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Navigating Institutions: Parents' Knowledge of the Educational System and Students' Success in Education

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Abstract

This study investigates whether families navigate educational institutions more successfully if they have a higher knowledge of the pathways in the educational system that are available to their children. We also study whether this kind of knowledge mediates secondary effects of social origin, i.e. differences in educational pathways once achievement differences between children are accounted for. The role of parents' knowledge is consistent with various sociological theories concerning educational inequality. Knowledge can affect families' ability to make rational choices for education but it can also be understood as a form of cultural capital. We use longitudinal student cohort data from the Netherlands combined with individual-level register data on educational attainment to study the importance of knowledge for short-term outcomes (up- and downward transitions in secondary education as well as track placement) and final educational attainment. Our results show that parents' knowledge is a significant predictor of educational success net of parents' education, socio-demographic characteristics, and demonstrated ability. If we apply a stricter test to the measure, however, we can see that knowledge matters for downward transitions and obtaining a tertiary degree but that the effect is negligible for upward transitions and track placement if other mechanisms such as cultural capital and aspirations are considered. Further, we conclude that knowledge matters especially for transitions in the educational system that require a move to a new and unknown school environment such as post-secondary or tertiary education. The study shows that knowledge is one useful avenue to investigate when we are confronted with the question why social disparities in educational decision-making arise.

Introduction

Inequality of opportunity in education is a common phenomenon in most societies: students from lower social origin are less likely to obtain high levels of education than students from higher socio-economic status (SES) families. Moreover, sociological research has demonstrated that inequalities cannot be fully explained by SES differences in academic achievement (Boudon, 1974; Jackson, 2013). Instead, *secondary effects* exist on top of achievement-related inequality (i.e. *primary effects*). Secondary effects, typically accounting for around 40 per cent of total inequality in education (Jackson and Jonsson, 2013), have been explained by the different educational decisions made by students of

different socio-economic backgrounds. Family resources that are related to SES contribute to these decisions and potentially explain secondary effects. However, these intermediary mechanisms are not yet fully understood as secondary effects have mostly been studied indirectly by looking at residual SES effects on educational attainment once differences in academic achievement are accounted for (e.g. Kloosterman *et al.*, 2009; Tieben, de Graaf and de Graaf, 2010; Jackson, 2013; Bukodi, Erikson and Goldthorpe, 2014).

We contribute to the existing literature by directly studying a particular theoretical mechanism that might explain the different educational choices of students from different social origin: parents' knowledge of the educational system. We investigate if families navigate educational institutions more successfully if they know more about the opportunities that are available to their children. We also study whether this kind of knowledge can explain SES differences in educational pathways. Knowledge of parents is potentially an important mechanism for policymakers. If parents' knowledge matters for secondary effects, interventions that remedy knowledge deficits can be an adequate way of addressing educational inequalities.

The role of parents' knowledge for educational success is consistent with various sociological theories concerning educational inequality. An important theoretical perspective in the field is based on rational decision-making (Becker, 1964; Breen and Goldthorpe, 1997). Thereby, varying levels of knowledge affect families' ability to make optimal choices for education. However, parents' knowledge can also be understood as a form of cultural capital. Middle class families navigate institutions more successfully than families with lower social status because they are more familiar with how those institutions work (Bourdieu and Passeron, 1977; Lareau, 2011).

The navigation of educational institutions is especially relevant for educational attainment in complex educational systems that require choices between different school tracks. Therefore, we focus on the Netherlands where secondary school students are faced with a large variety of tracks and educational opportunities. Previous research has shown that in the Netherlands secondary effects are relatively small at the transition to secondary education but quite large in subsequent transitions—the phase in the educational career that we study (Büchner and Van der Velden, 2013; Jackson and Jonsson, 2013). We investigate short- and long-term educational outcomes after the transition to secondary school by looking at track placement and transitions within secondary education as well as final educational attainment. Next to introducing parents' knowledge as a mechanism for secondary effects we also account for more commonly studied factors such as social and cultural capital,[1] parental involvement as well as educational aspirations. We test whether knowledge has an independent influence on educational outcomes once we consider those alternative explanations for secondary effects.

It needs to be stated at this point that our ambitions are rather descriptive. We do not study information or knowledge in an experimental setting but instead look at associations over part of the school career. Nevertheless, we believe, that a descriptive assessment of the role of parental knowledge is useful as little is known about its role especially in conjunction with other explanations of inequality. We combine Dutch school cohort data with a rich set of family level explanatory variables and register data on further school careers. Thereby, we have extraordinarily detailed data at our disposal which offer a unique possibility of studying parents' knowledge and its long-term consequences for educational outcomes.

Theoretical Framework

Parents' Knowledge Enables Rational Choices

Parents' knowledge can be understood as part of rational choice theory. The application of rational choice to education goes back to economist Gary Becker who describes education as investment in human capital (Becker, 1964; Becker and Chiswick, 1966). By means of cost-benefit calculations, individuals decide whether obtaining more education will pay off given costs, benefits and probabilities of success. In the last decades of the 20th century, rational action theories also became popular in sociology (Coleman, 1986; Breen and Goldthorpe, 1997; Goldthorpe, 1998). In pure rational choice settings which assume full information, differences in educational choices across social groups stem from differential pay-offs to education. However, information is a prerequisite for the rational calculation of pay-offs. Therefore, the role of information or knowledge is especially compatible with theories of bounded rationality. When cognitive demands on rational calculations are high, individuals resort to intuition instead of reasoning (Kahneman, 2003). On the other hand, information helps to reduce the costs, effort, and time needed to make rational decisions. Likely, differences in information across socio-economic groups prevent some individuals from making fully rational decisions even if returns to education would be similar (Stocke, 2007). Low SES students experience more noise and contradicting information in their surroundings about the

opportunities available to them. This lack of clear information lowers their commitment to enrolling in longer and riskier educational trajectories (Morgan, 2005). This makes knowledge differentials a promising avenue for research on social inequalities in education.

There are a number of studies that investigate the role of information, most often in the context of returns to higher education—with mixed results. While Webbink and Hartog (2004) find that in general students are capable of predicting returns to college education, Grodsky and Jones (2007) demonstrate that low SES families have less precise information on college costs than high SES families. In a field experiment, Barone *et al.* (2017) show that an increase in information decreased misperceptions of returns but did not change enrolment behaviour. They also find that low SES students more often enrol in vocational programmes instead of weak tertiary programmes if they are given more information on returns whereas high SES students choose stronger tertiary fields (Abbiati *et al.*, 2017). Somewhat in contrast, Ehlert *et al.* (2017) conclude that a correction of biased knowledge leads low SES students to enrol in college more often. Next to these studies on returns to higher education, there has been some experimental research on the role of information earlier in the school career. Barone *et al.* (2018) find that information biases divert low SES students away from prestigious academic tracks. Hastings and Weinstein (2008) show that information on school achievement standards helps parents to choose better performing schools for their children. Finally, there is evidence that providing information on high school graduation rates improves the entrance into high-performing schools, although comparatively advantaged children use this information more than disadvantaged children (Corcoran *et al.*, 2018). Next to this experimental evidence, there is research on the Dutch context by Tolsma, Need and De Jong (2010) who show that subjective success probabilities of students that are dependent on information explain educational differentials better than ability differences.

The form of knowledge that we study differs from the conceptualization in most previous research. We do not directly induce information in an intervention as many field experiments have done. Rather, we observe knowledge as a form of processed information. Hence, we do not study information in a controlled experimental setting and we do not distinguish between the causes why families lack knowledge. An advantage of our approach is that we observe processed information—we can be sure that the information parents received about the educational system at one point has been processed and understood by them. Moreover, we focus on knowledge of options and pathways in the educational system, which is different from information on returns to education that has been studied in previous work. Even if knowledge in our sense differs from the information that is typically studied within the rational choice framework, we argue that parents' knowledge can be understood as part of rational choice explanations of educational decision-making. Most previous studies have looked at educational systems with a simple structure, often without different tracks in secondary education. In those systems, returns to education might be the most important feature for families when making decisions about education. However, in more complex systems with various pathways, families cannot make optimal choices if they do not know through which pathways higher education can be reached. Therefore, the knowledge of parents concerning options in the educational system will help to choose more promising pathways especially in those countries.[2]

Parents' Knowledge as Form of Cultural Capital

In addition, our conceptualization of knowledge can also be understood as part of cultural reproduction theory (Bourdieu and Passeron, 1977; Bourdieu, 1984). Differences in students' educational outcomes stem from differences in family cultural capital. Cultural capital works as a mechanism of social closure. Children from high status families receive cultural resources through their upbringing that are more compatible with the school environment than the resources of low SES children (Lareau, 2011). Knowledge is one important resource here but not in the form of conscious information about options and returns but rather as implicit cultural knowledge. In later work, Bourdieu also refers to cultural capital more generally as "information capital" (Bourdieu and Wacquant, 1992). Parents' of high SES students are more familiar with the educational system as they spent more time in it themselves. They have more knowledge of the institutional complexities and can better plan longer-term trajectories for their children (Erikson and Jonsson, 1996: p. 22).

However, while in Bourdieu's original theory, parental SES and cultural resources are often equated, empirical research shows that cultural capital can also be prevalent in low SES families and might even be a mechanism for social upward mobility (DiMaggio, 1982; De Graaf, De Graaf and Kraaykamp, 2000; Sullivan, 2001). Therefore, it is important to find direct measures for the cultural capital mechanism instead of relying on SES as a proxy. Parents' knowledge of the educational system is

such a direct measure, in addition to indicators of a family's school-enhancing climate.

Hypotheses

Based on the theoretical arguments outlined above, we make the following predictions for the association between parents' knowledge and educational outcomes. Thereby, we study four different short- and long-term educational outcomes:

H1: Parents' knowledge of the educational system is positively associated with upward transitions in secondary education (1), with higher track placement in 11th grade (2) and with obtaining a tertiary degree (3) net of children's demonstrated ability. It is negatively associated with downward transitions in secondary education (4) net of children's demonstrated ability.

H2: Parents' knowledge mediates part of the association between SES and upward and downward transitions in secondary education, track placement and on obtaining a higher education degree net of children's demonstrated ability.

Accounting for Other Explanations of Educational Inequality

There are several other theoretical mechanisms that have been discussed as proponents for increasing educational inequalities net of achievement differences. We control for the most often proposed explanations to assess the independent contribution of parents' knowledge more thoroughly.

The most prominent is cultural capital which has already been discussed above. Even if we consider parents' knowledge as a kind of cultural capital, there are other—more often studied—forms of cultural capital that we want to consider. Those are cultural activities (e.g. visits to museums and concerts), reading environment (e.g. possession of books and reading activities) as well as language skills. While we subsume language skills under primary effects, we want to account for the reading environment at home as it seems to be particularly important for educational outcomes (De Graaf, 1986; De Graaf, De Graaf and Kraaykamp, 2000; Sullivan, 2001). Lareau (2011, 2015) extends Bourdieu's version of cultural reproduction theory by showing how parental involvement in the school context differs widely between socio-economic groups. Middle class parents exhibit a high level of involvement which is more compatible with the schools' institutional culture and thereby set their children on a path of success while working class parents' involvement is less compatible and leads to less favourable outcomes. This version of cultural reproduction is strongly linked to a further explanation for social class differences in education: social capital (Coleman, 1988). Social capital theory emphasizes the role of networks around schools among parents and children (Coleman, 1988; Carbonaro, 1998; Morgan and Todd, 2009). Through this so-called intergenerational closure, families can make use of collective resources that foster the school success of their children.

Next to cultural and social capital, educational aspirations play a role in the educational attainment process (Sewell and Shah, 1968; Sewell, Haller and Portes, 1969; Dumais, 2002). Status attainment theory argues that aspirations of significant others (e.g. parents and teachers) differ across social classes and lead to educational inequalities. Educational aspirations also feature in rational choice approaches, including Morgan's (2005) work on differences in aspirations and beliefs across social and racial groups and Goldthorpe's (1996) theory of relative risk aversion.

Context, Data, and Methods

The Educational System of the Netherlands

In the Netherlands, children are selected into different school tracks at the age of 12 (see Figure 1).

The cohort that we are studying entered secondary education in 1993 and had the choice between four main tracks: preparatory vocational education (*vbo*), lower general education (*mavo*), intermediate general education (*havo*), and preparatory university education (*vwo*). These tracks provide different curricula and vary in their academic difficulty. Furthermore, the completion of each secondary school track has consequences for the further opportunities available to a student. From *vbo* and *mavo*, the standard pathway leads to intermediate vocational education (*mbo*), although a transition to *havo* can be made. *Vbo* offers more vocationally oriented content whereas *mavo* provides basic general training. The curriculum in *havo* and *vwo* is more academic. Graduates from *havo* have direct access to universities of applied sciences (*hbo*). *Vwo* offers a pre-university curriculum and graduates can directly access research universities. The tracks also differ in length with *vbo* and *mavo* taking 4 years, *havo* 5 years, and *vwo* 6 years.

Initial placement in tracks occurs according to teacher recommendation which is largely based on the results of a standardized test taken by most students in the Netherlands in the last year of primary school. Even with this standardized procedure, SES bias in teacher

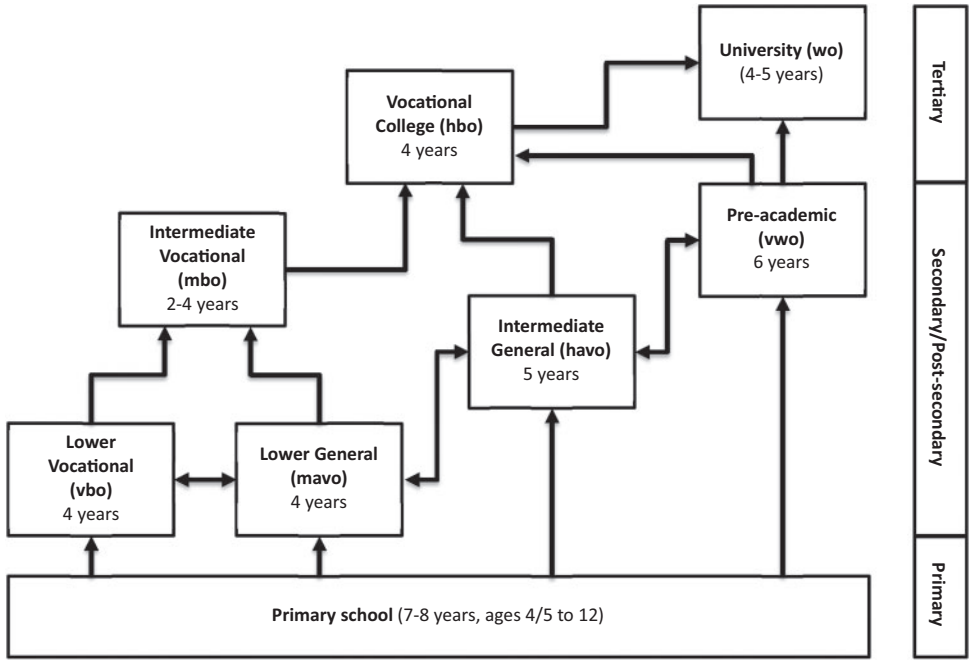

Figure 1. The Dutch Educational System (1993) including possibilities of transitions between tracks

recommendations remains after accounting for test results (Timmermans *et al.*, 2018). After initial placement, there are still opportunities for mobility between tracks during secondary education. These intra-secondary transitions are less standardized and usually initiated by parents and teachers when track placement seems a poor match for a student. Thereby, these unstandardized transitions leave room for parents' wishes for a different educational attainment of their child. Nevertheless, the choice of track early in secondary education is quite consequential for final educational attainment.

Data and Sample

We use data from the longitudinal Dutch student cohort study *Voortgezet Onderwijs Cohort Leerlingen* (VOCL), cohort 1993–2003 (Centraal Bureau voor de Statistiek, 1965) which followed students from seventh grade (first grade of Dutch secondary education) until high school graduation. Data were collected from students and parents. We complement these data with individual-level information on higher education degrees from the register-based *System of Social-statistical Datasets* (SSD) provided by *Statistics Netherlands* (CBS). The full sample consists of 20,059 students.

To ensure that the individual-level trajectories in our sample are comparable, we exclude students who experienced grade retention between seventh and ninth grade and students who were born abroad. After these selections, we are left with a sample of 17,346 students. As we are confronted with a substantial share of missing data[3] on single variables but do not want to discard valuable information, we use multiple imputation to complete all independent variables (imputation by chained equations with 20 iterations). We use our dependent variables to specify the imputation model but do not include imputed values of them in our main analyses. This leads to 511 missing cases for upward transitions, 151 for downward transitions, and 325 for track placement.[4] More detailed information on the imputation model can be found in Supplementary Appendix SA.

We investigate four outcomes for which we rely on different sub-samples. Upward transitions in secondary education are studied by looking at students who were in the three lower tracks *vbo*, *mavo*, and *havo* in ninth grade and thus can make an upward transition (13,544 students). For the study of downward transitions, we select all students for which we have this information (17,021 students) as students in *vbo*, the lowest track, can make downward transitions by leaving education. For track placement in 11th grade and final educational attainment, also all students are selected for which the dependent variable is not missing. These are 17,021 students for track placement and 17,346 students for obtaining a tertiary degree.

Measurement of Variables

Summary statistics and descriptions of all variables can be found in Table 1. As the calculation of sample standard deviations is not straightforward with multiple imputation data, we only provide means.

Our main independent variable is parents' knowledge of the educational system. It was evaluated by a short test about the possibilities certain diplomas offer to students (e.g. "Is it possible to go to university with a *havo* diploma?"). A grid with 24 dichotomous items was presented to parents.[5] We use the standardized sum score (Cronbach's alpha = 0.75) of these 24 items as our measure of knowledge.[6] The second predictor of interest is the SES of families which we operationalize as the highest education of both parents combined.

Next to parents' knowledge, we measure four other factors that contribute to secondary effects of social origin. The reading component of parents' cultural capital is proxied by the number of books in the home. Parents' involvement in the child's school life was assessed by three questions on how much parents talked to their children about what has been taught in school, about incidents at school, and about children's performance. Moreover, we include intergenerational closure as a measure for school-related social capital. Parents were asked how many other parents they knew in their child's school class. Finally, parents' aspirations for the education of their child are measured by the highest educational degree they wished for their child to obtain. Table 1 shows that the average levels of knowledge, cultural capital, involvement, closure, aspirations as well as SES become higher with higher track placement.

Furthermore, we include Cito test scores as a measure of children's performance to capture primary effects of social background as we want to study effects of social background net of achievement-related differences. The Cito test is a standardized test which is used in the Dutch educational system to determine the allocation of students to the different secondary school tracks. It contains questions on language, mathematics, and information processing and is administered to a large share of Dutch students in sixth grade, the last year of primary school. An adapted version was presented to VOCL students in seventh grade. This test contained 20 items that were combined into a scale by the survey administrators (Cronbach's alpha = 0.91; Van der Werf, Lubbers and Kuyper, 1999).

We also control for a number of other variables. The gender of children is added as boys and girls differ in their Cito performance as well as in track enrolment and graduation rates. An indicator of the child's migration background is added as immigrant groups differ in their average educational attainment and we can also expect different patterns of knowledge of the educational system. To assess family processes and resource dilution, we add a measure of the number of children growing up in the family's home. Finally, an indicator of the track of a student in ninth grade ensures comparability of upward and downward transitions in subsequent years as in some tracks the probability of transitions is higher than in others.[7]

We study the effect of parents' knowledge on four outcomes. Upward transitions in secondary education measure if a student moves from a lower to a higher track during their first secondary school trajectory or after obtaining a diploma from the lower track. We take upward transitions into account that occur within 4 years after the initial measurement of parents' knowledge. As these transitions are usually "ambitious" choices, students often accept delays in terms of longer schooling time in secondary education to achieve a higher diploma. This is especially the case when students obtain the lower track diploma first and then move on to a higher track as this implies repeating a grade in the higher track. An example could be a student who is enrolled in *mavo* in ninth grade (when parents' knowledge is measured), obtains a *mavo* diploma after 10th grade and afterwards decides to continue her education in *havo*. Due to the more difficult curriculum, the student needs to enter the 10th grade of *havo* instead of moving to 11th grade directly and will, therefore, graduate from *havo* a year later than students who have followed the *havo* trajectory from the beginning. We take these delays into account by allowing for a 4-year period of occurrence for transitions after the ninth grade measurement.

Downward transitions are instances in which a student moves from a higher to a lower track after ninth grade and, thereby, gives up on obtaining the higher level diploma or leaves school before she completes the standard trajectory predicted by track placement. We measure whether a downward transition occurs within 2 years after ninth grade. Here, an extended time period is not necessary as downward transitions do not lead to delays but rather occur if grade retention in the higher track is not desired. For both up- and downward transitions, we are only interested in occurrence and not timing or frequency.

Third, we look at track placement in 11th grade, 2 years after the measurement of parents' knowledge. We measure whether a student is enrolled in one of the two highest tracks, *havo* or *vwo*, in 11th grade as opposed to being enrolled in *vbo*, *mavo*, or *mbo*. This is an indicator of whether the student is on the way of reaching higher education.

Table 1. Descriptive statistics overall and by ninth grade track enrolment (imputed sample)

	vbo (mean)	*mavo* (mean)	*havo* (mean)	*vwo* (mean)	overall (mean)	Time of measurement	Description
Independent variables							
Parents' education						Seventh grade 1993	Originally six categories obtained from the parent questionnaire are recoded into three levels (i) lower secondary education or less, (ii) upper secondary education and (iii) tertiary education.
Lower secondary or less	0.49	0.28	0.17	0.10	0.31		
Upper secondary	0.44	0.52	0.48	0.37	0.46		
Tertiary	0.07	0.20	0.36	0.53	0.24		
Parents' knowledge (*z*-score)	−0.53	0.04	0.34	0.43	−0.05	Ninth grade 1995	Sum score calculated from 24 questions on knowledge of the educational system (correct = 1, wrong = 0) asked to parent. Cronbach's alpha is 0.75. Standardized for sample.
Books at home (logged at base 2)	4.73	5.55	6.16	6.77	5.58	Ninth grade 1995	Exact number of books for adults (excluding children, youth, and comic books) at home reported by parent. Original values of the variable ranged from zero to 980. As the variable is highly right skewed, a log with base 2 is taken (0 is recoded to 1 before taking the log to avoid missing values on the logged variable).
Parents' involvement (*z*-score)	−0.09	−0.03	0.05	0.07	−0.02	Ninth grade 1995	Scale of three items (Cronbach's alpha: 0.81): talking to children about what has been taught in school, talking about incidents at school, and talking about children's performance. Standardized for sample.
Intergenerational closure (*z*-score)	−0.32	0.07	0.11	0.25	−0.03	Ninth grade 1995	Number of other parents known in child's school class reported by parent. Original range was from 0 to "10 or more". Variable is treated as continuous and standardized for sample.
Parents' aspirations (*z*-score)	−0.66	0.03	0.33	0.68	−0.05	Ninth grade 1995	Highest education that parents aspire for child. Original range was from *ivbo* (the lowest sub-level of *vbo*) to university. Variable is treated as continuous and standardized for sample.
Cito test (*z*-score)	−0.85	−0.01	0.62	1.11	−0.01	Seventh grade 1993	For the VOCL study, a shorter version (20 items) of the Cito test was completed by the sampled students. The scale has a Cronbach's alpha of 0.91 and is standardized for the sample.

(continued)

Table 1. (Continued)

	vbo (mean)	*mavo* (mean)	*havo* (mean)	*vwo* (mean)	overall (mean)	Time of measurement	Description
Female (ref = male)	0.42	0.53	0.54	0.54	0.49	Seventh grade 1993	Gender of child.
Migration background						Seventh grade 1993	Calculated from information on birth country of mother and father obtained from SSD register data. Migration background is present if at least one of the parents was born in the respective country. Children who were born abroad themselves are not part of our analysis.
None	0.85	0.89	0.89	0.88	0.87		
Morocco	0.02	0.01	0.01	0.004	0.01		
Suriname/ Antilles	0.03	0.02	0.02	0.02	0.02		
Turkey	0.03	0.02	0.01	0.01	0.02		
Other	0.07	0.06	0.08	0.09	0.07		
Children in household	2.55	2.62	2.67	2.62	2.60	Seventh grade 1993	Number of children living in household with target child indicated by parent. Values range from 0 to "6 or more".
Dependent variables							
Upward transition	0.01	0.14	0.09		0.08	Ninth grade + 4 years	Variable is 1 (and 0 otherwise) if an upward transition occurred within 4 years after ninth grade without taking into account the timing of the transition and without looking at subsequent downward transitions.
Downward transition	0.42	0.16	0.14	0.25	0.27	Ninth grade +2 years	Variable is 1 (and 0 otherwise) if a downward transition occurred within 2 years after ninth grade without taking into account the timing of the transition and without looking at subsequent upward transitions.
Havo/vwo in 11th grade	0.001	0.16	0.86	0.97	0.36	Ninth grade +2 years	Variable is 1 if student is enrolled in *havo* or *vwo* 2 years after ninth grade. Variable is 0 if student is enrolled in *vbo*, *mavo*, or *mbo* or has left education
Tertiary degree	0.93	0.71	0.41	0.23	0.66	Up to 2014	Obtained from register data. The variable has three categories: no tertiary degree, degree from a vocational college (*hbo*), and university degree. As we can assume that all degrees are registered, missing in register data is coded as not having a degree.
None	0.06	0.25	0.43	0.28	0.21		
Voc. college (*hbo*)	0.01	0.05	0.17	0.49	0.13		
University	0.93	0.71	0.41	0.23	0.66		
Observations	6,251	5,267	2,577	3,251	17,346		Number of observations for the imputed data set.

Note: The number of observations varies for the dependent variables as we do not use the imputed versions of them in the analyses.
Source: VOCL 1993 + SSD register data, own calculations. Sample means are displayed.

Finally, we study long-term effects of parental knowledge by looking at final educational attainment of children which is measured by whether a student obtains a university degree, a degree from a university of applied sciences or no tertiary degree. We follow students in the registers until 2015 when they were about 32 years old and most of them will have finished full-time education. We study final degrees instead of higher education

enrolment as they portray final educational inequality and thereby show long-term consequences of parental knowledge. In addition, the decision is based on data availability. It would have been interesting to directly look at the transition to higher education as this transition is closely related to an important educational decision. However, we lack reliable data for higher education enrolment. We are aware that obtaining a degree is dependent on two decisions: the decision to enrol in higher education and the decision not to drop out. This should be kept in mind when interpreting our results.

Empirical Strategy

For our three dichotomous dependent variables—upward transitions, downward transitions, and track placement—we employ binary logistic regression. We use ordinal logistic regression to deal with our three-category dependent variable for tertiary degrees. If dependent variables are relatively skewed, logistic regression offers better estimates than linear probability models (Long, 1997). That is especially true for upward transitions and to a lesser extent for the other three dependent variables. However, we are aware of criticisms concerning the non-linear model. As we are among other things interested in mediation effects, we employ KHB-modelling to adjust the coefficients for scaling effects and to correctly estimate the size of the mediation (Karlson, Holm and Breen, 2012; Breen, Karlson and Holm, 2013). In all analyses, cluster robust standard errors are applied that account for the nesting of students in different schools.

In order to assess H1, we estimate (ordinal) logistic regression models where we use parents' knowledge as a predictor next to parents' education. In a second set of models, we add the four alternative "explanations" as control variables. We assess whether there is an association between knowledge and outcomes and whether this relationship persists once we control for alternative factors. To address H2 on mediation, we turn to KHB decompositions of total, direct, and indirect effects of parents' education using parents' knowledge as mediator (Breen *et al.*, 2013). Again, we apply this decomposition once without and once with controls for the alternative explanations. As we look at secondary effects, all models control for Cito test scores. Furthermore, all models contain controls for gender, migration background, number of children in the household and high school track in ninth grade.

Next to these main analyses, we carry out several additional analyses and robustness checks. First, we look at transitions in secondary education separately by track in ninth grade. As transition probabilities and opportunities differ vastly by track, it is interesting to investigate whether knowledge plays a different role for students of different tracks. We report the results shortly in the results section and show the full regression table in Supplementary Appendix SD. Second, we look at whether performance moderates the effect of knowledge. If returns to education were negative for some students, more knowledge would only encourage the students with high performance to pursue education. The results of this analysis can be found in Supplementary Appendix SE. Third, we vary our measure of knowledge. In Supplementary Appendix SF, we report an analysis where we consider knowledge about high tracks (*havo*, *vwo*) and knowledge about low tracks (*vbo*, *mavo*) separately. We are interested whether specific knowledge helps some students more than others. We also carry out a robustness check in which we use only part of the items in the knowledge test as described in endnote 6. Finally, we redo our analysis using only complete cases instead of imputed data. The last two analyses do yield largely the same results and are available upon request.

Results

Does Parents' Knowledge Matter for Educational Outcomes?

Table 2 presents the results of the logistic regression models for all four dependent variables.

Model 1 shows the associations between parents' education and the four outcome variables without controlling for knowledge or any of the other four theoretical explanations of secondary effects. Parents' education is positively related to making upward transitions, to track placement, and to receiving a tertiary degree net of all control variables including performance. Parents' education is negatively related to downward transitions. These associations between parental SES and educational outcomes are quite strong, given that we control for primary effects in the form of Cito performance and further demographic characteristics. For example, having parents with upper secondary education instead of less increases the odds of a tertiary degree by 54 per cent,[8] having parents with a tertiary degree even by 169 per cent. From Model 1, we can infer that substantial secondary effects of social origin exist.

In Model 2, we see that parents' knowledge is positively associated with upward transitions and obtaining a tertiary degree and negatively related to downward transitions. This relationship is present even if parents'

Table 2. Logistic regression models predicting the four outcome variables

	Upward transition				Downward transition				*havo/vwo* 11th grade				Tertiary degree			
	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4
Parents' education																
Upper secondary	0.40***	0.35***	0.26**	0.24**	−0.32***	−0.26***	−0.22***	−0.19**	0.35***	0.32***	0.29***	0.27***	0.43***	0.37***	0.34***	0.31***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)	(0.06)	(0.06)	(0.03)	(0.04)	(0.04)	(0.04)
Tertiary	1.05***	0.97***	0.73***	0.71***	−0.79***	−0.69***	−0.57***	−0.53***	0.88***	0.83***	0.73***	0.70***	0.99***	0.89***	0.79***	0.75***
	(0.15)	(0.16)	(0.15)	(0.16)	(0.07)	(0.07)	(0.06)	(0.06)	(0.09)	(0.10)	(0.10)	(0.11)	(0.07)	(0.07)	(0.09)	(0.08)
Knowledge (*z*-score)		0.12*		0.05		−0.14***		−0.07***		0.09		0.06		0.15***		0.10***
		(0.05)		(0.05)		(0.02)		(0.01)		(0.05)		(0.05)		(0.02)		(0.02)
Parental aspirations (*z*-score)			0.20***	0.19***			−0.36***	−0.35***			0.13**	0.13**			0.30***	0.29***
			(0.04)	(0.04)			(0.04)	(0.04)			(0.05)	(0.04)			(0.04)	(0.04)
Books at home (logged base 2)			0.12***	0.12***			−0.02*	−0.01			0.05**	0.05**			0.03**	0.02*
			(0.02)	(0.02)			(0.01)	(0.01)			(0.02)	(0.02)			(0.01)	(0.01)
Parental involvement (*z*-score)			0.00	0.00			0.01	0.01			−0.00	−0.01			0.01	0.01
			(0.04)	(0.04)			(0.01)	(0.01)			(0.04)	(0.04)			(0.02)	(0.02)
Intergenerational closure (*z*-score)			0.05	0.05			−0.10***	−0.10***			−0.00	−0.00			0.05**	0.05*
			(0.03)	(0.03)			(0.01)	(0.01)			(0.03)	(0.03)			(0.02)	(0.02)
Constant	−4.76***	−4.68***	−5.19***	−5.15***	−0.53***	−0.64***	−0.71***	−0.78***	−7.37***	−7.31***	−7.53***	−7.49***				
	(0.30)	(0.31)	(0.33)	(0.35)	(0.17)	(0.18)	(0.20)	(0.20)	(0.43)	(0.44)	(0.44)	(0.45)				
Constant cut 1													2.73***	2.62***	2.70***	2.62***
													(0.35)	(0.35)	(0.36)	(0.35)
Constant cut 2													4.53***	4.43***	4.52***	4.44***
													(0.24)	(0.24)	(0.25)	(0.24)
Observations	13,544	13,544	13,544	13,544	17,021	17,021	17,021	17,021	17,021	17,021	17,021	17,021	17,346	17,346	17,346	17,346
Pseudo R^2	0.18	0.18	0.19	0.19	0.07	0.07	0.09	0.09	0.69	0.69	0.69	0.69	0.25	0.25	0.26	0.26

Notes: All models also contain controls for track in ninth grade, gender, migration background, number of children in household, and Cito scores. Full tables with all coefficients can be found in Supplementary Appendix SC. Coefficients are log odds. Standard errors in parentheses.

Significance: $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.

Source: VOCL 1993 cohort + SSD register data, own calculations.

education, performance, and the control variables are taken into account. More in detail, if knowledge increases by one standard deviation, children have 13 per cent higher odds of making an upward transition in secondary education. A standard deviation higher on knowledge leads to 13 per cent lower odds of moving down a track. Finally, a one standard deviation increase in knowledge leads to 16 per cent higher odds of obtaining a university or *hbo* degree versus not obtaining a degree. The relationship between parents' knowledge and track placement in 11th grade is only significant at the 0.1 level but in tendency positive with 9 per cent higher odds of being in a high track for a standard deviation increase in knowledge. Also in a robustness check using list-wise deletion, this association was significant, so we tend to conclude that an association is present.

Model 3 shows the association between parents' education and educational outcomes if we account for the other factors that contribute to secondary effects, books at home, parents' involvement, intergenerational closure, and parents' aspirations. Parental aspirations and books at home are positively related to upward transitions, track placement and having a tertiary degree and negatively related to downward transitions. Intergenerational closure is related negatively to downward transitions and positively to a tertiary degree. Parental involvement does not seem to play a role for the outcomes.

Finally, Model 4 assesses the contribution of parents' knowledge if we control for the four other influence factors. For upward transitions and track placement, we see that the coefficient for parents' knowledge is now insignificant.[9] For downward transitions, the association between knowledge and outcome persists. When controlling for alternative explanations an increase in knowledge by one standard deviation reduces the odds of making a downward transition by 7 per cent. Also for obtaining a tertiary degree, the coefficient for knowledge is still positive. A standard deviation increase in knowledge increases the odds of a tertiary degree by 11 per cent. The answer to the question whether the association with knowledge persists when we account for alternative explanations is mixed. While knowledge is not clearly related to upward transitions and track placement, the coefficient is significant for downward transitions, and having a tertiary degree.

A weak version of H1 is confirmed for all four dependent variables: knowledge matters for educational outcomes. However, if we apply a stricter test by controlling for alternative explanations, the relationship only persists for downward transitions and tertiary degrees. For upward transitions and track placement in 11th grade the association with knowledge disappears if other resources of the family such as aspirations and other forms of cultural capital are considered.

Separate Analyses of Transitions by Track

As transitions within secondary education are not standard outcomes in research on the effect of parental background on educational outcomes, we will explore the relationship a bit more in detail. The different tracks present very different opportunities and, therefore, transitions to a higher level are of different importance and likelihood for students of each track. We present analyses where we consider upward and downward transitions from each track separately in Table 3, the full results can be found in Supplementary Appendix SD.

Concerning upward transitions, we see that the relationship with knowledge is especially strong for making upward transitions from *vbo*. Upward transitions from *vbo* are rare but if they happen, knowledge is highly associated with them. For *mavo*, the effect is similar to the overall effect shown in Table 2, also here knowledge does matter. For *havo* students, knowledge does not contribute to upward transitions. It seems that knowledge is particularly important if a transition from a non-academic track can be made to *havo* or *vwo* which give access to tertiary education. However, in all these cases, the relationship disappears if we consider the other explanations.

For downward transitions, we see that the result for *vbo* students is similar to the overall results in Table 2. For *mavo* students, knowledge shows the strongest association. For students from *havo* and *vwo* knowledge does not have an effect. Knowledge seems to protect students especially from leaving education after *vbo* or *mavo* or moving to the lowest track. Moving from one of the academic tracks to the lower tracks is not prevented by knowledge. One reason for this could be that in instances where student performance is too low for an academic track, it can be reasonable to move down to a non-academic option instead of failing in the higher tracks. Dropping out or graduating from the lowest track, however, might be avoided at any cost.

Does Parents' Knowledge Mediate the Effect of Socio-Economic Background?

Now, we turn to H2 on whether parents' knowledge mediates part of the association between social background and educational outcomes. As logistic regression models do not allow for the comparison of coefficients across models, we turn to a KHB-analysis of the same models as presented in Table 2 to evaluate how much of the parental SES effect can be explained by knowledge.[10]

Table 3. Separate analyses for up- and downward transitions by track in ninth grade

	Upward from *vbo*		Upward from *mavo*		Upward from *havo*		Downward from *vbo*		Downward from *mavo*		Downward from *havo*		Downward from *vwo*	
	w/o controls	with controls	w/o controls	with controls	w/o controls	with controls	w/o controls	with controls	w/o controls	with controls	w/o controls	with controls	w/o controls	with controls
Effect of knowledge	0.36*	0.31	0.12**	0.06	0.04	−0.03	−0.15***	−0.09***	−0.26***	−0.16***	−0.01	0.01	−0.08	−0.02
	(0.16)	(0.17)	(0.05)	(0.05)	(0.11)	(0.11)	(0.02)	(0.02)	(0.04)	(0.03)	(0.06)	(0.06)	(0.05)	(0.05)
Observations	5,990	5,990	5,084	5,084	2,470	2,470	6,077	6,077	5,157	5,157	2,561	2,561	3,226	3,226
Pseudo R^2	0.11	0.12	0.04	0.05	0.07	0.08	0.04	0.05	0.04	0.06	0.07	0.07	0.12	0.15

Notes: All models also contain controls for track in ninth grade, gender, migration background, number of children in household, and Cito scores. Models that are titled "with controls" additionally control for the alternative explanations parental aspirations, books at home, involvement and closure. Full tables with all coefficients can be found in Supplementary Appendix SD. Coefficients are log odds. Standard errors in parentheses.
Significance: *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.
Source: VOCL 1993 + SSD register data, own calculations.

First, we look at whether there is a relationship between parents' education and parental knowledge, as this is a prerequisite for mediation. The bivariate regression in Table 4 shows that this is the case.

Having established that there are differences in parents' knowledge across groups of parental education, we can investigate to what extent these differences can explain the association between parents' SES and educational outcomes. We make two comparisons. First, we investigate how much the parental education effect is mediated by knowledge without accounting for other possible factors that might explain the effect of social origin. Second, we look at how strong the mediation still is if we take the alternative explanations into account.

The results are shown in Figure 2. Here, we see the percentage of the parental education effect that is mediated by parents' knowledge and whether the mediation is significant.[11] The mediation percentages for upper secondary (vs. lower) education of parents are displayed with striped bars, percentages for tertiary education with solid bars. For each dependent variable, we show percentages with and without controls for the other factors.

Without controlling for the alternative explanations, the mediation is significant for three of the four dependent variables. Parents' knowledge mediates a significant part of secondary effects for those three educational outcomes. For upward transitions, 13.9 (upper secondary parental education) and 8.6 per cent (tertiary) of secondary effects are explained by parents' knowledge. For downward transitions, this is 20.2 and 12.7 per cent, respectively. For obtaining a tertiary degree 16.1 and 10.9 per cent of the parental education effect are explained by knowledge. The mediation is not significant for track placement.

Table 4. Bivariate OLS regression of parents' knowledge on parents' education (SES)

	DV = Knowledge
Parents' education	
Upper secondary	0.63***
	(0.01)
Tertiary	1.07***
	(0.04)
Constant	−0.59***
	(0.06)
Observations	17,346
R^2	0.16

Notes: B-coefficients, standard errors in parentheses.
Significance: *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.
Source: VOCL 1993, own calculations.

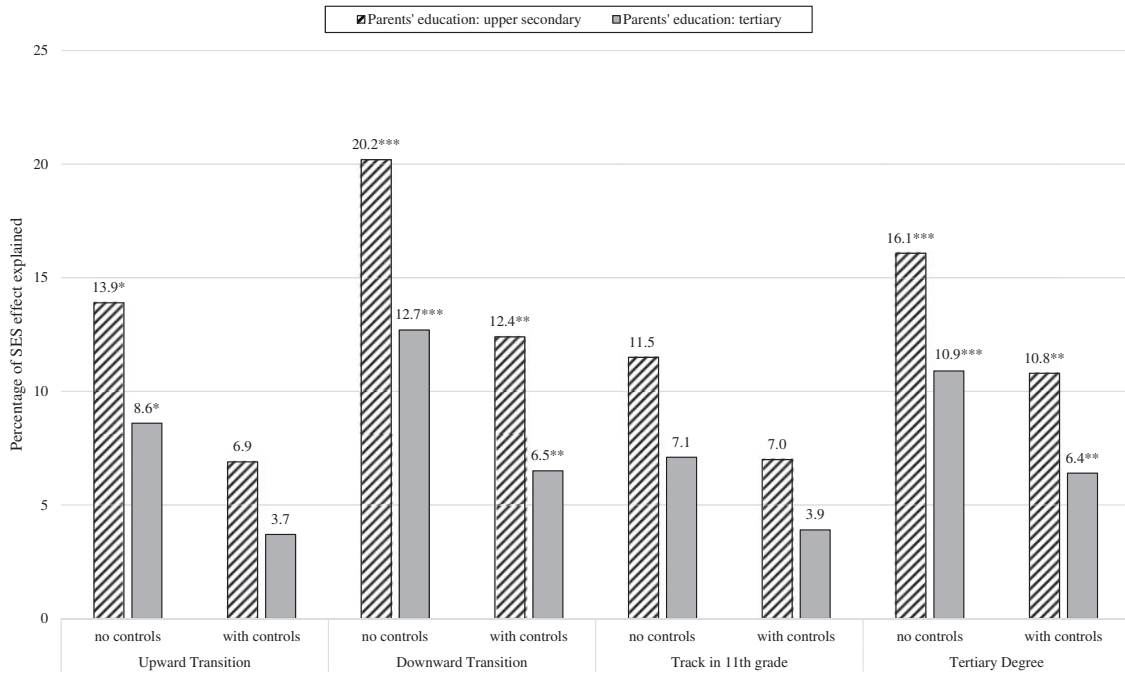

Figure 2. Percentages of the total SES effect explained by parents' knowledge (models without and with controls for other factors)

Significance: $*P < 0.05$, $**P < 0.01$, $***P < 0.001$.

Note: Mediation percentages are based on Models in Supplementary Appendix SC.

Source: VOCL 1993 + SSD register data, own calculations.

If we control for the alternative explanations, the mediation effect of parents' knowledge is reduced to insignificance for upward transitions. For downward transition and tertiary degree, the effect persists but is reduced in size. Parents' knowledge explains 12.4 and 6.5 per cent of the SES effect on making a downward transition, and 10.8 and 6.4 per cent of the SES effect on obtaining a tertiary degree. For upward transitions other mechanisms seem to explain away the effect of parents' knowledge. In Table 2, we can see that aspirations and books are important for upward transitions while parental knowledge does not have an additional effect on this outcome.

Discussion

We studied the role of parents' knowledge of the educational system for children's educational outcomes. Our results show that knowledge is a significant factor for educational success net of parents' education, sociodemographic characteristics, and demonstrated ability. If we apply a stricter test to the measure, however, we can see that knowledge only matters for some educational outcomes whereas it is negligible for others if other, more important, factors are considered. These are in particular other forms of cultural capital and parental aspirations. The association with parents' knowledge does persist for downward transitions and also for higher education degrees even if we take these other factors into account. Furthermore, we found evidence that parents' knowledge mediates part of secondary effects of social origin. Depending on the outcome, between 8.3 and 20.1 per cent of secondary effects could be explained by parents' knowledge. If we also control for other factors, we find that parents' knowledge still explains 10.8 (parental upper secondary vs. lower education) and 6.4 per cent (parents' tertiary education) of secondary effects in obtaining a tertiary degree and 12.4 and 6.5 of secondary effects in making a downward transition.

One interesting observation from this study concerns the differences between our four outcome variables. Parents' knowledge seems to be of importance for downward transitions and higher education degrees. Furthermore, we also observe differences across the separate tracks in the case of up- and downward transitions. Overall, it seems to be the case that the strongest evidence for correlations with knowledge are found in

transitions that involve changing to a new school environment, and in particular changing from secondary to post-secondary (*mbo*) or tertiary education (*hbo*, *university*). The analyses of separate tracks show that knowledge matters in particular for downward transitions from *vbo* and *mavo* and that this effect also persists after controlling for possible other factors. Most of these students move from one of those tracks out of school. Higher levels of knowledge seem to help students to avoid such a downward move and to enrol in intermediate vocational training (*mbo*) instead of leaving preparatory vocational school (*vbo*) without further schooling. Also for enrolling in and completing tertiary education, knowledge of parents seems to matter. Higher education is a rather distant institutional environment that is not part of everybody's educational strategies and involves more uncertainty. Adequate parental knowledge of how to navigate the educational system is a mechanism through which this distant world of higher education becomes accessible. In contrast, transitions between *havo* and *vwo*, which often happen within the same geographical school location are not affected by knowledge.

Our results indicate that it might be important to focus on interventions that are geared at improving information and knowledge especially at those transitions that involve moving out of secondary school and to a new school environment. For transitions within secondary education and track placement, other factors, in particular aspirations and classical cultural capital seem to be more important. These other factors are more deeply engrained in family cultures and hard to tackle with policy measures. Information or knowledge of parents on the other hand can be addressed more easily with interventions using information campaigns or trainings for families. Given that parents' knowledge mediates up to 12 per cent of secondary effects in avoiding downward transitions and in obtaining a higher education degree independent of other factors such as cultural capital or aspirations, these interventions could be potentially very valuable for remedying educational inequality. Our recommendations necessarily stay tentative with our descriptive analysis. Nevertheless, we show that parents' knowledge is an important pathway to consider in further research and in educational policy.

Needless to say that our study is faced with some limitations. First, as just mentioned, we do not have experimental data at our disposal and cannot provide direct insights on the effectiveness of interventions in the way other studies on information or knowledge have done (Barone *et al.*, 2017). Nevertheless, an advantage of our data is that we can observe long-term consequences on educational inequality by looking at outcomes several years after knowledge was assessed and at final educational attainment. We can do this for a nationally representative sample of students in contrast to experiments who necessarily rely on small samples from a narrower context such as one particular school. Furthermore, we have a wide array of relevant variables available that we can use as controls. Therefore, our observational data are well suited to complement research that focuses on causal effects of specific information interventions.

Second, even with our rich data, a share of secondary effects in our outcomes remains unexplained. We operationalize parents' knowledge and other theoretical mechanisms with the available data but we miss parts of the different concepts. For example, for operationalizing the factors predicted by rational choice or cultural reproduction theories it would be valuable to directly measure costs and benefits of education that influence rational choices or other components of social or cultural capital. However, we do not intend to fully assess one of those theories with our analysis. Rather, we want to establish parents' knowledge of the educational system as a factor that is compatible with those theories and that is in itself worth to investigate in the study of educational inequality.

Another data limitation is that we can measure parents' SES only via education of parents and not using parents' occupational status or their income. It is likely that parents' education is more strongly correlated with parents' knowledge than income or occupational status. We are aware that the results might differ if those alternative measures of SES are used. However, parents' education is widely used as measure for SES in research on educational inequality and it is more strongly correlated with children's education than parental occupation in the Netherlands (Rijken, Maas and Ganzeboom, 2007; Van De Werfhorst and Dronkers, 2016).

Finally, we are faced with endogeneity concerning our mechanisms. We cannot exclude the possibility that parents' knowledge (or the other explanations) is influenced by track placement in the transition to secondary education that has happened before knowledge is assessed. Families adjust their aspirations and interest in the school system to previously made decisions and, therefore, obtain a lower knowledge of further transitions in education. We are aware that because of this we cannot test the full mediation process of parents' knowledge across the entire school career of a child. Nevertheless, we can give important insights in educational choices after the transition to secondary education based on the information we have on parents' knowledge in ninth grade. Several studies have shown that secondary effects in these later transitions become more and more important for overall educational inequality

(Dronkers and Van de Werfhorst, 2016). We are, therefore, confident that we capture an important step in the creation of inequality.

Overall, this study provides a starting point for the investigation of parents' knowledge of the educational system as a mechanism of educational inequality. Educational decisions are crucial in today's world of increasing inequalities, and families' knowledge is one useful avenue to investigate if we are confronted with the question why social disparities in educational decision-making arise.

Notes

1 Even if knowledge could be part of cultural capital explanations, here, we use a more conventional operationalization of cultural capital: books in the parental household which represents the home-reading environment of the child.
2 For upward transitions, high track placement and higher education degrees this argumentation is straightforward. Parents' knowledge will help to navigate institutions successfully and to put children on more promising pathways. In the case of downward transitions, the argument is more ambiguous. Admittedly, in some cases knowledge might help to choose a downward transition and a detour to higher education if, for example, a student's performance level does not allow for a direct path to higher education. However, in general, parents' knowledge will make them realize how much more costly detours are in terms of time and resources. More knowledge will, therefore, make them try to avoid such detours.
3 Most of the missing data are due to non-participation of parents while the level of compliance of schools was very high. Next to missing parent questionnaires, there is also some item and unit-nonresponse for the student questionnaires and the Cito test.
4 Most of these missing cases refer to students that left the study without it being clear whether they left school or whether they moved to a different context. All students that left the VOCL sample because they dropped out of school are coded as making a downward transition and not as missing.
5 More information on the knowledge test can be found in Supplementary Appendix SB.
6 Additionally, we did a principal component analysis to investigate dimensionality among the items that measure knowledge. The analysis shows eight factors with an eigenvalue higher than one. Ten items load higher than 0.4 on the first factor. We carried out a robustness check where we only use those 10 items for our knowledge scale. The results are extremely similar and the correlation between the two knowledge scales is 0.96. We decided to keep the scale with all 24 items for the main analyses.
7 A small proportion of the students is still in a combined track in ninth grade, e.g. *havo-vwo*. In these cases, we code the track according to the highest track that can be reached without switching pathways. For example, *havo-vwo* is then coded as *vwo*.
8 Calculation of percentage change in odds from log odds coefficients in table: $(100(e^{0.43} - 1) = 54)$.
9 In the robustness check using list-wise deletion, the coefficient for track placement stays significant and also the effect size for upward transitions becomes slightly larger, so we do see tendencies for a relationship. However, the evidence for these two variables stays weaker than for downward transitions and tertiary degrees. We, therefore, use a rather conservative interpretation here.
10 When we write about effects and explanation in this section, we mean the statistical effects represented by the coefficients in the model. We do not claim that these effects are causal.
11 Further results can be found in Supplementary Table SCC2.

Supplementary Data

Supplementary data are available at *ESR* online.

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