Effective Students and Families: The Importance of Individual Characteristics for Achievement in High School[1]

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ABSTRACT

The school careers in secondary education are influenced by individual and environmental characteristics. Using longitudinal data on 7,000 students from 450 classes in 150 schools in The Netherlands, we present results on the importance of student and family characteristics for achievement (text comprehension and mathematics combined in a multivariate multilevel model) in high school. The main question is: To what extent do characteristics at the individual level influence the achievement of students in the 3rd year of secondary education? In order to answer this question, we use a structure of concentric circles. The achievement of students on text comprehension and mathematics appears to be determined by both structural and cultural characteristics. Student characteristics account for more variance than family characteristics.

INTRODUCTION

Many researchers have investigated the influence of student and family characteristics on achievement (e.g., Bourdieu, 1977; De Graaf, 1987; Kohn, 1977; Meijnen, 1977; Van der Velden, 1991). In many of these studies, researchers

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did not restrict themselves to describing differences in educational outcomes. More and more, researchers sought to find out *why* there are differences between students from lower and higher social classes, between boys and girls, between ethnic minority and native students, and between children from single-parent and dual-parent families. However, as yet the cause of differences in the achievements of students can only be explained in part. One of the reasons for this might be that most researchers have investigated the influence of just a few characteristics on achievements. In our view, researchers are faced with the challenge of investigating the many characteristics of families and students in conjunction.

Veenstra (1999) has developed a structure of (concentric) circles to order the sources of influence on academic achievement (see Fig. 1).
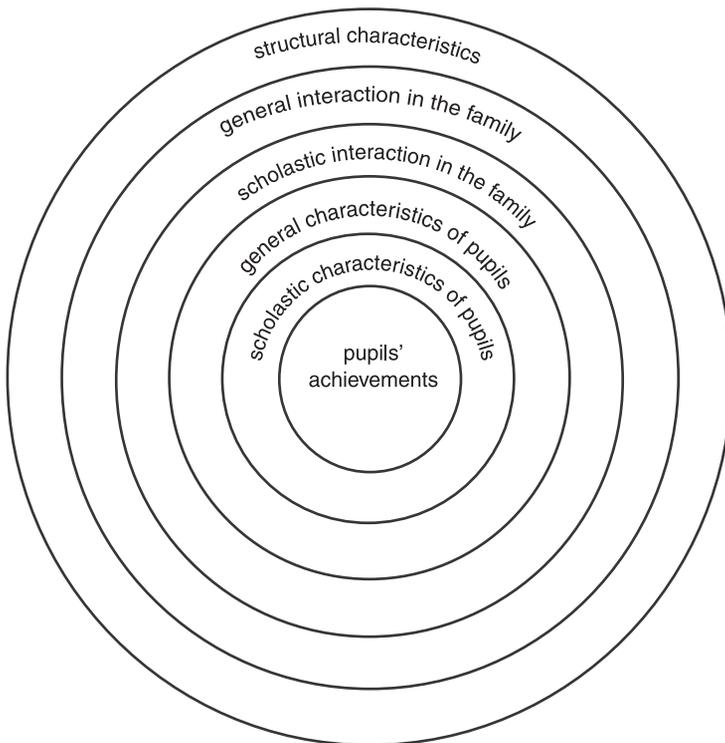
Fig. 1. Structure of concentric circles.

Apart from the dependent variable(s) in the center, Veenstra (1999) distinguishes a total of five categories at the individual level: one category with *structural* characteristics and four categories with *cultural* characteristics. These categories form a *structure of concentric circles* (see Fig. 1). This structure is inspired on Ryan and Adams (1995).

The *structural* characteristics, such as the socioeconomic status, the gender, and the ethnicity, form the outermost circle (the fifth). The *cultural* characteristics have been placed as intermediate circles between the structural characteristics and the dependent variable(s). The general interaction in the family, which consists of the parenting style, forms the fourth circle. The scholastic interaction in the family, for instance homework monitoring, comprises the third circle. The second circle consists of the students' general characteristics, such as their activities in their spare time. The scholastic characteristics of students form the first circle. These comprise, for instance, a student's earlier achievements and intelligence.

Using this structure, we aim to arrange the various influences and to offer more insight into the relations between the characteristics. It would also seem possible to explain the effects of characteristics such as the socioeconomic status or the ethnicity on school achievements by means of intermediate variables. An attempt will be made to explain the effects of characteristics from the outer circles by means of characteristics from the inner circles. The influence of characteristics in one circle will be regarded as a whole. This means that the possible arrangement of connections will not be investigated.

We have applied this structure on data on about 7,000 students from 450 classes in 150 schools (information from the cohort study VOCL'93, a highly representative sample of students in secondary education in The Netherlands). Dependent variables are Dutch reading comprehension and mathematics in the 3rd year of secondary education (similar to grade 9 in the US). The aim of the study is threefold: (1) to look at the joint contribution of a large number of characteristics; (2) to use the structure of concentric circles in an empirical study; (3) to analyze the data in a multilevel analysis with multivariate dependent variables. The central research question is: *To what extent do characteristics at the individual level influence the achievements of students in the 3rd year of secondary education*?

Before elaborating the theoretical background, some general remarks on the structure of Dutch education might be helpful. Children start their education at the age of 4 and leave primary education about 8 years later. Then they will enter secondary education, which is divided into five tracks:

individualized pre-vocational education (IVBO), pre-vocational education (VBO), junior general secondary education (MAVO), senior general secondary education (HAVO), and pre-university education (VWO). The duration of the three lower tracks is 4 years (recently these lower tracks have been integrated into VMBO), of HAVO 5 and of VWO 6 years. Secondary schools use the recommendation of primary schools and test scores in their decision to admit students and to assign them to a particular stream in the 1st year. These streams represent the five tracks or are a combination of two or three tracks. In the next grades the classes become more singular tracked.

Theoretical Background

We have used the structure of concentric circles to organize a number of well-known concepts (variables), which are used as predictors of achievement. The overview below does not intend to be exhaustive. We concentrate on the following concepts: ethnicity, socioeconomic status, gender, family composition (circle 5), number of contact hours, parenting style (circle 4), educational support (circle 3), self-concept, lifestyle (circle 2), intelligence, effort, work attitude, achievement motivation, and school well-being (circle 1).[2]

Structural Student and Family Characteristics (Circle 5)

There is much evidence that children from the higher social strata outperform children from the lower social strata. The school careers also differ between these groups. Researchers explain the importance of the *socioeconomic status* for achievement in at least three different ways, namely income/wealth, occupational status, and educational status (cf. Paterson, 1992).

Because education is almost free in The Netherlands until the age of 16, the importance of the financial position of parents for their child's career will be relatively low in comparison with many other countries.

Secondly, researchers look at the profession of parents. People with a higher occupational level often have more autonomy. This autonomy is related to other characteristics of the family, such as the lifestyle, the parenting style, and the aspirations of themselves and their children. Parents with a high occupational level educate their children more authoritatively, whereas

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[2]There are other aspects that we might add to the review, for example cultural capital (circle 4), personality characteristics (circle 2), or metacognitive skills (circle 1). However, this presentation is not exhaustive. It is a first illustration of the use of a structure of concentric circles.

parents with a low occupational level educate their children more restrictively (cf. Meijnen, 1977).

Thirdly, the educational level of parents is important for the scholastic achievement of their children. Having reached a low standard of education, parents have less opportunities to support their children. For example, they have more difficulties in assisting with homework, talking to the teacher about learning or behavioral problems, and stimulating their child intellectually than parents with a high educational background. The natural learning climate is less favorable to the child's school career in that case. Highly educated parents have the advantage that they understand the educational system. They know of the pros and cons of different routes through the educational system.

The importance of the socioeconomic status of parents for the achievement of children can partially be explained through intermediate characteristics, such as the educational support, the lifestyle, and the parenting style of parents. The relation between social strata and achievement might also be explained by the partial heritability of intelligence. Dronkers (1997a) shows evidence that the socioeconomic status is related to the start position in secondary education, and that these differences do not increase further.

Differences in *ethnic background* might also influence the achievement of students. In general, Dutch students outperform ethnic minorities (e.g., De Jong, 1989; Driessen, 1995), but there are large differences amongst different ethnic minorities. Especially, the achievement of Moroccan and Turkish students is low on average, while Western students perform well. The relation between socioeconomic status and ethnicity is strong in The Netherlands. Taking one of these characteristics into account, the other characteristics have a smaller or no effect on the achievement of students.

Besides the lower socioeconomic status of immigrant students, the language spoken at home and the length of stay in The Netherlands are aspects of the ethnicity that affect achievement. Differences in culture or migration history might also explain achievement differences between ethnic groups. These differences can result in distinctions in educational support, lifestyle, and parenting style. Moroccan and Turkish parents talk less often with their children about school and have less knowledge about the Dutch educational system. In general, they think that education is not their business, unless the school mentions problems. Nevertheless, most immigrant parents are hopeful about the ability and the future of their children, but it is doubtful that these parents have an adequate frame of reference. Dronkers (1997a) also emphasizes the importance of the migration history.

The *family composition* appears to be also related to the students' achievement. Even after controlling for relevant background characteristics, such as scholastic achievement and socioeconomic status, children from single-parent families have on average a less successful school career than other children (e.g., Bosman, 1993; Downey, 1994). According to Bosman (1993) single-parent (mother) families may be more permissive. Bosman points also at other explanations, such as a decrease of income, less social-adjusted behavior of children, and the fact that single parents have to make decisions alone. The history of these families is probably important. A divorce has a larger affect on the behavior and achievement of children than the death of a parent. The tensions that accompany a divorce have a negative effect on children (Dronkers, 1997b).

The number of siblings can also exert influence on the achievement of a student (e.g., Downey, 1995). As the number of children increases, parents can offer their children fewer resources. If other relevant background characteristics are taken into account, the number of children still has an effect on achievement (Downey, 1995). The position in the row of children also exerts influence on the scholastic achievement of a child. Eldest and only children outperform other children on average (e.g., Falbo & Polit, 1986).

When they enter secondary education, *girls* perform better on average in language and *boys* perform better in mathematics. Girls are placed in higher tracks of secondary education, but later on choose less often the exact subjects (pure mathematics, physics, chemistry). They also perform worse on the final exams in secondary education. However, it has to be taken into account that girls pass the final exams on average at a higher level than boys do. If all students, from pre-vocational to pre-university education, were to sit the exams at the same level, girls would probably perform better than boys. Sammons (1995) concludes this for Great Britain. The lifestyle might also explain differences between both groups. This might affect the scholastic achievement. There is evidence that girls score higher on school well-being, achievement motivation and effort (homework time) than boys (e.g., Kuyper & Guldemond, 1997; Kuyper & Swint, 1996).

General Family Interaction (Circle 4)
The first aspect of the family interaction is the *parenting style*. So-called *authoritative* parenting exerts a positive influence on the scholastic achievement of children (e.g., Steinberg, Elmen, & Mounts, 1989; Steinberg, Lamborn, Dornbusch, & Darling, 1992). Characteristics of this parenting

style are monitoring, providing support, and autonomy. The influence of author-itative parenting comes largely into play by the parental involvement in schools and the effort, the achievement motivation, and the self-concept of the child.

There is also evidence that the *number of contact hours* between parents and children is important for the scholastic achievement of children. Children that are often alone do homework less often and have more problems with finishing their homework. Seeing their parents only occasionally, children benefit too little from their skills and knowledge (Coleman & Hoffer, 1987). Muller and Kerbow (1993) make clear that as children are more often alone, they perform worse.

Scholastic Family Interaction (Circle 3)
Parents can try to stimulate the performance of their children in different ways. For instance, they can help them with their homework or they can talk with them about school. However, research outcomes show that the relation between most aspects of parental *educational support* and scholastic achievement of children is negative (e.g., Muller & Kerbow, 1993). The interpretation is that parents will help more often with homework, will talk more often to them about their grades, and will contact more often their teachers when the achievement of students becomes worse. We will name such parental behavior *crisis-intervention*.

It is also possible that some parents raise their children with certain pedagogical principles in mind, for example to learn them work ethos or particular skills. In that case it is likely that parents will not only *talk* about school if the pupil receives bad results but also if he receives good grades. This *grow-intervention* might be beneficial for the achievement of pupils and can be connected to the natural learning climate in family.

General Student Characteristics (Circle 2)
In general, a student brings in his personality and *self-concept* (e.g., Bandura, 1988; Shavelson, Hubner, & Stanton, 1976). The attribution theory of Weiner (1979) specifies how the self-concept may influence achievement. A person with a positive self-concept will be inclined to blame unstable characteristics for failure. As a result, he will not change his expectations for the completion of a new, similar task. However, he will ascribe success to stable characteristics, such as his own (high) ability. Therefore, his expectations for future success will increase and his positive self-concept will be confirmed. A person with negative self-concept explains situations the other

way round. He will be inclined to blame stable characteristics for failure and to explain success by unstable characteristics.

The *lifestyle* of a student outside school can also affect his achievement. Hanging out with friends or going out indicates a lifestyle which emphasizes nonscholastic activities. Lots of students spend a large amount of time on such an activity (Steinberg, 1996). A job can also require much of the student's time. Steinberg (1996) reports that students who spend more than 20 hr a week on a job, do less homework, play truant more often, have a more negative sense of school well-being and have lower educational aspirations, and consequently perform worse than students who spend less time on a job.

Scholastic Student Characteristics (Circle 1)

It is often shown that *intelligence* affects scholastic achievement strongly (e.g., Fraser, Walberg, Welch, & Hattie, 1987). Neisser et al. (1996) have given a review of research on intelligence. They claim that heritable factors affect about 45% of the variance in intelligence of younger children, and about 75% of the variance in intelligence of adolescents. Furthermore, the *earlier achievement* of students affects largely their future performance. The earlier achievement is not the same as the intelligence. Pointing at the mathematics achievement of students in Japan and Taiwan, Neisser et al. (1996) argue that their high achievement is primarily the result of differences in culture and schooling and secondly of differences in intelligence.

The *effort* of students is important for their achievement. Keith (1982) shows that as students spend more time on homework, given their intelligence, their grades become higher (cf. De Jong, Westerhof, & Creemers, 2000). However, the students with the highest ability do not always work hard. Kuyper and Swint (1996) argue that most students use an optimalization strategy. They try to pass the exams with well enough grades and a minimal effort. As a result, in Dutch research the relation between homework time and performance appears to be weak or even negative for students following the same track.

The *work attitude* of students is also relevant. Lots of students do not have the concentration and discipline to listen to their teacher. According to Hermans (1981), more than half of the students have problems with concentration. Students try also to postpone their duties. They take much time before they start with their homework. This behavior correlates negatively with the mean grades of students (Kuyper & Swint, 1996).

The *motivation* of students to strive for success, associated with positive feelings, affects their achievement also (e.g., Fraser et al., 1987; Steinberg

et al., 1989). The achievement motivation is also strongly related to the amount of time students spend on homework.

The *school well-being* of students depends on many aspects, such as (their opinion on) school rules and their relations with teachers and classmates. Rutter, Maughan, Mortimore, and Ouston (1979) state that the school well-being of students affects their behavior and exam results. Students' well-being at school will affect other characteristics, such as their achievement motivation, work attitude, and effort.

This overview leads to the following set of predictions, which form together a specification of the central research question. We predict that the performance on the text comprehension and mathematics test is higher for: (1) children belonging to the ethnic majority; (2) children living in two-parent families; (3) eldest and only children; that (4a) girls outperform boys in text comprehension; (4b) boys outperform girls in mathematics. We expect that performance is also higher when the student lives in a family: (5) with a higher socioeconomic status; (6) with fewer children. We expect that students perform better on both tests when: (7) the parenting style is more authoritative; (8) the student has more contact with grown-ups; (9) the student talks more often with his parents; (10) the parents have been less involved in ensuring completion of homework. We expect that performance is better when the student: (11) spends less time hanging out with friends; (12) spends less time working on a job; (13) spends less time going out; (14) has a more positive self-concept. We expect that students perform better on the text comprehension test when: (15) they spend more time reading and working on hobbies. Finally, we expect that the achievement level is higher when the student: (16) is more positive about classmates; (17) is more positive about the teachers and the school rules; (18) has a higher achievement motivation; (19) postpones homework less often; (20) does homework more days a week; (21) achieved better on the nonverbal intelligence tests; (22) achieved better on the language, information processing, and arithmetic tests in year 1.

METHOD

Sample, Data Collection and Response
We investigated the importance of student and family characteristics for scholastic achievement in a subset of a longitudinal Dutch dataset, which contains information about students who entered secondary school in 1993.

Data were collected in 1994 (year 1) and 1996 (year 3). At the second occasion, students were about 15 years old. Van der Werf, Lubbers, and Kuyper (1999) and Veenstra (1999) describe the sample. The sample is highly representative for all high schools in The Netherlands (Van der Werf et al., 1999). The subset used in this study consists of about 7,000 students in 450 classes in 150 schools, which are relatively ''complete.'' At the second occasion, participation of the schools on the tests was less than 50%. Van der Werf et al. (1999) discuss the response bias on a number of cognitive variables assessed in the 1st year. The maximum bias is 0.15 of a standard deviation. This is considered a small ''effect size.''

Not only the students but also their parents have answered a questionnaire. The parent questionnaire contains items about, among other things, family composition, socioeconomic status, and ethnicity. About 85% of the parents responded to this questionnaire. In this case the response bias is larger, 0.42 maximum. In addition, nonresponse is high for ethnic minorities in general, and for Turkish and Moroccan parents in particular (see also Brandsma, Lugthart, & Van der Werf, 1997).

Variables

Achievement in year 3 (in the US: grade 9) was measured on a text comprehension and a mathematics test. Both tests were constructed by the Cito (National Institute for Educational Measurement). The text comprehension test consists of six texts and 40 multiple choice items. The Cronbach's alpha of the scale is 0.78. Test scores range from 10, which is equal to the score that a student would receive guessing all questions, to 40. For mathematics two versions were used, namely an A-version for students in the highest three tracks and a B-version for students in the two lowest (vocational) tracks. The A-version consists of 27 open and 6 multiple choice questions, the B-version of 31 open and 2 multiple choice questions. Due to an overlap of 7 items, the two versions could be equated. Equation was performed with the One Parameter Logistic Model (Verhelst, Glas, & Verstralen, 1995). After the equation procedure, the reliability is 0.83 for the A- and 0.87 for the B-version. The scores on the text comprehension and mathematics test have been standardized into z-scores. These two variables are the dependents in the multilevel analyses. The variables below are the predictor variables at the student level.

The structural student and family characteristics were gathered by the school administrations and/or by the parent questionnaire. The school administrations provided the information about the *gender* and *ethnicity* of the students. The parents answered this for themselves. We make a distinction

between the following groups: (1) Dutch; (2) Western (e.g., German, American, or French); (3) Turkish; (4) Moroccan; (5) Postcolonial immigrants (Antillean, Aruban, Surinam, & Moluccan); (6) Other (for example Central Europeans or Asians). If a student belongs to one of the last four groups, we will classify him in the ethnic minority category. Following Brandsma and Van der Werf (1997), if the student or one of his parents has been born in a foreign country, the student ''belongs to'' an ethnic minority. This means that we include also children from mixed families (for example a Turkish husband and a Dutch wife).

The family composition and the position of the child were also asked in the parent questionnaire. The family composition consists of the *number of parents* (1 or 2) and *the number of children*. Following Downey (1995), we have recoded the number of children (X) into an inverse score (1/X). The position of the child consists of two dummy variables: *only child* (0, 1) and *eldest child* (0, 1).

The *educational level* and *occupational level* of the parents (parent questionnaire) have five categories each. The educational level pertains to both parents (if present), the occupational level to the breadwinner only. For the educational level the categories are: (1) elementary education; (2) lower tracks of secondary education; (3) higher tracks of secondary education; (4) academic and senior vocational education; (5) postdoctoral academic education. And for occupational level: (1) people without a paid job; (2) workers; (3) tradesmen, farmers, and lower employees; (4) middle employees; (5) higher employees and independent jobs.

The other variables were taken in the student questionnaire. Students have given information about the time they spend at home, and about the time they are alone at home. Using these questions, we have calculated the *number of contact hours* per day, which has a range of 0 to 9 hr. The *parenting* style was measured with 8 items about who makes the decision on eight topics. The topics are for instance: how late the child can stay out, whether the child can drink alcohol at home, and when the child does his/her homework. The answer categories are: the parents, the parents after consideration with their child, the parents and the child together, the child after consideration with his parents, or the child by himself. The answer ''the child after consideration with his parents'' is indicative for the *authoritative parenting style*. We have counted the number of answers in this category, which may range from 0 to 8.

The educational support consists of *talking with the parents* (7 items) and supervision of homework (2 items). The first seven items concern scholastic affairs. The Cronbach's alpha of this scale is 0.77.

The *self-concept* is measured with 11 items (for instance about the satisfaction with themselves). Cronbach's alpha is 0.75. The lifestyle of the students was measured with 12 items about the time spent on activities during the weekend. The activities are for instance: visiting family, working on a job, doing homework, and watching television. Students could choose the following answers: (0) no time; (1) 0,5 hr; (2) 1 hr; (3) 1,5 hr; (4) 2–3 hr; (5) 3–5 hr; (6) 5–8 hr; (7) 8 or more hr. We calculated how much time was spent on each activity relative to all other activities. In this article, we only use the relative time spent on *a job*, on *going out*, on *being outside with friends*, and on *reading and working on hobbies*.

The final group of predictor variables consists of the scholastic student variables. In year 1, nonverbal intelligence was assessed with two subtests from the PSB (Horn, 1969). PSB-3 measures *reasoning*, PSB-8 *abstracting*. Both subtests consist of 40 items, which had to be answered in 8 min. As total test scores were provided, we could not analyze the reliability in this sample. Initial achievement was assessed with three tests for Dutch language, arithmetic, and information processing, with reliability coefficients of 0.76, 0.84, and 0.78, respectively. The *achievement motivation* was measured with 21 items. The reliability is 0.85. The *work attitude* was measured with a single item about postponing homework. For *effort* we use the number of days on which homework is done.

School well-being was measured with 18 items, resulting in two scales: *opinion on teachers and rules* (14 items, $\alpha = 0.83$) and *opinion on other students* (4 items, $\alpha = 0.51$). Since the score on this last scale correlates rather strongly with the scholastic achievement, we also use it in the analysis.

In addition to these predictor variables, one other variable is used as a predictor, namely a dummy variable that indicates whether the parent questionnaire has been answered by the parents. The Appendix summarizes the dependent and predictor variables used in the multilevel analyses. With the exception of the dummy variables, all variables have been standardized (a mean of 0 and a standard deviation of 1). This facilitates the interpretation of the multilevel analysis results.

Multivariate Dependent Variables Multilevel Analysis

Data were analyzed with a multilevel or hierarchical linear model. Multilevel analysis has various advantages over analyses at one level, such as a regression analysis with aggregated or disaggregated data (Bryk & Raudenbush, 1992; Goldstein, 1995; Snijders & Bosker, 1999). By taking into account the

hierarchy of data (students within classes within schools), the results are more accurate and may be interpreted easier than the results from an analysis at one level (e.g., only the lowest level).

A multivariate model is a model with two or more dependent variables per research unit. We have used two criterion variables, namely the test scores Dutch and mathematics. These dependent variables form level zero of the multilevel model, the pseudolevel. A multivariate approach has some advantages over separate analyses for each dependent variable (Duncan, Jones, & Moon, 1996; Snijders & Bosker, 1999). An important benefit of the multivariate model is that it is possible to investigate whether predictor variables have *a similar or a different effect* on the dependent variables by doing a significance test. Secondly, it is possible to calculate the *correlation* between the dependent variables at the *different levels*. Do the same students make progress in Dutch and in mathematics? And what does this relation look like at the class or the school level? These correlations cannot be computed when the analyses are separate for Dutch and mathematics. Third, it is not necessary that for each respondent an observation of each of the dependent variables is available. Research units can be included when they have scored on at least one of the dependent variables. The influence of a unit is mainly on the analysis of the dependent variables with an available observation. However, including the covariance between the different dependent variables, the analysis of the dependent variables with a missing value becomes more accurate in the multivariate approach.

In a multivariate multilevel analysis with two dependent variables within students within classes within schools, Y_{hijk} is the dependent variable. It is an indicator on dependent variable h, for student i in class j and school k. If a variable has the index $_{h00k}$, it varies only at the school level. In the equation V_{h00k}, U_{h0jk} and R_{hijk} are random variables with a mean of zero and, as assumed, a normal distribution, and respectively as residual component σ_v^2, σ_u^2, and σ_r^2. Multilevel analysis is characterized by the inclusion of the *random effects* (V_{h00k}, U_{h0jk} and R_{hijk}) in the analysis structure:

$$Y_{hijk} = \beta_{h000} + V_{h00k} + U_{h0jk} + R_{hijk} \qquad (1)$$

The empty model is useful for the calculation of the residual variances between schools, classes, and students. The *intraclass correlation coefficient* is the measure for the degree of resemblance between micro-units belonging

to the same macro-unit. The intraclass correlation coefficient for the class and school levels in relation to the individual level is the variance *between* schools and classes divided by the total variance: $(\sigma_v^2 + \sigma_u^2)/(\sigma_v^2 + \sigma_u^2 + \sigma_r^2)$. Furthermore, it is also possible to calculate the intraclass correlation coefficient for the school level in relation to the class level: $\sigma_v^2/(\sigma_v^2 + \sigma_u^2)$.

The second step is to add fixed effects of independent variables at the *individual level* to the empty model. With one independent variable X the model can be written as:

$$Y_{hijk} = \beta_{h000} + \beta_{h100}\, x_{1hijk} + V_{h00k} + U_{h0jk} + R_{hijk} \tag{2}$$

Equation (2) consists in an intercept, a regression coefficient and three residual variance components. The regression coefficient β_{h100} can be interpreted in the regular way: An increase of a unit in X results in an increase of β_{h100} units in Y. The intercept and the regression coefficient form the systematic part of the model. The three variance components form the random part. The random part is at the individual, the class, and the school levels, but not at the pseudolevel. For this model, we can calculate again the relative size of the variance components. This measure is called the *residual intraclass correlation coefficient*.

In the multivariate model we do not only have variance components, but also the covariance between the dependent variables. With these three estimates we can calculate the correlation between the criterion variables at each level. At the school level it is:

$$\rho(U_{100k}, U_{200k}) = \frac{\mathrm{cov}(U_{100k}, U_{200k})}{sd(U_{100k})sd(U_{200k})} \tag{3}$$

Significance Tests

To check whether the *fixed effects* differ significantly from zero, we have calculated the quotient of the parameter value and the standard error (a t-value). To compare two models, it is necessary to calculate the deviance of both models. The deviance of a model is equal to minus twice the natural logarithm of likelihood. The parameters are estimated by the maximum likelihood method. This deviance can be regarded as a measure of lack of fit between model and data. To test whether a model benefits from the addition of one or more variables, one has to look at the difference *in deviance* for several models fitted to the same dataset. This difference has a chi-squared distribution.

Explained Variance

The variance in Y can be split into an explained and an unexplained part. We have calculated the explained variance in three-level models by the formulas of Snijders and Bosker (1999). In the multivariate approach this is:

$$R_{h1}^2 = 1 - \frac{\text{var}(Y_{hijk} - \sum_g \delta_g X_{ghijk})}{\text{var}(Y_{hijk})} \tag{4}$$

$$R_{h2}^2 = 1 - \frac{\text{var}(\overline{Y}_{h.jk} - \sum_g \delta_g \overline{X}_{gh.jk})}{\text{var}(\overline{Y}_{h.jk})} \tag{5}$$

$$R_{h3}^2 = 1 - \frac{\text{var}(\overline{Y}_{h..k} - \sum_g \delta_g \overline{X}_{gh..k})}{\text{var}(\overline{Y}_{h..k})} \tag{6}$$

Adding one or more independent variables, the explained variance at level 1 is the proportional reduction in the sum of σ_v^2, σ_u^2, and σ_r^2. At level 2 it is the proportional reduction in the sum of σ_v^2, σ_u^2, and σ_r^2/n. The variance at the individual level has to be divided by the number of the research units within level 2 (it is a weighted sum). This differs from class to class. With such unbalanced data it is wise to add a representative value for the number of students (Snijders & Bosker, 1999). We have chosen the representative value $n = 20$. The explained variance at level 3 is the proportional reduction in the sum of σ_v^2, σ_u^2/j, and σ_r^2/nj, and j is the number of classes and nj the number of students per school. We have considered the representative value to be $j = 3$.

RESULTS

By the standardizing of the dependent and the continuous predictor variables the interpretation of the results is clearer. In this way, we can estimate simultaneously the independent effects of different variables on the test score. When the other effects are kept constant, if a student differs one standard deviation from the mean, the effect of a variable will be the amount of change in the dependent variable. The partial regression coefficient of dichotomous variables is the difference between the two categories, for example between boys and girls. The multilevel analysis was performed in a number of steps. After estimating the empty model, in each next step a group of predictors (corresponding with the circles) has been added. The results of these analyses

are summarized in Tables 1a, 1b, and 2. Tabel 1a shows the regression coefficients for the analyses on text comprehension, Tabel 1b the coefficients for mathematics. Tabel 2 provides information about the variance components and the values of the deviance.

First, we consider the effects of the structural characteristics on the test scores. There are six predictors which have a significant ($p < 0.01$, one-sided) effect on both tests: *ethnicity*, *educational level mother and father*, *eldest child*, *gender,* and *no parent questionnaire*. Taking the other structural characteristics into account, ethnic minority students achieved one fifth standard deviation below ethnic majority students on both tests. Girls achieved better in text comprehension, whereas boys were better in mathematics. The educational level of the mother and the father has a positive effect. Eldest children within families scored better than the younger children, as well as only children. Furthermore, the number of parents has a positive effect on mathematics. Finally, if there was no parent questionnaire the scores on both tests were lower.

The next column in Tables 1a and 1b shows the results after adding the *authoritative parenting style* and the *number of contact hours*. Both variables have a significant influence on both tests. Moreover, it can be seen that the presence of these predictors does not change much the results for the structural characteristics. Most regression coefficients have become somewhat smaller.

Subsequently, the characteristics of circle 3 (*talking with parents* and *supervision of homework*) were added. The first variable is positively related with both tests, the second one negatively. Again, the result of adding these predictors on the earlier regression coefficients is small. Only on text comprehension the regression coefficients of ethnicity and gender show a somewhat larger decrease.

Of the general student characteristics *hanging out with friends*, *reading and hobbies*, and the *self-concept* have an effect on both tests. The effects of time spent on reading and hobbies, and of a positive self-concept are positive, whereas the effect of hanging out with friends is negative. In addition, the time spent on a job has a negative effect on text comprehension, and the time spent on going out a negative effect on mathematics. The addition of these predictors has some influence on the regression coefficients in earlier circles. In both tests, *number of contact hours* is no longer significant. The coefficient of *ethnicity* increases (becomes more negative) somewhat on both tests, the coefficient of *gender* increases (becomes more negative) on text comprehension and decreases (becomes less negative) on mathematics. Such changes are not unusual when predictors are added in a series of multiple regression analyses.

Table 1A. Multilevel Analysis – Dutch. Circle 5 to 1. (bold: p < 0.01, one-sided)

5	Ethnicity (1 = ethnic minority)	**−0.205 (0.042)**	**−0.195 (0.042)**	**−0.164 (0.042)**	**−0.185 (0.041)**	**−0.096 (0.039)**
	Occupational level breadwinner	−0.004 (0.011)	−0.001 (0.011)	−0.002 (0.011)	−0.006 (0.011)	−0.011 (0.010)
	Educational level father	**0.045 (0.012)**	**0.040 (0.012)**	**0.042 (0.012)**	**0.037 (0.012)**	**0.034 (0.011)**
	Educational level mother	**0.056 (0.011)**	**0.052 (0.011)**	**0.053 (0.011)**	**0.046 (0.010)**	**0.029 (0.010)**
	Number of parents (1 = two)	0.025 (0.028)	0.022 (0.028)	0.019 (0.028)	0.007 (0.027)	−0.012 (0.025)
	Number of children (1/x)	0.020 (0.020)	0.023 (0.019)	0.022 (0.019)	0.026 (0.019)	0.021 (0.018)
	Only child (1 = only child)	−0.055 (0.064)	−0.066 (0.064)	−0.064 (0.063)	−0.095 (0.062)	0.062 (0.064)
	Eldest child (1 = eldest child)	**0.069 (0.022)**	**0.064 (0.021)**	**0.066 (0.021)**	**0.047 (0.021)**	0.010 (0.020)
	Gender (1 = male)	**−0.197 (0.019)**	**−0.193 (0.019)**	**−0.152 (0.019)**	**−0.190 (0.019)**	**−0.191 (0.020)**
	No parent questionnaire	**−0.067 (0.030)**	−0.059 (0.029)	−0.057 (0.029)	0.048 (0.029)	−0.002 (0.027)
4	Authoritative parenting style		**0.081 (0.009)**	**0.080 (0.009)**	**0.072 (0.009)**	**0.040 (0.009)**
	Number of contact hours		**0.042 (0.009)**	**0.037 (0.009)**	0.010 (0.009)	0.003 (0.009)
3	Talking with parents			**0.019 (0.009)**	0.002 (0.009)	0.004 (0.009)
	Supervision of homework			**−0.099 (0.009)**	**−0.073 (0.009)**	**−0.055 (0.009)**
2	Hanging out with friends				**−0.055 (0.010)**	**−0.036 (0.010)**
	Reading and hobbies				**0.081 (0.010)**	**0.051 (0.010)**
	Job				**−0.029 (0.009)**	**−0.024 (0.009)**
	Going out				−0.004 (0.010)	0.010 (0.009)
	Self-concept				**0.090 (0.009)**	**0.053 (0.010)**
1	Opinion on fellow students					**0.039 (0.009)**
	Opinion on teachers and rules					**0.039 (0.009)**
	Achievement motivation					−0.008 (0.010)
	Postponing homework					−0.015 (0.010)
	Number of days at homework					**0.039 (0.010)**
	Nonverbal intelligence					**0.027 (0.010)**
	Language achievement year 1					**0.178 (0.013)**
	Information processing achievement year 1					**0.238 (0.013)**
	Arithmetic achievement year 1					**0.086 (0.013)**
	Constant	−0.043 (0.056)	−0.034 (0.055)	−0.050 (0.054)	0.003 (0.052)	0.101 (0.037)

Table 1B. Multilevel Analysis – Mathematics. Circle 5 to 1. (bold: $p < 0.01$, one-sided)

5	Ethnicity (1 = ethnic minority)	**−0.191 (0.040)**	**−0.182 (0.039)**	**−0.162 (0.039)**	**−0.186 (0.039)**	**−0.071 (0.034)**
	Occupational level breadwinner	−0.005 (0.011)	−0.002 (0.011)	−0.002 (0.010)	−0.006 (0.010)	−0.002 (0.009)
	Educational level father	**0.026 (0.011)**	0.022 (0.011)	0.024 (0.011)	0.020 (0.011)	0.022 (0.010)
	Educational level mother	**0.047 (0.010)**	**0.042 (0.010)**	**0.043 (0.010)**	**0.037 (0.010)**	0.014 (0.008)
	Number of parents (1 = two)	**0.091 (0.026)**	**0.091 (0.025)**	**0.091 (0.025)**	**0.075 (0.025)**	0.043 (0.022)
	Number of children (1/x)	−0.017 (0.018)	−0.017 (0.018)	−0.015 (0.018)	−0.013 (0.018)	−0.017 (0.015)
	Only child (1 = only child)	−0.016 (0.059)	−0.018 (0.059)	−0.018 (0.059)	−0.037 (0.058)	−0.014 (0.050)
	Eldest child (1 = eldest child)	**0.054 (0.020)**	**0.051 (0.019)**	**0.057 (0.020)**	**0.043 (0.019)**	0.011 (0.017)
	Gender (1 = male)	**0.232 (0.018)**	**0.233 (0.018)**	**0.248 (0.018)**	**0.209 (0.019)**	**0.130 (0.017)**
	No parent questionnaire	**−0.120 (0.028)**	**−0.113 (0.027)**	**−0.115 (0.027)**	**−0.106 (0.027)**	**−0.047 (0.023)**
4	Authoritative parenting style		**0.082 (0.009)**	**0.083 (0.009)**	**0.076 (0.009)**	**0.030 (0.008)**
	Number of contact hours		**0.017 (0.008)**	**0.018 (0.008)**	−0.009 (0.009)	−0.005 (0.008)
3	Talking with parents			**−0.022 (0.008)**	**−0.037 (0.009)**	**−0.022 (0.008)**
	Supervision of homework			**−0.065 (0.008)**	**−0.042 (0.009)**	**−0.026 (0.007)**
2	Hanging out with friends				**−0.058 (0.009)**	**−0.037 (0.008)**
	Reading and hobbies				**0.036 (0.009)**	0.010 (0.008)
	Job				−0.017 (0.009)	−0.013 (0.008)
	Going out				**−0.038 (0.009)**	**−0.024 (0.008)**
	Self-concept				**0.078 (0.009)**	**0.041 (0.008)**
1	Opinion on fellow students					0.005 (0.008)
	Opinion on teachers and rules					**0.029 (0.008)**
	Achievement motivation					−0.008 (0.009)
	Postponing homework					−0.013 (0.008)
	Number of days at homework					**0.047 (0.008)**
	Nonverbal intelligence					**0.106 (0.009)**
	Language achievement year 1					**0.080 (0.011)**
	Information processing achievement year 1					**0.148 (0.011)**
	Arithmetic achievement year 1					**0.355 (0.011)**
	Constant	−0.345 (0.064)	−0.340 (0.063)	−0.344 (0.063)	−0.292 (0.061)	−0.136 (0.037)

Table 2. Multilevel Analysis. Variance and Covariance Components and Model Fit.

	Par. (S.E.)			Deviance	Decrease in Deviance
	Variance Dutch	Variance Mathematics	Covariance		
Empty Model					
Individual level	0.522 (0.009)	0.396 (0.008)	0.138 (0.007)	26,925.4	
Class level	0.229 (0.021)	0.299 (0.026)	0.236 (0.021)		
School level	0.312 (0.048)	0.433 (0.065)	0.342 (0.053)		
Circle 5					
Individual level	0.507 (0.009)	0.377 (0.007)	0.140 (0.006)	26,329.2	596.2
Class level	0.206 (0.019)	0.276 (0.024)	0.213 (0.019)		$(df = 20)$
School level	0.258 (0.040)	0.394 (0.059)	0.294 (0.046)		$p < 0.001$
Circle 4					
Individual level	0.500 (0.009)	0.371 (0.007)	0.134 (0.006)	26,179.2	150.0
Class level	0.195 (0.018)	0.265 (0.023)	0.203 (0.018)		$(df = 4)$
School level	0.239 (0.037)	0.374 (0.056)	0.275 (0.044)		$p < 0.001$
Circle 3					
Individual level	0.493 (0.009)	0.367 (0.007)	0.129 (0.006)	26,025.9	153.3
Class level	0.188 (0.018)	0.262 (0.023)	0.197 (0.018)		$(df = 4)$
School level	0.230 (0.036)	0.369 (0.056)	0.268 (0.043)		$p < 0.001$
Circle 2					
Individual level	0.475 (0.009)	0.355 (0.007)	0.116 (0.006)	25,668.5	357.4
Class level	0.173 (0.017)	0.247 (0.022)	0.183 (0.017)		$(df = 10)$
School level	0.212 (0.034)	0.344 (0.052)	0.246 (0.039)		$p < 0.001$
Circle 1					
Individual level	0.421 (0.008)	0.271 (0.005)	0.065 (0.005)	22,992.1	2,676.4
Class level	0.052 (0.007)	0.050 (0.006)	0.029 (0.005)		$(df = 16)$
School level	0.062 (0.011)	0.094 (0.015)	0.050 (0.010)		$p < 0.001$

Finally, the nine scholastic student characteristics were added. Six of these have a significant influence on both tests: the *three achievement tests* and *nonverbal intelligence in year 1*, the *opinion on teachers and rules*, and the *number of homework days*. The *opinion on fellow students* has an effect on text comprehension only. The influence of achievement in year 1 on achievement in year 3 is large. Although the effect of all *three achievement tests* is significant in both cases, the relative influence (the regression coefficients) differs markedly. On text comprehension, information processing has the strongest effect ($\beta = 0.24$), followed by Dutch language ($\beta = 0.18$). This may

seem odd. The explanation is that some of the information processing items dealt with text comprehension. On mathematics, arithmetic has the strongest effect ($\beta = 0.36$), followed by information processing ($\beta = 0.15$). The effect of arithmetic on text comprehension is almost the same as the effect of Dutch language on mathematics (0.09 and 0.08, respectively.) The effect of *nonverbal intelligence* is stronger on mathematics (0.11) than on text comprehension (0.03). The number of days that *homework* is made, is also positively related with both tests (0.04 on text comprehension and 0.05 on mathematics).

Variance Components and Model Fit

In Table 2, we compare the variance components and the model fit of the different models. First, we present the empty model (Equation (1)). In this model the *variance components* are for text comprehension 0.522, 0.229, and 0.312, at the individual, class, and school levels respectively. The intraclass correlation coefficient for differences between classes and schools is $(0.229 + 0.312)/(0.522 + 0.229 + 0.312) = 0.51$. For mathematics, the intraclass correlation coefficient is 0.65.

Table 2 shows also the *covariance components* between text comprehension and mathematics. Using the estimations of the variances and covariance, we can calculate the *correlation* between both tests at each level. In the empty model the correlation is 0.93 at the school, 0.90 at the class, and 0.30 at the individual level. [The calculation of the correlation at the school level is: $0.342/\sqrt{(0.312 * 0.433)} = 0.93$.] When a class or a school achieves higher in one subject, the achievements are also higher in another subject. However, the relation between the achievements of students (within classes within schools) is only moderate.

In the next model, we have added the structural characteristics. These characteristics explain some of the variance at the individual, class, and school levels: 9, 14, and 16% for text comprehension and 7, 8, and 9% for mathematics. The calculation of the explained variance for text comprehension is at the *individual level*: $1 - (0.507 + 0.206 + 0.259)/(0.522 + 0.229 + 0.312) = 0.087$. At the *class level* the formula is (the representative number of students is 20): $1 - (0.507/20 + 0.206 + 0.259)/(0.522/20 + 0.229 + 0.312) = 0.137$, and at the *school level* the equation is (the representative number of classes is 3 and students is 20): $1 - (0.507/60 + 0.206/3 + 0.259)/(0.522/60 + 0.229/3 + 0.312) = 0.156$. Taking more characteristics into account, the explained variance increases for text comprehension at the

individual level with 3% by the fourth circle, 2% by the third circle, 5% by the second circle, and 31% by the first circle. At the individual level, these percentages are for mathematics 3 for the fourth, 1 for the third, 5 for the second, and 47% for the first circle. At the individual level, the total explained variance is for text comprehension 50% and for mathematics 63%. At the class and the school level the percentages are 76–79.

At the individual level, the *structural characteristics*, circle 5, explain 9 and 7% of the variance in the test scores. The *cultural characteristics*, the other circles, explain 41 and 56% of the variance (which can be divided into two parts, namely 26 and 36% explained by the past performance, and 16 and 20% explained by the other 14 cultural characteristics).

At both the class and the school level, the structural characteristics explain about 15 and 8% of the variance in the test scores, and the cultural characteristics 62 and 71%. The explained variance at the class and the school levels is almost identical.

In the full model in Table 2, the variance components for text comprehension are at the individual level 0.421, at the class level 0.052, and at the school level 0.062. The residual intraclass correlation coefficient between classes and schools is 0.21. For mathematics, the variance between classes and schools is 35%. It is common that the variance between classes and schools is higher for mathematics than for Dutch language (Scheerens & Bosker, 1997). Variances between classes and schools of 21 and 35% are high.[3] In the full model, the correlation between text comprehension and mathematics is 0.65 at the school, 0.58 at the class, and 0.19 at the individual level.

Including an extra circle, the deviance decreases (see Table 2). The decrease in deviance is significant all the time. The inclusion of an extra circle results in a better explanation of both test scores.

Similar or Different Effects

For all predictors we have tested whether the effects on text comprehension and mathematics are *similar or different*. First, we have calculated a *contrast* by subtracting the parameter for mathematics from the parameter for text comprehension. The value is positive, when the parameter for text comprehension is larger than the parameter for mathematics, and vice versa. The significance of a contrast can be tested with a chi-square test with one

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[3]Adding the school track (Veenstra, 1999), the variances become 12 and 17%, which is a regular percentage (Scheerens & Bosker, 1997).

degree of freedom. The following effects differ significantly: number of parents, gender (circle 5), talking with parents, supervision of homework (circle 3), reading and working on hobbies, going out (circle 2), opinion on fellow students, nonverbal intelligence, and the three achievement tests from year 1 (circle 1). The other variables have a similar effect on both tests. In a parsimonious model, these effects can be represented by one parameter.

It is theoretically plausible that a great number of these effects are different for each subject. This is the case for the gender effect, for example, because boys achieve better on mathematics and girls achieve better on text comprehension, in accordance with the expectations. It was also expected that the effect of reading and hobbies would differ per subject. As it turns out, there is an effect of this characteristic on text comprehension, but not on mathematics. The subject-specific effects for nonverbal intelligence and previous achievements are also plausible. The extent of these effects differs per subject, because language and information processing have a stronger connection with text comprehension, and nonverbal intelligence and arithmetic have a stronger connection with mathematics. For the other characteristics it is unclear why there are differences per subject.

DISCUSSION AND CONCLUSION

The achievement of students in text comprehension and mathematics are determined by both structural and cultural characteristics. Even if the prior achievement of students is taken into account, it is important to know the *education of the parents* and whether they belong to *ethnic minorities* or to *the native-born majority*. When the effect of these characteristics is studied in conjunction, there is a strong effect. A native-born student whose parents have received a higher professional education, will score one quarter of a standard deviation higher than a student of an ethnic minority whose parents have received only a basic education (the difference in achievements between students in different school types, for example a student in lower and a student in intermediate general secondary education, is around one half of a standard deviation). The difference between students of ethnic minorities and native-born students does not disappear if the characteristics of the socioeconomic status are taken into account. Ethnicity has therefore an extra effect on achievements, not only in Dutch, but also in mathematics.

If the other characteristics are kept constant, *gender* also has a strong effect on the achievements of students. Girls have a better average score on Dutch and boys have a better average score on mathematics.

In addition to the effects of structural characteristics, there are also effects of cultural characteristics. *Homework monitoring* and an *authoritative parenting style* are forms of interaction between parents and children that have a rather strong connection to the students' achievements.

One of the general characteristics of students with a positive effect is the students' self-concept. This effect is as strong as the combined effect of the education of both parents. The *lifestyle* also has a strong effect on the achievement of students. Students who spend half their spare time going out, working or hanging out with friends, and who do not spend any time on reading or hobbies, have scores a quarter of a standard deviation lower on Dutch, and one fifth of a standard deviation lower on mathematics than students who spend 20% of their time on reading or on hobbies and who do not spend time on the three other aspects.

Naturally, the strongest effects on the achievements stem from the effects of *past performance*. For instance, when a student achieves one standard deviation above average for all year-1 tests (reading, information processing, and mathematics), this student's achievements are at HAVO-level 2 years later. At two standard deviations above average, the student's grades are at VWO-level in the 3rd year. A difference of one standard deviation is roughly equivalent to a difference in school type. Thus it is clear that the students' prior achievements are a good predictor of their later achievements. With regard to the other characteristics in circle 1, the number of days that a student does homework is of considerable influence. When a student does homework for only 2 days instead of 5, the achievement in tests drops by one tenth of a standard deviation.

It is unusual in educational research to combine several achievement variables simultaneously in a *multivariate multilevel model*. In the current study, the analyses for Dutch and mathematics were conducted concurrently. This has the advantage that it facilitated a test of whether explanatory variables have the same effect on these two dependent variables. Moreover, the correlations between the dependent variables at various levels may be determined. Students who lack a certain value for one of the dependent variables may be included in the study, so incomplete data can be used more efficiently. A multivariate multilevel model has important advantages over the models which were used a few decades ago. The development of these models

enables better and more extensive research on differences in study achievements between students.

The development of multilevel analysis makes it possible to study the influence of students, families, teachers, and schools in *conjunction*. The current study shows the importance of verifying the characteristics at the individual level. In studies of effective teachers and schools, the verification is often reduced. Researchers of educational effectiveness take structural characteristics and past performance of students into account, but they have disregarded cultural characteristics. However, in order to explain differences in achievements between students, these cultural characteristics are at least as important as structural characteristics. In order to make statements about effects at the class and school levels, the researcher should take both structural and cultural characteristics into account.

In this study, we have used a *structure of concentric circles*. The structure enables an organization of various influences and an indication of (causal) relations between characteristics. Effects, such as the mother's education or the ethnicity, can be explained for an important part by characteristics with a more direct relation to achievements. About three fifths of both effects can be explained by cultural characteristics. Therefore, the structure of concentric circles seems particularly suited to explaining the differences in achievements at the individual level.

The analyses showed that the variance between classes and schools is high in The Netherlands. The explanation is that students are ordered according to school type. In *Education at a glance* (OECD, 1998), it is stated that The Netherlands is an international frontrunner in interschool variance in secondary education. Other countries with high scores in this respect are Ireland, Germany, Switzerland, Austria, and the Flemish part of Belgium. In contrast, in Korea and Japan the gross variance between classes and schools is less than 5%. Incidentally, this measure does not say anything about the inequality in achievements within a country. As it turns out, there is no clear relationship between the interschool variance (a relative measure) and the overall variance in achievements (an absolute measure). In order to compare schools or countries with each other, the net variance should be computed.

When we look into the differences in achievement in The Netherlands, the large differences between students are striking. In year 3 of secondary education, students of ethnic minorities perform less well than native-born students in Dutch and mathematics. In addition to ethnicity, there are also

clear differences according to socioeconomic status. Adolescents from lower social classes have lower scores on the tests than students from higher classes. An inequality between the sexes is also apparent. Boys perform better in mathematics than girls. Girls perform better in Dutch than boys. To conclude, it may be stated that there are clear differences in these structural characteristics at the end of the school age.

Finally, the present study attributes all of the explained variance to variation among students and families. In future research, it would be worthwhile to investigate the extent of differential effectiveness in text comprehension and mathematics, and to add measures of teacher and school quality (Teddlie & Reynolds, 2000). Furthermore, the concentric circles are nice in classifying variables. However, this classification should give rise to the development of a theory that explains how student and family characteristics are related to each other and to educational achievement and progress.

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APPENDIX

Student and Family Characteristics

	Mean	*SD*	min.	max.	*N*
Students' achievements					
Text comprehension (z-score)	0.0	1.0	−2.0	2.6	6,593
Mathematics (z-score)	0.0	1.0	−4.6	3.7	5,842
Scholastic student characteristics					
Achievement grade 1					
— language (19 items)	11.7	3.8	0	19	6,896
— information processing (20 items)	12.2	4.0	0	20	6,896
— arithmetic (20 items)	11.4	4.7	0	20	6,896
Nonverbal intelligence					
— reasoning (40 items)	25.4	5.2	2	40	6,894
— abstracting (40 items)	23.8	7.0	1	40	6,894
Effort					
— number of days at homework	4.7	1.5	0	7	6,586
— postponing homework	1.5	1.7	0	6	6,201
Achievement motivation (21 items)	53.2	8.7	23	83	6,277
School well-being					
— opinion on fellow students (4 items)	11.8	2.2	4	16	6,861
— opinion on teachers and rules (14 items)	38.9	6.8	14	56	6,801
General student characteristics					
Self-concept (11 items)	34.4	4.9	14	44	6,838
Lifestyle					
— going out	9.3	7.3	0	35	6,611
— hanging out with friends	10.2	7.2	0	35	6,601
— reading and hobbies	8.6	6.6	0	35	6,689
— job	7.3	8.5	0	35	6,579
Scholastic family interaction					
Educational support					
— talking with parents (7 items)	16.0	2.8	7	21	6,798
— supervision of homework (2 items)	3.0	1.2	2	8	6,292

(*continued*)

(*continued*)

	Mean	*SD*	min.	max.	*N*
General family interaction					
Authoritative parenting style	19.2	17.0	0	100	6,878
Number of contact hours	4.3	2.1	0	9	6,283
Structural student and family characteristics					
Gender (1 = male)	.49	.50	0	1	6,896
Position in the row of children					
— only child	.11	.32	0	1	6,048
— eldest child	.33	.47	0	1	6,048
— other children	.56	.50	0	1	6,048
Family composition					
— number of parents (1 = two parents)	.86	.35	0	1	6,823
— number of children	2.8	1.4	1	10	6,041
Socioeconomic status					
— educational level mother	2.4	.9	1	5	6,041
— educational level father	2.6	1.1	1	5	6,041
— occupational level breadwinner	3.0	1.3	1	5	6,041
Ethnicity (1 = ethnic minority)	.06	.23	0	1	6,896
No parent questionnaire	.12	.33	0	1	6,896