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THE ORGANIZATIONAL DIFFERENTIATION OF STUDENTS IN SCHOOLS

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ABSTRACT

This paper focusses on the consequences for student opportunities and performances of grouping students in classrooms, grades, tracks, etc. The organizational differentiation of students is shown to define a structure of flows in educational systems that structure educational opportunities, create different learning and social environments and present a set of signals about the competencies and futures of students. A number of substantive hypotheses regarding the effect of grouping practices on student outcomes are presented and methodological implications of the analysis are discussed.

The Organizational Differentiation of Students in Schools

1. INTRODUCTION

The deliberate assignment of students to groups, generally grades and classrooms, is an integral part of education in schools; in addition, tracks, streams, and ability groups are created in many educational systems. The resulting partitioning of students is referred to here as the organizational differentiation of students. The purpose of this paper is to analyze the consequences of various forms of organizational differentiation in regard to opportunities and achievements of students.

The topic of this paper has received some attention by researchers. Sociologists in particular have been concerned about the effects of various forms of organizational differentiation of students on equality of opportunity; that is, whether certain patterns of differentiation reinforce or weaken the well established association between social origins and educational outcomes. Educational researchers have tended to concentrate on the impact of grouping practices on learning, and on student outcomes, such as self-esteem. The research interest at least partly reflects a considerable public interest in the topic, most recently in Western Europe, where changes or proposals for change in patterns of organizational differentiation have generated much controversy. The public interest is easy to understand: The organizational differentiation of students structures educational opportunities, and educational opportunities structure social and economic opportunities in society. Hence the organizational differentiation of students becomes structures for the preservation or removal of inequalities.

This paper does not attempt to review the research on the topic, since the literature is noncumulative and filled with inconclusive and inconsistent findings. Reading the literature, it is easy to lose enthusiasm for the topic: It is apparently much easier to invent stories about possible effects than it is to establish these effects. This is particularly true for the research conducted in American schools on ability grouping. One is tempted to conclude that there is perhaps not very much there, as one is tempted to draw the same conclusion regarding the effect of between school differences in educational resources. But as with between school differences, the lack of consistent findings on the effects of organizational differentiation may be due to inadequate conceptualizations of the processes that create observed outcomes, rather than to the lack of a true relationship.

The organizational differentiation of students is a potentially important policy variable. Patterns of groupings are deliberately designed by school authorities to achieve administrative ends, to obtain certain pedagogical results, and perhaps also to satisfy groups of parents and other influentials, as well as tradition. Hence, if inadequate conceptualization is responsible for inconclusive research, we might miss an important opportunity to create better schools. For this reason, this paper concentrates primarily on conceptual issues, to determine the mechanisms that produce the effects of organizational differentiation on opportunities and performances of students, and to identify the variables that capture the salient aspects of the organizational differentiation of students.

Conceptualization implies certain methodological principles, as the identification of mechanisms and variables tells what to look for

and how. These principles result in decisions about the specification of functional forms and how to establish relations among variables. The formulation of these methodological implications forms the second main objective of this paper.

The focus is on the differentiation of students in primary and secondary schools. The most differentiated of all parts of the educational system--higher education--is not analyzed here, since it raises a very different set of questions. But the existence of higher education is in many ways crucial for the differentiation of students that takes place in lower levels of education. To say organizational differentiation structures the educational opportunities of students usually refers to opportunities for gaining access to higher education. It is the existence of higher education that gives organizational differentiation its significance for individual attainment; and however unfortunate it may seem from a pedagogical point of view, it is the preparation for higher education that justifies much differentiation of learning, with respect both to amount and content.

It is natural in an American context to focus on organizational differentiation within schools: Until recently, the comprehensive high school reflected a unique American institution. But some of the most dramatic forms of organizational differentiation involve the assignment of children to different school buildings, according to their assumed abilities and aspirations. This is the traditional European mode of organizational differentiation. The analysis of both these forms of organizational differentiation implies a comparative perspective which might reveal important potential variation in dimensions of organizational differentiation. Whether organizational differentiation takes place within or between physical buildings should not affect our conception of the

phenomenon. Some of the most conclusive research on the consequences of organizational differentiation comes from outside the U.S., particularly from Britain.

The most important forms of organizational differentiation are surveyed in the following section. Next, an attempt is made to identify the most significant concepts characterizing grouping systems. The conceptual framework is in turn used to analyze the impact of organizational differentiation on learning and socialization, and on equality of opportunity. Finally, methodological implications of the analysis are presented.

2. MODES OF ORGANIZATIONAL DIFFERENTIATION

At the most elementary level, the organizational differentiation of students is a way of obtaining benefits from a division of labor. The societal division of labor produces teachers who specialize in instructional and custodial activities. Group instruction makes it possible to have fewer teachers than students in each time period. Although completely individualized instruction would still produce benefits from creating specialists in the activity of teaching, and considering the average life of a teacher is several times the typical schooling time of youngsters, the benefits from the societal division of labor are still several times increased by assigning a number of students to a teacher in each time period. The number of students assigned customarily ranges from 20 to 40, which seems to reflect a compromise between maximizing the gain from having specialized teachers, and minimizing costs in the form of noise and lack of individualized attention. The number of students in an instructional group is rarely below 10, and only the well disciplined students of higher education are instructed in very large groups.

The formation of groups for instructional purposes takes a plethora of forms, and no aspect of the organizational differentiation of students can be said to be truly universal. Classrooms defined as groups of students sharing a physical location and one teacher over a time period are of course a basic unit in most systems, but classroom boundaries are diffuse in open schools, or at least are intended to be. Further, classrooms are often subdivided by teachers for instructional purposes. Such subdivisions, for example, according to ability, may be highly relevant for the opportunities and learning of students, and should not be ignored in an analysis of the consequences of the organizational differentiation of students. Between classroom groupings are, however, the most often discussed feature of the organized differentiation of students, and may be argued to usually have more dramatic effects because between classroom groupings involve different teachers, and the physical and temporal boundaries of the classroom may be important for social interaction processes and the social environments students are exposed to.[1] I concentrate on between classroom groupings in this survey of groupings.

Learning is a cumulative process where what is learned in one period may be important for what can be learned in later periods. Schools reflect this almost universally by grouping classrooms in grade levels, using a year as the unit. The criteria used reflect the seniority of students in the system, and since intake is usually kept age-homogenous, the main qualification for access to a grade level becomes age in comprehensive systems. In noncomprehensive systems, such as the traditional European systems of secondary education, access to higher grade levels depends on academic achievement. This was the case even in primary schools in Victorian Britain, where grade

progression was determined exclusively by academic achievement, and grade levels consequently were age heterogeneous and achievement homogeneous. In fact, teachers were paid according to the number of students they made able to pass from one grade level ("standard") to the next (Dent, 1949).

The fairly typical pattern of "nongrading" in primary schools refers not to the absence of grade levels but to within classroom differentiation of students according to achievement levels in specific subjects (usually reading and math). The phenomenon of "multigrading" refers to the formation of instructional groups across grade levels, usually in combination with attempts to implement team teaching and open school concepts.

The overtime stability of instructional groups across grade levels is of importance for the analysis of the consequences of groupings. The typical American pattern is to have teachers assigned to grade levels and frequently also to reconstitute classrooms at each grade level. However, within a grade level the much used pattern of the "self-contained" classroom results in a single teacher handling almost all topics. The identification with a single classroom at a given grade level is less pronounced at the high school level, where departmentalized teaching is the rule. Stable groupings of students across grade levels in both primary and secondary schools are found frequently outside the U.S., and are often combined with the assignment of a teacher (or a set of teachers at higher grades) to a class of students across grades.

Although there are a number of specific grouping patterns (see Rubin, 1977), most can be reduced to two main forms: the differentiation of classroom according to curriculum, and differentiation according to assumed capacity to learn. Differentiation according to curriculum is often

accompanied by the definition of linkages between classes so that clusters of classes define a program or track. Track systems generally result in groupings that are also ability groupings. However, the comprehensive American high schools usually claim that the assignment to tracks is a question of student interests, and educational and vocational plans. Assignment of students to ability groups is seen as an instructional device with nonelective assignment, particularly when such groupings are done at the primary level.

The comprehensive school with its professed elective assignment to classrooms defined by curricula was a unique American institution until the 1960s, in sharp contrast to the highly selective European systems of secondary education. These latter systems, whether the British Grammar school, the German and Scandinavian Gymnasium, or the French Lycée, have their roots in medieval church schools preparing for church universities. As institutions of formal education they precede primary schools, not a universal institution before the nineteenth century. As church universities became state universities these schools served as channels of recruitment for clergy and loyal administrators serving the ruler. It appears that until the nineteenth century, these schools were important as channels of sponsored upward mobility. With the growth of professions, they became rather exclusively the dominant schools of the societal elite. The nineteenth century first saw the emergence of primary schools for the lower classes and later the emergence of another secondary school system (often private) for the children of the new middle classes in need of relevant technical and business instruction. The basis for the resulting system of education in social structure is explicit:

> First grade schools (i.e., grammar and "public" schools) [were used by] men with considerable incomes independent of their own exertions [and] the great body of professional men, especially the clergy, medical men and lawyers [who] have nothing to look to but education to keep their sons on a high social level. [While schools of the second grade] were for the army, all but the highest branches of the medical and legal professions, civil engineering [and others] who view to some form of commercial or industrial life. (Banks, 1955, quoting British school commissions from 1868 and 1895)

These systems were administratively integrated in Britain and in other countries around the turn of the century. As those not selected for either secondary system began seeking more education, a third branch was instituted. The result was a tripartite system of secondary education still dominant in Europe, with different schools for different branches, with different school-leaving ages, and with selection for the different branches around ages 10 to 12. A comprehensive system was pioneered in Sweden in 1962, and later introduced in England.

The European system combines selection for ability with curriculum differences, generally resulting in access to higher education being permitted only for those who are admitted to the academic branch of secondary education. The American pattern clearly is very different. The idea of the common school, as opposed to the school for common people, which motivated the introduction of primary schools in Europe, goes back to colonial times (Cremin, 1951). The progressive idea in education further made American schools into a system of mass education up to the university level. As a result there is no selection into secondary school (except the existence of a few elite schools, modeled on the European system). Ability grouping at lower levels of education therefore lacks the clear career consequences associated, for example, with streaming in British primary schools as the preparation for the 11^{+} examination that determines

access to secondary schools.

On the surface it would seem that American schools are not well suited settings for the study of the negative consequences of the organizational differentiation of students that so often are looked for. And, in fact some of the most unambiguous findings of the effects of differentiation will be found in studies of European schools. But ability grouping and tracking exist, and the conventional system of tracking often hints at the tripartite division of selective secondary systems: college, vocational, and general tracks are the common possibilities.

Groupings according to criteria other than educational seniority, ability/achievement, and curriculum may be important: Sex and race are the most significant possibilities. However, the effects of sexual segregation are surprisingly unresearched, and the consequences of racial segregation within schools is a topic beyond the scope of this paper; hopefully, some of the ideas that follow may be relevant for research.

3. BASIC CONCEPTS

There are three concerns that have dominated research on the organizational differentiation of students: (1) the impact of patterns of organizational differentiation for equality of opportunity; (2) the consequences of specific modes of organizational differentiation, particularly ability grouping, for academic achievement; and (3) the consequences of grouping for outcomes other than achievement, such as self-esteem, attitudes toward learning, etc. It is convenient to organize the discussion in terms of these outcomes, though of course consequences of the organizational differentiation in one area are

relevant for outcomes in other areas, as attitudes are relevant for learning, and differential learning relevant for equality of opportunity. The relevant dimensions and mechanisms of the organizational differentiation for the various outcomes are identified in this section, followed by the substantive analysis in sections 4 and 5.

For the purposes of the desired analysis it is fruitful to conceive of the organizational differentiation of students in three ways: (1) as an educational structure defined by flow and curriculum relations among instructional groups; (2) as a differentiation of learning and socialization environments; and (3) as a set of signals about the competencies, interests, and futures of students. These are complementary perspectives. In the first perspective we focus on the career trajectories defined by a system of organizational differentiation and the creation of these trajectories by the assignment of students to groups. In the second perspective we focus on what goes on within instructional groups in terms of the opportunities for learning they provide and the social environments they create. In the third perspective we focus on the expectations concerning competencies and futures created by grouping systems. These perspectives are also interdependent. The system of inequality and the career trajectories defined by the organizational differentiation of students will affect the opportunities and environments for learning because of differential allocation of instructional resources and of students to groups, and because of the signals provided by groups. The student outcomes produced by groupings will affect the movement of students in the career trajectories defined in the system. Even when no differential learning is produced by groupings the signals created by the

assignments may be relevant for the careers of students as they affect future assignments.

Organizational Differentiation as a Structure of Educational Systems

The organizational differentiation of students governs student educational attainments by defining a set of career trajectories in the educational system. The differentiation of students further governs student academic performances and student socialization by exposing students to different curricula, and to different learning and socialization environments in instructional groups. The distribution of attainments, performance, and competencies that results from the educational process thus reflects the structure of educational systems as determined by the organizational differentiation of students. The purpose here is to specify a concept of educational structure and use it to identify certain key variables and processes.

The starting point for the endeavor is a notion of structure as a set of relations defined on pairs of entities or elements of a set--instructional groups. Classrooms may for many purposes be considered the basic entities, but in some situations it is appropriate to consider within classroom groupings such as ability groups in particular subject matters. A minimal requirement of the instructional groups that are the basic elements of the structure is that they have some permanency in time--a school year in most instances.

The instructional groups may be conceived as forming nodes in a network, with arcs representing relations among the groups. Alternatively, one may use adjacency matrices of such networks, with rows and columns

corresponding to the instructional groups, and cell entries reflecting the relations between groups. The latter representation is used here. There are a number of relations that could be defined among instructional groups, but for an analysis of the impact of organizational differentiation on student opportunities and achievements the most relevant appear to be (1) curriculum relations and (2) flow relations. Curriculum relations are those defined by schools as tying together instructional groups in educational programs. Flow relations are counts of students moving over time from one instructional group to another as they pass through the educational system.

Flow and curriculum relations are important because they define the educational activities of instructional groups, their composition, and the opportunity structure associated with grouping systems. The relevance of curricula and composition of groups is discussed further later in this section. I first describe how the structural representation of the organizational differentiation of students can be used to determine the career trajectories and the opportunity structure of educational systems; then follows a discussion of the process that creates the flows in a system of educaiton--the matching of students to instructional groups.

The identification of career trajectories and opportunity structures. Both curriculum and flow relations between instructional groups may be used to define career trajectories of an educational system. Somewhat different information is provided by the two representations of the structure, but the main difference is that flow relations create a representation of the structure by the trajectories actually used. These trajectories are a subset of the formal possibilities presented by curriculum relationships.

The representation of the curriculum relations among instructional groups can be obtained by forming a matrix, with rows and columns as the instructional groups existing in a system, and cell entries indicating for each pair of groups whether they form a proscribed, permitted, or prohibited combination. If groups are ordered according to grade levels, submatrices can be identified along the main diagonal of the main matrix that identifies which instructional groups can be combined at a given level, while the off-diagonal would indicate sequences of groups over time. The resulting structure is one that identifies programs and tracks (if any) in an educational system, as described in handbooks and catalogues. It is a structure that can identify the formally defined career routes in the system to various educational endpoints that are educational credentials.

If schools have clearly defined tracks and programs, the structure of curriculum relations should identify them. However, schools may not have explicitly defined tracks and programs, and educational outcomes may still be strongly determined by the combination and sequences of instructional groups that students attend. In fact, there seems to be some confusion in the minds of principals, students, and researchers about what constitutes track systems (Rosenbaum, 1976). The use of actual flows may overcome this difficulty in identifying the career trajectories of educational systems.

The flow relations between instructional groups are obtained by forming a matrix, with rows representing the groups at one point in time, and columns representing groups at a later point in time. The cell entries would be counts of students moving from one group to another in a time period, say a school year. The basic idea can most conveniently be

introduced through an example. Suppose we have a very simple educational system with only age grading, that is, each grade forms an instructional group.[2] Further assume that only five grades exist: two primary grades, two secondary grades, and one grade of higher education. No grade skipping is allowed and no one repeats grades. Students begin to leave the system in the secondary grades and everyone will have left at the end of higher education. Assume that grades are of equal length in time. The flows in each time period in such a system are depicted in Figure 1.

There are six rows and six columns in this matrix, one for each grade and one for the outside. Since there is no grade skipping and repeating, nonzero entries only occur in the major subdiagonal, and in the row and column associated with the outside. The matrix is of the same form as the population projection matrix, well known from mathematical demography (see Keyfitz, 1968, for an extensive treatment). The matrix representation of a population has births going from the outside to the first year of age, and deaths leaving for the outside from each year of age, in the same manner as students are entering and leaving the system depicted in Figure 1.

Richard Stone (1971, 1975) has shown that the population matrix provides a powerful tool for the analysis and description of a variety of flows in society, in particular flows in an educational system. Stone's main purpose is to provide an accounting model useful for planning purposes and policy formulation. However, the approach lends itself to numerous purposes, some of which I suggest here, relying on a probabilistic interpretation of the flows. This approach serves mainly as a conceptual device, and I do not go into mathematical details and the problems associated with the actual implementation of the approach.

Grades	t \ t+1	0	1	2	3	4	5
	0		1000				
Primary	1		0	1000			
	2			0	1000		
Secondary	3	212			0	788	
	4	454				0	334
College	5	334					0

Figure 1. Flows in an educational system.

Many of the basic properties of systems such as Figure 1 are revealed by manipulations on the matrix obtained by dividing each entry by its row sum, and deleting the column and vector corresponding to the outside. Denote this matrix C. It will have entries that are survival probabilities in each state of the system. Since everyone eventually leaves the system, this matrix can be taken as the submatrix of transient states in an absorbing Markov Chain. This interpretation imposes restrictions on the survival or transition probabilities if the Markov model is to be taken as a realistic representation of actual flows. I point out some implications of this below.

Multiplying the C matrices will trace flows over time for persons remaining in the system, i.e., C^2 will give the two step flows in the system as the elements of $c_{ij}^{(2)} = \sum_k c_{ik}c_{kj}$. Summing such powers of C will provide a representation of the overall experiences of students in the system. As the powers of C form a geometric series their sum will be the so-called fundamental matrix $(I-C)^{-1}$. For illustration, the $(I-C)^{-1}$ matrix corresponding to the system of Figure 1 is shown in Figure 2.

The entries of the $(I-C)^{-1}$ matrix give the amount of time spent in the various states before leaving the system. Thus, a person starting out in grade 1 can expect to spend .3 years in higher education, .42 years in grade 4, etc. Summing these entries for each row will give the total amount of time a person can expect to spend in the system. Since everyone starts out in state 1, this will be 4.1 years overall. This is, of course, the mean educational level for persons passing through our system measured in years of schooling.

The system of Figure 1 is a very simple one and the manipulations on the C matrix are perhaps not very informative. However, it does share an important characteristic with empirical systems; the educational process

Grades	5	4	3	2	1
5	1.0				
4	.424	1.0			
3	.334	.788	1.0		
2	.334	.788	1.0	1.0	
1	.334	.788	1.0	1.0	1.0

Figure 2. $(I-C)^{-1}$ matrix for the folws of Figure 1.

is described as an attrition process--students leaving the system do not return, so that the number reaching the highest level are the survivors remaining after exposure to a set of survival probabilities. These survival probabilities determine the total opportunities available to someone entering the system by determining the overall probability of reaching the highest level of education. This overall probability has some importance, and is referred to as the inclusiveness[3] of the system. The attrition process means that educational seniority alone governs educational opportunities--the higher the grade level attended the greater the probability of obtaining the highest level of education.

A more interesting situation is obtained by allowing for groupings within grades. Such a modificaiton is carried out in Figure 3, where the system of Figure 1 is modified so that each of the secondary grade levels has two instructional groups: a college and a noncollege track. As a result, submatrices are defined at each of the secondary grade levels, replacing the single entries of Figure 1. Both the C matrix for such a system and the $(I-C)^{-1}$ matrix are presented in Figure 3; the overall survival probabilities from each grade level are kept as in Figure 2.

The entries of Figure 3(b), as previously, have an interpretation in terms of expected time spent in various states before leaving the system for persons entering the system in the states corresponding to the rows. However, these entries can also be given a probabilistic interpretation: If each of the entries in the various rows of matrices, such as Figure 3(b), is divided by the diagonal elements of the column, the resulting elements will be the probabilities of eventually reaching the state corresponding to the column. These quantities are directly obtained here since the entries on the main diagonal are all one. Hence the probability of getting

(a) C Matrix

Grades	1	2	3a	3b	4a	4b	5
1		1.0					
2			.53	.47			
3a					.79	.21	
4a	4a						.82
4b							.05
5							0

Note: Entries on track mobility and transitions to college are adapted from Rosenbaum (1976, Tables 3.3 and 5.3).

(b) $(I-C)^{-1}$ Matrix

Grades	5	4b	4b	3b	3a	2	1
5	1						
4b	.05	1					
4a	.82	0	1				
3b	.04	.58	.02	1			
3a	.66	.21	.79	0	1		
2	.33	.41	.38	.53	.47	1	
1	.33	.41	.38	.47	1	1	

Figure 3. Flow matrices for an educational system with tracking.

a higher education for someone assigned to a college track in grade 3 is .66, and .04 for a person not assigned to a college track in that grade.

It should be noted that the submatrices of Figure 3(a) share an important property with empirical systems: There is very little mobility among tracks and the mobility that exists is mostly downward (Rosenbaum, 1976). There are several reasons for this pattern, but most obviously it reflects the differential learning environments produced by the groupings.

The entries of $(I-C)^{-1}$, then, present a map of the educational routes followed by students passing through the system. Each column of $(I-C)^{-1}$ shows the career implications of being assigned to various instructional groups for the outcomes represented by the column. In particular, the entries in the column corresponding to higher education directly reflect variation in opportunities for higher education connected with assignment to instructional groups.

The actual implementation of the procedure suggested by these examples is this: Arrange the instructional groups that exist in an educational system into a matrix of the form exemplified above; that is, for each grade level create a submatrix that shows the flows between instructional groups (classrooms) from one grade level to the next. (Information about these flows can be found in school records.) From the resulting C matrix, the fundamental matrix $(I-C)^{-1}$ is then obtained. It will describe the educational career trajectories defined by a pattern of organizational differentiation, and, by showing the implications of assignments to specific groups, reveal the opportunity structure of an educational system.

The flow matrix representation of the structure of educational systems serves to define variables of relevance for the analysis of the organizational differentiation of students. The entries of the $(I-C)^{-1}$ matrix that give the probabilities of attaining higher education may be used to arrange groups in a hierarchy reflecting the inequality of opportunities for educational attainments associated with assignments to particular instructional groups. The hierarchy expresses the vertical differentiation of instructional groups and the position of a group in this hierarchy may be referred to as its educational rank. The educational rank of an instructional group is, in general, a function of its grade level and the differential advantage of assignment to the particular group within the grade level. The rank order of groups may be deliberately intended as in the case of ability groups or it may be less obvious as when instruction in certain subject matters confers a differential advantage. The educational rank, in turn, should be an important determinant of who seeks admission to the group and who gets admitted. The differential advantage should be further reflected in the opportunities for learning provided, and in the learning and socialization environment created in the group.

For the analysis of the learning and socialization environments provided by groups it is important to know the amount of time a student will spend with particular other students in instructional groups. The relevant variable is the scope of the organizational differentiation, defined as the fraction of time over some schooling period that a student spends with a particular group of classmates. The

flow matrix will indicate the scope of a grouping system in the submatrices that give flows among instructional groups across adjacent grade levels. The dimension of these submatrices will equal the number of groups existing at a particular grade level, and hence indicate the number of partitionings made of a cohort of students. The dispersion of flows from one grade level to the next will indicate the stability of these partitionings over time; that is, how much mobility there is among tracks and other career trajectories over time.

The flow matrix for an actual school system will have a very large dimension, equal to the total number of instructional groups existing in the system. It is of considerable interest to attempt to reduce the dimensionality of such matrices by collapsing the classroom and other instructional groups into higher order units. Similarity of flows originating from groups as detected from the $(I-C)^{-1}$ matrix will serve as the criterion for the formation of such higher order groupings. Thus the educational ranks of instructional groups can serve to identify track systems, even when such programs are not explicitly defined, if instructional groups of equal ranks (that is, with similar career consequences) are grouped together. Such an approach to detecting the basic structure of an educational system is similar to the approach taken in algebraic analysis of social networks (see, for example, White, Boorman, and Breiger, 1976), where similarity of relations among entities also forms the basis for higher order structural units.

Aside from its use in studying the structure of educational systems and in defining important dimensions of grouping systems, the flow matrix representation of the organizational differentiation also serves to identify an important conceptual and methodological

problem in the analysis of groupings: how the flows are generated. This problem will be discussed next.

The matching of students to instructional groups. The flows that form the entries of the matrix representation of an educational structure are created by the assignment of students to instructional groups. These assignments match characteristics of students and the availability of places in instructional groups to determine which studnets get assigned to which groups. The exception is completely random assignment with the sole purpose of providing a partitioning of a cohort of students into classrooms with no curriculum or ability differentiation. Random assignment is, of course, an often used procedure, particularly in primary grades, and such assignments have no systematic career consequences. The focus here is on assignments that influence the career trajectories of individual students.

The assignment procedure may be characterized by whether it is elective or selective; that is, whether the student wishes to determine the assignment or not. Complete electivity is rare, particularly in assignment to groups of different educational ranks, because the creation of instructional groups usually involves considerations other than satisfying student interests. Student wishes are, however, often a necessary but insufficient condition for the assignment to groups. Completely selective assignment where student preferences play no role are typical of assignment to within classroom ability grouping.

Except in the case of purely elective assignment an assignment criterion is applied. The criterion is usually based on either (1) past performance, both with respect to level and subject matters; (2) current achievement as measured by a test of an examination; or

(3) a direct measure of cognitive skills, such as an intelligence test. The choice of criterion is important for the resulting composition of the instructional group and is discussed from this perspective in the next part of this section. Here it suffices to note that any such assignment criterion will correlate, in general, with a variety of individual characteristics, such as the family background, ability, and past educational career of students. This will also be the case for the aspirations and preferences that determine elective assignments.

Since the individual assignments depend on student characteristics the outcomes of the assignments will reflect the distribution of these characteristics in a cohort of students. However, a student will only get access to an instructional group if there is room. Hence the outcome of assignments will also reflect the number of available places in instructional groups. This distribution of available places will not, in general, have an invariant relation to the distribution of relevant student characteristics. Schools rarely create instructional groups with the sole concern of accomodating a given distribution of student abilities and interests; rather staffing, building, administrative, and disciplinary concerns will govern the number and sizes of instructional groups to be found in a school. The resulting distribution of available places will not necessarily correspond to the distribution of assignment relevant characteristics in the student bodies. These, perhaps elementary, observations have a number of important implications.

For the interpretation of the flow matrix as an absorbing Markov Chain, the dependency of individual flows on student characteristics means that the transition probabilities of the Markov Chain must be assumed to vary with these individual characteristics. This is a standard problem in the application of stochastic process models

to social processes. Several methods are available in the literature (Spilerman, 1972; Tuma, Hannan, and Groeneveld, 1977) that permit analysis of the sources of variation in transition probabilities. These solutions, though probably adequate for some purposes of empirical analysis, do not solve the conceptual problem: the relation between the opportunity structure represented by aggregate flows and representing the distribution of available places, and the individual flows that depend on characteristics of students.

The problem results from the fact that the aggregate flows will not, in general, reflect only the distribution of students characteristics in a school; still, the individual flow reflects these characteristics and must sum to the aggregate flows. This means that the functions that relate individual characteristics to transition probabilities are determined by the grouping system adopted in a school. One may conceive of the situation as one where the aggregate flows present an opportunity structure available to students differing in their ability to take advantage of these opportunities. No standard methods are available to handle this simultaneous determination of flows and individual careers. I return to the methodological problem later, and here outline a few substantive implications of the problem.

A student can only get access to an instructional group if there is a place for him/her in the group. This means that a student's ability to get access to a group and take advantage of the career trajectory associated with the group depends on the ability and/or interests of other students exposed to the same grouping system. Hence movements of students in an educaitonal system cannot be assumed

to be independent of each other. The interdependence of movement has profound implications for the educational process.

Schools institute a variety of procedures to manage the interdependence of flows of students. To a considerable extent they rely on ranking procedures in assigning students to groups in nonelective assignments. As a result, it is generally not a student's absolute ability level that counts for assignment but the level of ability relative to others. In elective and semi-elective assignments schools are faced with the problem of keeping group sizes stable in the face of possible changes in student preferences. It is well documented that counsellors play an important role in the matching process by convincing students about "true" interests that secure the preservation of stable aggregate flows (Cicourel and Kitsuse, 1963; Rosenbaum, 1976). These procedures secure the management of grouping systems, but they should also introduce considerable variation in the relationships between individual characteristics and career trajectories across schools.

The relation between the opportunity structure and the individual career trajectories not only creates interdependence among individual educational careers, but also among the efforts and achievements of students. The structure of competition for access to higher ranked educational groups among students does not resemble competition in the classical economic sense. In the classic conception of the economic market the actions of a single individual have no impact on the returns or prices obtained, and the actions of one person are independent of the actions of others. The result is that one person can, for example, increase his/her income by increasing his/her labor supply regardless of what other persons do. This is not the case in the competition for

places in the educational system. An increase in effort may not result in the desired reward--that is, access--if other students also increase their efforts. If students act independently of each other and if access is an important good, they are therefore likely to increase their efforts without increasing the likelihood of succeeding. Students know this, and rather than acting independently of each other, form peer groups that attempt to regulate effort. This is a problematic solution as there will always be incentives to break the norms of peer groups prohibiting too much display of effort. Whatever the outcome, the efforts and achievements of students, in addition to their careers, will be interdependent as a result of the duality of flows representing both opportunity structures and individual careers.

Organizational Differentiation as Differentiation of Learning and Socializing Environments

Schools are meant to produce changes in students. They attempt to teach students knowledge and skills relevant for their educational careers and for roles outside the educational system. They further try to instill in students values, norms, and behaviors deemed appropriate for adult life. These changes are produced in instructional groups and are for the larger part deliberately created. The career trajectories of the educational system are meant to result in different knowledge and skills possessed by the graduates of the system. This is perhaps elementary, but nevertheless it is not always recognized in the interpretation of research results. It is more surprising to find no effect of placement in a college track on attainment of higher education, and in some ways a source of greater concern, than it is to find an effect--college tracks are meant to have this outcome.

If schools were successful in translating curricula into knowledge, skills, and values possessed by students, and if only curriculum differences were responsible for differences in student outcomes, research on the organizational differentiation of students would not rely on sociology and social psychology, but on curriculum theory. But presumably students learn from sources other than the curriculum, and they may not learn the curriculum. The organizational differentiation of students creates social and instructional environments that presumably are relevant for the actual changes (or lack of them) that take place in students. The purpose here is to identify relevant concepts for an analysis of such impact on student outcomes.

Three sets of variables deserve attention: (1) differences in teacher behavior and characteristics produced by the organizational differentiation, (2) differences in the allocation of instructional resources produced by groupings; and (3) differences in social environments produced by the organizational differentiation. Of these, much of the variation in (1) and (2) reflect curriculum differences, and differences in outcomes are intended. However, even in cases where curricula are supposed to be identical, as in many ability groupings, variation may exist, and it is the latter type of variation that is of most interest here: variation in teacher behavior induced by the differential prestige of instructional groups, and differential allocation of resources and hence opportunities for learning to groups of different rank. The effects of such variation will be discussed in the following section.

The third source of impact of organizational differentiation on learning and socialization--that is, differences in social environments--

deserves elaboration here. The differences in social environments for learning and socialization produced by the organizational differentiation of students are relevant insofar as they result in the creation of social influence processes that modify student outcomes. The instructional groups that exist in a system of education create spatial and temporal boundaries for the formation of social interaction processes. These boundaries may be more or less salient. Their salience determines whether a particular pattern of instructional grouping will have predictable consequences for the social influence processes students are exposed to. The effects of the organizational differentiation produced by social influence processes depend on the scope of the grouping; that is, the amount of time a student spends with a given group of classmates in an instructional group. Groups with low scope generally can not be expected to have predictable consequences for social influence processes, since the boundaries for actual interaction processes will not coincide with the temporal and spatial boundaries of groupings.

Assuming high scope, the social interaction process in a classroom may influence student outcomes if it produces changes in values, aspirations, and attitudes. The relevant mechanism is peer group formation, and to the extent that peer groups actually tend to reduce between peer variation in relevant characteristics, predictable change can occur. But it is widely believed that friends tend to be alike. Thus a further necessary condition that can be assumed for peer groups to produce changes in student outcomes is that peers indeed will differ initially. This makes knowledge of the composition of a classroom important for our ability to form predictions about the consequences of

groupings for student outcomes produced by the social environments created. This composition reflects (1) the assignment procedure used in allocating students to instructional groups, and (2) the overall composition of the student body from which the groups are formed.

The assignment procedure was characterized before by whether it is elective or selective. Further, when the assignment is not wholly a question of student preferences, some index of learning capacity must be relied on as the assignment criterion, and three types of criteria were suggested as likely: (1) past performance, (2) current achievement level, or (3) a direct measure of cognitive skills.

These measures differ in regard to their dependency on noncognitive characteristics relevant for learning, with measures of intelligence purportedly less dependent than the other two. Past performance and current achievement take noncognitive factors, such as attitudes and aspirations, explicitly into account, since they are indices of learning accomplished. Past performance, as measured by obtained grades is, in addition, dependent on student teacher relationships, for grades reflect teacher evaluations. Since the noncognitive characteristics are those most likely to be directly transmitted in social interaction processes, the choice of criterion will influence how strongly the learning and socialization environment of students are affected by groupings.

Random assignments will produce instructional groups that reflect the compositions of the student body from which they are formed. It is clearly necessary when analyzing the differences in learning environments created by the organizational differentiation of students to assess this impact relative to the environments that would have resulted under random assignments. Student body compositions differ between schools as a result

of community and neighborhood characteristics, and this causes differences in learning environments that should not be confounded with the differences caused by nonrandom assignments to instructional groups.

The fact that assignments are matchings of students to available places is relevant. As argued above, schools will rarely let the number of groups, say in an ability grouping, depend on the distribution of the student body. Instead, a given number of groups of roughly equal size will be formed and they will be filled by imposing arbitrary divisions of the distribution of students according to the criterion variable. If the true variation in characteristics relevant for learning is very small, assignments will still be done, and the result will be an almost random assignment. If the assignment has implications for student outcomes and later careers, this almost random assignment will confer differential advantage, and more inequality will be created where less existed.

The impact of organizational differentiation of students on learning and socialization is created in sum by (1) exposing students to different curricula, (2) differential allocation of instructional resources, and (3) the social environments created in instructional groups. The social environments created in instructional groups have further been argued to depend on (1) the assignment criterion, (2) the distribution of relevant characteristics in the student body from which assignments are made, and (3) the number and relative sizes of instructional groups. The substantive hypothesis about how these different variables influence learning and socialization will be discussed in section 4.

Organizational Differentiation as Signals

Any assignment criterion is fallible. Teachers and others responsible for assignments know this, and if they do not, parents will convince them. Assignments are therefore rarely done anonymously and on the basis of a single criterion: Evaluations and records of past history are relevant. This points to an important function of the organizational differentiation of students. Earlier assignments become part of a student's record, and will act as signals conveying information, or what is believed to be information, about a student's capacities. Thus, even if groupings produce no differential learning or actual changes in values and beliefs, they may become relevant for educational careers. Consequently, ability groupings may confer differential advantage even in the absence of any actual effect on students, as long as those responsible for later assignments believe earlier assignments mean something about the students involved. The phenomenon is parallel to what has been argued to be the function of education in labor markets (Spence, 1974): Education acts as a signal regarding productive capacity and thus serves to reduce employer uncertainty in the hiring process, even if education has not created any productive skills.

The signalling function of organizational differentiation is relevant not only for teachers and others responsible for assignments; it is important also to the student involved, and may profoundly affect attitudes and aspirations. Thus, assignments may affect student outcomes irrespective of the importance of the social environment that may result from the grouping. Finally, assignments are signals to parents about the potential futures of their children, something that will be shown below to be

relevant for the consequences of organizational differentiation for equality of opportunity.

Summary

This section has proposed a number of concepts characterizing the organizational differentiation of students. The point of departure has been the concept of an educational structure created by the flows of students and the curriculum relations among instructional groups. Representing this structure in a matrix of flows reveals the career trajectories of school systems, and the resulting opportunity structure identifies the vertical differentiation of instructional groups in terms of their educational rank. It was further argued that the assignment of students to groups, which creates the flows, is a matching process where characteristics of students and the availability of places determine the outcomes. The nature of this matching process has important implications for the educational process as it creates interdependencies of student careers, efforts, and achievements, and results in the use of rankings of students that ignore the absolute level of ability for assignments to groups.

The career trajectories reflect exposures to different learning and socialization environments produced by differences in curricula, allocation of instructional resources, and classroom social environments created by the assignments of students to groups. Finally, the assignments and the resulting career trajectories act as signals that influence the decisions of teachers, parents, and the students themselves.

Differential changes in students and the signals created by assignments will influence the associations between variables (such as ability and

aspirations) relevant for assignments and outcome variables (such as learning and attainments). Further, the career trajectories defined by groupings will perpetuate these associations. Such associations among variables of interest are usually created not only by the organizational differentiation of students, but also by the assignment of children to specific families and other social environments. The organizational differentiation may, however, serve to reinforce or weaken the associations created by other agencies. This is the main proposition used to generate hypotheses in the sections that follow. However, the assignment of students to instructional groups has in one instance been shown to be directly responsible for the creation of an association among variables that most would believe are unrelated: month of birth and academic achievement. The result, reported by Jackson (1964), is the relation between assignment to different streams in British primary schools and students' birthmonth. It is reproduced in Table 1 since it is so striking and unexpected.

The example is a good illustration of basic ideas proposed in this section. The initial assignments (in the first grade) to ability groups are unintentionally correlated with birthmonth. The assignment results in different career trajectories as students tend to stay in the groups of the same educational rank at different grade levels. They are exposed to different learning environments and likely also provided with different signals about competencies that further perpetuates the initial inequality. Hence, the early assignment has created a new form of inequality of opportunity: differential advantage by season of birth.

4. ORGANIZATIONAL DIFFERENTIATION AND LEARNING AND SOCIALIZATION

A large number of studies have focussed on the consequences of organizational differentiation, particularly ability grouping, for

Table 1

Relation Between Month of Birth and Assignment to Ability Groups: Birthdays of 11 Year Old Children in 252 Three-stream Schools

	Stream			
Children born between	A %	B %	C %	N
Sept. 1 and Dec. 31	44.5	34.2	21.3	4489
Jan. 1 and Apr. 30	37.0	36.0	27.0	4828
May 1 and Aug. 31	30.1	37.7	32.2	4883
All children	37.0	36.0	27.0	142000

Source: Adapted from Jackson (1964, Table 11).

learning. The findings of this research are largely inconclusive, perhaps due to methodological problems. (I will discuss this possibility later.) This section discusses some of the patterns found and the possible explanations for them, ignoring the methodological problems. The explanations have the nature of hypotheses because of the inconclusiveness of research. Conceivably they may in turn be used to generate conclusive findings.

The first part of this section discusses direct effects of assignments to different patterns of organizational differentiaiton on instruction and learning. These effects are produced by differences in teaching, teacher behavior, and the allocation of instructional resources. The second part treats indirect effects produced by the impact of differentiation on student attitudes and aspirations that in turn act on learning, permitting a discussion of the effect of organizational differentiation on outcomes other than academic achievement.

Learning will be conceived here as resulting from the interaction of three main variables: the ability and the efforts of students, and the opportunities for learning to which they are exposed (cf. Sørensen and Hallinan, 1977). Effort is indexed by such variables as motivation to achieve, aspirations, and attitudes toward self and school. Whether such indicators actually cause variation in effort as opposed to reflecting academic success is often dubious, but analysis of this problem falls outside the scope of this paper. Ability is measured by tests of cognitive skills such as intelligence tests. Ability and effort may be said to form a student's intellectual resources. These resources interact with the opportunities for learning, which are measured by the amount of material presented to students in the teaching process, and depend on curricula, teacher behavior,

and the allocations of instructional resources such as library facilities, teaching machines, and teaching aids. The relation between opportunities for learning and the students' instructional resources should be modeled as a multiplicative one. No one can learn what has not been taught, and it seems most appropriate to see the intellectual resources of students determine which fraction of the material taught will be learned, rather than to see the opportunities somehow adding to the resources of students. Learning is an over time process. Hence the appropriate model for studying the effect of various variables on learning should be a dynamic model, where measures of opportunities for learning interact with students' intellectual resources in producing change in achievement over time. An example of such a model is presented and discussed by Sørensen and Hallinan (1977). However, this type of model has not been used in existing research on the effect of organizational differentiation of students.

Curriculum differences among instructional groups will produce differences in the kind and amount of material presented in a time period. Differences in amount of material taught produce differences in opportunities for learning, and the resulting differences in academic achievements are intended. The absence of an effect of grouping on learning is more surprising than the presence of an effect when comparing, for example, the math achievement of students assigned to an advanced curriculum to the achievement of other students at the same grade level. These effects of groupings have not been a major concern in research, perhaps because they seem too obvious. The problem has usually been defined as one of identifying the effect of pure ability grouping--that is, grouping of children according to learning capacity or past achievement--where it is intended that everybody eventually master the same material. The comparison is between learning in a system with ability grouping and in a system

with random assignment, where both systems attempt to teach the same curriculum.

Differences among instructional groups in the kind of material taught may influence the rate of learning even in the absence of differences in the amount taught. The reason is that students differ in specific abilities and interests. When matched to a curriculum that suits these abilities and interests, students should learn more than when matched to a less satisfyng curriculum. This is a commonly used rationale for creating curricular differentiation with elective assignments, but no one seems to have tried to test the validity of the rationale and its implications.

Direct Effects

The rationale for ability grouping appears to be that learning is cumulative so that what can be learned depends on what has been learned; teaching should accomodate to this so that what is taught depends on what the student knows. But this indicates individualized instruction, which is expensive. Grouping children according to capacity to learn allows group instruction to accomodate to the different rates of learning of children.

The argument implies that students in high ability groups will learn more than students in low ability groups over the same period of time. Only in the cases where teachers terminate teaching in high ability groups before completing teaching to low ability groups should such a pattern not emerge. Teachers probably rarely engage in such behavior, especially when different teachers are assigned to different ability groups. They may do so with within classroom groupings in the

absence of nongrading, but the frequency with which this occurs is not known.

Ability grouping, then, implies that students in high ability groups will learn more than students in low ability groups. This is generally true, but is perhaps trivial. The question of most interest is whether children of equal ability level learn more in grouped than in ungrouped systems. However, the expected pattern among ability groups has one important implication: Students wrongly assigned to ability groups will tend to conform to the group they are assigned to rather than to their true ability level (Baker Lunn, 1970; Douglas, 1964). This tends to favor autumn-born children, middle-class children, and girls, since they are most likely to be assigned to a "too high" ability group.

For comparison between grouped and nongrouped systems the rationale for ability grouping predicts that almost every ability group will profit from the grouping, except the ability group teachers in ungrouped systems accomodate to in their teaching. Assuming this is the middle ability group, children of high ability and children of low ability will suffer from not being grouped. Children of high ability suffer because they are not given enough opportunities for learning, and children in low ability groups suffer because they cannot comprehend what is being taught. This pattern is in fact the conclusion of early research on the effects of ability grouping (Otto, 1950).

Later research has been unable to find such a clear pattern, perhaps because the researchers did not believe as strongly in the teaching-to-the-level-of-students rationale for grouping. To the extent that more recent research reports any consistent findings they seem to conform to a different pattern (e.g., Blandford, 1958; Borg, 1964; Baker Lunn, 1970; Daniels, 1961):

that bright children get brighter and dull children get duller in ability grouped or streamed systems, as opposed to nongrouped systems. This is an effect on variances that need not be reflected in a difference in mean achievement among grouped and ungrouped children.

The accomodation-of-teaching mechanism predicts a mean difference, but no change in the variance in outcomes. That dull children get duller from being grouped together runs counter to the accomodation-of-teaching pattern that predicts that dull children learn more from being grouped together. The increased variance effect can be explained both by direct and indirect effects of grouping. The latter focuses on the impact of grouping on student attitudes and aspirations, and on the resulting differences in social environments; these mechanisms are described below. The explanations in terms of direct effects of grouping on instruction can focus either on the signalling effect of grouping, or on the effect of differential allocation of instructional resources.

The signalling effect of grouping could produce an increased variance in achievement if teacher expectations about students influence the achievement of those students. Placement in low ability groups signals that the student is dull, and placement in high ability groups that the student is bright. Furthermore, if teachers themselves are responsible for assignments, they may be concerned about validating their assignments, especially in within classroom groupings. The search for an effect of signals produced by grouping on learning is the topic of Rosenthal's and Jackson's research (1968). Their results regarding the effect of teacher expectation on learning has not been replicated and support may still be missing.

Differential allocation of instructional resources can also predict a pattern of increased inequality as a result of grouping. It seems safe to assume that teaching bright children universally commands higher prestige than teaching less bright children. Hence, high ability groups should get more competent teachers than low ability groups, whereas competence presumably is randomly allocated in nongrouped systems. There is support for this mechanism, with respect to the allocation of teachers and other resources, from research done in British schools (Baker Lunn, 1970; Jackson, 1964), and from the U.S. with respect to the allocation of counselling (Heyns, 1974).

It should be stressed that the pattern of increased variance is not a robust result; it needs further validation. The one robust result is the absence of consistent main effects of ability grouping on academic achievement. Much of potential relevance has been left uncontrolled in existing research. One largely ignored variable that would seem to be important is teacher behavior in different instructional settings. Baker Lunn (1970) considered this variable and found that one reason for the absence of consistent main effects is that teaching in ungrouped classrooms is a more difficult endeavor than teaching in grouped systems. The grouped or streamed schools can tolerate a greater diversity in both teaching methods and teacher behavior. In newly unstreamed schools many teachers proceed without changing their methods to accommodate the greater diversity of students, and in fact often defeat the objectives of nonstreaming by introducing ability groups within the classroom by seating arrangements.

Indirect Effects

Both the signalling function of groupings to students and the possible differences created in social environments can account for the effects of groupings in regard to student motivation and attitudes displayed toward learning. Research on the effect of ability groupings on self image and attitudes toward schools again reports inconsistent effects. Goldberg, Passow, and Justman (1966) found an overall positive effect of grouping on self-esteem in a large-scale experiment. The research on streaming in British primary schools, on the other hand, consistently finds a differential effect on self-image that follows the pattern of effects on achievement. Students assigned to low ability groups suffer a deterioration of attitudes, toward themselves and schools, while those assigned to high ability groups suffer no such consequences. This pattern of effect on attitudes could then explain the effects on achievement, while the overall positive effect reported by Goldberg, Passow, and Justman could not.

Several mechanisms could account for the relation between grouping and attitudes. One mechanism is the signal to individual students about their own competencies and futures that is produced by the ability grouping. The importance of this mechanism depends on the visibility of the grouping and its salience for educaitonal opportunities. A second mechanism is the social environments created by grouping. If it is assumed that attitudes and ability are correlated, peer groups within classrooms may reinforce this correlation and produce an effect of grouping. In particular, peer groups may reinforce the effect of the signal from the grouping itself. The importance of this second

mechanism depends on the scope of the grouping that determines how important within classroom social influences will be. These two mechanisms will predict the same pattern of effects of grouping on attitudes.

A third possible mechanism would lead to a different prediction. This mechanism predicts effects of grouping on attitudes because of within group differentiation. The argument is that attitudes are dependent on achievement relative to the achievement of others in the same group, and that grouping will create a "frog pond" effect. This produces more students of low ability with high self-esteem in grouped systems. The overall effect could then well be a positive mean difference in attitudes among grouped and nongrouped systems. This mechanism again assumes high scope, but in contrast to the first mechanism, the signalling effect of grouping would be weak.

The British results are consistent with the first two mechanisms, the U.S. results with a third. Groupings in British schools are of high scope and salience for educational opportunities because of the 11^{+} exam. The results of Goldberg, Passow, and Justman were obtained from an experiment where the implications of grouping for future careers would appear to have been unclear to students. Hence the signalling effect was weak.

Characteristics of assignments to instructional groups may be hypothesized to have other effects. It can be argued that elective assignments should increase feelings of control over the environment, a variable that has been found to correlate highly with academic achievement. However, electivity is, as mentioned, rarely complete, and even when it appears to be so may be constrained by counselors concerned about matching the right number of students to the given sizes of groups.

Some student choice may, as mentioned above, result in better matches of curricula to student interests and abilities, and therefore increase satisfaction and learning. Evidence on such outcomes of groupings is lacking.

Conclusion

The main arguable hypothesis concerning the effect of ability grouping on learning and other outcomes is that such grouping increases the variance of outcomes over what it would have been had there been random assignment to groups. This hypothesis may lack firm support, but methodological problems--to be discussed later--may be held responsible for some of the inconclusiveness of research.

It is important to keep in mind that the effects of organizational differentiation looked for here are pure effects of ability grouping with a given curriculum. Even if such effects are absent, the organizational differentiation of students has a profound effect on learning by defining a structure of educational systems where students are allocated to different career trajectories, exposing them to different curricula and other determinants of their opportunities for learning. These intended effects on learning and other outcomes are usually not referred to as effects of the organizational differentiation of students. The underlying assumption seems to be that the only grouping choice open to schools is whether to group according to ability or not. This is evidently not true and the isolated focus on ability grouping therefore may mislead. The organizational differentiation of students governs how much and what students are taught. Unless students do not learn anything or unless there is completely individualized instruction,

the organizational differentiation of students creates most of the learning differences produced in the educational process.

The importance of career trajectories for learning outcomes means that an increased variance effect of ability grouping has more important implications than the significance levels indicate. The importance of the effect should be evaluated in the context of the career trajectories defined by the organizational differentiation. Differential learning produced by early assignments will be important for later assignments, which will usually result in exposure to different curricula. The (perhaps) initially modest differential advantage conferred by early assignments will therefore be magnified as students move through the educational system.

5. ORGANIZATIONAL DIFFERENTIATION AND EQUALITY OF OPPORTUNITY

The organizational differentiation of students defines an opportunity structure that, as shown above, can be represented by the aggregate flows of students in an educational system. The careers of individual students in the career trajectories defined by the organizational differentiation depend on characteristics of those students. These characteristics influence the assignments to instructional groups because they influence student choices and/or determine a student's position on an assignment criterion. Students enter schools with unequal values on the variables relevant for their ability to utilize the opportunities defined by organizational differentiation. The concept of equality of opportunity refers to how all, or some, of the characteristics of students present before entering schools influence final outcomes.

Concepts of Equality of Opportunity

There are at least two different interpretations of the concept of equality of educational opportunity. The first would be a translation of the general cultural notion of equality of opportunity into an educational context. This notion is that everyone has equal chances at the outset and can make independent individual choices that may result in unequal outcomes. In the educational context this means that differences in individual transition probabilities do not depend on preexisting differences, including differences in ability, and that all differences produced by a system of education depend on individual choices in completely elective assignments.

This concept of equality of opportunity is not very feasible in the educational context, though it is clear that the American system of education is an attempt to implement it. For this concept to be realized, student choice should not be influenced by parents, since preexisting differences would then be relevant; preexisting differences in ability should not be relevant for learning. Further, the very nature of assigning a given number of students to a given number of slots in instructional groups implies, as argued above, that student choices become interdependent. Hence no one can be in complete control of his/her own destiny in a bureaucratic educational system: The outcome of choices depends on the choices of others.

The second concept of equality of educational opportunity can be referred to as the meritocratic concept. It is the concept usually implied in research on equality of educational opportunity and states that equality of opportunity prevails only when ability differences make

a difference in educational outcomes. This concept is only consistent with the equal chance concept if all ability differences are produced by the educational system, which is usually not assumed. Rather preexisting differences in ability are allowed, but these differences are the only ones allowed for. All other differences in educational careers caused by sex, race, or social origin reduce equality or opportunity. The meritocratic concept of equality of opportunity allows for nonelective assignments, permitted as long as outcomes only depend on ability.

Origin and preexisting differences in ability are correlated for genetic and environmental reasons. This means that meritocratic equality of opportunity can never remove the association between social origins and educational outcomes unless preexisting ability differences are compensated for--and that would not be meritocratic--or equality of outcomes are identical for all. The latter points to an empirically important mechanism for change in the association between origins and educational outcomes: Changes in the distribution of education can in fact account for most of the recent changes toward increased equality of opportunity (Boudon, 1974).

Meritocratic equality of opportunity is in general believed to be a feasible concept; that is, schools should be able to reduce the dependency of outcomes on origins and other ascriptive characteristics. The organizational differentiation of students is often argued to be an important instrument for this purpose.

The Effect of Organizational Differentiation on Equality of Opportunity

Organizational differentiation can affect equality of opportunity in two ways: (1) by creating a more even distribution of education, and (2) by establishing assignments and grouping systems that reduce the dependency of outcomes on origins for given ability.

The first use of the organizational differentiation to create more equality of opportunity has been an important argument for introducing comprehensive secondary schooling as an alternative to the European system of tripartite secondary education. The desired greater equality of opportunity in comprehensive systems is obtained foremost simply by creating a more inclusive system at this level of education. The use of assignment criteria associated with comprehensive education has been argued to be important too. Comprehensive systems mean later assignments and usually also elective assignments. Both have been argued to be important for the association between origins and educational outcomes.

That later assignments to vertically differentiated groups reduce the relation between origins and outcomes can be seen easily. A vertical differentiation usually means different opportunities for learning. Assume students in each time period learn a fraction of the materials they are exposed to where this fraction is determined by their ability. Students of equal ability will then learn less when exposed to fewer opportunities for learning than when exposed to more opportunities. The more time spent in instructional groups with unequal opportunities for learning, the larger the difference. As long as ability is correlated with origins this will increase the correlation between origins and academic achievement and presumably other outcomes also. In addition,

the mechanism will increase the association between ability and outcomes, so increased meritocratic equality of opportunity is not guaranteed by late assignments to groups of different educational rank. However, if there are independent effects of origin on assignments, the mechanism should result in greater inequality of opportunity with early assignments, other things equal. Other things are, however, not equal if later assignments are elective, since elective assignments do not necessarily reduce the dependence of educational outcomes on origins, as I argue below.

The research on the impact of the assignment procedure of equality of opportunity has usually accepted the meritocratic conception and focussed on the possible independent effect of origin on assignment controlling for a measure of ability. The main result is that there is such an association and that the independent effect of origin is positive so that assignments increase the association between origins and outcomes over and above what can be accounted for by the association between ability and origins. Numerous studies from British primary schools report an independent effect of origins on nonelective assignments (Baker Lunn, 1970; Douglas, 1964; Jackson, 1964; and others). In the U.S., a number of researchers (Alexander and McDill, 1976; Hauser, Sewell, and Alwin, 1976; Rosenbaum, 1976; Schafer and Olexa, 1971) have found the effect in connection with semi-elective assignments in high school. The magnitude of the effect depends on the methodology--Rosenbaum presents a much more striking effect from his case study than do those using surveys. There are also exceptions: Heyns (1974) reports no social class bias in assignment to college track, using survey data, regression and quite similar models. The likely reason for the discrepancy is that her

antecedent measure of ability might as well be seen as an outcome variable: It is verbal achievement measured after the assignment.

The actual assignment criteria used should influence the extent of the origin bias. It is well established that the more dependent a measure of ability is on noncognitive traits, the more highly it will correlate with family background (Wilcox, 1961; Husén, 1967). Teachers may be justified in using a measure of learning capacity that is reasonably reflective of student efforts and aspirations. The consequence may be a high independent effect of origin.

It is sometimes implied that the way to get rid of an origin bias in assignments would be to introduce purely elective assignments. While this may be true abstractly, it is not likely that elective assignments would actually increase meritocratic equality of opportunity, unless the association between aspirations and origins controlling for ability is smaller than the association between an assignment criterion and origin controlling for ability: Not likely to be the case if the comparison is made to assignment criteria that are measures of aptitudes or intelligence. Vertical differentiation is salient for everyone, but most salient for persons from favorable social origins, since their ability to at least obtain the same position in society as their parents is crucially dependent on their educaitonal attainment. Consistent with this, Husén reports (1967) that controlling for ability and academic achievement, students from less favorable origins are less likely to seek admission to high ability streams than are students from more favorable backgrounds.

Nonelective assignment to ability groups may in fact reduce the association between origin and aspirations for able students over what it would be with no assignments. Such a pattern is reported by Baker Lunn

(1970). Parents of lower class students assigned to high ability streams have significantly higher aspirations for their children than similar parents have for their children of equal ability in nonstreamed schools. Nonelective assignments can evidently act as a positive signal to parents about their children's competencies--and possible futures.

Origin bias in assignments should increase the association between origins and outcomes because of differential opportunities for learning and because of peer group reinforcement of origin related attitudes and beliefs. The latter is the commonly used argument for racial and social class integration. However, it is possible to argue for mechanisms that would have the opposite effects. One such mechanism is the frog pond effect that might reduce the self-esteem of lower-class children when they are integrated with students from more favorable social origins. It is, however, unclear whether self-esteem is a crucial variable for other outcomes. Another mechanism reflects the competition for a fixed number of places, say in a college track. Despite possible positive effects on peer groups when a student from unfavorable origins is exposed to more favored students, it is rank that counts and not absolute level of achievement. The conceivable disadvantage is reinforced if students react to such competition by establishing norms of minimizing effort, as suggested above.

Conclusion

The research addressing the effect of organizational differentiation of opportunity has focussed mainly on whether or not there is an independent effect of origin on assignments to instructional groups controlling for variables such as ability and past achievements that reflect the meritocratic nature of assignments. Most research reports that there is an

independent effect of origins on the majority of assignments to instructional groups of unequal educational ranks. Hence the assignment procedures associated with a system of organizational differentiation may increase the amount of inequality of opportunity created in an educational system.

As with the effects of ability grouping on learning, it is important to keep in mind that what is being studied are specific assignments to groups, not the overall impact of the organizational differentiation on equality of opportunity. The career trajectories defined by a system of organizational differentiation lead to unequal educational attainments. The degree of inequality of attainment will determine the degree of inequality of opportunity as long as individual flows of students are correlated with origins. This means that the organizational differentiation of students has a profound importance for inequality of opportunity even if there are no independent effects of origins--that is, if all effects of origins are mediated by meritocratic variables. Consequently, the restructuring of career trajectories in educational systems may have a much more profound impact on equality of opportunity than elimination of origin bias in assignments. This calls for research on these trajectories through the analysis of flows of students in an educational system.

6. METHODOLOGICAL IMPLICATIONS

Research on the organizational differentiation of students has used one of three designs: (1) experimental or quasi-experimental design; (2) surveys; (3) intensive case studies. The experimental design is found in numerous American studies of ability grouping; a particularly noteworthy example is the large scale experiment in New York State conducted by Goldberg, Passow, and Justman (1966). Most studies using the experimental

design are, however, small-scale. Surveys using testing and/or questionnaires and/or school records have been relied on in investigations of streaming in British primary schools (e.g., Baker Lunn, 1970; Douglas, 1964); in studies of tracking (e.g., Alexander and McDill, 1976; Heyns, 1974; Jencks and Brown, 1975; Schafer and Olexa, 1971); and in some investigations of ability grouping (Borg, 1964). Intensive case studies are less frequent, but Hollingshead's pioneering study (1949) is one. Baker Lunn and Jackson (1964) combine surveys with intensive case studies, and Rosen (1976) studies tracking in a single high school.

Experiments are sometimes presented as the ultimate conveyors of truth. However, the truth about ability grouping is evidently difficult to convey using an experimental design. Numerous variables and mechanisms operate when children are grouped according to ability, as this paper has tried to indicate. If the mechanisms and variables that would produce outcomes were well specified, experiments would be a useful design. But when grouped and ungrouped systems are contrasted, mechanisms are not well specified; rather, experiments become black boxes, where any number of things could produce observed effects. Experiments focus on change and this is a valuable, in fact usually necessary, concern when analyzing school processes. But the field experiments that have been carried out on ability grouping are usually short term, and long term impacts are missed.

The survey design makes it possible to focus on a larger number of variables and may permit the analysis of the possible complex mechanisms that could be involved in organizational differentiation of students. Much survey research is cross-sectional, so inferences on changes produced by

organizational differentiation must be made comparing different respondents and making assumptions about the temporal order of variables. Noteworthy exceptions are the longitudinal studies on streaming from Britain (Baker Lunn, 1970; Douglas, 1964). Jencks and Brown (1975) and Alexander, Cook, and McDill (1977) are also using longitudinal data in their analysis of high school effects, though Jencks and Brown do not focus much attention on the impact of groupings.

Early survey research has primarily used cross-classification and percentaging. This may not be an efficient use of information, though it can be informative. Recent research has adopted regression techniques, often in combination with structural equation models. Much of the discussion that follows is directed at this methodology.

Because of the continuing popularity of the survey design--in contrast to the evidently declining popularity of the experimental design--most attention is focussed on the methodological problems this design poses in the analysis of the organizational differentiation of students. Particular attention is focussed on the use of structural equation models with data obtained from surveys.

The intensive case study (e.g., Jackson, 1964; Rosenbaum, 1976) has merit. It enables informative in-depth study of the various processes that go on in schools, and it can provide a rich description of mechanisms not though of or not revealed because of complexity in surveys. The obvious drawback is generalizability, and this is particularly serious in relation to grouping practices. Since goruping is a matching process where a given number of students will be allocated to a predetermined number of places, different matchings will occur in schools that differ

in student body composition and grouping systems. Hence much may be made of a local phenomenon that will not appear in other locales.

The conceptualization of the organizational differentiation of students presented in this paper has a number of methodological implications. I discuss some of these here, focussing on some particularly salient features.

The Effect of Organizational Differentiation is Over Time

The structure of opportunities created by the organizational differentiation of students is a structure in the time domain. The outcome of groupings on learning and attitudes are changes in achievements and attitudes over time. Most studies nevertheless focus on the level of achievement at a point in time when analyzing learning outcomes, and on the proportion in given instructional groups and not on flows when analyzing the causes and consequences of assignments to groups. This will, in general, not produce the same inferences as when change is analyzed directly. The formal argument is developed here for analysis of learning. It applies equally well to the analysis of flows.

Learning. It was mentioned above that learning can be conceived of as resulting from the interaction of the ability and effort of students on the one hand, and the opportunities for learning presented to students on the other hand. A simple model for learning, relying on this notion, can be used to illustrate the different implications of studying change rather than the observed level of achievement. Let $y(t)$ denote the level of achievement at a point in time; s_i the ability and effort of a student, i.e., his/her intellectual resources; and the amount of material from a given curriculum a group of students have been exposed to by time t. Assume that s_i will determine what fraction of the new material a student

will learn in a small interval of time. This implies

$$\frac{dy_i(t)}{dy(t)} = s_i. \tag{1}$$

Let the total amount of material presented in a period be v^*, and assume that $dv(t)$ declines as a constant fraction of $(v^* - v(t))$, i.e. in the beginning most material presented in the classroom is new, but as time goes by, less and less material will be new material. Then it can be shown (Sørensen and Hallinan, 1977) that (1) can be written as

$$\frac{dy_i(t)}{dt} = s_i + by(t), \tag{2}$$

where $b = -\frac{1}{v^*}$ is a measure of the opportunities for learning a student is exposed to. The solution to (2) is

$$y_i(t) = y_i(0)e^{bt} + \frac{s_i}{b}(e^{bt} - 1). \tag{3}$$

The ability and effort of students can be written as a linear function of characteristics of students, i.e., $s_i = c_{i0} + \sum_j c_{ij}x_{ij}$, where x_{ij} is the value on variable j for student i. The x_j variables would be measures of a student's background, ability, and attitudes. Inserting this expression into (3) will produce a linear lagged equation that may be estimated and from which the parameters b and c_i that govern the process can be retrieved.[4] As $t \to \infty$, equation (3) (with the specification of s_i) reduces to

$$y(e) = -\frac{c_0}{b} - \sum_j \frac{c_j}{b}x_j \tag{4}$$

This equilibrium solution will only obtain if $b < 0$, but this is required by the definition of b as opportunities for learning. Equation (4) is identical to the linear algebraic equation estimated in much recent research on schooling processes of the form $y = d_0 + \sum_j d_j x_j$ with $d_j = c_j/b$. This derivation has a number of implications.

1. Variables that affect opportunities for learning affect b, and their influence is not captured by the coefficients to the x_j variables that measure ability and effort. This means that attempts to measure effects of grouping believed to be brought about by the creation of different opportunities for learning cannot be ascertained by introducing grouping as an independent variable alongside measures of student characteristics relevant for their ability and effort. Rather, estimates of b for each group should be obtained.

2. The effect of opportunities for learning and of the student's intellectual resources can only be separated by studying change. The cross-sectional analysis will confound b and the c_j parameters.

3. Equation (4) only holds when the process has reached an equilibrium. That equilbrium is obtained is not a reasonable assumption to make about learning processes in schools. Failure of the assumption means that estimated coefficients to independent variables in equation (4) will be functions of time.

Since achievement differences are such an important concern and since groupings should affect opportunities for learning, change studies are needed. Such studies have indeed been done (e.g., Jencks and Brown, 1975). But it is also necessary to <u>model</u> change to find the quantities that govern change, and not merely apply the cross-sectional apparatus on change data.

<u>Flows</u>. The same argument can be applied to analysis of flows, which should be but are not, an important concern in analysis of the opportunity structure created by the organizational differentiation of students. When grouping, particularly tracking, is studied it is common to use a dichotomous variable (college versus noncollege track). This variable corresponds

to the y(t) variable above. The quantities that govern change in this variable are transition probabilities. Just as dy(t)/dt is the proper concern in models of learning, the transition probabilities, not the proportions in groups that they determine, are the quantities that should be focused on in modeling and estimation of flows.

Grouping May Result in Different Educational Environments.

It has been recognized that, since schools may present different educational environments, it is proper to analyze schooling processes using an analysis of covariance design. This is done by subtracting individual values of variables from school means after first testing for between school interactions. The technique (pioneered by Hauser) is employed by most recent studies that include attention to grouping variables (Alexander and McDill, 1976; Hauser, Sewell, and Alwin, 1976; Heyns, 1974; Jencks and Brown, 1975). In only one instance has a study (Jencks and Brown) considered the possibility that grouping might also represent different educational environments, and that within group (track) analysis ought to be performed; but an analysis is not carried out. It is argued that the effect of grouping relative to the effect of other variables is modest. This is not a strong arguement against such analysis. The possible role of grouping in creating differential opportunities for learning cannot be assessed in their analysis. Further, their measure of the relative effect of a dichotomous variable is difficult to interpret, as I argue below.

Whether grouping creates differential environments for learning should be assessed by estimating models such as equation (3), with the decomposition of s_i for each group. Jencks and Brown (1975), and Alexander, Cook, and McDill (1977) in fact use a lagged equation, but on the pooled data and

without an interpretation of parameters in terms of the mechanisms that produce outcomes. They use grouping as an independent variable alongside measures of achievements and other student characteristics. This means, in the framework proposed here, that grouping is considered a variable measuring an intellectual resource of students. This seems an inadequate conceptualization, since whatever the grouping has done to students with respect to learning is already captured by other variables in the models used by these researchers.

Whether groupings create different educational environments is an empirical question. The extent to which such environments are created can be analyzed using covariance techniques with lagged equations, but not be introducing grouping as a single dichotomous variable in a model applied to data pooled over a whole school. The various mechanisms proposed in section 4 could then be tested by relating the existence of different learning environments to the scope of groupings and the assignment criterion used.

Grouping is a Categorical Variable

All research using regression methods on the consequences and causes of individual assignments to tracks has used a dichotomous variable to represent grouping in tracks. This variable is then entered alongside continuous variables as an independent variable in analyses of the consequences of grouping, and is used as an endogenous variable in analyses of the assignments to tracks and the role of tracking as in intervening variable in educational attainment processes. The categorical nature of the variable of interest creates a number of problems in this methodology.

When used as a dependent variable in a linear model, it is well known that a dichotomous variable is at best inefficient and likely also results in a misspecified model. This follows from the fact that the variable represents a probability, which is constrained to vary between zero and one, and have a variance that depends on the mean: $p(1-p)$. Standard methods, in the form of probit and logit models, are available to overcome these problems; but they have never been employed in research on grouping.

The inefficiency of the linear probability model means that the absence of a significant effect on the assignment to groups should be interpreted with caution. The inefficiency and the likely misspecification means that comparisons of R^2's in linear probability models to R^2's for other dependent variables are fairly meaningless. Further, when using simulataneous equation systems (e.g., path models) with an interest in specifying the direct and indirect effect of variables, the use of college track as a mediating variable is likely to result in an underevaluation of its importance, since not much variance can be accounted for in a dichotomous variable.

The use of college track as a dichotomous independent variable might be without problems in this context, except for the nearly universal use of standardized measures of effect. A standardized effect is an effect measured relative to the variance in the independent variable focussed upon. The standardized effect of college track on something else will therefore have a minimum when half the students go to college track and a maximum when nearly everyone or nearly no one goes, other things equal. This does not seem to make inferences on the importance of college track based on the standardized coefficient very meaningful.

Grouping Results in Interdependent Outcomes

It has been pointed out repeatedly in this paper that one of the most salient features of organizational differentiation is that it results in matching processes where students will get access to groups only when there is room. As a result, the probability that a student will be assigned to an instructional group will depend not only on his/her own characteristics but on the distribution of relevant characteristics in the student body being assigned. This results in interdependent outcomes; it can be added that learning in groups should always result in some interdependence, since everyone in an instructional group is exposed to the same teacher.

The interdependence of outcomes has (1) statistical, (2) modeling, and (3) measurement implications. The statistical implications are that observations on individual students in grouped systems will not be statistically independent. Errors will be correlated across students and standard errors will in general be underestimated. This affects all school research. Standard methods do not seem to be available to overcome the problem. Their development should be of interest to those researching groupings in schools.

The modeling implications are serious. The flow matrices and the interpretation of them suggested in this paper as absorbing Markov Chains may be appropriate as descriptive devices and as a framework for conceptualizing opportunity structures. However, the interdependency of outcomes and individual flows means that the Markov model is probably not a realistic model for prediction, even if individual variations in transition probabilities are accounted for. The problem is not peculiar to this application; it

occurs in the analysis of all mobility and matching processes. One solution to the problem in the analysis of mobility is to focus on the flows of vacancies rather than of persons (White, 1970). This approach could be implemented in the analysis of educational flows by focussing on what Stone (1975) calls admission probabilities. Admission probabilities track flows backward in a system from given end-points. The problem is that the concept of vacancies is somewhat nebulous in educational systems, since grouping boundaries may be more flexible than job positions in organizations with a predetermined job structure.

The measurement implications have to do with the fact that rankings, not absolute values of relevant variables, determine matchings to instructional groups. A student's chance for getting access depends on the number of groups, their size, and the composition of the student body, as these quantities determine the rank order of students for assignments. This is not well reflected in the research on organizational differentiation where the independent variables employed are usually used with identical metrics across schools.

7. CONCLUSION

This paper has outlined a number of mechanisms by which the organizational differentiation of students may affect student outcomes. Organizational differentiation creates career trajectories in an educational system, and thus structures educational opportunities. It may create different learning and social environments relevant for academic achievement and socialization. It presents a set of signals about the competencies and likely futures of students relevant for the decision making of teachers, parents, and the students themselves.

If one single conclusion can be drawn from this paper, it is that establishing the relevance of organizational differentiation is a matter of identifying the mechanisms that could account for observable outcomes. The simple question of whether grouping makes a difference is not a very useful research question. It leads to black box research that is not suitable here since several mechanisms are likely to be operating simultaneously in any given grouping system. Research should instead focus on these mechanisms directly, and identify the relevant dimensions of groupings.

The recent research on organizational differentiation of students using structural equation models (Alexander and McDill, 1976; Alexander, Cook, and McDill, 1977; Heyns, 1974) is a considerable advance over earlier research because it specifies causal models that mirror the complex interrelationship among a large number of variables. However, this advance only gets the topic part of the way out of the black box. The organizational differentiation of students is not just another variable to be added to measures of ability, family background, race, and sex. The groupings of students result in complex processes that are not always captured by focussing on the relative effect of track membership, as the methodological section has tried to show.

The main proposal of the present paper is to recognize in future research that the organizational differentiation of students defines a structure of flows in an educational system. Most existing research has focussed on the causes and consequences of single assignments to, for example, college tracks or ability groups, neglecting that such assignments are part of sequences of assignments that produce educational attainments. Small initial effects are therefore cumulated and translated into unequal educational outcomes. The processes that govern the flows

in educational systems is a far broader research topic that the isolated concerns for the existence of an origin bias in assignments, or a learning effect of ability groupings.

NOTES

[1]It should be noted that within classroom groupings may have major significance for educational opportunities because they occur early in the educational process. Within classroom ability grouping is the major form for nonrandom grouping in primary grades in the U.S.

[2]Alternatively, one may justify the use of grades as units by assuming random assignment to classrooms within grades.

[3]This and other concepts used to characterize systems of organizational differentiation are also discussed in Sørensen (1980).

[4]The resulting equation can be written as $y(t) = c_o^* + b^* y(0) + \sum_j c_j^* X_j$, and estimated using least squares techniques. The b and c_j parameters may be obtained, solving the equations $b^* = e^{bt}$ and $c_j^* = c_j/b(e^{bt} - 1)$, from estimates of b^* and the c_j^*'s.

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