" (Elliot & Dweck, 2005, p. 8). One prominent self-belief construct is the academic self-concept, which describes students' perceptions of their competence in academic domains (Marsh et al., 2017). Previous research demonstrates that the academic self-concept is related to various beneficial outcomes, like achievement or educational and occupational attainment (Trautwein & Möller, 2016).

Rooted in sociological work (Davis, 1966; Meyer, 1970), a large body of psychological research shows that students' academic self-concept is negatively predicted by the average achievement of educational environments, that is, schools or classrooms when controlling for individual achievement (for an overview, see Marsh & Seaton, 2015). In other words, equally able students have lower academic self-concepts in high-achieving environments. This finding is called the big-fish-little-pond effect (BFLPE; Marsh, 1987). The BFLPE emerges as a consequence of social comparison processes in which students evaluate their academic capabilities by comparing their achievement with that of other students in their educational environment (e.g., Huguet et al., 2009; Marsh et al., 2014). The psychological mechanism causing the BFLPE is a contrast effect, implying that a student of given achievement forms contrasts with a generalized other—that is, the classroom or school environment—to fulfill comparison needs (Marsh et al., 2000, 2008). Thus, if a student assumes that this generalized other's achievement is superior (inferior), it harms (fosters) the student's self-concept.

Empirical research on the BFLPE suggests that comparisons within proximal student environments—namely, those that students are directly exposed to (e.g., the classroom)—matter most for self-concept formation (e.g., Liem et al., 2013; Marsh et al., 2014). To date, research on the BFLPE focused on the role of learning environments within formal education settings (e.g., schools, tracks, classes).

However, residential settings—that is, local living environments like neighborhoods—constitute another important environment that students are directly exposed to (e.g., Boardman & Saint Onge, 2005; Childress, 2016). The association between socioeconomic neighborhood composition and educational outcomes has been investigated by sociologists, urban geographers, and economists (see Galster, 2012; Galster & Sharkey, 2017; Sampson et al., 2002; Sharkey & Faber, 2014).

This research suggests that advantageous socioeconomic neighborhood conditions promote academic development (i.e., achievement, educational aspirations/choices, and school behavior (e.g., Bowen & Bowen, 1999; Hartung & Hillmert, 2019; Nieuwenhuis & Hooimeijer, 2016). Moreover, the neighborhood-effects literature demonstrates that due to catchment areas, classrooms and schools are typically composed according to residential criteria. Hence, an analysis of neighborhood effects that does not control for schools or classrooms may lead to misleading results (Jargowsky & Komi, 2011).

The present study's aim is twofold: First, we are interested in how advantageous socioeconomic neighborhood conditions predict students' academic self-concept. Second, we address the interrelation between classrooms and neighborhoods by simultaneously analyzing their effects on academic self-concept.

Background

Reference-Group Effects on Academic Self-Concept

Self-concept is defined as a person's self-perceptions formed via experiences with the environment (Shavelson et al., 1976). Academic self-concept is students' perception of their academic abilities (Marsh et al., 2017). A positive academic self-concept is known to foster academic achievement (e.g., Huang, 2011; Valentine et al., 2004). Moreover, academic self-concept represents an important predictor of career aspirations and academic choices (Eccles & Wigfield, 2002; Guo et al., 2015; Marsh & Yeung, 1997).

Davis's (1966) seminal study demonstrated that students from high-ability schools report lower perceptions of their academic abilities and are less likely to choose a high-performance career compared to students attending low-ability schools (also see Alexander & Eckland, 1975; Alwin & Otto, 1977; Meyer, 1970). This finding was explained by the mechanism of *relative deprivation* (Stouffer et al., 1949), namely, the "the judgment that one is worse off compared to some standard accompanied by feelings of anger and resentment" (Smith et al., 2012, p. 203). This has been referred to as the *frog-pond effect*.

Early sociological frog-pond research exclusively focused on school context to analyze different types of compositional effects and predicted outcomes. While Davis (1966) used school-level grade point average (GPA) to predict students' career choices, Meyer (1970) disentangled *school-average status* and *school-average achievement* effects. Meyer (1970) demonstrated that analyzing the joint effect yielded a positive association between school status and students' college intentions, while school achievement was negatively associated with both students' college intentions and self-conceptions (see Alexander & Eckland, 1975; Alwin & Otto, 1977 for similar findings). While this early sociological research focused on broad sets of outcomes, beginning with Marsh and Parker (1984), psychological reference-group effects research targeted the construct of academic self-concept (for an exception, see Göllner et al., 2018).

Marsh (1987) advanced the sociological frog-pond perspective by psychological social comparison theory (Festinger, 1954) and emphasized that controlling for individual achievement differences, academic self-concept is negatively impacted by school-average achievement. This is widely known as the BFLPE, sharing with its sociological predecessor the assumption that the average academic achievement of students' learning environments should be negatively associated with educational outcomes that are susceptible to social comparison.

Subsequently, psychological research aimed at resolving how affiliations with high-status groups might instead *positively* affect self-perceptions (Cialdini & Richardson, 1980;

Snyder et al., 1986). According to this assimilation mechanism, average achievement would positively affect students' academic self-concept, resulting in a "basking in reflected glory effect" (BIRGE; Felson, 1984; Felson & Reed, 1986; Marsh, 1984). Indeed, Marsh et al. (2000) found perceived school status to positively predict academic self-concept. Including school status in their analyses amplified the negative frame-of-reference effect. Hence, Marsh et al. (2000) concluded that the BFLPE is a net effect of dominating contrast and less-pronounced assimilation processes (see also Chmielewski et al., 2013; Trautwein et al., 2009).

Early BFLPE studies had been predominantly limited to the analysis of *school* composition effects (Marsh, 1984; e.g., Marsh, 1987). With a study by Zeidner and Schleyer (1999), *classrooms* emerged as an alternative reference frame. Current research within the BFLPE paradigm has concluded that more proximal frames of reference—namely, those that students are daily exposed to (i.e., classrooms)—are pivotal for academic self-concept formation. Studies that simultaneously tested the effects of school- and class-average achievement observed that school achievement effects were completely absorbed when simultaneously controlling for class achievement (e.g., Liem et al., 2013; Marsh et al., 2014). The idea that proximal frames of reference are key to self-evaluations is further supported by experimental work: Zell and Alicke (2010) showed that participants preferred local to global comparison information, a mechanism labeled as the "local dominance effect."[1]

Neighborhood Effects on Educational Outcomes

Research on neighborhood effects investigates the relationship between socioeconomic neighborhood composition and educational or other behavioral outcomes. Studies on neighborhood composition effects have used indices of occupations, income, or employment (Casciano & Massey, 2008; van Ham et al., 2012). Furthermore, neighborhood-effects research focusing on ethnic concentration showed that these effects cannot be reduced to socioeconomic inequality between neighborhoods (Owens, 2018; Reardon et al., 2015).

Neighborhood effects on educational outcomes are predominantly discussed as "advantages of advantaged neighbors," also called "Wilson's theory" (Mayer & Jencks, 1989; Wilson, 1987, 1996). For the United States, an advantageous socioeconomic neighborhood composition appears to be beneficial for child well-being and development (Brooks-Gunn et al., 1993; Duncan et al., 1994; Leventhal & Brooks-Gunn, 2000), academic aspirations (Stewart et al., 2016), and academic achievement and attainment (Aaronson, 1998; Ainsworth, 2002; Catsambis & Beveridge, 2001; Nieuwenhuis & Hooimeijer, 2016).

In the European context,[2] studies corroborated this positive effect of a positive social or economic neighborhood composition with lower effect sizes compared to the United States (e.g., Dunn et al., 2015; Hartung & Hillmert, 2019; Kauppinen, 2008; Kintrea et al., 2015; Sykes & Musterd, 2010; Wicht & Ludwig-Mayerhofer, 2014). Most neighborhood-effect studies controlled for either school or classroom effects (see the following section for a detailed description). A literature review by Brazil (2016) shows that neighborhood-effect studies are much more likely to consider school contexts than vice versa; in the literature on school and teaching effectiveness, neighborhood effects remain largely unconsidered. Rich and Owens (2023) suggest that research on the relation between an outcome of interest and the neighborhood–school (and by extension also classroom) structures should bear in mind contextual selection and segregation.

Various theoretical mechanisms that might account for positive neighborhood effects have been discussed (for systematic reviews, see, e.g., Alexander & Eckland, 1975; Ellen & Turner, 1997; Galster, 2008, 2012; Galster & Sharkey, 2017; Sharkey & Faber, 2014; Harding et al., 2011). They can be caused by *collective socialization processes* (Wilson, 1987) in which individuals' behavior is impacted by peer residents acting as positive role models. Processes of collective socialization are susceptible to neighborhoods' cultural contexts. Based on the concept of cultural heterogeneity, Harding (2011) and Merolla (2017) suggest that students from disadvantaged neighborhoods show a greater heterogeneity in educational goals, ultimately affecting their educational chances.

Besides, *social networks* and *peer influences* (Coleman, 2000; P. Cook & Goss, 1996; Sampson et al., 1997) that supply residents with assistance or institutional resources—for example, the provision of high-quality schooling but also information on schools or jobs—have been proposed to explain the beneficial effects of advantaged neighborhoods.

Overall, neighborhood effects are known to vary in their intensity over the individual life course (e.g., Ellen & Turner, 1997; Sharkey & Faber, 2014; van Ham & Tammaru, 2016; Wheaton & Clarke, 2003; Wodtke et al., 2016). One reason for this variation could be that a certain duration of exposure is needed for socioeconomic contexts to take effect on individual behavior and attitudes (Wodtke et al., 2016). This development is particularly interesting to study during students' secondary school career: On the one hand, research from the United States observed that at this age, students are more sensitive to neighborhood contextual conditions compared to younger children (Alvarado, 2016; Wodtke, 2013). On the other hand, it is reasonable to assume that effects decrease in this age period as more distant contexts become more relevant when the action radius of adolescents increases (Hillmert et al., 2023, p. 263, see Figure 11.5). Building on these arguments, we concentrate on two crucial time points in students' school careers—namely, after transitioning to secondary school (fifth grade) and the end of compulsory general school (ninth grade).

Beyond the "advantages of advantaged neighbors", researchers have postulated "disadvantages of advantaged neighbors" (Mayer & Jencks, 1989). This idea is strongly related to the concept of relative deprivation (Davis, 1966; Stouffer et al., 1949), meaning that advantageous socioeconomic neighborhood conditions might result in dissatisfaction as a consequence of residents' poor evaluation of their own situation compared to their neighbors. Whereas relative deprivation effects of neighborhoods on several noneducational outcomes like depression (Nieuwenhuis et al., 2017) or rioting (Canache, 1996) have been observed, we are not aware of any study that reports advantageous neighborhood conditions to predict educational outcomes negatively.

Investigating how socioeconomic neighborhood composition affects academic self-concept is especially interesting as this educational outcome has been shown to be susceptible to social comparison processes for which negative neighborhood effects can theoretically be expected. In Table 1, we summarize the hypothesized underlying mechanisms, predictors and outcomes, seminal theoretical and empirical contributions, and conceptual interrelations of both sociological frog-pond research, the BFLPE/BIRGE paradigm, and neighborhood-effects studies on (other) educational outcomes.

Neighborhood Effects on Academic Self-Concept

As outlined above, empirical results from neighborhood-effects research suggest advantageous socioeconomic neighborhood conditions to positively predict a broad range of educational outcomes. However, educational outcomes that are susceptible to social comparisons might be negatively affected by advantageous socioeconomic neighborhood conditions through contrastive social comparison processes. Decades of research showed academic self-concept to be an educational outcome that is negatively affected by aggregated school or class achievement, thus being highly susceptible to social comparison. While Crosnoe (2009) assumed that frog-pond-alike socioeconomic composition effects could also emerge on the school level (see discussion in Note 1), we argue that the underlying mechanism(s) are more likely to take effect on the neighborhood level.

Following framing theory (e.g., Kroneberg & Kalter, 2012), salient cues of social situations canalize how situations are defined by individuals, thereby guiding subsequent (social) action. Within schools, achievement differences between learning environments provide situational cues—the salience of which may be even higher than the ones provided by the socioeconomic composition of the learning environment. This is empirically supported by research showing the BFLPE to become increasingly pronounced once the socioeconomic composition of learning environments is controlled for (Chmielewski et al., 2013; Marsh et al., 2000; Trautwein et al., 2009).

In contrast, the most salient situational cue of neighborhoods is their socioeconomic composition, which is reflected in various interrelated neighborhood aspects, for example, housing prices, attractivity, and reputation (Casciano & Massey, 2008; Permentier et al., 2008; van Ham & Manley, 2015). Although individuals may well notice achievement-related compositional characteristics, for example, the perceived share of academics, these perceptions will usually coincide with perceptions of other status characteristics. Individuals' relative achievement in a neighborhood is much less mirrored compared to the perpetual evaluative setting of schools and classrooms. Consequently, contrast effects of neighborhoods on self-comparison-related educational outcomes will likely be expressed in the perceptions of neighborhoods' socioeconomic conditions. Thereby, neighborhoods may simultaneously exert beneficial effects on behavioral outcomes and harmful effects on self-comparison-related outcomes, including academic self-concept.

Hence, we hypothesize that equally able students living in advantageous neighborhoods have a lower academic self-concept due to unfavorable social comparisons. For instance, students living in a neighborhood in which most children commute to an upper-level secondary school will have a lower academic self-concept compared to equally able children living in neighborhoods in which most children attend a local lower-secondary school. Similarly, children living in a neighborhood dominated by middle-class families would have lower academic self-concepts compared to students living in neighborhoods dominated by lower-class families.

The Close Connection Between Neighborhoods and Educational Environments

It is well established that neighborhood-effects studies are much more likely to consider school contexts than vice versa (Brazil, 2016). Yet even when studies that focus on one context control for other contexts, they typically grounded on different theoretical perspectives. Due to specific catchment areas, student bodies are often composed according to residential criteria (Newman & Schnare, 1997; Saporito & Sohoni, 2007). Thus, students in a certain school typically live in one neighborhood, which might result in similar mechanisms taking effect on students' educational outcomes.

We argue that it is important to gain a better understanding of the intersection between educational environments—among which we subsume schools and classrooms—and noninstitutional, yet educationally relevant, neighborhoods. From a theoretical perspective, focusing on only one environment does not allow for the identification of the relative importance or overlap between contextual effects. From a methodological standpoint, any analysis that omits a context runs the risk of overstating or misstating the effect of the other (Jargowsky & Komi, 2011).

TABLE 1
Summary of Mechanisms

	Analytical Level(s) of Predictors	Typical Predictor(s)	Typical Outcome(s)	Underlying Theory	Hypothesized Mechanism	Direction of Effect	Seminal Research	Comments	Conceptual Similarity to. . .
1) Frog-pond effect	School	Achievement composition	Performance perception; aspirations; choices; grades	Relative deprivation theory (Stouffer et al., 1949)	Relative deprivation	Negative	Davis (1966); Meyer (1970); Alwin and Otto (1977)	Could not properly account for multilevel structure of data	2); 5)
2) Big-fish-little-pond effect (BFLPE)	School or classroom	Achievement composition	Academic self-concept; aspirations	Social comparison theory (Festinger, 1954)	Contrast / reference group effect	Negative	Marsh (1987); Marsh et al. (2008); Marsh and Seaton (2015)	Empirical BFLPE only net effect of simultaneous contrast and assimilation effect	1); 5)
3) Basking-in-reflected-glory effect (BIRGE)	School (sporadically classrooms)	Social composition; tracking	Academic self-concept	Social comparison theory (Festinger, 1954)	Assimilation effect	Positive	Marsh et al. (2000); Trautwein et al. (2009); Chmielewski et al. (2013)	BFLPE becomes stronger when controlled for BIRGE	4)
4) Advantages of advantaged neighbors	Neighborhood	Social or ethnic composition	Child development; achievement; aspirations; school dropout	Wilson's (1987, 1996) theory	Collective socialization	Positive	Crane (1991); Brooks-Gunn et al. (1993); Ainsworth (2002) Stewart et al. (2016)	Educational outcomes that are susceptible to social comparison not considered hitherto	3)
5) Disadvantages of advantaged neighbors	Neighborhood	Social composition	Depression; rioting	Relative deprivation theory (Stouffer et al., 1949)	Relative deprivation	Negative	Canache (1996); Nieuwenhuis et al. (2017)	No educational outcomes analyzed hitherto	1); 2)

Theoretically, the relation between neighborhood and educational environment effects has been expressed by viewing schools/classrooms as a mediating factor of neighborhood effects (Arum, 2000; Ferryman et al., 2008; Jencks & Mayer, 1990; Johnson, 2012; Mayer & Jencks, 1989; Sanbonmatsu et al., 2006; Wilson, 1987). Additionally, the school environment is viewed as the place where youth interact with their neighborhood peers (Sykes & Musterd, 2010). Generally, the need for a joint consideration of both environments has been acknowledged for the above-named reasons (e.g., Arum, 2000; Johnson, 2012; Rich & Owens, 2023; Sampson et al., 2002). Several studies addressed this intersection—also known as the school–neighborhood mesosystem (Gaias et al., 2018)—and simultaneously modeled both environments to disentangle contextual effects. Most of these studies found neighborhood effects to decrease substantially when controlling for characteristics of educational environments (e.g., Dunn et al., 2015; Kauppinen, 2008; Sykes & Musterd, 2010; Wicht & Ludwig-Mayerhofer, 2014). However, there are studies that reported effects on both levels (e.g., Owens, 2010; Rendón, 2014) or even mainly neighborhood effects (e.g., Wodtke & Parbst, 2017; Wodtke et al., 2020). Most of this research focused on schools as potential mediators of neighborhoods (see overview by Brazil, 2016), with only a few studies explicitly considering classrooms (e.g., Lauen & Gaddis, 2013; Zangger, 2019).

While there is a growing awareness that unobserved neighborhood effects might represent effects of the educational environment, it is also possible that the direction is reversed, that is, unobserved educational environment effects are actual neighborhood effects. The design-based challenge posed by the confounding of educational environment and neighborhood characteristics means that to date, there is no clear understanding of how educational environments and neighborhoods jointly influence academic self-concept.

In this study, we simultaneously analyze effects of educational and neighborhood environments on students' academic self-concept. By doing so, we bring together research on the BFLPE and research on neighborhood effects on educational outcomes. As research on the BFLPE has shown that the classroom—as the more proximal frame of reference—is of greater importance for academic self-concept formation than the school (e.g., Liem et al., 2013; Marsh et al., 2014), we focus on classroom context to model educational environments.

The Present Study

The present study separately and simultaneously investigates the effects of classrooms and neighborhoods on students' academic self-concept. Thereby, the study contributes to the literature in four ways.

First, we replicated the BFLPE by analyzing the effects of class-average achievement on students' academic self-concept, when controlling for individual achievement differences.[3]

Second, we analyzed the predictive power of socioeconomic neighborhood composition for students' academic self-concept. Based on previous research, two potential patterns of results are plausible: First, if academic self-concept is impacted by collective socialization, advantageous socioeconomic neighborhood conditions should positively predict students' academic self-concept. This pattern has been observed in neighborhood effect studies focusing on a wide range of educational outcomes. Second, if academic self-concept is impacted by social comparison—or in sociological terms—relative deprivation, it should be negatively predicted by advantageous socioeconomic neighborhood conditions. This pattern is supported by both early sociological frog-pond research and the vast body of empirical evidence on the BFLPE.

Third, we analyzed the combined effects of both classroom and neighborhood composition. As learning environments are often composed according to residential criteria, students from neighborhoods with advantageous socioeconomic neighborhood conditions might attend educational environments with high average achievement, confounding influences from both sources. Thus, without controlling for both neighborhood and classroom composition, classroom effects might erroneously be attributed to the level of neighborhoods—and vice versa. Consequently, the simultaneous consideration of both will provide further insight into the mechanisms of frame-of-reference effects.

Fourth, we use the German National Educational Panel Study (NEPS) data, which allows us to incorporate several educational contexts, that is, neighborhoods and classrooms, simultaneously and from a longitudinal perspective. Moreover, the German secondary school system is a hierarchically tracked system with three (sometimes two, depending on the federal state) tracks. Considering the different school tracks allows us to control for different baselines of academic self-concept among several reference groups.

Empirically, two patterns of results are plausible: First, it may be that the joint consideration of both student environments will weaken or even cancel out neighborhood effects. This result might indicate that neighborhood effects could be hidden classroom effects. Second, it may be that the joint consideration of both environments will result in two independent contextual effects, which might indicate the existence of social comparison processes within neighborhoods that have not yet been accounted for in research on the BFLPE.

Method

Data

We used data from Starting Cohort 3 (SC3) of the NEPS (Blossfeld et al., 2011), a longitudinal multicohort study that includes information on individual students (e.g., academic self-concept, standardized achievement, socioeconomic background), learning environments (i.e., class identifiers that enable us to build reliable achievement aggregates), and

neighborhood conditions (e.g., social status, income, employment). This study established a representative sample of children attending fifth grade in Germany in the school year of 2010–2011. SC3 is based on a multistage sampling procedure that sampled schools as the first step and selected all students from two classes of each school in the second step (Skopek et al., 2012). Students in SC3 were followed along their educational careers through secondary education.

At the time of the study, most German federal states sorted students into one of three hierarchically differentiated school types, namely, "Hauptschule" (low track), "Realschule" (intermediate track), and "Gymnasium" (high track). Additionally, there is "Gesamtschule" (comprehensive schools), where students were either tracked within schools or within classrooms or were not explicitly tracked at all. Some federal states employed a dyadic system with only comprehensive schools and the Gymnasium. Tracks differed in their curriculum, with the high track preparing students for entering higher education (for a more detailed description of the German educational system, see Dräger, 2022).

In NEPS SC3, students' academic self-concept was assessed in Wave 1 (students in Grade 5) and Wave 5 (students in Grade 9). We focused on these two measurement time points of this specific cohort (NEPS SC3). In the German education system, Grades 5 and 9 are important stages of educational careers as they are the beginning of secondary schooling and the end of compulsory general schooling, respectively.

The total NEPS SC3 sample contained 5,778 students in fifth grade. In our framework, cases could be considered only if they were assigned to a class and a neighborhood. Thus, we had to exclude 1,872 students for whom identifiers for either classroom or neighborhood were missing. This resulted in a sample of 3,906 students (48.42% female) who were nested in 234 schools, 466 classes, and 2,617 neighborhoods. Following the same procedure in ninth grade, we excluded 2,501 students for whom identifiers for classroom or neighborhood were missing. This resulted in a sample of 3,277 students (50.60% female) nested in 247 schools, 597 classes, and 2,314 neighborhoods.

Instruments

Academic Self-Concept. General self-concept (e.g., *I learn fast in most of the school subjects*), math self-concept (e.g., *I have always been good at math*), and German self-concept (*I learn fast in German*) were assessed by three items each (for the exact wording of all academic self-concept items, see Table S1 in the supplemental material in the online version of the journal; for a detailed description of the self-concept instrument, see Wohlkinger et al., 2016). Each academic self-concept item was answered on a 4-point Likert scale ranging from *does not apply at all* to *applies completely*. For subsequent analyses, a mean score comprising these items was constructed (at least two items had to be completed for mean score calculation). Cronbach's alphas were $\alpha_{g5} = .83$ and $\alpha_{g9} = .84$ for general self-concept, $\alpha_{g5} = .87$ and $\alpha_{g9} = .89$ for math self-concept, and $\alpha_{g5} = .75$ and $\alpha_{g9} = .82$ for German self-concept.

Academic Achievement. Mathematics academic achievement was assessed by a competency test based on the German Mathematics Education Standard framework as well as the Programme for International Student Assessment (PISA) framework (Neumann, 2013). The reliability of the Weighted Maximum Likelihood Estimate (WLE) scores was .778 in Grade 5 and .812 in Grade 9 (for detailed technical information, see Duchhardt & Gerdes, 2012; van den Ham et al., 2018). German achievement was computed by averaging achievement estimates from reading and orthography tests. Reading achievement was assessed by a competency test based on the literacy-oriented PISA framework (Gehrer et al., 2013; OECD, 2009). WLE reliability was .767 in Grade 5 and .787 in Grade 9 (for detailed technical information, see Pohl et al., 2012; Scharl et al., 2017). The orthography test is described in detail by Blatt et al. (2017). Expected A Posteriori/Plausible Values (EAP/PV) reliability was .963 in Grade 5 and .941 in Grade 9. General academic achievement was computed by averaging mathematics and German academic achievement.

Socioeconomic Neighborhood Composition. Within the NEPS framework, neighborhood characteristics are provided by the commercial company Microm Consumer Marketing (Schönberger & Koberg, 2017).

We used neighborhood characteristics on the eight-digit postal code (PLZ8) level, thus being able to use more fine-grained neighborhood-level information than the five-digit (PLZ5) level which is common in Germany. The PLZ8 system divides geographical space into neighborhoods comprising on average 500 households. As a first measure of socioeconomic neighborhood conditions, we used a composite social status index. The index is based on information about the distribution of both academic titles and occupations and is measured on a scale from 1 to 9 (1: *lowest status*, 2: *far below average*, 3: *below average*, 4: *slightly below average*, 5: *average* . . . 9: *highest status*).

A second indicator of socioeconomic neighborhood conditions is the neighborhoods' average income level, measured by the purchasing power per household in Euros (average net income). Purchasing power for PLZ8 neighborhoods is based on purchasing power at the municipality level and calculated with the help of statistical models accounting for several PLZ8 characteristics (e.g., age, status, etc.).

As a third measure of socioeconomic neighborhood conditions, we used the neighborhoods' employment rates (proportion of employed people in relation to the total amount of potentially working people). Unemployment rates for PLZ8

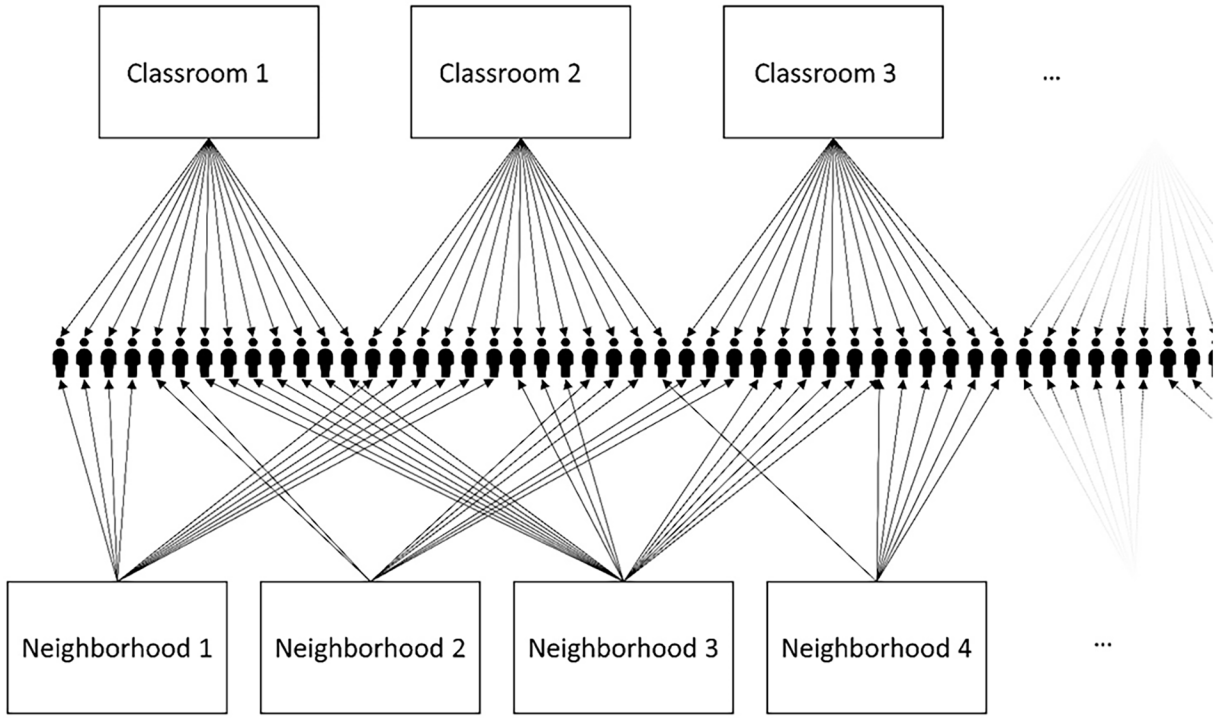

FIGURE 1. *Graphical depiction of data structure (exemplary three classrooms and four neighborhoods).*

neighborhoods were retrieved from the German Federal Employment Agency. We subtracted the unemployment variable from 1, resulting in the rate of neighborhood residents who are employed, so that higher values represented more advantageous socioeconomic neighborhood conditions for all neighborhood-level variables. For our analyses, we used a composite score given by the arithmetic mean of the three standardized neighborhood variables. To examine if a specific neighborhood variable was responsible for the composite effect, we replicated our analyses using the distinct indicators for neighborhood employment, status, and income, with simultaneous controls for parental employment, status, and income, respectively (see Tables S2 and S3 in the online version of the journal).[4]

Individual Socioeconomic Background. Individuals' socioeconomic background was measured by social status, income, and employment status retrieved from the parental questionnaire of SC3. Social status was operationalized as the highest ISEI (level of occupations according to an international standard classification) of both parents combined (Ganzeboom, 2010; Ganzeboom et al., 1992). In the case of missing information for one parent, the information for the remaining parent was used. Income was measured by the monthly household income after deductions and was surveyed by an open question. Employment status was a dichotomous variable (0 for unemployed, 1 for employed), measuring whether at least one of the students' parents received unemployment benefits.[5] All analyses were also controlled for federal state and school type. By doing so, it is possible to approximate between-school differences in achievement caused by students' allocation to different school tracks in the German educational system.

Analyses

Our focus was to provide both separate and simultaneous analyzes of classroom and neighborhood composition effects on students' academic self-concept. Concretely, we modeled individuals' (*i*) membership in classes (*j*) and neighborhoods (*k*), where (*i*), (*j*) represent cross-classified factors (for a graphical depiction of the data structure, see Figure 1). In our cross-classified multilevel models (Hox et al., 2017), we controlled for federal state, and school type.

All analyses were run in Mplus 8 (L. K. Muthén & Muthén, 1998–2017), where cross-classified multilevel models are estimated using Bayesian analysis. Thereby, Mplus outputs a one-tailed *p* value based on the posterior distribution. For a positive estimate, the *p* value is the proportion of the posterior distribution that is below zero. For a negative estimate, the *p* value is the proportion of the posterior distribution that is above zero (B. Muthén, 2010). Individual-level and neighborhood-level variables were *z*-standardized (implying grand-mean centering), and class-average achievement aggregates were calculated using the standardized individual-level measures. This procedure

allows for interpreting higher-level effects as contextual effects that are effects of aggregated variables, controlled for the corresponding individual-level variables (Enders & Tofighi, 2007).

To replicate the BFLPE (Model 1), we regressed individual-level academic self-concept on class-average achievement controlling for individual-level academic achievement:

$$Self-concept_{i(j,k)} = \gamma_{00} + \gamma_{10} \cdot achievement_{i(j,k)} + \gamma_{01} \cdot class-average\,achievement_{k} + u_{0j} + v_{0k} + e_{i(j,k)}. \quad (1)$$

For each domain (i.e., general vs. math vs. German language), academic self-concept was predicted by the corresponding domain-specific achievement scores measured at both the student and the classroom level. For instance, math self-concept was predicted by both student- and classroom-level math achievement scores.

To analyze the predictive power of socioeconomic neighborhood composition for students' academic self-concept (Model 2), we regressed academic self-concept on socioeconomic neighborhood composition while controlling for both individual academic achievement and individual socioeconomic background:

$$Self-concept_{i(j,k)} = \gamma_{00} + \gamma_{10} \cdot achievement_{i(j,k)} + \gamma_{01} \cdot socioeconomic\,neighborhood\,composition_{k} + \gamma_{20} \cdot individual\,socioeconomic\,background_{i(j,k)} + u_{0j} + v_{0k} + e_{i(j,k)}. \quad (2)$$

To jointly analyze classrooms and neighborhoods (Model 3), we regressed academic self-concept on socioeconomic neighborhood composition and class-average achievement, while controlling for individual academic achievement and socioeconomic background:

$$Self-concept_{i(j,k)} = \gamma_{00} + \gamma_{10} \cdot achievement_{i(j,k)} + \gamma_{01} \cdot socioeconomic\,neighborhood\,composition_{k} + \gamma_{20} \cdot individual\,socioeconomic\,background_{i(j,k)} + \gamma_{05} \cdot class-average\,achievement + v_{0k} + e_{i(j,k)}. \quad (3)$$

Missing data rates for academic self-concept and achievement variables were low (between 0% and 3%). Due to parent nonresponse, missing rates for individual socioeconomic background variables were higher (between 6% and 45%). Missing values were accounted for by using the full-information maximum likelihood procedure (FIML; Enders, 2010; Graham, 2009). In Model 1, we included individual socioeconomic background and socioeconomic neighborhood composition as auxiliary variables. In Model 2, we included class-average achievement as an additional auxiliary variable. Thus, all Models (1–3) contained the same information (Graham, 2009).

Results

Descriptive Statistics

We present descriptive statistics for the Grade 5 and Grade 9 samples in Tables 2 and 3. The correlation pattern between achievement and self-concept variables was in line with earlier research (for a meta-analysis, see Möller et al., 2009). We found weak correlations between mathematics and German self-concept (r_{G5}=.06/r_{G9}=−.06) and moderate correlations between domain-specific achievement and self-concept measures (mathematics: r_{G5}=.28/r_{G9}=.37; German: r_{G5}=.35/r_{G9}=.35). In addition to the reliability measures that we presented earlier, this finding is further evidence for the validity of self-concept and achievement measures. Variance proportions resulting from variance decomposition in an "empty" random intercept model with students nested in classrooms and neighborhoods can also be found in Tables 2 and 3. In Grade 5, self-concept variables mainly varied on the individual level. This finding suggests that classrooms and neighborhoods did not strongly differ in their mean levels of academic self-concept. Achievement measures varied on the individual and the class level with only small variability on the neighborhood level, suggesting that classrooms but not neighborhoods differed in their academic achievement. The variance proportions pattern in Grade 9 was similar to that in Grade 5.

Validity of Neighborhood-Level Indicators

To assess the validity of the neighborhood variables, we took a closer look at the descriptive statistics. Neighborhood social status, which was based on academic titles and occupations was on average M_{G5}=5.29 and M_{G9}=5.25 (SD_{G5}=2.42/SD_{G9}=2.36), measured on a scale from 1 (*lowest*) to 9 (*highest*). Our data indicate that the observed neighborhood status in our sample was slightly above the German average of 5. Neighborhood income was on average M_{G5}=43,810 € and M_{G9}=45,070 € (SD_{G5}=8,930/SD_{G9}=9,500), and neighborhood employment was on average M_{G5}=94.01% and M_{G9}=94.11% (SD_{G5}=4.82% /SD_{G9}=4.60%). The neighborhood variables correlated weakly with the academic self-concept measures (*r*s between <.01 and .06), whereas associations with academic achievement were considerably larger (*r*s between .13 and .24). Thus, although students from socioeconomically advantageous neighborhoods had higher academic achievement, they did not necessarily report a higher academic self-concept.

As expected, neighborhood social status was correlated with individual social status by r_{G5}=.30/r_{G9}=.31. Associations between neighborhood income and individual income were r_{G5}=.12/r_{G9}=.10. Neighborhood employment was correlated with individual employment by r_{G5}=.29/r_{G9}=.20. Suggesting a considerable overlap between the measures, correlations between the three neighborhood variables ranged from *r*=.64 to *r*=.69.

TABLE 2
Descriptive Statistics of Model Variables in Grade 5 Sample

	Mis.	*M*	*SD*	VP_i	VP_c	VP_n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Self-concept general	.03	3.16	0.60	.94	.05	.01																	
2. Self-concept math	.03	2.93	0.85	.93	.06	.01	.36																
3. Self-concept German	.03	3.01	0.66	.93	.05	.02	.52	.06															
4. Achievement general	.00	0.04	1.04	.47	.52	.01	.22	.18	.28														
5. Achievement math	.00	0.06	1.16	.55	.42	.03	.16	.28	.16	.91													
6. Achievement German	.00	0.02	1.12	.54	.45	.01	.24	.05	.35	.91	.66												
7. Class achievement general	.00	0.04	0.77				.14	.11	.18	.74	.67	.68											
8. Class achievement math	.00	0.06	0.79				.13	.12	.17	.73	.69	.64	.98										
9. Class achievement German	.00	0.02	0.79				.15	.09	.19	.73	.62	.70	.98	.91									
10. Status	.12	53.06	16.62	.70	.21	.09	.12	.04	.14	.35	.31	.32	.40	.39	.39								
11. Income	.22	3.62	3.35	.94	.04	.02	.06	.03	.04	.16	.14	.16	.19	.19	.19	.27							
12. Employment	.09	0.92	0.28	.64	.30	.06	.04	.02	.08	.26	.23	.24	.30	.29	.30	.24	.18						
13. Neighborhood status	.00	5.29	2.42				.01	.01	.05	.24	.22	.22	.28	.26	.28	.30	.17	.23					
14. Neighborhood income	.00	43.81	8.93				.02	.04	.02	.16	.14	.16	.18	.16	.19	.18	.12	.19	.69				
15. Neighborhood employment	.00	94.09	4.82				.01	.02	.03	.24	.22	.23	.28	.26	.28	.21	.13	.29	.68	.65			
16. School type: Gymnasium	.00	0.483	0.25				.14	.12	.17	.57	.52	.52	.77	.75	.74	.35	.17	.22	.21	.14	.14		
17. School type: Comprehensive	.00	0.146	0.12				−.04	−.06	−.03	−.20	−.17	−.2	−.27	−.25	−.28	−.05	−.05	−.11	−.12	−.18	−.25	−.40	
18. School type: Hauptschule	.03	0.117	0.10				−.08	−.04	−.12	−.4	−.35	−37	−.53	−.51	−.53	−.25	−.11	−.16	−.05	−.03	−.01	−.36	−.15

Note. Mis. is the percentage of missing data. *M* refers to a variable's arithmetic mean, and *SD* to its standard deviation. For the three dummy variables "School type: Gymnasium" (16), "School type: Comprehensive" (17), and "School type: Hauptschule" (18), *M* can be interpreted as a measure of proportion, respectively. VP_i, VP_c, and VP_n are variance proportions on the individual, the class, and the neighborhood level, respectively.

TABLE 3
Descriptive Statistics of Model Variables in Grade 9 Sample

	Mis.	*M*	*SD*	VP_i	VP_c	VP_n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Self-concept general	.01	2.91	0.59	.95	.03	.01																	
2. Self-concept math	.01	2.52	0.90	.94	.04	.02	.35																
3. Self-concept German	.01	2.97	0.61	.88	.10	.02	.42	−.06															
4. Achievement general	.00	0.10	0.96	.40	.55	.05	.30	.25	.24														
5. Achievement math	.00	0.11	1.20	.52	.43	.05	.25	.37	.12	.89													
6. Achievement German	.00	0.11	1.22	.45	.48	.06	.27	.05	.35	.85	.59												
7. Class achievement general	.00	0.10	0.76				.15	.10	.17	.79	.69	.71											
8. Class achievement math	.00	0.10	0.87				.14	.15	.12	.75	.73	.62	.95										
9. Class achievement German	.00	0.11	0.92				.14	.04	.20	.74	.60	.76	.94	.82									
10. Status	.36	54.27	16.53	.67	.24	.09	.13	.06	.13	.37	.33	.32	.42	.39	.39								
11. Income	.45	3.74	3.75	.86	.08	.06	.05	.04	.05	.13	.12	.12	.17	.16	.18	.25							
12. Employment	.19	0.96	0.21	.86	.08	.06	.03	.03	.03	.14	.12	.12	.19	.18	.18	.19	.12						
13. Neighborhood status	.00	5.25	2.36				.05	.02	.03	.24	.22	.21	.29	.29	.26	.31	.13	.18					
14. Neighborhood income	.00	45.07	9.50				.06	.04	.01	.17	.16	.13	.19	.20	.17	.19	.10	.14	.68				
15. Neighborhood employment	.00	94.11	4.60				.05	.02	.01	.21	.20	.17	.24	.26	.21	.20	.10	.20	.68	.64			
16. School type: Gymnasium	.00	0.56	0.24				.09	.06	.19	.61	.53	.57	.76	.72	.74	.39	.17	.17	.21	.09	.11		
17. School type: Comprehensive	.00	0.07	0.06				−.01	−.04	−.03	−.16	−.14	−.15	−.20	−.19	−.20	−.08	−.05	−.1	−.03	−.08	−.17	−.31	
18. School type: Hauptschule	.04	0.08	0.09				−.02	−.01	−.06	−.38	−.31	−.35	−.47	−.42	−.46	−.23	−.09	−.07	−.1	−.01	−.01	−.34	−.08

Note. Mis. is the percentage of missing data. *M* refers to a variable's arithmetic mean, and *SD* to its standard deviation. For the three dummy variables "School type: Gymnasium" (16), "School type: Comprehensive" (17), and "School type: Hauptschule" (18), *M* can be interpreted as a measure of proportion, respectively. VP_i, VP_c, and VP_n are variance proportions on the individual, the class, and the neighborhood level, respectively.

Modeling the BFLPE

To replicate the BFLPE, we regressed academic self-concept on class-average achievement, controlling for individual achievement (Model 1; results can be found in Table 4 for the fifth-grade sample and in Table 5 for the ninth-grade sample). As expected, students' academic achievement positively predicted their self-concept outcomes. This achievement effect was more pronounced in Grade 9 (coefficients ranging from $b = .47$ to $b = .56$ depending on the domain, all $ps < .001$) as opposed to in Grade 5 (coefficients ranging from $b = .26$ to $b = .43$ depending on the domain, all $ps < .001$).

In line with prior research, class-average achievement negatively predicted all self-concept outcomes (coefficients ranging from $b = -.18$ to $b = -.24$ depending on both domains and grade levels, all $ps < .001$). Thus, an increase of one standard deviation in class-average achievement was associated with a decrease of 0.18 to 0.24 standard deviation in academic self-concept when controlling for all covariates. Hence, in line with previous BFLPE research, equally able students had lower academic self-concept in high-achieving classes.

Modeling Neighborhood Effects

To examine how socioeconomic neighborhood composition predicts students' academic self-concept, we regressed academic self-concept on the neighborhood composite variable, controlling for individual achievement and social background (Model 2; see Table 4 for the fifth-grade sample and Table 5 for the ninth-grade sample).

In Grade 5, advantageous socioeconomic neighborhood conditions negatively predicted general academic self-concept ($b = -.06$, $p = .002$). Hence, an increase of one standard deviation in neighborhood status was associated with a decrease of 0.06 standard deviation in general academic self-concept. The effect on math self-concept was $b = -.05$ ($p < .001$), and the effect on German self-concept was $b = -.04$ ($p = .028$).

In Grade 9, advantageous socioeconomic neighborhood conditions negatively predicted math self-concept ($b = -.05$, $p = .02$). The effects on general and German self-concept were negative but insignificant (general: $b = -.02$, $p = .276$; German: $b = -.03$, $p = .182$).

Simultaneous Consideration of Both the Class and the Neighborhood: The Combined Model

To examine how class-average achievement and socioeconomic neighborhood composition simultaneously predict academic self-concept, we regressed academic self-concept on the neighborhood composite variable and class-average achievement, controlling for individual-level achievement and social background (Model 3; see Table 4 for the fifth-grade sample and Table 5 for the ninth-grade sample).

Controlling for the neighborhood level only slightly affected the class-level BFLPEs. In Grade 5, socioeconomic neighborhood conditions still negatively predicted general ($b = -.05$, $p = .004$) and math self-concept ($b = -.04$, $p < .001$). The effect of socioeconomic neighborhood conditions on German self-concept was still negative but no longer significant ($b = -.03$, $p = .102$). The fact that advantageous socioeconomic neighborhood conditions negatively predicted general self-concept and math self-concept, after controlling for class-average achievement, might imply "direct" social comparison processes within neighborhoods. The fact that advantageous socioeconomic neighborhood conditions did not predict German self-concept, after controlling for class-average achievement, might indicate that corresponding neighborhood effects in Model 2 were hidden classroom effects. Students living in advantageous neighborhoods attend high-achieving classes, which negatively impacts academic self-concept.

In Grade 9 advantageous socioeconomic neighborhood conditions did not predict general ($b = .00$, $p = .946$), math ($b = -.02$, $p = .206$), or German self-concept ($b = -.01$, $p = .742$). As for Grade 5, this implies that neighborhood might be hidden classroom effects.

To sum up, we found no *positive* neighborhood effect that significantly differed from zero. On average, neighborhood effects were negative and small. Neighborhood variables were more predictive for students' general and math self-concept as opposed to German self-concept. In Grade 5, neighborhood variables more negatively predicted students' academic self-concept as opposed to in Grade 9.[6]

Discussion

In the present study, we separately and simultaneously analyzed the effects of classroom and neighborhood effects on students' academic self-concept. Our results can be summarized as follows: First, corroborating BFLPE research, we found class-average achievement to negatively predict academic self-concept. Hence, equally able students had lower self-concepts in high-achieving classrooms. This frame-of-reference effect is known to result from social comparison processes in educational settings.

Second, we found neighborhood socioeconomic composition to negatively predict general, math, and German self-concept in Grade 5 and negatively predict math self-concept in Grade 9. Third, when simultaneously analyzing effects of classroom and neighborhood composition, math and general self-concept in Grade 5 were negatively predicted by neighborhood composition, whereas all other neighborhood effects were no longer significant. Class-average achievement remained a strong negative predictor of academic self-concept, stressing the well-known persistence of the BFLPE.

TABLE 4
Results From Cross-Classified Multilevel Models in the Grade 5 Sample With Academic Self-Concept as the Outcome

	Model 1		Model 2		Model 3	
	b	*p*	*b*	*p*	*b*	*p*
General						
Individual level						
Achievement	.26	<.001	.23	<.001	.26	<.001
Status (ISEI)			.05	.010	.05	.006
Income			.02	.430	.02	.432
Employment			−.02	.818	.00	.972
Class level						
Class achievement	−.19	<.001			−.17	.004
Neighborhood level						
Neighborhood conditions			−.06	.002	−.05	.004
Math						
Individual level						
Achievement	.37	<.001	.35	<.001	.38	<.001
Status (ISEI)			−.03	.092	−03	.152
Income			.01	.702	.01	.658
Employment			−.08	.200	−.09	.086
Class level						
Class achievement	−.23	<.001			−.19	<.001
Neighborhood level						
Neighborhood conditions			−.05	<.001	−.04	<.001
German						
Individual level						
Achievement	.43	<.001	.39	<.001	.42	<.001
Status (ISEI)			.04	.020	.05	.016
Income			−.02	.246	−.02	.238
Employment			.06	.358	.06	.298
Class level						
Class achievement	−.18	<.001			−.17	.002
Neighborhood level						
Neighborhood conditions			−.04	.028	−.03	.102

Note. All analyses were controlled for federal state and school type.

As—to our knowledge—our study was the first to examine how socioeconomic neighborhood composition predicts students' academic self-concept, we chose an exploratory approach and investigated different operationalizations of both neighborhood composition and self-concept domains (general, math, German) at different grade levels (Grade 5, Grade 9). Math self-concept was the domain that turned out to be most susceptible to neighborhood effects. This may have been because students perceive math to be of crucial importance for intellectual ability, and as such predictive for success in later life. As Bleazby (2015) notes, "for over two thousand years, mathematics has been firmly entrenched at the top of the curriculum hierarchy" (p. 674). Contrarily, neighborhood effects on academic self-concept appear to be mostly mediated by classroom context. This pattern is less dominant for math self-concept and thus leaves more leverage for the effects of neighborhood context. Since we are the first to apply neighborhood socioeconomic conditions as a frame of reference to explain students' academic self-concept, our study is explorative by nature. Therefore, not all aspects and mechanisms—especially domain-specific variations and potential subgroup effects—are entirely resolved. As such, we hope that our study sets off further in-depth analyses and discussions, which fruitfully link psychological research on reference-group effects with research on neighborhoods and contextual effects.

We also found neighborhood effects to be more prevalent in Grade 5 than in Grade 9. This is plausible from the

TABLE 5
Results From Cross-Classified Multilevel Models in the Grade 9 Sample With Academic Self-Concept as the Outcome

	Model 1		Model 2		Model 3	
General						
Individual level						
Achievement	.47	<.001	.40	<.001	.47	<.001
Status (ISEI)			.00	.048	.00	.058
Income			.00	.558	.00	.534
Employment			.03	.800	.03	.764
Class level						
Class achievement	−.21	<.001			−.23	<.001
Neighborhood level						
Neighborhood conditions			−.02	.276	.00	.946
Math						
Individual level						
Achievement	.56	<.001	.51	<.001	.58	<.001
Status (ISEI)			−.01	.512	.00	.852
Income			.02	.256	.03	.198
Employment			.04	.662	.01	.848
Class level						
Class achievement	−.24	<.001			−.32	<.001
Neighborhood level						
Neighborhood conditions			−.05	.020	−.02	.206
German						
Individual level						
Achievement	.48	<.001	.43	<.001	.48	<.001
Status (ISEI)			.02	.288	.03	.142
Income			.01	.690	.01	.634
Employment			.01	.962	.05	.514
Class level						
Class achievement	−.20	<.001			−.29	<.001
Neighborhood level						
Neighborhood conditions			−.03	.182	−.01	.742

Note. All analyses were controlled for federal state and school type.

perspective of neighborhood-effects literature as the effect of different neighborhood features varies with age (e.g., Ellen & Turner, 1997; Sharkey & Faber, 2014; van Ham & Tammaru, 2016; Wheaton & Clarke, 2003; Wodtke et al., 2016). On the one hand, it needs some time of exposure to neighborhood conditions to exert effects on individual outcomes (Wodtke et al., 2016). On the other hand, effects might decrease with age as more distant contexts become more relevant with increasing action radii of adolescents (Hillmert et al., 2023).[7]

Our unique contribution to the literature on academic self-concept formation is in considering the neighborhood as a noninstitutional learning environment in addition and relation to the institutional environments. The neighborhood constitutes a central social environment in which students interact on a daily basis, yet it was unclear if the neighborhood is associated with students' academic self-concept formation. Our findings contribute to the BFLPE literature by demonstrating that students' academic self-concept results from social comparison processes not only within classrooms but indeed within neighborhoods. Simultaneously, our study adds to the literature on neighborhood effects by introducing an educational outcome that is highly susceptible to social comparison processes.

Theoretical Implications

Finding negative neighborhood effects on students' academic self-concept calls for elaborate discussions of the underlying mechanisms, which, of course, can only be theorized within the limitations of a study that is correlational by design.

First, our results suggest that academic self-concept might be an educational outcome that is not impacted by collective socialization in neighborhoods but rather by relative

deprivation. That may not come as a surprise for research in the tradition of the BFLPE, but nonetheless challenges the assumption of "advantages of advantaged neighbors," also referred to as Wilson's theory (Mayer & Jencks, 1989; Wilson, 1987, 1996).

Second, some neighborhood effects vanished when class achievement was included in the model, suggesting that neighborhood effects could be hidden classroom effects. Since classrooms are often composed according to local criteria, students living in neighborhoods with advantageous socioeconomic conditions have a higher likelihood of attending high-achieving classes and consequently experience a decline in their academic self-concept in terms of BFLPEs.

Third, as some of the neighborhood effects remained when controlling for class achievement, these effects might indeed reflect social comparison processes *within* the neighborhood. For instance, when students perceive the school that their neighborhood fellows attend as a signal of the neighborhood's average ability, students living in a neighborhood with a higher share of students commuting to higher-track schools might have a lower academic self-concept compared to equally able students living in neighborhoods with a higher share of students commuting to lower-track schools.

Beyond that, other, potentially less apparent mechanisms might be driving our neighborhood effects. Our findings in the fifth-grade sample might have been a residual effect of primary education. Academic self-concept was measured 2 to 5 months after students entered secondary education and might have been impacted by elementary school class composition, which usually represents students' neighborhood composition to a much stronger degree than secondary education. In other words, equally able students might have reported lower academic self-concept in high-SES neighborhoods because they attended a high-achieving class in elementary school. In technical terms, this means that we might not have found negative neighborhood effects in Grade 5 if we had also controlled for class-average achievement in elementary school. However, this potential objection is weakened by a recent study by M. Becker and Neumann (2018), which showed that BFLPEs on domain-specific academic self-concept fade away in the transition from primary to secondary education. Given our limited observation window, it remains a direction for future research to further explore the mechanism(s) that are driving these results.

In previous research on the BFLPE, classrooms were observed to be the pivotal frame of reference for academic self-concept formation (in contrast to the more global school environment; Marsh et al., 2014). This finding was explained by the local dominance effect (Zell & Alicke, 2010), that is, individuals' tendency to use proximal comparison information for ability self-evaluations. The neighborhood presents another, yet noninstitutional, environment to which children and adolescents are directly exposed in everyday life. Depending on both students' academic self-concept domains and their grade level, our empirical analyses support our main argument that students' neighborhoods can constitute an additional frame of reference for academic self-concept formation. Thus, our results suggest that students make use of several comparison standards simultaneously, which once more underlines the complexity of academic self-concept formation.

By predicting academic self-concept—an educational outcome that is typically considered in educational psychology—by indicators of socioeconomic neighborhood composition, our study integrated elements of sociological neighborhood-effects research into educational psychological social comparison theory. It thereby calls attention to the considerable conceptual similarity of the social-psychological mechanisms described by different terminologies between the two disciplines. Contrastive frame-of-reference effects are the psychological counterpart to the sociological concept of relative deprivation. And assimilation effects have much in common with the sociological concept of collective socialization.

We contributed to sociological neighborhood-effects research by showing that advantageous socioeconomic neighborhood conditions do not positively impact all educational outcomes. In fact, advantageous socioeconomic neighborhood conditions might indeed negatively impact educational outcomes, especially those that are highly susceptible to social comparison processes. Although "relative deprivation" is discussed as a potential mechanism of neighborhood effects in the literature (see Galster, 2012), surprisingly few studies took a closer look at educational outcomes that might be negatively impacted by advantageous socioeconomic neighborhood conditions (for an exception, see Turley, 2002).

Additionally, we found neighborhood effects to be eradicated after controlling for class achievement in some of our models. Thus, our study cautions researchers to carefully translate the theoretical neighborhood mechanism of interest into an adequate statistical model. An identification of neighborhood effects as "true" contextual effects—that is, as a result of direct neighborhood interaction or other forms of exposure—is possible only if compositional effects of all lower levels, for example, institutional effects operating within the school environment, are rigorously controlled for.

Practical Implications

The neighborhood effects we observed were generally small (between $b = -.04$ and $b = -.06$), which mirrors the findings of previous studies with other outcomes. Thus, one may argue that socioeconomic neighborhood conditions are not practically relevant for academic self-concept formation. On the other hand, the neighborhood effects we observed were still up to 50% the size of respective BFLPEs (which ranged between $b = -.18$ and $b = -.24$).

Moreover, as neighborhood social polarization is less pronounced in European countries compared to, for example, the United States, contrastive neighborhood effects on academic self-concept might be even stronger depending on the country context. Our study does not propose a social stratification of neighborhoods to establish equality in students' academic self-concept. However, it offers an alternative perspective in that there might exist educational outcomes that are not or are even negatively impacted by advantageous socioeconomic neighborhood conditions.

For the school context, there is growing awareness that harmful social comparisons may have long-term detrimental effects also on more "objective" educational and career-related life-course outcomes, for example, later educational attainment, income, and occupational prestige (Göllner et al., 2018; Marsh et al., 2023). Similarly, the "disadvantages-of-advantaged-neighbors" hypothesis challenges the established view of univocally beneficial effects of socially advantageous neighborhoods. Most studies seem to confirm the latter view, but especially in the European context, perhaps also due to its lesser extent of segregation, empirical studies of the former mechanism are rare. While it is thus still an open question how both mechanisms measure up in the long run, we may yet conclude that the social destratification of neighborhoods will not necessarily contribute to closing the gaps concerning all educational outcomes.

Implications for practitioners—for example, teachers, social workers, job counselors, but also the students themselves—are that students' awareness of their contextual embeddedness and its relevance for their self-perception should be raised. Reflecting on the importance of contextual influences among students and teachers might already be relevant to counteract on harmful contrasting or relative deprivation mechanisms. Research has shown that the BFLPE can be reduced when students are exposed to individualized feedback about their achievement (Lüdtke et al., 2005). Future research should thus explore the extent to which similar instruments can counterbalance harmful social comparisons also within noninstitutional contexts, for example, neighborhoods. Similarly, teachers could be sensitized to the relevance of neighborhood context for students' social comparisons and implement these reflections in their individualized feedback to their students.

Limitations and Avenues for Future Research

Although the present study was—to the best of our knowledge—the first to investigate how socioeconomic neighborhood composition predicts students' academic self-concept, some limitations should be addressed in future research.

First, our study was based on nonexperimental cross-sectional data. Consequently, causal interpretations of our results require caution. However, we explicitly modeled several possible confounders and have good reason to conclude that depending on the domain under evaluation as well as students' grade level, equally able students in equally able classes have lower academic self-concept in advantageous neighborhoods. Generally, field-experimental approaches in neighborhood-effects research are not easily feasible and have been criticized for ethical reasons (Geronimus & Thompson, 2004). Also, laboratory experiments will be hardly able to model the complexity of simultaneously operating influences of student environments. Nonetheless, future studies of the neighborhood as a potential frame of reference for academic self-concept formation should make use of natural experiments (e.g., analyzing individuals' between-neighborhood mobility) or elaborated statistical methodologies that facilitate causal inference (e.g., instrumental variable approaches).

Second, we did not model schools as a distinct level of analysis. This was due to NEPS drawing only two classes from each school, making it hard to disentangle class and school effects. Thus, we were not able to control school achievement. Therefore, critics might argue that the neighborhood effects in our models are caused by school effects. However, experimental social comparison research assumes that proximal environments matter most for academic self-concept formation (Zell & Alicke, 2010). Moreover, the class environment represents the pivotal frame of reference for self-concept formation (Liem et al., 2013; Marsh et al., 2014). Having already controlled for school type—and thereby approximating between-school differences in student achievement caused by students' allocation to different school tracks[8]—there are few reasons to believe that additional controls for school achievement would have substantially impacted our results.

Third, our neighborhood-level indicators can be assumed to be only an approximation to the underlying constructs of interest. In particular, being able to differentiate more precisely between status- and achievement-related neighborhood-level measures could help to disentangle positive assimilation and negative contrast/deprivation effects that map previous research on the BFLPE in schools and classrooms (Chmielewski et al., 2013; Marsh et al., 2000; Trautwein et al., 2009).

Fourth, as the aim of our study was to establish the relevance of neighborhood context for students' academic self-concept over and above educational environment effects, we intentionally limited our analyses to a parsimonious *additive* interrelation of both context types. We encourage future research to further explore potential *multiplicative* interrelations (T. D. Cook, 2003), that is, interaction effects between neighborhood context on the one hand and school and classroom context on the other hand. Similarly, future research could also investigate the extent to which neighborhood effects on academic self-concept are moderated by student-level characteristics.

Fifth, there are limitations in terms of the generalizability of our results to other countries and educational systems. Future research is needed to investigate neighborhood effects on outcomes like academic self-concept in non-European countries.

Conclusion

In our study, we found negative neighborhood effects on academic self-concept, thereby introducing the neighborhood as a potential frame of reference for academic self-concept formation. Our results are of particular importance in light of neighborhood-effects research that generally reports advantageous socioeconomic neighborhood conditions to positively predict educational outcomes but has not yet focused on educational outcomes that are highly susceptible to social comparison processes.

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Open Practices

Due to data protection regulations, the original data must be analysed on-site at LIfBi. All analysis files to do so are available at https://www.openicpsr.org/openicpsr/project/204481/version/V1/view.

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Notes

1. In contrast to both early sociological frog-pond research and the BFLPE paradigm, Crosnoe (2009) observed *harmful* effects of schools' socioeconomic composition on effects on several social-comparison-related student outcomes (e.g., negative self-image, depression, social isolation). There are several potential explanations for this counterintuitive finding: (a) Analyses have not simultaneously controlled for achievement composition, (b) analyses have been limited to the school level without controls for classroom composition, and (c) the author particularly focused on specific vulnerable subgroups (e.g., Latinos, African Americans)—while the "global" positive assimilation effect is usually observed for the entire student sample.

2. In a bibliometric analysis, Baffoe and Kintrea (2022) showed that neighborhood research is largely dominated by the U.S. context, which makes findings for the European context—characterized by much less segregation (in particular ethnic segregation) and more developed welfare states—appear to look somewhat counterintuitive.

3. To address that the empirical BFLPE is actually a net effect of simultaneous contrast and assimilation effects counterbalancing one another (Marsh et al., 2000), our robustness analyses additionally controlled for classrooms' social composition. Thereby, we also considered both differences in early sociological frog-pond research as to whether social or achievement composition effects had been modeled and Crosnoe's (2009) observation of harmful school socioeconomic composition effects on several social-comparison-related student outcomes (see Note 1).

4. Results from these models suggest that the neighborhood-level composite status measure was mainly driven by neighborhoods' employment level, but not by their average income level.

5. For our robustness analyses reported (see Tables S7 and S10 in the supplemental material in the online version of the journal), each measure of student social background was aggregated onto the classroom level to measure classrooms' socioeconomic composition. This ensures, first, that the observed BFLPE was not distorted by simultaneous BIRGEs (Marsh et al., 2000). Student-level controls for social background were not only necessary to identify the contextual effect of classrooms' socioeconomic composition, but also to address potential social selectivity issues in parental school choice. While the major part of social selectivity in the German educational system occurs in the course of students' transition from primary school to one of the three hierarchically sorted secondary school tracks (R. Becker, 2003; Maaz et al. 2008), empirical evidence points to additional within-track social selectivity in that middle- and upper-class parents more frequently opt for geographically more distant (almost exclusively Gymnasium, i.e., highest-track) schools (which perhaps offer specialized educational programs, e.g., in music, art, or sports), while lower-class parents—and even those whose children attain the highest track—more often choose the geographically closest schools regardless of

school differences in educational programs (see, e.g., Jurczok & Lauterbach, 2014). To address potential additional student selectivity effects, our robustness analyses (see Tables S5–S10 in the online version of the journal) controlled for students' gender, cognitive abilities (measured by an indicator of students' capability of reasoning, and migration background. See Table S4 in the online version of the journal for the descriptive statistics of these variables.

6. To rule out that our analyses were affected by additional effects of students into one or the other context, we replicated our models by controlling for the following variables: students' sex, migration background, and reasoning, as well as classrooms' social composition (for the distribution of these additional variables see Table S4 in the online version of the journal; for the additional regression models, see Tables S5–S10 in the online version of the journal). The results of these robustness analyses can be summed up as follows: First, estimates of both the BFLPE and neighborhood effects that had been statistically significant in our analyses without controlling for the covariates remained statistically significant. Second, for our models of Grade 9 students, some estimates of both neighborhood status and the neighborhood composite score on students' general and math-related academic self-concept were statistically different from zero once one or the other covariate had been controlled for. As the substantive effects of our neighborhood coefficients remained small, we refrain from overinterpreting our results; yet we are confident to conclude that if the selectivity of students into contexts mattered, it did so via *suppressor effects*; that is, some neighborhood effects might be larger than they would be estimated had analyses not controlled for selectivity effects.

7. There are two arguments for the relation between time and (neighborhood) context. The first one relates to the temporal component, stressing that neighborhood effects (Sharkey & Faber, 2014; Wodtke et al., 2016) need a certain duration of exposure to take effect. Thus, to have an impact on young adults at all, they need to be living in a specific neighborhood for a considerable amount of time. The second argument relates to the spatial component, stressing that a decrease in effects relates to an increasing activity radius of young adults with age, which results in the immediate living environment becoming less important (Hillmert et al., 2023). The second argument is particularly evident in Germany when students enter secondary school because secondary schools (Gymnasium) are often not located in the nearby living environment but clustered in the city centers.

8. Tables S5–S10 in the online version of the journal indicate that attending the highest educational track (Gymnasium) is positively associated with academic self-concept in Grade 5, but (less consistently) negatively in Grade 9. This supports our assumption that schools and neighborhoods are of distinct relevance for academic self-concept formation.

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