Social Positions in Schooling

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In this article, the idea is developed that a track is a type of social position in students' relations with particular teachers and course work during their years of schooling. Using data from High School and Beyond, the authors derived eight curricular positions from an analysis of students' profiles of course work in high school. These curricular positions are associated with students' status characteristics (socioeconomic status, gender, and race) and attitudes (college plans and locus of control) and affect students' senior-year academic achievements net of their sophomore-year achievements, status characteristics, and sector (private versus public school attendance). The positive effects of private schools are explained by the curricular positions of their students, and there is a public school advantage with respect to science achievements for students in equivalent curricular positions.

In many schools, student bodies are differentiated into subgroups that are exposed to different arrays of course work. These so-called tracks differ in the substance, pace, and standards for mastery of the material that is taught. The evidence suggests that the odds of entering particular tracks are affected by many conditions, including the academic ability and socioeconomic origins of the students, and that tracks affect students' educational attainments, attitudes, decisions, and peer relations. Indeed, because of the massive evidence that tracking systems make an important contribution to the intergenerational transmission of social status, these systems have been the focus of educational reform efforts to equalize students' learning opportunities (Alexander and Pallas 1984; Gamoran 1996; Oakes, Gamoran, and Page 1992).

Research on tracks has increasingly concentrated on the amount and type of course work that students encounter in the schooling process, and less reliance has been placed on the formal classification of students with respect to their location in a particular track. This shift toward a micro-analysis of students' course work is reasonable because part of the effect of a track assignment on a student's achievement is based on the course work that defines the track. An emphasis on the discrete components of course work has been encouraged by descriptions of various patterns of curricular differentiation that occur in schools, from which it has become evident that the conventional track model of school differentiation (whereby students are typically categorized as being either in a college preparatory track or not) is more theoretically limiting than useful (see, for example, Cicourel and Kitsuse 1963; Cusick 1983; Finley 1984; Oakes 1985; Powell, Farrar, and Cohen 1985; Rosenbaum 1976; Sanders, Stone, and LaFollette 1984).

Not all schools have formal tracks. Those schools that have formal tracks vary in their number and type of tracks; moreover, the course work taken by a student is not necessarily restricted to a single track. Hence, some research (see, for example, Alexander and Cook 1982; Gamoran and Berends 1987; Garet and DeLany 1988; Stevenson, Schiller, and Schneider 1994) has discarded the track model and has delved into the separate
substantive components of students’ course work. However, if we deal exclusively with the effects of particular types of course work (in mathematics, reading, science, and so forth) on students’ accomplishments, then our hold on the concept of social positions in schooling is weakened. This is the problem we addressed in our study.

Tracking systems are simultaneously technical systems of curricular units and structures of social positions. As technical systems of curricular units, they are maintained and modified by professional educators who seek to improve learning opportunities. As structures of social positions, they are shaped by the cultural, socioeconomic, and demographic conditions of the communities in which these systems are located. A track not only encompasses a set of discrete learning opportunities that affect academic achievements, but can also involve an integrated program of study (entailing expected social rewards) and an array of social and ecological conditions that shape students’ interpersonal relations (peer networks), opinions (ambitions for achievement and self-concept), and decisions (dropping out of school and the choice of colleges to attend).

It is well recognized that tracking assignments have effects on achievements that are independent of the course work they involve (via effects on students’ attitudes and decisions) and that track assignments also have important effects on peer relations via the social ecology of instructional activity that affects students’ opportunities for interpersonal contact. Thus, decomposing a tracking system into its elementary curricular units of course work in mathematics, reading, science, and so forth shifts attention away from students’ social positions as objects of study.

This article is concerned with the development of a new approach to analyzing the social structure of schooling. Here, we suggest that social network theory and technique may be brought to bear on the description of patterns of social differentiation in schools. The distinctive feature of the network approach to social differentiation is that it eschews nominal (administrative) classifications of actors as a basis for describing the parts of a social structure; instead, it derives an image of social structure from the pattern of actors’ concrete relations to other actors and events. We argue that this approach has at least as much explanatory power as past approaches to tracks, that it addresses the problems that have been encountered in analyses of tracks, and that it opens the door to promising new lines of inquiry into the social differentiation of students in schooling.

In this article, we first describe the proposed approach to social positions in schooling. Second, using data from High School and Beyond (HS&B), a national sample of high school students, we apply this approach in an analysis of students’ high school course work. Third, we discuss possible extensions of this approach to social positions in schooling in which more information is taken into account about the concrete instructional events that define the curricular experience of a student in the schooling process.

SOCIAl POSITIONS

In social network research, the extent and pattern of differentiation in a population is described on the basis of relations among the population’s actors or events (Wasserman and Faust 1994). Actors occupy the same position (part of the social structure) to the extent that they have similar profiles of relations with other actors or events. By the same token, a social structure is defined by the existence of actors who occupy different positions in networks of relations. The most restrictive definition of similarity identifies two actors as structurally equivalent only if they have identical relations with other actors or events (for example, if they have exactly the same set of friends or belong to the same groups).

Generalizations of the early restrictive definition of structural equivalence have been vigorously pursued and have produced two lines of work. First, the
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qualitative definition of equivalence has been relaxed so that the extent of the similarity of the profile may be assessed. Second, the restrictive focus on patterns of relations to and from particular actors has been relaxed to allow for definitions of structurally equivalent network environments in which members are tied to the same types of actors; for example, two actors in the authority structures of different organizations are similar if they are located in similar positions in the separate structures.

The network approach to social positions has relied most heavily on interpersonal relations as the basis for defining positions. However, interpersonal relations is one of two main types of relations on which network positions may be defined. The other type of relation is a hypergraph, which involves linkages between actors and events. Our present work is based on hypergraphs.

A hypergraph may be described by a matrix, \( H = [h_{ik}] \), with \( N \) actors and \( K \) events:

\[
H = \begin{bmatrix}
h_{11} & h_{12} & \cdots & h_{1K} \\
h_{21} & h_{22} & \cdots & h_{2K} \\
\vdots & \vdots & \ddots & \vdots \\
h_{N1} & h_{N2} & \cdots & h_{NK}
\end{bmatrix}
\]

where \( h_{ik} \) indicates the relationship of actor \( i \) to event \( k \). The value of \( h_{ik} \) may be binary, to indicate the presence or absence of a link between an actor and an event, or a continuous measure of the strength of the linkage. For example, such actor-event linkages may indicate that actor \( i \) “possesses” or “experiences,” “is subject to the influence of,” or “is a member of” the event \( k \). With a hypergraph, social positions are based on the similarity of actors’ profiles of linkages to events.\(^1\) Actors who are structurally equivalent in a hypergraph have identical sets of linkages to events; for example, they may have the same set of status characteristics, group affiliations, or environmental circumstances. This hypergraph approach to social positions is closely related to the work of numerical taxonomists, who cluster units (animals, plants, commercial products, so forth) on the basis of an inventory of unit-level attributes and behaviors (Arabie and Hubert 1992; Sneath and Sokal 1973).

The social positions of actors can be defined in two steps. First, coefficients of profile similarity are obtained for each pair of actors in the hypergraph and, second, clusters of similar actors are formed. The event-profiles of two actors, \( i \) and \( j \) are simply:

\[
\begin{array}{c}
\text{Event} & x_1 & x_2 & \ldots & x_K \\
\hline
\text{Actor } i & h_{i1} & h_{i2} & \ldots & h_{iK} \\
\text{Actor } j & h_{j1} & h_{j2} & \ldots & h_{jK}
\end{array}
\]

where \( x_k \) identifies the \( K \) events to which the actors might be linked. In a population of \( N \) actors, there will be \( N(N-1)/2 \) pairs of such profiles to evaluate in terms of a measure of their similarity.\(^2\) The result is a \( N \times N \) matrix of (dis)similarity scores among the actors, which can be used to describe the pattern of social differentiation in the population either with a multidimensional scaling representation of the (dis)similarities among the actors or with any of a number of available cluster-analysis methods. Thus, this approach constructs an image of social differentiation from the pattern of actors’ concrete social relations and linkages with events. It entails no assumptions that social relations and events are organized in a particular way; instead, the pattern of social differentiation is revealed empirically from an analysis of the observed individual differences and similarities among actors.

The application of this hypergraph approach to describing students’ curricular positions in schooling is straightforward. Rather than define students’ curricular positions in terms students’ assignments to nominally (administratively) defined tracks, we can use students’ profiles of course work to describe the distinctive combinations of course work that have been pursued by subpopulations of students and thus reveal the major lines of curricular differentiation.
The attraction of this approach is that it circumvents problems that have been encountered in recent analyses of tracks (such as the absence of formally designated tracks in some schools). Moreover, as we will show, it also captures the central feature of students’ track locations—their association with students’ status characteristics, attitudes, and achievements—that has made them an important object of inquiry. We now turn to our empirical analysis, in which we demonstrate that this approach differentiates students on socioeconomic, attitudinal, and achievement dimensions and describes curricular positions that have at least as much explanatory power as the standard measures of students’ track locations.

**DATA AND METHODS**

**The Sample**

HS&B data have been frequently used in studies of tracking. Our sample from these data consisted of 10,786 students who participated in the first three waves of the survey (the Base Year Survey of Sophomores in 1980, the First Follow-up Survey in 1982, and the Second Follow-up Survey in 1984) and who had usable data on the variables we examined. For the analyses, the cases are weighted (TESTWT2) to compensate for unequal probabilities of selection and participation. TESTWT2 is a HS&B acronym; we use these acronyms throughout the description of the variables.

**Formal Model**

To construct a model for students’ academic achievements, we drew on the theoretical work of Sørensen and Hallinan (1978) and Sørensen (1987), regarding the specification of instructional effects on learning, and the empirical work of Gamoran and Mare (1989), concerned especially with the specification of positional effects on learning. We report HLM estimates (Bryk and Raudenbush 1992) of the effects of curricular positions on the students’ senior-year academic achievements, controlling for the students’ sophomore-year achievements and status characteristics. For these estimates, we specified a two-level, random-intercept, model:

\[ ACH_{ij} = \beta_{0j} + \beta_{1}(ACH10) + \beta_{2}(SES) + \beta_{3}(FEMALE) + \beta_{4}(MINORITY) + \beta_{5}(POSITION 2) + \ldots + \beta_{11}(POSITION 8) + r_{ij} \]  

(1)

and

\[ \beta_{0j} = \gamma_{00} + \gamma_{01}(PRIVATE) + u_{0j} \]

(2)

where \( r_{ij} \sim N(0, \sigma^2) \), \( u_{0j} \sim N(0, \tau_{00}) \) and the variables are centered around their grand means.

We included the variable PRIVATE as part of an explanation of the variance among schools in students’ achievements. Because most of the variance in students’ academic achievements occurs within schools, explanations of achievements in terms of school-level characteristics appears less compelling than explanations in terms of characteristics of students’ positions within their schools. Nevertheless, the differential achievements of students attending public and private schools are noteworthy and warrant attention, if only because the explanation of the sector effect (however modest) contributes to a better theoretical understanding of schooling (Alexander and Pallas 1983; Coleman and Hoffer 1987; Coleman, Hoffer, and Kilgore 1982; Lee and Bryk 1988).

**Academic Achievements**

We assessed students’ academic achievements with measures of sophomore- and senior-year achievements in vocabulary (YBVOCBSD, FYVOCBSD), reading (YBVREADSD, FYREADSD), mathematics (YBMTH1SD, FYMTH1SD), and science (YBSCINSD, FYSICNSD). These measures are scaled as T-scores, so that each measure has a mean of 50 and a standard deviation of 10.

**Course Work and Curricular Positions**

The network measures of students’ curricular positions are based on a course profile comprised of 56 binary (0,1) scores, which indicated whether or
not a student had taken at least one year, two years, three years, or four or more years of course work in mathematics (FY4A), English (FY4B), French (FY4C), German (FY4D), Spanish (FY4E), other languages (FY4F), history (FY4G), science (FY4H), business (FY4I), trade (FY4J), technical (FY4K), and other vocational (FY4L) and whether or not a student had taken first-year algebra (FY5A), second-year algebra (FY5B), geometry (FY5C), trigonometry (FY5D), calculus (FY5E), physics (FY5F), chemistry (FY5G), and biology (FY5H). We found that most of the students’ course profiles conformed exactly or closely to 1 of 139 different profiles. CONCOR, a hierarchical cluster-analysis algorithm (White, Boorman, and Breiger 1976), was used to partition these 139 profiles into eight clusters. Then each student’s course profile was matched against the 139 profiles, and a student was assigned to that cluster containing the profile to which the student’s profile most closely matched. We refer to these clusters as $P_1, P_2, \ldots, P_8$. The computer program we used to accomplish these tasks is available on request.

The numbers (subscripts) that were assigned to the positions are meaningful in two respects. First, the rank order of the effects of the positions on students’ academic achievements corresponds with the rank order of the identifying numbers for the positions; that is, students in $P_8$ have the highest mean academic achievement, followed by students in $P_7$, and so forth. Second, the identifying numbers of the positions convey information about how the positions were formed in the clustering algorithm. The algorithm proceeded hierarchically: the 139 profiles were partitioned into two subsets $\{P_1, P_2, P_3, P_4\}$ and $\{P_5, P_6, P_7, P_8\}$; then each subset was partitioned, which produced four subsets $\{P_1, P_2\}, \{P_3, P_4\}, \{P_5, P_6\}$ and $\{P_7, P_8\}$; and finally, each subset was partitioned, which resulted in the eight positions. Hence, for instance, $P_1$ and $P_2$ are less grossly differentiated than $P_1$ and $P_8$.

For purposes of comparison, we also used the standard self-report measure of a student’s track location, which is based on the HS&B variable HSPROG. GENERAL is coded 0 for students in the vocational and academic tracks and 1 for students in the general track. ACAD-EMIC is coded 0 for students in the vocational and general tracks and 1 for students in the academic track.

**Status Characteristics and Attitudinal Measures**

In the analysis of positional effects on students’ academic achievements, we controlled for four status characteristics. FEMALE is coded 0 for males and 1 for females. MINORITY, based on the HS&B variable RACE, and is coded 0 for Whites and 1 for others (Hispanic, American Indian, Asian, Black, Other). Socioeconomic status (SES) is the HS&B variable BYSES, a composite variable (scaled as a z-score) based on five components: father’s occupation, father’s education, mother’s education, family income, and material possessions in the household. PRIVATE, based on the HS&B variable SECTOR, is coded 0 for public schools and 1 for private schools.

To describe the students who occupied the eight curricular positions, we drew on the status characteristics just defined and two attitudinal variables. COLLEGE PLANS, based on the HS&B variable PSEPLANS, indicates the amount of education a student expects to receive; it is coded 0 for none, vocational-technical, or less than a four-year degree and 1 for a college degree or advanced degree. LOCUS OF CONTROL is the HS&B variable FYLOCUS, which is a composite variable (scaled as a z-score), based on the responses “agree strongly,” “agree,” “disagree,” and “disagree strongly” to four statements: “Luck is more important than work for success”; “When I try to get ahead, something or somebody stops me”; “Planning only makes a person unhappy, since plans hardly ever work out anyway”; and “People who accept their condition in life are happier than those who try to change things.”
RESULTS

Course Work in the Eight Curricular Positions

Table 1 presents data on the eight curricular positions that were derived from our analysis of the students’ profiles of course work. These data indicate, for example, that 81.4 percent of the students in position $P_1$ took a year or more of mathematics and that 52.5 percent of the students in position $P_2$ took calculus. Our analysis of the course work that defines each position indicated certain gross differences among the students’

![Table 1. Proportion of Students in Each Curricular Position Who Have Taken Particular Course Work](attachment:table1.png)

$^a$ $N$ is the number of students in a position; the base for a proportion may be less than $N$ owing to missing values. Curricular items that occur for less than .10 of the students in all eight positions are not reported: FRN4, GER2, GER3, GER4, SPN4, LAN2, LAN3, LAN4, TRD4, TCH3, TCH4, VOC4.
The curricular profiles in positions \( P_1, P_2, P_3, P_4 \) are less science oriented than those in positions \( P_5, P_6, P_7, P_8 \). Students in the former set of positions were more likely to have taken certain trade, technical, and vocational courses than were students in the latter, whereas students in the latter set of positions were more likely to have taken four years of mathematics (including course work in algebra, geometry, trigonometry, and calculus) and three or four years of science (including course work in physics, chemistry, and biology) than students in the former. For convenience, we refer to the former set as vocational positions and the latter set as academic positions.

Among the four academic positions, \( P_5, P_6 \) are more likely to entail course work in Spanish than \( P_7, P_8 \), which are more likely to entail course work in French; hence, we refer to the former as academic-Spanish positions and the latter as academic-French positions. The two academic-Spanish positions differ in the likelihood of advanced mathematics and science course work \( (P_5 < P_7) \) and in the likelihood of trade, technical, and vocational course work \( (P_5 > P_6) \). The two academic-French positions differ in the likelihood of course work in advanced mathematics and science \( (P_7 < P_6) \), business \( (P_7 > P_6) \), and languages other than French \( (P_6 < P_8) \).

Among the four less academically oriented positions, the likelihood of course work in trade and technical subjects is greater, and the likelihood of course work in business subjects is less, in \( P_1, P_2 \) than in \( P_3, P_4 \); hence, we refer to the former as vocational-trade positions and the latter as vocational-business positions. The two vocational-business positions differ in the likelihood of advanced course work in mathematics and science \( (P_3 < P_4) \). The two vocational-trade positions differ in the likelihood course work in mathematics, English, Spanish, science, history, business, and vocational subjects \( (P_3 < P_4) \). Our analysis suggests that the two curricular positions in each of the four larger encompassing sets of positions (vocational-trade, vocational-business, academic-Spanish, and academic-French) are differentiated with respect to an emphasis on technical course work (including work in mathematics and science). Hence, we refer to one position as regular and the other as technical (see Figure 1).

Position 1 is a baseline in terms of the level academic work, and we used it as our baseline comparison group for the HLM estimates. The contrasts between Position 1 in the vocational-trade set and Position 8 in the academic-French set are especially dramatic. Comparing the latter to the former, we found that three years of mathematics is more than 11 times as likely (.837 versus .076), three years of English is more than 2 times as likely (.942 versus .442), three years of history is more than 2 times as likely (.386 versus .147), and three years of science is over 34 times as likely (.827 versus .024).

**Distribution of Students’ Status Characteristics, Attitudes, and Achievements**

Table 2 presents data on the eight curricular positions in relation to certain socioeconomic characteristics, attitudes, and academic accomplishments of the students who occupied the positions. The point estimates for each position are less important than is the evidence of a dramatic differentiation among the students with respect to their socioeconomic characteristics, attitudes, and academic accomplishments. The labels that we gave to the positions are based on our analysis of the proportion of students in each position who took various types of course work and are suggestive, rather than exact, descriptors of the course work that is entailed in each of the curricular positions.

If students were randomly distributed among the positions, then the expected percentage of women in each position would be 55.9 percent. However, we found that in the vocational-business positions, approximately 75 percent of the students are women. The lowest
A proportion of women (32.6 percent) is in Position 8, which is the most academically rigorous and science oriented of the eight positions. The underrepresentation of women in the technical positions, which is especially pronounced among the academic positions, points to the type of “hidden” forms of tracking that this approach can reveal and that would not be apparent in the standard (college versus noncollege) approach to track locations.

The curricular positions are neatly differentiated with respect to the average SES of the students in each; there is nearly a full standard deviation difference between Position 1 and Position 8 (−0.40 versus 0.54), and the SES compositions of the other positions are spread out within this range, with the academic positions being above the mean SES for the population and the vocational positions being below the population mean.

There also are noteworthy differences in the racial-ethnic composition of the eight curricular positions. With respect to racial-ethnic categories, the expected proportions in each position are 38.2 percent (Whites), 17.4 percent (Blacks), 38.6 percent (Hispanics), and 4.1 percent (Asians); we have not reported the findings for the other categories (such as American Indians). Whites are especially overrepresented in the two academic-French positions and in the

![Figure 1: Hierarchy of Curricular Positions](image)

### Table 2. Composition of the Eight Positions

<table>
<thead>
<tr>
<th>Compositional Indicators</th>
<th>Vocational Positions</th>
<th>Academic Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trade</td>
<td>Business</td>
</tr>
<tr>
<td></td>
<td>Reg Tec</td>
<td>Reg Tec</td>
</tr>
<tr>
<td>% Female</td>
<td>48.8 54.8</td>
<td>76.6 74.6</td>
</tr>
<tr>
<td>Mean SES</td>
<td>−0.40 −0.31</td>
<td>−0.32 −0.22</td>
</tr>
<tr>
<td>% White</td>
<td>40.9 30.1</td>
<td>55.3 39.7</td>
</tr>
<tr>
<td>% Black</td>
<td>13.4 13.9</td>
<td>16.3 17.4</td>
</tr>
<tr>
<td>% Hispanic</td>
<td>40.4 50.6</td>
<td>24.3 40.3</td>
</tr>
<tr>
<td>% Asian</td>
<td>1.9 1.7</td>
<td>2.0 0.8</td>
</tr>
<tr>
<td>% College plans</td>
<td>16.1 31.1</td>
<td>18.8 38.4</td>
</tr>
<tr>
<td>Mean locus of control</td>
<td>−0.19 −0.13</td>
<td>−0.22 0.07</td>
</tr>
<tr>
<td>Mean vocabulary achievement</td>
<td>45.2 46.5</td>
<td>46.8 49.5</td>
</tr>
<tr>
<td>Mean reading achievement</td>
<td>48.8 46.9</td>
<td>45.6 48.5</td>
</tr>
<tr>
<td>Mean mathematics achievement</td>
<td>44.3 45.0</td>
<td>45.6 47.9</td>
</tr>
<tr>
<td>Mean science achievement</td>
<td>45.4 45.2</td>
<td>45.8 46.4</td>
</tr>
</tbody>
</table>

*The expected percentages based on a random distribution of students among the positions are 55.9 (Female), 38.2 (White), 17.4 (Black), 4.1 (Asian), and 60.5 (college plans).*
vocational-business-regular position and are underrepresented in the vocational-trade-technical position. While Blacks are distributed relatively evenly among the positions, Hispanics are not. The pattern for the Hispanics is the converse of that for the Whites; that is, Hispanics are underrepresented in the two academic-French positions and in the vocational-business-regular position and are overrepresented in the vocational-trade-technical position.

The students are also differentiated in their attitudes and preferences. Students who declared an intention to pursue a college or advanced degree are neatly arrayed according to position: The percentages are higher in the technical than in the regular positions, and within these two classifications (technical and regular), the percentage increases with the academic orientation of a position. Moreover, with respect to their locus of control, students in the more academically oriented positions are, on average, less fatalistic and more self-efficacious than are students in the vocationally oriented positions; the distribution of means on this variable is especially poignant in indicating that (along with the differences in career plans) the social differentiation of these students penetrates deeply into their cognitive orientation toward their role in society.

Finally, these curricular positions differentiate students across a broad spectrum of academic achievements. A substantial proportion of the variance in students' academic achievement is between the positions in each of the areas of achievement. The intraclass correlations indicate that approximately 25–30 percent of the variance in vocabulary, reading, and science and 42 percent of the variance in mathematics achievement is between the positions.6

Positions and Academic Achievements

Table 3 presents estimates of the effects of the positions on senior-year mathematics and science achievements, and Table 4 presents the estimates for senior-year vocabulary and reading achievements. In both tables, Model 1 gives the total effects for the status variables (female, minority, and SES) and for sector (private versus public school). Model 2 adds the positional variables to the account, and Model 3 adds a control for sophomore-year achievement. The pattern of findings is fairly consistent across these areas of academic achievement.

There are significant total effects of status and sector on academic achievements (Model 1). Male students have higher mean achievements than do female students. Minority students have lower mean achievements than do non-minority students. Mean achievements increase with the SES of students. Private school students have higher mean achievements than do public school students (except in science, where there is no significant difference).

The students' curricular positions have significant effects on academic achievement independent of students' status characteristics and sector, and the effects of status and sector depend on the curricular positions that the students occupy (Model 2). Females students who occupy the same curricular positions as male students have lower mean achievements. The curricular positions at best make a modest contribution to the explanation of the gender effects. Minority students who occupy the same curricular positions as non-minority students have lower mean achievements, and these differences are actually somewhat increased once students' curricular positions have been taken into account. Mean achievements increase with the SES of students among students who occupy the same curricular positions; however, unlike the case of minority status, the differences decrease once students' curricular positions have been taken into account. The effects of private versus public schools are somewhat more complex but especially interesting. In mathematics and reading, the positive effects of private schools disappear among students who occupy the same curricular positions; and in vocabulary, where a private school advantage persists, the advantage is substantially decreased. In science,
Table 3. HLM Estimates for Models of Mathematics and Science Achievement\(^a\)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mathematics</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>-2.212***</td>
<td>-1.824***</td>
</tr>
<tr>
<td>(0.225)</td>
<td>(0.194)</td>
<td>(0.136)</td>
</tr>
<tr>
<td>Minority</td>
<td>-1.915***</td>
<td>-2.648***</td>
</tr>
<tr>
<td>(0.200)</td>
<td>(0.171)</td>
<td>(0.122)</td>
</tr>
<tr>
<td>SES</td>
<td>2.443***</td>
<td>1.086***</td>
</tr>
<tr>
<td>(0.123)</td>
<td>(0.108)</td>
<td>(0.077)</td>
</tr>
<tr>
<td>Private school</td>
<td>2.574***</td>
<td>-0.522</td>
</tr>
<tr>
<td>(0.415)</td>
<td>(0.331)</td>
<td>(0.201)</td>
</tr>
<tr>
<td>Position 2</td>
<td>0.685*</td>
<td>1.124***</td>
</tr>
<tr>
<td>(0.331)</td>
<td>(0.235)</td>
<td></td>
</tr>
<tr>
<td>Position 3</td>
<td>1.591**</td>
<td>0.798*</td>
</tr>
<tr>
<td>(0.334)</td>
<td>(0.380)</td>
<td></td>
</tr>
<tr>
<td>Position 4</td>
<td>4.454***</td>
<td>2.595***</td>
</tr>
<tr>
<td>(0.313)</td>
<td>(0.223)</td>
<td></td>
</tr>
<tr>
<td>Position 5</td>
<td>7.248***</td>
<td>3.593***</td>
</tr>
<tr>
<td>(0.301)</td>
<td>(0.217)</td>
<td></td>
</tr>
<tr>
<td>Position 6</td>
<td>11.539***</td>
<td>5.847***</td>
</tr>
<tr>
<td>(0.303)</td>
<td>(0.223)</td>
<td></td>
</tr>
<tr>
<td>Position 7</td>
<td>11.414***</td>
<td>5.602***</td>
</tr>
<tr>
<td>(0.352)</td>
<td>(0.257)</td>
<td></td>
</tr>
<tr>
<td>Position 8</td>
<td>15.513***</td>
<td>6.150***</td>
</tr>
<tr>
<td>(0.334)</td>
<td>(0.255)</td>
<td></td>
</tr>
<tr>
<td>Sophomore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mathematics score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>score</td>
<td>0.680***</td>
<td>0.737***</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Sophomore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>science score</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.610***</td>
<td>0.640***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>General track</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.579***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.196)</td>
<td></td>
</tr>
<tr>
<td>Academic track</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.997***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.173)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>51.559</td>
<td>51.795</td>
</tr>
<tr>
<td>(\sigma^2)</td>
<td>64.162</td>
<td>47.330</td>
</tr>
</tbody>
</table>

\(a\) Standard errors are in parentheses. HLM estimates are centered on their grand means. Cases have been weighted to compensate for unequal probabilities of selection and participation in the sample. The \(\sigma^2\) estimates, based on random-effects ANOVA models of mathematics and science achievements, are 67.033 and 67.863, respectively.

* \(p < .05\), ** \(p < .01\), *** \(p < .001\) (two-tailed test).

Public school students who occupy the same curricular positions as private school students have higher mean achievements in science than those of their private school counterparts.

A control for sophomore-year achievement (Model 3) permits an estimate of the effects of students' status characteristics, sector, and curricular positions on senior-year achievements that are independent not only of sophomore-year achievements, but also of all other contributions to senior-year achievements (based on unmeasured variables), which are transmitted via sophomore-year achievements. Hence, this model gets us closer to an assessment of the direct (unmediated) effects of students' status characteristics, sector, and curricular positions; for this reason, Sørensen and Hallinan (1978) and Sørensen (1987) argued that it provides an especially useful specification of instructional effects on learning. With one noteworthy exception, the pattern of estimates obtained with Model 3 is virtually identical to the pattern we reported for Model 2. The major differences are the previous negative estimates for minority status on achievements, which are now substantially
Table 4. HLM Estimates for Models of Vocabulary and Reading Achievement

<table>
<thead>
<tr>
<th>Variables</th>
<th>Vocabulary</th>
<th>Reading</th>
<th>Vocabulary</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3-Track</td>
</tr>
<tr>
<td>Female</td>
<td>-0.839***</td>
<td>-0.758**</td>
<td>-0.251</td>
<td>-0.219</td>
</tr>
<tr>
<td></td>
<td>(0.224)</td>
<td>(0.121)</td>
<td>(0.148)</td>
<td>(0.148)</td>
</tr>
<tr>
<td>Minority</td>
<td>-2.791***</td>
<td>-3.245***</td>
<td>-0.933***</td>
<td>-0.730***</td>
</tr>
<tr>
<td></td>
<td>(0.201)</td>
<td>(0.188)</td>
<td>(0.134)</td>
<td>(0.134)</td>
</tr>
<tr>
<td>SES</td>
<td>2.198***</td>
<td>1.283***</td>
<td>0.310***</td>
<td>0.385***</td>
</tr>
<tr>
<td></td>
<td>(0.122)</td>
<td>(0.117)</td>
<td>(0.084)</td>
<td>(0.085)</td>
</tr>
<tr>
<td>Private school</td>
<td>3.360***</td>
<td>1.041**</td>
<td>0.152</td>
<td>0.434*</td>
</tr>
<tr>
<td></td>
<td>(0.422)</td>
<td>(0.376)</td>
<td>(0.210)</td>
<td>(0.215)</td>
</tr>
<tr>
<td>Position 2</td>
<td>1.194**</td>
<td>1.073***</td>
<td></td>
<td>0.949*</td>
</tr>
<tr>
<td></td>
<td>(0.359)</td>
<td>(0.259)</td>
<td></td>
<td>(0.387)</td>
</tr>
<tr>
<td>Position 3</td>
<td>0.247</td>
<td>-0.048</td>
<td></td>
<td>-0.479</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.434)</td>
<td></td>
<td>(0.626)</td>
</tr>
<tr>
<td>Position 4</td>
<td>3.646***</td>
<td>2.262**</td>
<td></td>
<td>3.133***</td>
</tr>
<tr>
<td></td>
<td>(0.340)</td>
<td>(0.245)</td>
<td></td>
<td>(0.365)</td>
</tr>
<tr>
<td>Position 5</td>
<td>6.168***</td>
<td>3.650***</td>
<td></td>
<td>5.408***</td>
</tr>
<tr>
<td></td>
<td>(0.327)</td>
<td>(0.237)</td>
<td></td>
<td>(0.352)</td>
</tr>
<tr>
<td>Position 6</td>
<td>8.803***</td>
<td>4.452***</td>
<td></td>
<td>8.318***</td>
</tr>
<tr>
<td></td>
<td>(0.330)</td>
<td>(0.242)</td>
<td></td>
<td>(0.355)</td>
</tr>
<tr>
<td>Position 7</td>
<td>8.824***</td>
<td>4.380***</td>
<td></td>
<td>8.657***</td>
</tr>
<tr>
<td></td>
<td>(0.384)</td>
<td>(0.280)</td>
<td></td>
<td>(0.414)</td>
</tr>
<tr>
<td>Position 8</td>
<td>10.661***</td>
<td>4.447***</td>
<td></td>
<td>12.345***</td>
</tr>
<tr>
<td></td>
<td>(0.367)</td>
<td>(0.271)</td>
<td></td>
<td>(0.392)</td>
</tr>
<tr>
<td>Sophomore vocabulary</td>
<td>0.653***</td>
<td>0.662***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>score</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sophomore reading score</td>
<td></td>
<td></td>
<td>0.626***</td>
<td>0.645***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.007)</td>
<td>(0.211)</td>
</tr>
<tr>
<td>General track</td>
<td>1.533***</td>
<td></td>
<td></td>
<td>1.652**</td>
</tr>
<tr>
<td></td>
<td>(0.213)</td>
<td></td>
<td></td>
<td>(0.242)</td>
</tr>
<tr>
<td>Academic track</td>
<td>3.407***</td>
<td></td>
<td></td>
<td>3.197**</td>
</tr>
<tr>
<td></td>
<td>(0.187)</td>
<td></td>
<td></td>
<td>(0.211)</td>
</tr>
<tr>
<td>Constant</td>
<td>51.371</td>
<td>51.583</td>
<td>51.439</td>
<td>51.416</td>
</tr>
<tr>
<td></td>
<td>51.717</td>
<td>51.875</td>
<td>51.681</td>
<td>51.652</td>
</tr>
<tr>
<td>\sigma^2</td>
<td>65.896</td>
<td>57.754</td>
<td>30.754</td>
<td>31.246</td>
</tr>
<tr>
<td></td>
<td>75.947</td>
<td>65.973</td>
<td>35.519</td>
<td>40.118</td>
</tr>
</tbody>
</table>

* Standard errors are in parentheses. HLM estimates are centered on their grand means. Cases have been weighted to compensate for unequal probabilities of selection and participation in the sample. The \sigma^2 estimates, based on random-effects ANOVA models of vocabulary and reading achievements, are 68.664 and 78.099, respectively.
* p < .05, ** p < .01, *** p < .001 (two-tailed test).

Reduced relative to the total effects in Model 1.

In comparison to the standard self-reported measure of track location, the present approach to curricular positions offers a more precise specification of sector and status effects on students’ achievement. These results are reported in the last columns of Tables 3 and 4. The effects of SES are generally larger and the effects of minority status are generally smaller in the three-track model than in Model 3, which is based on the more refined curricular positions. Hence, our evidence suggests that the standard approach somewhat overestimates the effects of SES and underestimates the effects of minority status on students’ academic achievement. Moreover, there are certain important differences in the sector effects: The negative effect of private schools on science achievement is detected by our model but not by the three-track model, and the three-track model does not entirely dispose of the sector effects on vocabulary achievement.

Summary of Findings

We used basic information on the profiles of high school students’ course
work and derived eight curricular positions that involve distinctive combinations of high school course work. There are marked variations in the status characteristics (gender, race) and attitudes (college plans, locus of control) of the students who are located in these different curricular positions, and substantial proportions of the variance in senior-year academic achievements are between positions. These curricular positions affect students’ senior-year academic achievements net of the students’ sophomore-year achievements, status characteristics, and sector (attendance at private versus public schools). The curricular positions of students enter importantly into the account of the effects of gender, minority status, and parents’ SES on achievements and account entirely for the positive effects of private schools on academic achievement. Hence, we should expect similar academic performances from students in public and private schools who have similar profiles of course work and who are equivalent in gender, minority status, and home conditions; the single exception, and it is an interesting one, is science achievement, in which case comparable students significantly benefit from attending public schools.

The comparison of these findings with those obtained with a standard three-track model of curricular differentiation demonstrates that the proposed approach is as least as powerful as the standard approach. Hence, it appears feasible to discard the problem-ridden conceptualization of school differentiation as a set of formal tracks, but to retain the idea that students are distributed in a structure of curricular positions during their years of schooling. Our evidence suggests that the results of previous studies that were based on the traditional approach are not grossly misleading and that there are important payoffs in pursuing the effects of tracks on students, especially in terms of a more refined set of curricular positions that are based on students’ profiles of course work.

**DISCUSSION**

Our results are consistent with the reform efforts that aim to diminish the negative effects of certain status characteristics on academic achievements by altering the profiles of students’ course work. Efforts that encourage female, minority, and low-SES students to enter more academically rigorous programs of study should pay off with some diminishment of the negative effects of these status characteristics on achievements. Our results also suggest that private school education offers no distinctive advantage to students, except in those cases where students would not receive as rigorous a program of study if they were to enter a public school (Bryk, Lee, and Holland 1993). In settings where the public schools afford access to such courses of study, the decision to attend a private or public school need not be driven by concerns of a substantial difference in expected achievements, depending on which school is attended.

Science achievement is a special case because it appears that public schools do confer an advantage. We suspect that this advantage is the result of the quality of the science laboratories and equipment that public schools are able to support, but that many private schools cannot afford.

The present approach to defining social positions in schooling addresses several concerns that have been raised in the literature on tracking. First, it entails no assumptions about the extent pattern of social differentiation, and it allows a description of complex configurations of curricular differentiation. Second, the approach constructs positions on the basis of objective (transcript) experiences of students, rather than on students’ perceptions of their positions, which do not always correspond to students’ actual positions and may confound students’ college plans with their profiles of course work (Rosenbaum 1980). Third, the approach eschews a reliance on formal or nominal differentiation as a basis for describing social structure: It is able to reconstruct such organization when it exists, and when such formal differentiation does not
exist, the approach is able to reveal the differentiated positions that emerge as negotiated order from an elective system (Finley 1984). The data demands of this approach are not qualitatively different from those of past survey-research studies of students’ achievements and reinforce the current demand for denser samples of students in schools.

A concern with the description of students’ curricular positions is warranted when those positions are comprised of stable conditions into which students are channeled and when they, in turn, have important effects on students’ attitudes and behaviors. There is good reason to suppose that such stable and influential positions for students are formed and maintained in many educational systems. Community and societal norms and policies shape the decisions of educators in local school systems concerning the provision of course work in particular subjects, and these norms and policies also influence students’ preferences for the pursuit of certain patterns of course work in high school. Hence, the social positions of students may sometimes be viewed as instantiations of more global and institutionalized curricular positions. Such instantiations are evident in nations, such as France and Japan, in which state-level educational policies severely constrain the curricula of schools.

Notable differences in students’ educational attainments accumulate over time and, therefore, may be understood as arising from differentiated patterns of course work in multiyear sequences of schooling. Multiyear histories may be particularly important in tracing the transmission of socioeconomic origins. We have illustrated the feasibility of implementing a network approach to curricular positions; however, it may be that the most powerful findings from this approach will emerge from analyses of refined social positions that take into account a sequence of students’ encounters with particular teachers in elementary and secondary schools. We elaborate on this point later.

Curriculum, teaching assignments, and scheduling are the primitive and essential features of all schools, and this formal organization of functions (the course-teacher-time nexus) implies a corresponding social structure of students. Students are differentiated on the basis of the formal units of subject matter they encounter (such as courses), the teachers they have who deliver this subject matter, and the time of the encounters. Along these lines, social positions may be defined in the hypergraph of students’ linkages to a course-teacher-time event $x_{ikt}$, where $k$ is a course, $j$ is the instructor of the course, and $t$ is the time at which the course was taught. On the basis of students’ links with course-teacher-time events $(x_{ikt})$, students will occupy similar positions only to the extent that they have passed through the “halls” of the same schools and the “hands” of the same teachers at the same times.

Social positions, which are embedded in the detailed relations of students with particular course work and teachers, may be especially sensitive indicators of conditions that affect the schooling process. Students’ positions are strongly shaped by the combination of the residential segregation of the student population (based on income and race) and the formal organization of schooling, which links place of schooling with place of residence. The SES of parents constrains place of residence, which, in turn, constrains the sequence of teachers a student encounters during the schooling process. This constraint may be more complete or less complete, depending on the availability of alternative schools and teachers at each grade level. Given the opportunity to choose among schools and teachers in schools, parents’ interest in education is manifested, in part, by parents’ success in controlling the classroom assignments of their children whenever alternative assignments are possible. Hence, high school seniors who began their schooling in the same elementary school and who occupy similar curricular positions in high school can have been instructed by different teachers. Any variation in the quality of instruction among such
differentiated positions is likely to affect the students' academic achievements.

Finally, because these social positions are embedded in students' relations with particular milieus, the positions are likely to offer a powerful account of students' interpersonal interactions. If propinquity fosters face-to-face interactions, then the more similar the social positions of two students, the greater their opportunities for face-to-face interactions.\(^9\) From this viewpoint, formal tracks are only a superficial manifestation of a more profound structural basis of social differentiation in schooling. Even without a formal system of tracking, students would be dramatically differentiated at the end of their schooling with respect to the substantive, spatial, and temporal dimensions of their course work.

This approach is easily extended to an analysis of social positions in elementary schools. Elementary schools sometimes assign students to different classrooms on the basis of ability (Rowan and Miracle 1983). However, the more prevalent and distinctive organizational feature of elementary schools is the within-classroom differentiation of students arising from instructional groups for the development of basic skills (Barr and Dreeben 1983; Dreeben and Gamoran 1986; Rist 1973; Rowan and Miracle 1983; Sørensen and Hallinan 1986; Weinstein 1976). A network approach to defining within-classroom social positions is feasible, given a refined breakdown of the course work that may occur in such classrooms. For example, if the curricular events were defined in terms of elements of basic skills, then students' profiles would consist of a pattern of instruction in these skills. Such profiles might also entail measures of the intensity or pacing of the students' instructional encounters with particular elements of skills. In terms of such refined events, a differentiated within-classroom social structure would suggest that different students in the same class were exposed to different curricula.

The key idea of this article is that a network approach to students' curricular positions leads to a generalization of the concept of tracks. Because the proposed approach provides for a more refined social structural analysis of schooling than does the tracking construct, it may foster an understanding of how students' outcomes are shaped by students' passage into and through certain positions in the social organization of schooling. It has been noted that the conventional measures of curricular differentiation are an oversimplified analytical approach that may underestimate the effects of school organization (Gamoran and Berends 1987; Oakes et al. 1992). Although the usefulness of a more detailed structural analysis of schooling was recognized some time ago, for example, in Sørensen's (1970) discussion of the organizational differentiation of students, it has not been clear how such an analysis may be pursued. In this article, our aim has been to describe an approach that appears promising and that has proved useful in mapping patterns of social differentiation in a variety of formal organizations and communities.

**NOTES**

1. Hypergraphs have been used to construct two types of networks: a network of actor-affiliations, in which pairs of actors are more strongly or less strongly tied, depending on the similarity of their profiles of events, and a network of event-affiliations in which pairs of events are more strongly or less strongly tied, depending on the similarity of their profiles of actors. The present analysis focuses on the network of actor-affiliations.

2. For a useful discussion of alternative measures of profile similarity, see Sneath and Sokal (1973).

3. Hence, the course work in FY4A-FY4L are represented by 48 variables and the course work in FY5A-FY5H are represented by 8 variables.

4. Measuring the level of conformance as the proportion of matching items in two profiles, we found that over 90 percent of the student course profiles matched one of the 139 different profiles at a level of .87, and over 99 percent matched at a level of .80. These 139 profiles were obtained by an iterative search for distinctive profiles in a cumulative sample of profiles: a random sample of cases was drawn, the "duplicate"
profiles were eliminated from the sample, more randomly selected cases were added to
the sample, the duplicate profiles were eliminated, and so on. Two profiles were defined
as duplicates when the proportion of matching items in the two profiles was above a cer-
tain threshold (.95). The higher the threshold for duplicates, the larger the number of dis-
tinctive profiles of course work. A threshold of .95 was selected because it resulted in a
large number of distinctive profiles, but not so large that their clustering was impractical.
5. The large size of the HS&B data set disallows the direct clustering of students accordin-
g to the similarity of their course profiles. Thus, the present method clusters course
profiles, rather than students, and then assigns students to the clusters. The number of clusters can be increased or reduced, depending on the level of refine-
ment that is sought for a description of the pattern of curricular differentiation.
6. These intraclass correlations are based on a one-way random-effects ANOVA
model, \( Y_{ij} = \beta_{0i} + r_i + u_{ij} \), where \( Y_{ij} \) is the achievement of a student
in the \( j \)th position, \( \beta_{0i} \) is the mean achievement of students in the \( i \)th position, \( r_i \)
is the grand mean achievement, and \( u_{ij} \) are random disturbances.
7. We are not pitting the standard measure against our approach. Since many
schools have abandoned formal tracks or have elaborated them in various ways, work
on tracking effects has been troubled by concerns about the usefulness of students’ self-
reports on their locations in a college-preparatory or some other track. The proposed
approach addresses these concerns, and the purpose of presenting these results on the
three-track model is to demonstrate that the proposed approach not only provides a prac-
tical solution to these concerns, but is at least as powerful as the standard approach in elucidating the effects of schooling on students’ achievement.
8. The timing of a course serves to distinguis-
ghish different sections of a course that are taught by a teacher at the same time (quarter, semester), as well as instances of the same course taught by a teacher at different times.
9. Social foci effects (Feld 1981) on peer
relations have been observed both in high
schools (Alexander, Cook, and McDill 1978; Alexander and Eckland 1975; Alexander
and McDill 1976) and in elementary schools
(Hallinan and Sørensen 1987; Hallinan and Tuma 1978; Rowan and Miracle 1983).

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