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Examining Neighbourhood and School Effects Simultaneously: What Does the Dutch Evidence Show?

Brooke Sykes and Sako Musterd

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Abstract

Neighbourhoods and schools are two contexts in which youth spend vast amounts of their time—making friends, forming opinions and attitudes, and learning the social and academic skills that help them navigate through life. In the neighbourhood effects literature, schools are theorised to be a pathway or mechanism of the neighbourhood's influence on children and youth. We tested this hypothesis using a longitudinal dataset of 9897 secondary school students. We estimated school and neighbourhood effects separately, and then considered youths' simultaneous membership in both contexts. In the latter analysis, the associations between neighbourhood characteristics and achievement were reduced to non-significance, while the associations with the school context remained strong and significant. These results point to schools as a pathway through which the influence of the neighbourhood may be transmitted, and underscore the need for better conceptualisations of the multiple and interrelated contexts that youth inhabit.

Introduction

Examining neighbourhood and school processes together has been recognised as a necessary step towards better understanding the role these contexts play in the lives of young people (Arum, 2000; Jencks and Mayer, 1990; Lupton, 2004; Sampson *et al.*, 2002). In the neighbourhood effects literature, schools are considered to be an important pathway or 'institutional mechanism' of the neighbourhood's

influence on children and youth. As neighbourhood population tends to inform local school populations, schools are places where young people get into contact with neighbourhood peers and their parents. Previous studies have also documented relationships between neighbourhood characteristics and the geography of education provision, parental school choices, and the internal processes

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of schools (Lupton, 2004; Noreisch, 2007; Oberti, 2007; Thrupp and Lupton, 2006). The literature contends that schools are a pathway through which neighbourhood conditions may indirectly influence young people (Ellen and Turner, 1997; Leventhal and Brooks-Gunn, 2000). This hypothesis has only seldom been tested, however, and the relationships between school and neighbourhood effects are still not well understood.

From the standpoint of neighbourhood research on children and youth, the connections between neighbourhood and school factors are arguably among the strongest reasons why neighbourhoods matter for young people's development and outcomes. Neighbourhoods play a role in sorting students into schools and in conditioning families' school choices, and thus in informing the composition of local schools and their internal school processes (Lupton, 2004; Rumberger and Palardy, 2005). Research has shown that these internal school processes (for example, peer relations, school organisation and management, teacher instruction, classroom climate and discipline) and measures of school composition (normally a proxy for the former processes) are associated with a range of youth outcomes (for a review, see Thrupp *et al.*, 2002). The few studies that have simultaneously examined the school and neighbourhood context offer some evidence for the mediation of neighbourhood effects through the school context (Brännström, 2008; Kauppinen, 2008; Pong and Hao, 2007).

The current paper tests for associations between Dutch youths' educational achievement in secondary school and features of their school and neighbourhood contexts, while taking important individual and family background attributes into account. Running separate models for schools and neighbourhoods, we first test whether features of these contexts are associated with students' achievement. We then consider students' simultaneous membership in schools and

neighbourhoods, allowing us to test for the potential transfer of neighbourhood effects through the school context. The next section discusses the neighbourhood effects literature and reviews the mechanisms thought to drive neighbourhood and school effects, with a special focus on the place of schools in neighbourhood effects theory. We then present the research questions that guide our analysis, followed by a brief section in which we describe key elements of the Dutch context. A section on the current study's methodology, data sources and analytical approach follows. Empirical results from a series of multilevel and cross-classified multilevel models are then reported, followed by a discussion of the results, caveats of our analysis, implications for future research and a conclusion.

Linking School and Neighbourhood

There has been a longstanding interest in the ways in which our social contexts affect us. Theories from developmental psychology describe the individual as a member of a series of interconnected and overlapping contexts, from the proximal family to the more distal city and national contexts (Bronfenbrenner, 1989). The crucial role the immediate family plays in helping to shape many child and youth outcomes is well known. The school and neighbourhood settings, and in effect also the peer group, are the extrafamilial contexts thought to be the most salient for young people. In these settings, children and youth spend a large part of their time acquiring the formal knowledge and skills important for navigating through life, as well as developing their social competencies, attitudes and aspirations. Roots in different disciplinary traditions, as well as the complexity of disentangling and measuring the impact of contexts, have meant that the fields of 'school effects' and 'neighbourhood effects' have remained largely separate. However,

scholars are increasingly joining these two fields, as well as taking other multicontextual approaches, in the recognition that the processes happening in these contexts are interrelated (for example, Brännström, 2008; Cook *et al.*, 2002; Kauppinen, 2008; Kohen *et al.*, 2008; Lupton, 2004).

The field of neighbourhood effects research is concerned with the role that an individual's place of residence might play in shaping their wellbeing and life chances. The fundamental question in this field is whether the social and institutional context of a neighbourhood works in a way to disadvantage (or benefit) residents over and above what their background characteristics would predict, and how — through which processes and mechanisms — this comes about. As a key neighbourhood institution, schools have long been considered to be a pathway through which neighbourhood effects may be transmitted (Jencks and Mayer, 1990).

In the theoretical discussions of neighbourhood effect mechanisms, schools have been hypothesised to play several roles. As a so-called *institutional mechanism*, schools are one of the local institutions thought to contribute to place-based effects (Galster and Santiago, 2006; Sampson *et al.*, 2002). The notion of an institutional mechanism of a neighbourhood effect refers to the fact that neighbourhoods vary in terms of the quality, availability and access to institutions and services, such as libraries, childcare facilities, health services, schools and educational programmes, and this variation can bring about advantages or disadvantages for individuals. Some neighbourhoods, for example, have poor access to certain institutions, have inferior public service provision and may be stigmatised by external governmental, institutional or market actors (Galster and Santiago, 2006). For instance, youth living in areas not well served by certain types of educational programmes, or where particular school courses or options are lacking (for

example, advanced tracks, special language options), may be at a disadvantage relative to their peers with better access to these resources (Oberti, 2007). Indeed, research has documented the uneven distribution of schools across the metropolitan landscape, in terms of their specific course and programme offerings, resources, quality and absolute numbers. In Amsterdam, Gramberg (1998) identified a relationship between the character of neighbourhoods and that of the schools in them; the highest (i.e. academic) tracks of secondary school were more often located in better-off neighbourhoods and these neighbourhoods also had a greater number of primary schools and were home to the more exclusive primary schools (for example, Dalton schools and international schools). Oberti (2007) also found school provision in the Paris metropolitan area—including the diversity and attractiveness of schooling programmes and settings—to be strongly correlated with the social profiles of different neighbourhoods and to correspond to sharp disparities. In the case of the US, large disparities in educational financing and resources exist among districts, which clearly demonstrate the inequitable provision of public schools (Kozol, 1991).

Another grouping of neighbourhood effect mechanisms are *social interactional mechanisms*. These mechanisms focus on the people and intergroup relations in a neighbourhood and include such processes as socialisation, peer effects, role modelling, social networking, social norms and control, and collective efficacy (Jencks and Mayer, 1990). The school context is also relevant to this set of mechanisms. As a local site, the school is a place where these kinds of processes will also take place—for example, peers interacting with each other, children observing role models, parents exchanging information and the establishment of social norms. With parallels to the field of neighbourhood effects, school composition

research considers the extent to which the composition of the student body may be relevant for various individual educational outcomes and behaviour, such as school achievement, inter-ethnic friendships and academic aspirations. Thrupp *et al.* (2002) explain that school composition effects were first envisioned as a hypothesis about the impact of peers on students' motivation, aspirations and attitudes towards school, while later work showed that characteristics of student groups can also influence school organisation, curricula offerings, teacher instruction, classroom dynamics and wider management processes, which in turn have effects on student learning and achievement.

Despite the obvious connections between neighbourhoods and schools, few studies have examined neighbourhood and school effects together and tested for the simultaneous effects of these contexts (Leventhal and Brooks-Gunn, 2000). There are some notable exceptions. In Sweden, Brännström (2008) examined school and neighbourhood effects in a cross-classified model for around 26 000 secondary school students. He found that what originally appeared to be a large amount of between-neighbourhood variability in youths' school outcomes, was drastically reduced upon inclusion of the school context in the analysis. His results suggest that the neighbourhood's influence is transmitted through the school context, at least for the majority of students. The work of Kauppinen (2008) in Finland also supports this finding. Upon entering school socioeconomic status (SES) into a logistic model regressing neighbourhood SES and student background characteristics on school outcomes, he found the effect of neighbourhood SES to be significantly attenuated and effectively explained by the mediating role of school SES.

Pong and Hao (2007) examined neighbourhood and school conditions for a nationally representative sample of around 17 000 secondary school students in the US. They tested whether differences in neighbourhood and school conditions contributed to the achievement

gaps between students of different ethnic and nativity backgrounds. Attributes of the school (i.e. SES, climate) and neighbourhood (i.e. SES, share of foreign born and limited English proficiency) were found significantly to predict youths' school performance and helped to explain the lower achievement of some groups. Neighbourhood effects appeared to be fully mediated by school characteristics for native youth; however, for youth with an immigrant background, significant associations between school performance and neighbourhood conditions persisted after the introduction of school factors.

Also in the US, Burgess *et al.* (2001) found the school, family and local area characteristics experienced during youth to exhibit a significant association with individuals' later earnings and poverty risk. As expected, the strongest factors were those of the family, followed by the school and then the local area. While they did not discuss their findings in light of possible mediation effects, they demonstrated 'extensive overlap' in the explanatory power of the three contexts when considered together, versus separately. They argue that the impact of young people's family contexts is exacerbated by the schools they attend and the areas they live in; however, they did not explicitly test for statistical interactions between context attributes. Ainsworth's (2002) study of neighbourhood effects on the school outcomes of around 13 000 US tenth-graders provides evidence for the existence of neighbourhood effects and the partial mediation of these effects through school factors.

While the main notion put forth in the literature is that neighbourhood effects on youths' school outcomes are likely to work through the school context—that is, to be mediated—some of the literature suggests that direct (independent) effects and interaction (moderated) effects between these two contexts may also be taking place (Burgess *et al.*, 2001; Cook *et al.*, 2002).¹ Young people's experiences in schools and neighbourhoods, and the impact of these two contexts, might be

quite different for at least two main reasons. First, these two contexts will clearly not be geographically embedded for all students; that is, they may be in entirely different locations and comprise entirely different populations and social environments. And, secondly, functional differences between the neighbourhood and school context, as well as differences in individuals' extent and frequency of exposure, the existence of policies and interventions and so on, will mean that even if these two contexts do share some geographical and population overlap, different processes (or the same processes of different intensities) could nonetheless be taking place in them (Szulkin and Jonsson, 2007). Certainly, for different types of outcome (for example, behavioural, educational, health), the nature of and potential relationship between neighbourhood and school effects are expected to vary (Oberwittler, 2007). Moreover, differences in school choice and admission policies, school provision and urban scale, are also likely to result in variation in the relationships between schools and neighbourhoods across different policy frameworks and settings.

If effects associated with the school and neighbourhood are taking place, it is also possible that one of these contexts could buffer (or reinforce) the negative or positive processes of the other. This idea is in part what motivates parents in weak neighbourhood environments to send their children to schools outside their area (Karsten *et al.*, 2003). While the notion of one context buffering or moderating the effects of another has been put forth by several authors (Burgess *et al.*, 2001; Hanushek *et al.*, 2003; Oberwittler, 2007), only a few have touched upon it in empirical studies. Cook *et al.* (2002) tested whether certain constellations of school, neighbourhood, peer and family context might work in an interactive rather than additive fashion in predicting youths' longitudinal success. As they explain

The hope was to identify combinations of contexts that especially protect young people

by more than additively countervailing against any negative contextual forces in their lives (Cook *et al.*, 2002, p. 1286).

They found no evidence to support this, however, as the measures of context quality that they used appeared to work additively. While they tested for interaction effects between key features of the different contexts, they did not explore whether the influence of any one context was mediated through another context—which is probable, given the correlation and overlap among the different context attributes.

The findings discussed thus far shed light on neighbourhood–school links and the effects that these contexts may have on young people's educational outcomes. After studying the literature, several questions emerge. There is a longstanding notion in the neighbourhood effects literature that neighbourhood conditions might influence young people's outcomes by way of the school; this suggests the mediation of neighbourhood effects through the school context. Some of the literature also suggests that these contexts may have important direct or interaction effects. In this paper, we explore whether the neighbourhood plays a role in predicting young people's school outcomes, to what degree this role is mediated by the school context or direct, and whether there are interactions between neighbourhood and school characteristics.

The Present Study

This paper focuses on the associations between characteristics of youths' schools and neighbourhood contexts and their academic achievement in secondary school. On the basis of literature, we have formulated the following research questions

- (1) Are neighbourhood and school characteristics associated with youths' educational achievement after controlling for a set of individual and family background variables?

- (2) Is there evidence that the school context mediates the neighbourhood's association with youth achievement? Are there indications of direct neighbourhood effects as well?
- (3) Can interactions effects between these two contexts be identified?

Several studies have indicated key differences in context effects on youth with migration or ethnic minority backgrounds on the one hand, and 'native' or ethnic majority youth on the other (Brännström, 2008; Oberwittler, 2007; Pong and Hao, 2007). Therefore, we will pay attention to the comparison of native Dutch and ethnic minority students with respect to each of the three research questions. Based on previous findings of non-linear context effects (Galster and Santiago, 2006), we will also explore the potential non-linearity of neighbourhood and school effects.

The Dutch Context

Most children in the Netherlands begin primary school at the age of four and transition to secondary education at the age of 12. Dutch secondary education is a selective system differentiated by five main academic tracks: A = pre-university education (6 years), B = senior general secondary education (5 years), C = junior general secondary education (4 years), D = pre-vocational education (4 years), E = pre-vocational education with individualised support (4 years). Students are advised by their primary schools as to the most suitable kind of secondary education, based mainly on results of a standardised test taken in the final year of primary school, as well as their general performance. While some secondary schools offer only one track, the majority are combined schools offering several different tracks and many offer all five.

The Dutch education system is characterised by a long history of open school choice and the absence of formal school catchment areas. Parents are free (and obliged) to choose their

children's school, both at the primary and secondary levels. Education is free of charge and all schools (i.e. public, private and denominational) are funded on an equal footing by the national administration. It is the government's objective to provide equal school opportunities to all students. In an effort to rebalance the potential negative effects of social background in primary education, all students are assigned a weight based on their socioeconomic (and until recently, migration) background and the total of these weights determines the level of additional funding given to the school. Similar types of mechanism operate at the level of secondary education, with extra funds allocated to schools with large shares of socio-economically disadvantaged pupils (see Ladd and Fiske, 2009, for more on school funding in the Netherlands). In principle, all children and youth have equal access to education and all schools offer similar qualities of education within each of the academic tracks. In reality, however, there are differences across schools in terms of quality and the type of atmosphere they offer, as well as the way they admit students. School choice and admission are not neutral processes and some families will obviously have an advantage over others in securing entry into particular schools (Gramberg, 1998; Karsten *et al.*, 2003; ten Broeke *et al.*, 2003).

Data and Methods

Data analysed in this paper come from a large study in the Netherlands called the 'Longitudinal Cohort Study in Secondary Education—Cohort 1999' (VOCL'99). Beginning in 1999, this study follows a cohort of students from their first year of secondary school (average age 13 years old) until they leave full-time education. From a random sample of 246 schools, 126 schools (including 825 entire classes) participated in the study. All students who entered the first year of these schools in 1999 belong to the cohort, totalling 19 391 students. The sample was constructed by Statistics Netherlands, who

also recruited the schools and is responsible for data collection.

The VOCL'99 dataset was matched using individuals' postcodes to neighbourhood identifiers, which were then matched to neighbourhood characteristics published by Statistics Netherlands. The full VOCL'99 sample has been found to be representative of students and schools in Dutch secondary education (Berkel, 1999), as well as neighbourhoods in the Netherlands (Sykes and Kuyper, 2009). We use a much-reduced version of this dataset due to the criteria for our analysis, which are as follows: no missing values on the dependent variable (Year 3 achievement); no missing values on the control variable for prior achievement (entry test achievement); and no missing values on essential background variables. These three criteria reduced the sample size to 9897 students; this is a reduction of 49 per cent and is largely due to the 9016 students for whom there were no Year 3 achievement scores and the additional 408 students missing scores on the entry test.

The missing values on the Year 3 test were mainly due to the non-participation of some schools in the second stage of testing. The extent of non-participation is in line with previous cohorts in the VOCL series and largely reflects the lower levels of participation on the part of schools offering the lowest (i.e. vocational) tracks of education. Due to the overrepresentation of ethnic minority students and lower-SES students in the vocational education tracks, this non-participation results in our selection of students containing comparatively fewer ethnic minorities (12 per cent versus 17 per cent in the full sample), comparatively more students with higher socioeconomic backgrounds and comparatively more students living in neighbourhoods and attending schools with higher levels of SES and smaller shares of ethnic minorities. On average, the students in our selection come from more economically advantaged family, neighbourhood and school settings with higher levels of SES and also

have higher levels of prior achievement than the non-selected students, with an effect size that is considered to be small (Cohen's $d=0.3$). Naturally, students who have dropped out of school are not included in our selection. The omission of dropouts and the relatively more economically advantaged circumstances of our sample is likely to result in a more stringent test for context effects, as past empirical findings have suggested that dropping out may be influenced by school and community characteristics (Crowder and South, 2003) and that the achievement levels of youth from higher socioeconomic backgrounds are less affected by neighbourhood and school attributes (Sykes and Kuyper, 2009).

Level 1: The Students and Their Parents

Students' background characteristics came from a parent questionnaire and school administrative data in the VOCL'99 and include: age, gender, ethnic minority status (0 = native Dutch, 1 = ethnic minority group,² family SES (based on the highest level of parental educational attainment, from 1 = primary school or less, to 5 = university or postgraduate degree), family structure (1 = married, 2 = registered partnership or living together, 3 = divorced, widowed, not married, 4 = unknown/missing) and prior achievement. Parental income or occupational data could not be used as indicators of SES due to large amounts of missing values; however, educational attainment has been found to be a good proxy for SES in the Dutch context (van Berkel-van Schaik and Tax, 1990) and research based on the previous (1993) cohort of the VOCL found parental occupational data to have no additional explanatory power in predicting youth achievement once parental educational status was considered (Veenstra and Kuyper, 2004). For the 603 cases missing parental educational information, regression imputation with a random (stochastic) component was used to impute missing values based on the relationship between relevant variables with complete cases. All other individual data were complete.

The outcome variable of interest is students' achievement in secondary school, operationalised as their scores on a standardised test taken in Year 3 of secondary school that consisted of three components: text comprehension, mathematics and general knowledge. The test is a highly reliable measure of achievement, with a Cronbach's alpha (internal consistency reliability) of 0.90. For the mathematics section, two versions were administered—one to students in the lowest two (vocational) tracks and another one to students in the highest three tracks; these two versions were later equated (see Zijssling *et al.*, 2005, for more details). In some models, scores from a standardised entry test taken in the first year of secondary school are used to control for prior achievement. The entry test also consisted of three components—namely, Dutch language, arithmetic and information processing; this test was designed to be applicable to all tracks. The entry test also has a Cronbach's alpha reliability of 0.90 (Kuyper *et al.*, 2003). Both tests were developed by the Dutch Institute for Educational Testing (CITO Groep). For ease of interpretation and comparison, we standardised students' scores on each test using the full VOCL'99 sample, resulting in overall mean scores of 50 and standard deviations of 10.

Level 2: Neighbourhoods

In this study, we operationalise 'neighbourhood' as the lowest administrative spatial sub-unit in the Netherlands, the *buurt*. These areas vary in terms of number of inhabitants and surface area, but tend to reflect natural borders, such as roads, railways and waterways, parks and building styles and periods. Nation-wide, there were 10 737 of these neighbourhoods in 1999, with a mean population of 1468. Students in our sample represent 2248 (21 per cent) of these neighbourhoods. The characteristics that we consider for these neighbourhoods are: *concentration of ethnic minorities* (defined by Statistics Netherlands as the share of non-Western migrants; due to a negative skew this predictor was divided into quintiles); *high SES*

(operationalised as the share of high-income residents); and *low SES* (operationalised as the share of residents receiving unemployment benefits). In a principal component analysis of six neighbourhood socioeconomic indicators (i.e. the share of high-income residents, low-income residents, unemployment benefit recipients, mean income per income-earner and per resident, mean home value), 'high income' and 'unemployment' emerged as the most important indicators of the constructs of neighbourhood 'affluence' and 'disadvantage' (which we term high and low SES respectively). We estimated models with the two extracted principal components, as well as with z-score summary scales of the high- and low-SES indicators, and came to equivalent results as when using 'high-income' and 'unemployment'; thus, to assist interpretation and comparison with the school SES variables, we use these two variables to represent neighbourhood high- and low-SES. Including these two variables in our model naturally reduces the problem of multicollinearity, which would occur if we entered all the (highly correlated) neighbourhood socioeconomic indicators into the model at once. We take the wider context within which the neighbourhoods are situated into account with a set of dummy variables based on the population of the surrounding municipality, from 'small city' (1 = < 50 000) to 'large city' (3 = > 100 000).

Level 2: School

Schools are the second level-2 unit in this study. Students in our sample attend 105 schools. We conceptualise the 'school' level as being the full first-year cohort at a given school, due to the sampling design of the VOCL'99 (i.e. all first-year classes in a school were sampled). Accordingly, all school compositional variables are made by aggregating the individual-level characteristics of these students. The following school characteristics are included: *concentration of ethnic minorities* (defined as the share of students with non-Western migrant backgrounds, divided into quintiles); *low SES* and

Table 1. Bivariate correlations between neighbourhood and school characteristics

	1	2	3	4	5
<i>Native Dutch</i>					
Neighbourhood ethnic minorities (percentage)	1				
Neighbourhood low SES	0.40	1			
Neighbourhood high SES	-0.26	-0.58	1		
School ethnic minorities (percentage)	0.39	0.11	0.05	1	
School low SES	0.12	0.28	-0.32	0.34	1
School high SES	0.08	-0.13	0.31	0.08	-0.66
<i>Ethnic minority</i>					
Neighbourhood ethnic minorities (percentage)	1				
Neighbourhood low SES	0.63	1			
Neighbourhood high SES	-0.47	-0.71	1		
School ethnic minorities (percentage)	0.62	0.40	-0.28	1	
School low SES	0.31	0.39	-0.43	0.60	1
School high SES	-0.08	-0.20	0.32	-0.25	-0.70

Notes: All significant $p < 0.05$. $N =$ native Dutch 8720, ethnic minority 1177; calculated at the level of the student.

high SES (two variables, defined as the share of students at the bottom and top ends of the SES categories, which are parental education levels of primary or lower-secondary school and university or postgraduate degree respectively); *school denomination* (five categories: public, Catholic, Protestant, Reformation, other).³ Since some schools offer several different tracks and others only one or two adjacent tracks, we control for this with the variable '*school type*' (0 = single track, 1 = multiple track).

Table 1 shows the correlations between all neighbourhood- and school-level variables, calculated at the level of the student and differentiated by native/ethnic minority status. First looking at the within-neighbourhood and school correlations, we can see that low SES and ethnic minority concentration are clearly related in both these contexts; these correlations are strongest for ethnic minority youth ($r = 0.63$ for neighbourhoods and 0.60 for schools). Between neighbourhoods and schools, the SES measures have medium-sized correlations. Ethnic minority concentration appears to be much more coupled at the school and neighbourhood level for ethnic minority youth ($r = 0.62$) than for natives ($r = 0.39$). These correlations indicate that youths' school

and neighbourhood compositions are highly but not perfectly correlated. In addition, there is a stronger overlap between the ethnic milieus of youths' schools and neighbourhoods than the SES milieus, and both of these dimensions are more strongly related for ethnic minority youth than for natives.

Given our interest in examining the effects of schools and neighbourhoods and the potential mediation of neighbourhood effects through the school, it is useful to give some background information about the typical links between schools and neighbourhoods in the Netherlands. Despite the Dutch policy of open school choice, families still report distance between home and school to be one of the most important factors in their school choice decisions (Karsten *et al.*, 2006; ten Broeke *et al.*, 2003). In our sample, the vast majority of students in urban areas travelled less than 2 kilometres to get to school and, for the full sample, the average distance travelled was approximately 3.8 km. However, not all students have a close link between home and school location—for instance, 20 per cent travelled over 6 kilometres. Thus, for the majority of students there is geographical proximity between home and school;

however, this is not the case for everyone, particularly for those in less urban areas.

Analysis

The structure of our dataset is students nested within neighbourhoods and schools. Since not all students in a given neighbourhood attend the same school and not all students from a given school live in the same neighbourhood, this dataset is said to have a ‘cross-classified’ structure and is best modelled using cross-classified multilevel analysis (Goldstein, 2003). Cross-classified models recognise the simultaneous membership of level-1 units (here, students) in multiple higher-level but non-nested units (here, schools and neighbourhoods). These models estimate the influence of each context while controlling for the respective other context, making it a well-suited strategy to deal with the case of individuals embedded in and potentially influenced by schools and neighbourhoods.

We began our analysis by estimating a set of unconditional or ‘empty’ models. These models identify the amount of variance in the dependent variable that is attributed to each of the levels and are used for assessing the fit of later models. From the variance values, the ‘intraclass correlation coefficient’ (ICC) can be calculated, which measures the proportion of the total variance that is accounted for by (observed and unobserved) factors operating at each of the levels and gives an indication of the importance of each level. After running the unconditional models, we ran separate 2-level neighbourhood and school models, adding individual and family characteristics and context attributes. We then combined the neighbourhood and school models into a cross-classified model, allowing us to address our main research question.

We ran our first set of models without controlling for students’ prior achievement, to get a first indication of broader contextual

associations and potential effects. We did this for two main reasons; first, because of the short time-span between the measures of entry test and Year 3 achievement, which may leave little room for measurable effects to take place and result in too conservative a test for context effects (Rumberger and Palardy, 2005). Prior achievement is naturally a powerful predictor of later achievement; in our sample, students’ scores on the two tests are highly correlated ($r = 0.70$). Because prior achievement will reflect the cumulative effects of an individual’s previous social history and past contexts, by including it in the model we run the risk of ‘overcontrolling’—that is, controlling for some of the influence of past neighbourhood and school (as well as peer and family) conditions (Sampson *et al.*, 2002). Neighbourhood effects theory stresses the cumulative impact of one’s residential environments (Duncan and Raudenbush, 1999; Galster *et al.*, 2007); therefore, by controlling for prior achievement, we are also controlling for some of the context effects experienced up until that point, which could undercut the potential importance of long-term community influences and cloud our understanding of the full impact of these settings (see Sampson *et al.*, 2002). Secondly, our main aim is to test for the potential mediation of neighbourhood effects through the school context, as opposed to assessing school effectiveness or the value-added of a specific programme or practice during secondary school. Thus, we have chosen to follow the strategy of Kauppinen (2008) and to compare models both with and without the control for prior achievement. However, given the short amount of time between the two tests and their high correlation, we expect only modest context effects on achievement in the models with prior achievement (Blau *et al.*, 2001).

In our final models, we tested for interaction effects between neighbourhood and school characteristics. This is based on the premise that the effects of one context might vary as a function of the other—for example, due to

attributes of one context buffering the impact of the other context. All models were estimated using MLwiN, version 2.13 (Rasbash *et al.*, 2009).

Analytical and Methodological Challenges

A number of important theoretical and methodological issues arise when trying to conceptualise and measure the influences that social contexts have on individual outcomes. While multilevel modelling and related approaches are useful tools for addressing the question of context effects and estimating associations, they are not without their shortcomings. In these models, each level of the model is treated as separate (here, the individual and family, school, and neighbourhood), while in reality we know these to be inter-related spheres with reciprocal relationships (Diez-Roux, 2004). Selection bias and endogeneity are also well-known challenges to estimating context effects, as individuals are not sorted randomly into their schools, neighbourhoods, friendships groups, etc. and, thus, attributes of these contexts should not be treated as exogenous to them (see, for example, Diez-Roux, 2004; Galster, 2008). Examining both school and neighbourhood effects together poses a substantial challenge to determining causality, as it involves the simultaneous non-random assignment of individuals to more than one context, implying multiple sources of potential selection bias. Families come to reside in neighbourhoods through non-random processes and clearly, schools do not acquire students at random.

While there are several strategies that attempt to reduce the threat of selection bias, we are unable to employ a first-difference equation (for example, Galster *et al.*, 2008) due to limitations of our dataset (i.e. many of the variables that would be needed are available for only one point in time) and, given the multiple sources of selection bias and multiple contexts considered, finding good instrumental variables proves unfeasible. However,

taking a cue from school effectiveness research (Goldstein, 1997; Raudenbush and Willms, 1995), we argue that controlling for prior achievement—in addition to individual and family background characteristics—is likely to guard against at least some selection bias. Including prior achievement in our models is expected to offer some protection from selection bias because this variable will capture much of the past social history of individuals, including omitted background variables and other unmeasured factors that might have helped sort them into their current neighbourhoods and schools. This is by no means an ideal control for selection bias—for example, some of these ‘unmeasured factors’ will undoubtedly continue to have an effect after youth have been sorted. However, our main aim is to test for the potential mediation of neighbourhood effects through the school context. While mediation certainly implies causation, we believe that an analysis of the data currently available, which allow us to examine school and neighbourhood contexts together and their simultaneous associations with youth outcomes, will provide insights into the potential links between school and neighbourhood effects and produce results that may be highly suggestive of mediation. Nevertheless, as Diez-Roux explains

Although using the most appropriate model for the research question at hand is of course important, ultimately models are simply tools that help us describe the data. Inferring causality is a much more complicated process and requires more than statistical models (Diez-Roux, 2004, p.1954).

We will come back to the issue of selection bias in the final section.

Results

Descriptives: Sample Characteristics

Table 2 describes the characteristics of our sample, differentiated by native/ethnic background. For both groups of students, there

are slightly more girls than boys. The more socioeconomically advantaged circumstances of native Dutch students, on average, are apparent. Native Dutch youths' parents have higher average levels of educational attainment, the largest difference being between those with a primary school education or less (5 per cent for natives versus 25 per cent for ethnic minority students). Native Dutch students' families appear to be more often intact (i.e. higher levels of marriage and lower levels

of divorce); however, ethnic minority students have a greater share of missing values on this predictor. Ethnic minorities are more likely to live in larger cities and to attend schools and live in neighbourhoods with higher concentrations of minorities and lower levels of SES. Both groups of students are spread across all of the school types, with Catholic, Protestant and public schools being the most common. The majority of both groups attend schools offering multiple tracks.

Table 2. Descriptives: individual, school and neighbourhood characteristics

Variable	Dutch		Ethnic minority	
	Mean	S.D.	Mean	S.D.
<i>Individual characteristics</i>				
Year 3 achievement (outcome variable)	50.63	(9.84)	46.39	(10.41)
Year 1 achievement	51.73	(9.71)	48.49	(10.11)
Age	12.97	(0.45)	13.15	(0.58)
Gender (girl)	0.52		0.53	
<i>Family SES</i>				
Primary school or less	0.05		0.25	
Secondary education, lower stream	0.15		0.20	
Secondary education, higher stream	0.47		0.31	
Higher professional education	0.24		0.14	
University or postgraduate	0.10		0.10	
<i>Family structure</i>				
Married	0.85		0.65	
Registered partnership or cohabitation	0.03		0.04	
Divorced, widowed, never married	0.07		0.12	
Missing/unknown	0.06		0.19	
<i>School characteristics</i>				
Low SES (percentage)	0.24	(0.14)	0.31	(0.20)
High SES (percentage)	0.09	(0.16)	0.09	(0.18)
<i>Ethnic minority concentration</i>				
Q1 (least)	0.26		0.05	
Q2	0.27		0.15	
Q3	0.24		0.27	
Q4	0.17		0.28	
Q5 (most)	0.06		0.26	
<i>School denomination</i>				
Public	0.18		0.32	
Catholic	0.39		0.36	
Protestant	0.21		0.20	
Other	0.09		0.11	
Reformation	0.13		0.02	

Table 2. (Continued)

Variable	Dutch		Ethnic minority	
	Mean	S.D.	Mean	S.D.
<i>School type</i>				
Multiple track	0.80		0.69	
Single track	0.20		0.31	
<i>Neighbourhood characteristics</i>				
Low SES (percentage)	0.16	(0.07)	0.21	(0.08)
High SES (percentage)	0.22	(0.08)	0.19	(0.09)
<i>Ethnic minority concentration</i>				
Q1 (least)	0.05		0.01	
Q2	0.40		0.16	
Q3	0.25		0.17	
Q4	0.17		0.22	
Q5 (most)	0.12		0.44	
<i>Wider context</i>				
Small city (< 50 000)	0.66		0.33	
Medium-sized city (50 000–100 000)	0.21		0.35	
Large city (>100 000)	0.13		0.32	

Notes: N = native Dutch 8720, ethnic minority 1177; SES = socioeconomic status.

Multilevel and Cross-classified Analysis

We began the analysis by running unconditional models and calculating the ICCs, in order to see where the variation in student achievement lies. All models were run separately for native Dutch and ethnic minorities. Model 1 in Table 3 is a two-level model with students nested in neighbourhoods. For both native and ethnic minority youth, there is a substantial proportion of variance in achievement associated with the neighbourhood level, as indicated by the ICCs, implying that (observed and unobserved) factors associated with the neighbourhood level account for 28 per cent and 40 per cent of the variation in students' achievement respectively (see ICC in model 1, Table 3) (Goldstein, 2003). These are considered to be very high ICCs, but will be to a large extent explained by the uneven distribution of students across neighbourhoods in terms of achievement level and associated characteristics. In model 2, schools are the level-2 units. In these models, a greater proportion of variance is associated with the

school level (i.e. 38 per cent for natives and 42 per cent for ethnic minority students). While this indicates a large potential for schools to affect achievement, much of this variation will also be explained by the uneven distribution of students across schools in terms of achievement level and associated characteristics. Cross-classified models are specified in model 3. In these models, we see a drastic reduction in the proportion of variance at the neighbourhood level, while the school-level variance remains large. This provides the first indication that neighbourhood effects are mediated through the school context, as the neighbourhood variance clearly diminishes upon distinguishing the school level.

The results of the cross-classified models in Table 3 indicate that there is a large amount of overlap in the variance associated with the neighbourhood and school levels. Although the neighbourhood-level variance diminished dramatically, the size of the ICCs, particularly for ethnic minority students, remains non-trivial. For ethnic minority students, the

Table 3. Unconditional models: between-neighbourhood and between-school variance in Year 3 achievement

	<i>Model 1</i> <i>Neighbourhoods</i> <i>as level-2 units</i>		<i>Model 2</i> <i>Schools</i> <i>as level-2 units</i>		<i>Model 3</i> <i>NH and SCH as cross-</i> <i>classified level-2 units</i>	
	<i>Native</i>	<i>Non-native</i>	<i>Native</i>	<i>Non-native</i>	<i>Native</i>	<i>Non-native</i>
<i>Variance</i>						
Level 1 Individual	71.71	65.54	64.38	64.39	62.24	59.94
Level 2 Neighbourhood	27.40	44.46			2.38	5.04
Level 2 School			39.82	47.03	39.88	46.12
<i>ICC</i>						
Level 2 Neighbourhood	0.28	0.40			0.02	0.05
Level 2 School			0.38	0.42	0.38	0.42
Deviance information criterion (DIC)	62001.52	8262.49	61065.25	8240.56	60767.29	8157.04

Notes: MCMC estimation, uninformative priors. $N = 8720$ native Dutch; 1177 non-native.

potential for effects of the neighbourhood and school context appears to be greater than for native Dutch students. The 'deviance information criterion' (DIC) at the bottom of the table is used to compare the fit and complexity of the models, with lower values indicating a better model fit. The cross-classified models reveal a clear improvement in the fit relative to the models in which just the neighbourhood or the school levels were included, suggesting that both contexts should be considered when predicting youth achievement.

Next, we ran two-level neighbourhood models, first including only individual background characteristics (model 1) and then adding neighbourhood characteristics (model 2), displayed in Tables 4 and 5. Most of the individual-level variables are significantly associated with achievement, both for natives and ethnic minorities. Age is negatively related to achievement level and being female is positively related; these associations appear to be somewhat stronger for ethnic minority students. The impact of family SES is as expected: higher levels of SES are associated with higher educational achievement. Registered partnership or cohabitation family structures relate negatively to educational achievement relative to married family structures, but this is only

true for native Dutch students. With regard to the impact of neighbourhood variables (model 2), high SES is significantly related to educational achievement, with a considerably larger coefficient for ethnic minority students. There appear to be no effects of the neighbourhood low-SES variable for either group. For native Dutch students, there is a negative association between the second neighbourhood ethnic concentration quintile and educational achievement. Living in a small city appears to be positively related to achievement for native students. Comparing the variance values in models 1 and 2 with the unconditional neighbourhood model in Table 3, we can see that the individual-level variables explain a far greater amount of between-neighbourhood variance than the neighbourhood predictors, reflecting the large variation in individual characteristics across neighbourhoods. The unique contribution of neighbourhood variables to the explained between-neighbourhood variance in model 2 is around 4 per cent for ethnic minorities and 2 per cent for natives.

Model 3 (Table 4 and 5) is a two-level school model with individual and school characteristics. The individual-level coefficients are similar to those in the two-level

Table 4. Multilevel and cross-classified models of neighbourhood and school effects on educational achievement, native Dutch students

Parameters	Model 1		Model 2		Model 3		Model 4		Model 5	
	Two-level, neighbourhood, individual characteristics		Two-level, neighbourhood		Two-level, school		Cross-classified		Cross-classified with prior achievement	
<i>Fixed effects</i>										
Constant	97.91 (2.86)	95.73 (2.94)	87.71 (3.19)	88.29 (3.48)	30.06 (2.72)					
<i>Level 1 (student-specific)</i>										
Year 1 achievement										
Age	-3.99*** (0.22)	-3.94*** (0.21)	-2.62*** (0.20)	-2.60*** (0.20)	0.61*** (0.01)					
Gender (1 = girl, 0 = boy)	1.21*** (0.19)	1.21*** (0.19)	1.21*** (0.17)	1.23*** (0.17)	-0.68*** (0.16)					
<i>Family SES (ref: primary school or less)</i>										
Secondary education, lower stream	0.38 (0.47)	0.35 (0.47)	-0.06 (0.43)	-0.10 (0.43)	-0.38 (0.35)					
Secondary education, higher stream	3.51*** (0.43)	3.39*** (0.43)	2.02*** (0.40)	1.98*** (0.40)	0.93** (0.33)					
Higher professional education	6.46*** (0.46)	6.24*** (0.46)	3.69*** (0.42)	3.67*** (0.43)	1.64*** (0.35)					
University or postgraduate	8.81*** (0.53)	8.49*** (0.53)	4.95*** (0.49)	4.97*** (0.49)	2.40*** (0.40)					
<i>Family structure (ref: married)</i>										
Registered partnership, cohabitation	-2.27*** (0.59)	-2.19*** (0.59)	-1.53** (0.54)	-1.57*** (0.53)	-1.14** (0.44)					
Divorced, widowed, never married	0.01 (0.38)	0.07 (0.38)	0.19 (0.34)	0.14 (0.34)	-0.03 (0.28)					
Missing/unknown	-1.04* (0.39)	-1.06* (0.39)	-0.62 (0.36)	-0.61 (0.36)	0.18 (0.30)					
<i>Level 2 (school)</i>										
Low SES										
High SES										
<i>Ethnic minority concentration (ref: Q1, least)</i>										
Q2										
Q3										
Q4										
Q5 (most)										

(Continued)

Table 4. (Continued)

	Model 1	Model 2	Model 3	Model 4	Model 5
<i>Parameters</i>	<i>Two-level, neighbourhood, individual characteristics</i>	<i>Two-level, neighbourhood</i>	<i>Two-level, school</i>	<i>Cross-classified</i>	<i>Cross-classified with prior achievement</i>
<i>School denomination (ref: Catholic)</i>					
Public			-1.84 (1.02)	-1.89 (1.06)	-0.77 (0.70)
Protestant			-1.77 (0.94)	-1.62 (0.97)	-0.59 (0.64)
Other			-0.81 (1.25)	-1.41 (1.24)	0.41 (0.86)
Reform			-2.41 (1.63)	-1.76 (1.61)	-1.17 (1.13)
School type (1 = multiple tracks; 0 = single track)			-1.35 (0.99)	-1.35 (1.06)	-1.27 (0.67)
<i>Level 2 (neighbourhood)</i>					
Low SES		-1.97 (2.36)		-0.40 (1.90)	0.60 (1.54)
High SES		7.15*** (1.95)		0.02 (1.64)	0.16 (1.33)
<i>Ethnic minority concentration (ref: Q1, least)</i>					
Q2		-1.33* (0.56)		-0.73 (0.43)	-0.17 (0.34)
Q3		-0.86 (0.60)		-0.73 (0.46)	-0.07 (0.37)
Q4		-0.23 (0.62)		-0.19 (0.50)	0.09 (0.40)
Q5 (most)		0.97 (0.69)		0.13 (0.57)	0.17 (0.45)
<i>Setting (ref: medium-sized city)</i>					
Small city		1.57*** (0.38)	0.89** (0.31)	1.09** (0.36)	0.37 (0.29)
Big city		0.75 (0.46)	1.38** (0.44)	1.34** (0.49)	0.67 (0.39)
<i>Variance parameters</i>					
Individual-level variance	65.89*** (1.10)	65.81*** (1.10)	60.66*** (0.92)	58.90*** (0.96)	39.84*** (0.63)
Between-neighbourhood variance	15.76*** (1.10)	15.15*** (1.15)		1.89*** (0.42)	1.24** (0.25)
Between-school variance			10.92*** (1.97)	10.82*** (2.08)	4.58*** (0.94)
DIC	61265.94	61254.80	60543.70	60285.11	56877.04

Notes: MCMC estimation, uninformative priors. Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$; Ref = reference category; $N = 8720$.

Table 5. Multilevel and cross-classified models of neighbourhood and school effects on educational achievement, ethnic minority students

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
	Two-level, neighbourhood, individual characteristics	Two-level, neighbourhood	Two-level, school	Cross-classified	Cross-classified with prior achievement
<i>Fixed effects</i>					
Constant	98.15 (7.03)	93.75 (7.03)	89.81 (6.28)	86.85 (6.95)	42.12 (6.60)
<i>Level 1 (student-specific)</i>					
Year 1 achievement	-4.11*** (0.45)	-4.07*** (0.45)	-2.86*** (0.46)	-2.82*** (0.43)	0.52*** (0.03)
Age	1.68*** (0.51)	1.55*** (0.51)	1.66*** (0.46)	1.61*** (0.47)	-1.44*** (0.38)
Gender (1 = girl, 0 = boy)					1.83*** (0.41)
<i>Family SES (ref: primary school or less)</i>					
Secondary education, lower stream	-1.18 (0.82)	-1.10 (0.82)	-0.93 (0.75)	-0.99 (0.73)	-0.79 (0.65)
Secondary edu., higher stream	3.60*** (0.73)	3.16*** (0.73)	1.66** (0.68)	1.48* (0.66)	0.50 (0.59)
Higher professional education	4.85*** (0.90)	3.97*** (0.90)	1.61* (0.80)	1.42 (0.84)	0.10 (0.73)
University or postgraduate	8.56*** (1.06)	7.35*** (1.06)	4.14*** (0.94)	3.82*** (0.96)	2.11* (0.87)
<i>Family structure (ref: married)</i>					
Registered partnership, cohabitation	-1.93 (1.27)	-1.73 (1.27)	-1.79 (1.17)	-1.68 (1.17)	-0.75 (1.02)
Divorced, widowed, never married	-1.66 (0.83)	-1.33 (0.83)	-1.26 (0.73)	-1.18 (0.74)	-0.67 (0.63)
Missing/unknown	-1.48 (0.74)	-1.37 (0.74)	-0.74 (0.67)	-0.73 (0.69)	-0.04 (0.59)
<i>Level 2 (school)</i>					
Low SES			-18.14*** (4.49)	-18.20*** (4.62)	-8.65* (1.35)
High SES			15.99* (7.91)	14.71 (8.17)	4.13 (6.94)
<i>Ethnic minority concentration (ref: Q1, least)</i>					
Q2			-1.50 (2.14)	-1.78 (2.13)	-0.67 (1.82)
Q3			-1.75 (2.21)	-1.81 (2.24)	-0.24 (1.89)
Q4			-2.37 (2.31)	-2.62 (2.37)	-0.62 (1.98)
Q5 (most)			-1.69 (2.59)	-1.98 (2.62)	-0.07 (2.18)

(Continued)

Table 5. (Continued)

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
	Two-level, neighbourhood, individual characteristics	Two-level, neighbourhood	Two-level, school	Cross-classified	Cross-classified with prior achievement
<i>School denomination (ref: Catholic)</i>					
Public			-1.91 (1.29)	-1.75 (1.27)	-1.38 (1.07)
Protestant			-2.11 (1.23)	-1.81 (1.27)	-1.28 (1.07)
Other			-0.79 (1.59)	-0.43 (1.59)	0.68 (1.34)
Reform			2.18 (2.91)	2.74 (2.89)	3.23 (2.51)
School type (1 = multiple track, 0 = single track)			-1.75 (1.23)	-1.97 (1.16)	-1.70 (1.01)
<i>Level 2 (neighbourhood)</i>					
Low SES		-0.69 (4.92)		2.16 (4.32)	-2.67 (3.72)
High SES		13.76*** (4.79)		4.68 (4.28)	2.20 (3.73)
<i>Ethnic minority concentration (ref: Q1, least)</i>					
Q2		1.98 (3.31)		-0.09 (2.75)	2.28 (2.43)
Q3		-0.71 (3.29)		-2.89 (2.76)	0.13 (2.44)
Q4		1.46 (3.31)		-1.21 (2.77)	1.92 (2.44)
Q5 (most)		1.84 (3.34)		-1.41 (2.88)	1.08 (2.48)
<i>Setting (ref: medium-sized city)</i>					
Small city		1.31 (0.82)		0.89 (0.91)	0.26 (0.77)
Big city		-0.47 (0.84)		0.56 (1.08)	-0.36 (0.92)
<i>Variance parameters</i>					
Individual-level variance	60.24*** (3.94)	59.65*** (3.60)	59.34*** (2.59)	55.40*** (2.89)	43.92*** (2.12)
Between-neighbourhood variance	25.21*** (4.21)	24.15*** (4.21)		4.16* (1.89)	1.61 (1.19)
Between-school variance			10.41*** (2.87)	10.03*** (2.84)	7.09*** (1.94)
DIC	8161.61	8150.12	8146.15	8063.44	7790.95

Notes: MCMC estimation, uninformative priors. Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$; Ref = reference category; $N = 1177$

neighbourhood models in terms of directions and significance; however, they are smaller in size, as differences in the schools that youth attend appear to explain some of the effects that were attributed to background characteristics, particularly family SES. The measures of high and low school SES are significantly associated with achievement for both groups of students. For native Dutch students, there is a negative association between attending a school with a high concentration of ethnic minorities (4th quintile) and educational achievement. Neither school denomination nor school type appears to be significantly associated with achievement.

We combine the school and neighbourhood models into a cross-classified model in model 4. Individual background variables show similar associations as in the previous models. The interesting differences are to be found at the context level. The associations with the school context do not differ much from the two-level school model, except that, for ethnic minorities, high SES at the school level is no longer statistically significant. Low school SES is still strongly and negatively related to educational achievement for both groups of students. For native Dutch students, there is still a negative association between school ethnic minority concentration and achievement (for the 4th quintile). The coefficient for neighbourhood high SES has dropped to non-significance for both groups, as has the coefficient for neighbourhood ethnic minority concentration in the native Dutch model. There are no significant neighbourhood composition variables remaining for either group; however, the variable indicating the wider city setting is still associated with achievement for native youth, with big and small cities associated positively with achievement levels, relative to medium-sized cities.

In model 5, prior achievement was added. As expected, the fit of the models improves substantially, since prior achievement is a strong predictor of later achievement. The

coefficients for age and family SES are still significant but have been largely attenuated by prior achievement, as these factors are also related to earlier learning and achievement. The positive effect of being female is still significant and has become larger, indicating that being a girl is especially associated with higher achievement during these first years of secondary school. The impact of school SES has been considerably attenuated; the coefficient for low SES has decreased by 53 per cent for ethnic minorities and 67 per cent for natives, but is still statistically significant and substantial. The coefficient for high SES (i.e. native Dutch model) is no longer significant. As in model 3, the neighbourhood composition variables do not have any significant associations with educational achievement. Differences between the urban settings for native youth are no longer significant. Comparing the coefficients for prior achievement between the two groups, we see that prior achievement is a stronger predictor of native youths' Year 3 achievement than of ethnic minorities'.

In our final model, we tested for cross-level interaction effects between characteristics of neighbourhoods and schools (for example, school low SES x neighbourhood low SES), but found no significant effects or improvements in the model fit (and therefore left these out of the model). This is unsurprising, given the lack of significant main effects of the neighbourhood variables and the very small between-neighbourhood variance remaining, which makes detecting such interactions unlikely (Goldstein, 2003). Thus, we find no support for the idea that one context moderates the effects of the other. It appears that, in our sample, once taking school, individual and family background characteristics into account, there is no significant direct or interacting effect of the neighbourhood environment on youths' educational achievement. In our final model, we also tested for non-linearities of the SES context variables

by collapsing the variables into categories, but found no support for non-linearity (not shown in the models); therefore, at least after taking prior achievement into account, the association between low school SES and educational achievement appears to be a linear one.

The overall amount of explained variance can be partitioned into the proportional reduction of original (unconditional) variance at the individual, neighbourhood and school levels that is accounted for in the final model (Goldstein, 2003). For native youth, our final model explains 0.36 of the original individual-level variance, 0.48 of the between-neighbourhood variance and 0.89 of the between-school variance; for ethnic minority youth these figures are 0.27, 0.68 and 0.85 respectively. The neighbourhood variables themselves explain little of the total variance; nearly all of the variance originally associated with neighbourhoods was actually explained by school and individual factors. This indicates that most of the variation in achievement between neighbourhoods can be explained by differences in schools and population characteristics across neighbourhoods.

Discussion and Conclusion

Theoretically and intuitively, the social contexts in which people live and grow up are expected to have an impact on their 'outcomes'. In this paper, we paid attention to educational achievement as the outcome and to school and neighbourhood contexts as the social environments that help to shape this outcome. We aimed to reach a better understanding of the possible links between neighbourhood and school effects, and specifically to test whether the influence of youths' neighbourhood environments might be transferred through the school context, implying the school's role as an 'institutional mechanism' of the neighbourhood's effect. As the literature describes several possible

relationships between neighbourhoods and schools and their potential effects on youth, we also tested for moderating or interaction effects (i.e. when the effects of one context vary as a function of the other).

When considered separately, we find that both the neighbourhood and the school context are significantly associated with youths' educational achievement. However, when the contexts are entered into the analysis simultaneously, the model improves in terms of fit, but the introduction of the school context reduces the association between the neighbourhood and achievement. In other words, upon considering youths' concurrent membership in both schools and neighbourhoods, the associations between the school and educational achievement remain significant, whereas the associations with the neighbourhood diminish and lose their significance. This finding suggests that the school is a mediating factor in the neighbourhood's effect on youth achievement.

We could not find support for the notion that neighbourhood and school variables interact in their influence on youth achievement. Although recognition of the neighbourhood context improves the fit of the model, it appears that, once taking individual, family and school characteristics into account, the neighbourhood does not play a significant (direct or interacting) role in predicting achievement, answering the second and third research questions. The dominant role of the school context (versus the neighbourhood) in predicting youth educational achievement is not that remarkable, given that schools function mainly as sites of educational learning. For other youth outcomes (for example, behavioural or health-related), neighbourhood and school associations could be quite different. Moreover, because of the proximity of neighbourhood and school for the vast majority of the students, school composition will be highly informed by neighbourhood composition and through that relation the

neighbourhood may be regarded as having an indirect impact. There may also be ways in which local neighbourhood context affects the internal functioning and organisation of schools (for example, Lupton, 2004); however, these were not explored in this paper.

While the size and significance of some of the coefficients in our model differed between native and ethnic minority youth, the overall picture of mediation did not differ. In line with other studies (for example, Pong and Hao, 2007), we found family SES to have a stronger and clearer association with native Dutch students' achievement than with ethnic minorities'. This suggests that socioeconomic background does not translate into educational outcomes for non-natives to the extent that it does for natives, or that SES may be measuring different things for these two groups. We also find prior achievement to be a stronger predictor of native students' achievement than of ethnic minorities'. Delving more deeply into the differences between (and within) these groups and their experiences in education is an area for future research; moreover, our dichotomous grouping of 'native' and 'ethnic minority' will mask much heterogeneity within these two groups.

We tested an important theory of the neighbourhood effects literature, using a large dataset with neighbourhood and school information and highly reliable measures of achievement. However, in addition to these strengths, our study has a number of limitations. We attempted to take some potential selection bias into account by controlling for prior achievement scores; however, this is likely to be a crude adjustment for selection effects. Although recent work suggests that taking even a fairly simple set of individual and family factors into account, including SES and ethnic background, "may make for a reasonable test of neighborhood influences" (Sampson and Sharkey, 2008, p. 25), selection bias remains a potential threat to our study. While accounting more effectively for selection

effects would have been preferred, our main aim was to test for the mediation of neighbourhood effects through the school, and we believe that our results provide important insights into that question, even if only serving to show patterns of association rather than causation. In particular, caution should be exercised when interpreting the effects of the school coefficients, not only because of potential selection bias, but also because we did not take a large set of school factors into account, specifically process and relational attributes. Thus, our results say nothing about which processes may be driving the association between school SES and achievement; research suggests that these may include school organisation, classroom climate and ethos, teacher instruction and peer influences (Thrupp *et al.*, 2002).

Our model is based on a number of other assumptions. We relied on readily available official data to measure neighbourhood characteristics. To the extent that these serve as weak proxies for the processes at work in neighbourhoods that are thought to be important for young people, we may be undercutting the role of the neighbourhood. While we shed some light on the relation between neighbourhood and school effects, it is up to future studies to examine the other processes and pathways that might transfer or moderate neighbourhood influences. Furthermore, while we considered some potential effect heterogeneity (i.e. across native/ethnic minority status), our models still tested for average effects across a large sample of youth; for specific types of youth and contexts (for example, youth attending a neighbourhood versus a non-neighbourhood school; different community and school types; different school levels), the role of the neighbourhood or school may be different. Examining the possibility of these more nuanced and less generic effects is an important avenue for future research. This calls for theories and methods that account

for the varied and complex interdependencies among young people and their social contexts. Moreover, the relationships among youth and their families, schools, neighbourhoods and decisions such as school choice, are also set within local and national institutional and policy contexts (Arum, 2000).

Our findings are based on a context in which universal and compensatory funding measures for schools exist, in addition to significant welfare state interventions at the family and individual levels. Neighbourhood segregation levels are comparatively modest in the Netherlands (Musterd, 2005); however, levels of segregation and stratification in schools are higher, both in absolute terms and relative to those in the US (Ladd *et al.*, 2009). Our findings corroborate those of Kauppinen (2008) and Brännström (2008) in other European welfare states and are also supportive of Pong and Hao's (2007) work in the US in terms of mediation, although they found neighbourhood effects to persist for some groups, even after the consideration of school factors. How neighbourhood and school effects and their association vary across contexts, and what causes this variation, remain to be seen.

One of the crucial findings of our analysis is that models of neighbourhood effects on educational outcomes that fail to consider the school context are likely to seriously overestimate direct neighbourhood effects and to leave potential pathways of neighbourhood effects unexamined. While research on neighbourhood effects on child and youth outcomes largely assumes that the school context is an important institutional mechanism of the neighbourhood's effect, this is rarely explicitly tested. In line with the results of other studies (for example, Brännström, 2008; Kauppinen, 2008; Pong and Hao, 2007), our findings underscore the importance of including the school context in models of neighbourhood effects on children and youth.

Recognising both contexts has important implications for how we understand the roles of schools and neighbourhoods and how we formulate policy responses.

Notes

1. See Baron and Kenny (1986) for a classic discussion of mediation, moderation and direct effects, and Plybon and Kliever (2001) for an example in the field of neighbourhood effects.
2. A student was considered to have an ethnic minority background if he/she or at least one parent was born abroad in a non-Western country. The largest ethnic minority groups are Antillean, Surinamese and Aruban (18 per cent), Turkish, (12 per cent) and Moroccan (11 per cent).
3. Religious schools in the Netherlands emerged out of the system of pillarisation, in which all sectors of social life became segmented along religious lines. However, since the 1960s, this system has receded in the face of the growing secularisation of society. Nowadays, most religious schools are culturally and religiously heterogeneous and schools' religious backgrounds have little effect on admissions policies and families' school choices.

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References

- Ainsworth, J. W. (2002) Why does it take a village? The mediation of neighborhood effects on educational achievement, *Social Forces*, 81(1), pp. 117–152.
- Arum, R. (2000) Schools and communities: ecological and institutional dimensions, *Annual Review of Sociology*, 26(1), pp. 395–418.

- Baron, R. M. and Kenny, D. A. (1986) The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations, *Journal of Personality and Social Psychology*, 51(6), pp. 1173–1182.
- Berkel, K. (1999) *Steekproef voor VOCL'99* [Sample for VOCL'99]. Centraal Bureau voor Statistiek, Heerlen.
- Berkel-van Schaik, A. B. van and Tax, B. (1990) *Naar een standaardoperationalisatie van sociaal-economische status voor epidemiologisch en sociaal-medisch onderzoek* [Towards a standard operationalisation of socioeconomic status for epidemiological and socio-medical research]. Ministry of Welfare, Health and Cultural Affairs, The Hague.
- Blau, J. R., Lamb, V. L., Stearns, E. and Pellerin, L. (2001) Cosmopolitan environments and adolescents' gains in social studies, *Sociology of Education*, 74(April), pp. 121–138.
- Brännström, L. (2008) Making their mark: the effects of neighbourhood and upper secondary school on educational achievement, *European Sociological Review*, 24(4), pp. 463–478.
- Broeke, L. ten, Bosveld, W., Kieft, M. van de *et al.* (2003) *Schoolkeuzemotieven: onderzoek naar het schoolkeuzeproces van Amsterdamse ouders* [School choice motivation: research on the school choice process of Amsterdam parents]. Research and Statistics Division, Amsterdam.
- Bronfenbrenner, U. (1989) Ecological systems theory, *Annals of Child Development*, 6(1), pp. 187–249.
- Burgess, S., Gardiner, K. and Propper, C. (2001) *Growing up: school, family and area influences on adolescents' later life chances*. CASE Paper No. 49, London School of Economics.
- Cook, T. D., Herman, M. R., Phillips, M. and Settersten, R. A. jr (2002) Some ways in which neighborhoods, nuclear families, friendship groups, and schools jointly affect changes in early adolescent development, *Child Development*, 73(4), pp. 1283–1309.
- Crowder, K. and South, S. J. (2003) Neighborhood distress and school dropout: the variable significance of community context, *Social Science Research*, 32(4), pp. 659–698.
- Diez-Roux, A. V. (2004) Estimating neighborhood health effects: the challenges of causal inference in a complex world, *Social Science & Medicine*, 58(10), pp. 1953–1960.
- Duncan, G. J. and Raudenbush, S. W. (1999) Assessing the effects of context in studies of child and youth development, *Educational Psychologist*, 34(1), pp. 29–41.
- Ellen, I. G. and Turner, M. A. (1997) Does neighborhood matter? Assessing recent evidence, *Housing Policy Debate*, 8(4), pp. 833–866.
- Galster, G. C. (2008) Quantifying the effect of neighbourhood on individuals: challenges, alternative approaches, and promising directions, *Schmollers Jahrbuch*, 128(1), pp. 7–48.
- Galster, G. C. and Santiago, A. M. (2006) What's the 'hood got to do with it? Parental perceptions about how neighbourhood mechanisms affect their children, *Journal of Urban Affairs*, 28(3), pp. 201–226.
- Galster, G. C., Andersson, R., Musterd, S. and Kauppinen, T. M. (2008) Does neighborhood income mix affect earnings of adults? New evidence from Sweden, *Journal of Urban Economics*, 63(3), pp. 858–870.
- Galster, G., Marcotte, D. E., Mandell, M. *et al.* (2007) The influence of neighborhood poverty during childhood on fertility, education, and earnings outcomes, *Housing Studies*, 22(5), pp. 723–751.
- Goldstein, H. (1997) Methods in school effectiveness research, *School Effectiveness and School Improvement*, 8(4), pp. 369–395.
- Goldstein, H. (2003) *Multilevel Statistical Models*, 3rd edn. London: Arnold Publications.
- Gramberg, P. (1998) School segregation: the case of Amsterdam, *Urban Studies*, 35(3), pp. 547–564.
- Hanushek, E. A., Kain, J. F., Markman, J. M. and Rivkin, S. G. (2003) Does peer ability affect student achievement?, *Journal of Applied Econometrics*, 18(5), pp. 527–544.
- Jencks, C. and Mayer, S. E. (1990) The social consequences of growing up in a poor neighborhood, in: L. E. Lynn and M. G. H. McGeary (Eds) *Inner-city Poverty in the United States*, pp. 111–186. Washington, DC: National Academy Press.
- Karsten, S., Ledoux, G., Roeleveld, J. *et al.* (2003) School choice and ethnic segregation, *Educational Policy*, 17(4), pp. 452–477.

- Karsten, S., Felix, C., Ledoux, G. *et al.* (2006) Choosing segregation or integration? The extent and effects of ethnic segregation in Dutch cities, *Education and Urban Society*, 38(2), pp. 228–247.
- 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), pp. 379–391.
- Kohen, D. E., Leventhal, T., Dahinten, V. S. and McIntosh, C. N. (2008) Neighborhood disadvantage: pathways of effects for young children, *Child Development*, 79(1), pp. 156–169.
- Kozol, J. (1991) *Savage Inequalities: Children in America's Schools*. New York: Crown Publishers.
- Kuyper, H., Lubbers, M. J. and Werf, M. P. C. van der (2003) *VOCL'99: technisch rapport* [VOCL'99: technical report]. Groningen Institute for Educational Research.
- Ladd, H. F. and Fiske, E. B. (2009) *The Dutch experience with weighted student funding: some lessons for the US*. Working paper, Duke University (<http://pubpol.duke.edu/research/papers/SAN09-03.pdf>; accessed 22 October 2009).
- Ladd, H. F., Fiske, E. B. and Ruijs, N. (2009) *Parental choice in the Netherlands: growing concerns about segregation*. Paper prepared for the *National Conference on School Choice*, Vanderbilt University, October (http://ncspe.org/publications_files/OP%20182.pdf; accessed 21 February 2010).
- Leventhal, T. and Brooks-Gunn, J. (2000) The neighborhoods they live in: the effects of neighborhood residence on child and adolescent outcomes, *Psychological Bulletin*, 126(2), pp. 309–337.
- Lupton, R. (2004) *Schools in disadvantaged areas: recognising context and raising performance*. CASE Paper No. 76, London School of Economics.
- Musterd, S. (2005) Social and ethnic segregation in Europe: levels, causes and effects, *Journal of Urban Affairs*, 27(3), pp. 331–348.
- Noreisch, K. (2007) Choice as rule, exception and coincidence: parents' understandings of catchment areas in Berlin, *Urban Studies*, 44(7), pp. 1307–1328.
- Oberti, M. (2007) Social and school differentiation in urban space: inequalities and local configurations, *Environment and Planning A*, 39(1), pp. 208–227.
- Oberwittler, D. (2007) The effects of neighbourhood poverty on adolescent problem behaviours: a multi-level analysis differentiated by gender and ethnicity, *Housing Studies*, 22(5), pp. 781–803.
- Plybon, L. E. and Kliever, W. (2001) Neighborhood types and externalizing behavior in urban school-age children: tests of direct, mediated, and moderated effects, *Journal of Child and Family Studies*, 10(4), pp. 419–437.
- Pong, S. and Hao, L. (2007) Neighborhood and school factors in the school performance of immigrants' children, *International Migration Review*, 41(1), pp. 206–241.
- Rasbash, J., Steele, F., Browne, W. J. and Goldstein, H. (2009) *A user's guide to MLwiN, version 2.10*. Centre for Multilevel Modelling, University of Bristol.
- Raudenbush, S. W. and Willms, J. D. (1995) The estimation of school effects, *Journal of Educational and Behavioral Statistics*, 20(4), pp. 307–335.
- Rumberger, R. and Palardy, G. (2005) Does segregation still matter? The impact of student composition on academic achievement in high school, *The Teachers College Record*, 107(9), pp. 1999–2045.
- Sampson, R. J. and Sharkey, P. (2008) Neighborhood selection and the social reproduction of concentrated racial inequality, *Demography*, 45(1), pp. 1–29.
- Sampson, R. J., Morenoff, J. D. and Gannon-Rowley, T. (2002) Assessing 'neighborhood effects': social processes and new directions in research, *Annual Review of Sociology*, 28, pp. 443–478.
- Sykes, B. and Kuyper, H. (2009) Neighbourhood effects on youth educational achievement in the Netherlands: can effects be identified and do they vary by student background characteristics?, *Environment and Planning A*, 41(10), pp. 2417–2436.
- Szulkin, R. and Jonsson, J. O. (2007) *Ethnic segregation and educational outcomes in Swedish comprehensive schools: a multilevel analysis*. Working Paper No. 2, Linnaeus Centre for Integration Studies, Stockholm University.
- Thrupp, M. and Lupton, R. (2006) Taking school contexts more seriously: the social justice challenge, *British Journal of Educational Studies*, 54(3), pp. 308–328.

- Thrupp, M., Lauder, H. and Robinson, T. (2002) School composition and peer effects, *International Journal of Educational Research*, 37(5), pp. 483–504.
- Veenstra, R. and Kuyper, H. (2004) Effective students and families: the importance of individual characteristics for achievement in high school, *Educational Research and Evaluation*, 10(1), pp. 41–70.
- Zijsling, D. H., Kuyper, H., Lubbers, M. J. and Werf, M. P. C. van der (2005) *VOCL'99-3: technisch rapport* [VOCL'99-3: technical report]. Groningen Institute for Educational Research.