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ABSTRACT

The data obtained from the National Longitudinal Study of the High School Class of 1972 was used to yield estimates of the total number of instructional hours in each of the academic areas over a 3 year period. Rates of exposure to industrial arts and commercial courses exhibited large sex differences and small racial differences. Both white and female advantages in exposure were due to differences in rates at which groups initiated course taking. Program differences in academic instruction were large and varied considerably across groups. The findings concerning allocation of vocational instructional resources were that pupils enrolled in non-vocational programs received more of vocational instruction resources than students enrolled in vocational programs. Females received more vocational instruction resources than males. It appeared black pupils received more vocational resources in academic programs, but less in vocational or general curricula. High school course track membership was found to be the major factor influencing a pupil's academic preparation for subsequent schooling and employment. This study concluded profound track-induced barriers to post-secondary access are built up due to the strong variation in course exposure over tracks. This occurred regardless of the ultimate aspirations of the students. (DWH)

Contractor Report

Curricular Resource Allocation and Course Exposure in Secondary Schools

National Center for Education Statistics

Curricular Resource Allocation and Course Exposure in Secondary Schools

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1. Introduction

The intent of this paper is to present in a non-technical fashion basic data concerning high school pupils' exposure to instruction in the various curricular areas. Such data are not readily available on a nationally representative basis, if the information sought is both comprehensive, i.e., covers all areas of the curriculum and the population of high school pupils, and if comparisons are to be made using characteristics of exposed pupils, e.g., race, sex, and track membership. The most recent (1972/73) national survey of course offerings and enrollments (Osterndorf, 1975; Osterndorf and Horn, 1976), for example, is complete with respect to the course exposure of those in non-vocational tracks, but omits vocational course enrollments for those in vocational tracks. In addition, no breakdowns are possible by race, sex, or track. The 1972 survey of vocational education (Osso, 1974), on the other hand, allows subdivision by pupil characteristics, but is comprehensive neither in course areas covered nor in high school enrollees. The 1977 National Survey of Science, Mathematics, and Social Studies Education (Weiss, 1978) was comprehensive in terms of high school pupils, but omitted a large portion of the curriculum.

Such data, even though difficult to obtain, are an extremely important aspect of schooling and of pupils' experiences as they participate in schooling. For school policy purposes, a pupil's instructional pursuits, however determined, are the most salient aspect of his school experience and have the most important lasting effects on his achievements, both academic and occupational. Consequently, we have taken some care in defining the indicators used here to describe those pursuits.

The data reported here were obtained from the National Longitudinal Study of the High School Class of 1972.[1] The work reported in this paper was supported by the National Center for Education Statistics in a policy-oriented analysis of these data.[2] During the base year data collection of that study, a school record information form was filled out by school officials on the pupils selected for study. A part of that form requested detailed course-taking information for the final three years of high school by curricular area from the pupil's academic record.[3] These data were transformed[4] to yield estimates of the total numbers of instructional hours in each of the academic areas over the three year period. These were then standardized to a weekly basis by dividing the product of 36 (weeks) and three (years). These numbers are the primary indicators reported in this paper. To demonstrate their direct policy importance, we have related pupils' course taking to college entrance course requirements for three selected universities (Section 4).

2. Differences in Course Exposure

The academic areas into which the pupils' pursuits were subdivided are listed on the left side of Table 1. As can be seen there, only six vocational course areas were designated, Technical Education (primarily a post-secondary area) being omitted. In what follows we assume that technical course enrollments are categorized with Trades and Industry in that occupations in these two categories are not easily distinguishable from each other, but are readily separated from the other areas. Also, it should be noted that Industrial Arts and Commercial courses are not considered to be parts of occupational or vocational curricula as they are not designed to lead to employment in specific occupations. Thus, vocational area courses have been restricted to those with the labels given in Table 1 under the heading Vocational-Technical.[5]

Table 1 Percent of Pupils Taking at Least One Course in Various Academic, Areas, by Race and Sex.

Area	White		Black	
	Male	Female	Male	Female
Academic				
Science	93.6	91.2	94.4	94.1
Foreign Language	53.7	60.1	33.5	45.5
Social Studies	98.4	98.7	97.5	97.6
English	98.3	98.6	97.5	98.2
Mathematics	91.9	87.5	91.2	91.2
Industrial Arts	47.2	7.2	43.0	8.4
Commercial	52.4	75.5	43.1	69.3
Arts	36.2	49.9	41.3	44.3
Vocational-Technical				
Agriculture	8.6	1.0	12.5	0.9
Business or Commercial	38.3	57.5	31.0	57.1
Distributive Education	4.4	5.1	5.8	6.9
Health Occupations	3.1	5.3	3.2	8.8
Home Economics	5.9	38.3	7.5	43.0
Trade or Industrial	34.0	4.7	36.8	7.2
Any Vocational Area (all)	63.7	71.8	67.8	75.7
(Not in Vocational Program)	43.3	44.8	40.3	48.2
Any Area	100.0	100.0	100.0	100.0

Table 1 gives the percentage of pupils, by race and sex, who had enrolled in at least one course in each of the curricular areas. English and Social Studies were taken by almost all pupils regardless of race or sex. Mathematics and Science were taken at uniformly high levels (in excess of 90%), except for white females who had somewhat lower exposure. Foreign Language courses were taken more often by whites and females (more than half the time), but black males had particularly low rates of exposure (34%), beginning course work at only 62 percent of the white male rate. Arts (fine and performing) courses were taken by less than fifty percent of pupils in every group, but blacks and females had generally greater exposure.

Rates of exposure to Industrial Arts and Commercial Courses exhibit large sex differences and small racial differences. Industrial Arts is taken by almost 50 percent of males, but by less than ten percent of females and commercial courses are taken by only about half of the males, but almost seventy-five percent of females. Courses formally classified as vocational-technical exhibit similar sex stereotyping. Courses relating to Business or Commercial Occupations and Home Economics being initiated predominantly by females, while Agriculture and Trade or Industrial occupations had predominantly male course taking. Distributive Education and Health occupations were more evenly split. Exposure to at least one vocational-technical course regardless of sub-area is quite high, over two-thirds of all pupils having such exposure. Male-female differences in minimal exposure are educationally significant, females having about twelve percent greater exposure than males. If we restrict our vision to those who are not enrolled in vocational-technical curricula, sex differences in exposure to such courses are greater for blacks (increasing to 20%) and smaller for whites (decreasing to 3%).

If we take a greater overview and look at average hours of total exposure to selected areas (Table 2), we also find important differences. Science and Mathematics are taken less extensively by females than males, but racial differences are not large, reflecting the above exposure differences. However, if we restrict the averaging to those who took at least one course, sex differences diminish but do not vanish, indicating that the total exposure gap between males and females is due both to lack of initial exposure to the areas and to less extensive courses taken once study was begun. Foreign language differences, both between sexes and races, almost disappear when we restrict our average, total instructional hours for those who have taken at least one course. Both the white and female advantages in total exposure are almost entirely due to differences in the rates at which the groups initiate course taking, depth of exposure varying little across groups for those who begin instruction. This finding also applies to instructional exposure in Industrial Arts, Commercial instruction, Fine and Performing Arts and to Vocational-technical courses in total. Differences in these areas, especially the large sex discrepancies, diminish considerably when we remove the discrepancies in initial exposure.

Table 2 - Average Hours of Instruction in Selected Academic Areas, Total and For Those Taking at Least One Course, by Race and Sex.

Total Mean Hours

Area	White		Black	
	Male	Female	Male	Female
Science	2.89	2.48	2.69	2.51
Foreign Language	1.36	1.63	0.86	1.14
Mathematics	2.98	2.42	2.83	2.66
Industrial Arts	1.60	0.15	1.33	0.22
Commercial	1.14	2.95	1.02	2.47
Arts	1.03	1.52	1.17	1.15
Total Vocational	2.68	3.63	3.02	4.00

Mean Hours for Those Taking At Least One Course

	White		Black	
	Male	Female	Male	Female
Science	3.09	2.72	2.85	2.67
Foreign Language	2.53	2.71	2.57	2.51
Mathematics	3.24	2.76	3.10	2.92
Industrial Arts	3.39	2.08	3.09	2.62
Commercial	2.18	3.91	2.37	3.56
Arts	2.85	3.05	2.83	2.60
Total Vocational	4.21	5.06	4.45	5.28

Average hours of instruction received by pupils in these four groups, for all curricular areas, totally and for each academic program[6], are given in Appendix Table D1. These data are summarized in the following tables.

Table 3. Average* Weekly Hours of Instruction in Selected Curricular Areas and Total Instructional Hours per Week by Race, Sex, and High School Track.

	Academic	General	Vocational
Science, Foreign Language, English, Mathematics			
White - Male	13.69	10.35	8.52
Female	13.05	9.49	8.16
Black - Male	13.72	10.12	9.11
Female	13.33	10.09	8.94
Social Studies			
White - Male	3.76	4.21	3.69
Female	3.70	4.03	3.58
Black - Male	3.92	4.05	3.67
Female	3.71	4.00	3.70
Art, Industrial Arts			
White - Male	1.77	3.35	3.56
Female	1.83	2.10	1.01
Black - Male	1.88	2.90	2.36
Female	1.61	1.33	1.15
Commercial			
White - Male	0.88	1.47	1.25
Female	1.46	3.01	5.52
Black - Male	1.00	1.13	0.88
Female	1.46	2.26	3.88
Total Vocational			
White - Male	1.26	2.94	5.68
Female	1.72	4.22	6.50
Black - Male	1.40	2.81	5.01
Female	2.29	3.67	6.41
Total Weekly Hours			
White - Male	21.34	22.32	22.69
Female	21.77	22.83	24.79
Black - Male	21.91	21.00	21.04
Female	22.41	21.35	24.07

*Average over the last three years of high school.

Total weekly course hours and course taking in certain selected curricular areas over the last three years of high school attendance, by track, shed light on the role of high school programs as they limit and shape pupils' academic experiences (Tabel 3). In general, we found that academic track students average fewer course hours per week than general and vocational track students; and female academic track students average the lowest number of course hours. Females in the vocational track, however, accumulate considerably more course hours than any other group. These extra hours do, however, not accumulate from course taking in the basic curricular subject matter areas. On the contrary, the hard core curricular areas -- science, foreign language, English, and mathematics together -- show fewer course hours for female high school students than for males, and within track, white females average the lowest hours in these subject matter areas. Course hours in social studies are less discrepant within track. Where then do female students accumulate more course hours? Well, females in general and vocational tracks even take less art and industrial arts courses than male students. The only course areas in which female students enroll more are commercial and vocational. Since commercial courses also have a vocational orientation, this means that females not only enroll to a higher rate in vocational programs, but in general, they take many more courses which are either vocational or have a vocational orientation. Since vocational education funds are mostly allocated on the basis of course enrollment and on the basis of vocational track or program enrollment, this might mean that females receive a higher share of vocational education funds, federal as well as state and local. However, courses mostly taken by female high school students typically require considerably less resources for equipment than courses oriented toward traditionally male occupations.

To show some of the course taking differences in greater detail, Table 4 exhibits percent differences between white males and white females, black males and black females, respectively, in total instructional hours for each curricular area, by high school program. In the academic course areas, differences in sex and race groups are generally duplicated across the programs, however, blacks in academic curricula are much closer to white males in foreign language exposure and blacks in vocational curricula generally have greater amounts of instruction in mathematics and science than white males.

If we focus on Art, Vocational-Technical, and related courses, we see some important differences among curricula: sex differences are generally sharper in the vocational programs and black males in academic curricula differ less than in other curricula from white males in course exposure averages.

Table 5 focusses directly on these program differences by contrasting vocational and academic program exposure means for each sex/race group separately. Extreme values index course areas in which there are large discrepancies between pupils in vocational versus academic programs. The largest discrepancies are for foreign languages, in which academic pupils take considerably more work and for Trade and Industrial occupations and Distributive Education which are primarily taken by vocational pupils. Program separation, although not as extreme, is also large for Agriculture (males only), Industrial Arts (males only), Home Economics and Business and Commercial (females only). Health occupations exhibits an unusual pattern of program separation, being more heavily vocational for black males and white females, but more strongly academic for white males and black females.

Table 4 Discrepancy in Course Hours: Blacks and Females Compared to White Males, by High School Program.

Area	General			Academic			Vocational		
	White Female	Black Male	Black Female	White Female	Black Male	Black Female	White Female	Black Male	Black Female
Science	- 13.6	0.0	- 8.2	- 14.3	- 2.5	- 10.0	- 15.2	+ 17.7	+ 6.1
Foreign Language	+ 12.2	- 32.9	- 12.2	+ 20.0	- 4.2	+ 8.8	+ 20.0	- 16.7	+ 83.3
Social Studies	- 4.3	- 3.8	- 5.0	- 1.6	+ 4.3	- 1.3	- 3.0	- 0.5	+ 0.3
English	- 1.5	- 1.3	+ 1.3	0.0	+ 6.0	+ 2.1	- 0.5	+ 0.2	+ 0.7
Mathematics	- 21.8	+ 3.9	- 0.8	- 15.4	- 1.4	- 7.7	- 19.6	+ 13.7	+ 1.0
Industrial Arts	- 89.7	- 18.6	- 87.1	- 85.0	- 5.0	- 72.5	- 94.6	- 52.5	- 92.9
Commercial	+104.8	- 23.1	+ 53.7	+ 65.9	+13.6	+ 65.9	+ 341.6	- 29.6	+ 210.4
Arts	+ 34.8	- 6.4	- 23.4	+ 76.3	+15.5	+ 43.3	+ 44.1	+ 61.0	+ 59.3
Agriculture	- 88.6	+ 28.6	- 91.4	- 90.0	+60.0	- 100.0	- 98.6	- 7.0	- 100.0
Business	+119.8	- 17.0	+ 60.4	+ 64.1	+12.5	+ 90.6	+ 395.8	- 34.7	+ 306.3
Distributive Education	+ 40.0	+ 40.0	+ 90.0	- 33.3	-67.7	- 67.7	- 20.0	+ 5.7	+ 25.7
Health Occupations	+100.0	+200.0	+350.0	+ 60.0	-20.0	+ 580.0	+ 366.7	+100.0	+ 800.0
Home Economics	+788.2	0.0	+758.8	+1200.0	+50.0	+1525.0	+1442.9	+228.6	+1571.4
Trade or Industrial	- 88.5	- 13.9	- 91.0	- 92.7	+ 2.4	- 82.9	- 92.2	- 14.2	- 81.3

Table 5 Discrepancy in Instructional Hours Between Vocational and Academic Programs as a Percent of Vocational Program Hours.

Area	White Male	White Female	Black Male	Black Female
Science*	-44.5	-45.1	-33.0	-34.5
Foreign Language*	-86.0	-74.4	-87.9	-76.6
Social Studies*	- 1.9	- 3.2	- 6.4	- 0.3
English*	- 3.0	- 3.5	- 8.3	- 4.3
Mathematics*	-44.0	-46.8	-35.4	-34.0
Industrial Arts	-73.1	-25.0	-46.1	+ 4.8
Commercial	-29.6	-73.6	+13.6	-62.4
Arts*	-39.2	-50.3	-15.2	-32.4
Agriculture	-85.9	0.0	-75.8	0.0
Business	-32.6	-77.7	+16.1	-68.4
Distributive Education	-91.4	-92.9	-97.3	-97.7
Health Occupations	+66.7	-42.9	-33.3	+25.9
Home Economics	-42.9	-51.9	-73.9	-44.4
Trade or Industrial	-88.5	-89.3	-86.3	-89.6

*For these subject areas academic program hours is the base for the percentage.

These curricular differences can be summarized and highlighted by graphical displays (Figures 1 and 2). We have plotted the total hours of Vocational and Academic (Total minus Vocational) Instruction as a two-dimensional graph: abscissa values equalling the vocational hours and ordinate values equalling the academic hours. The points plotted are the pairs of values for twelve combinations of programs (academic, general, vocational), race (black, white), and

Figure 1 Hours of Academic and Vocational Instruction, by High School Program, Race and Sex, Version A.

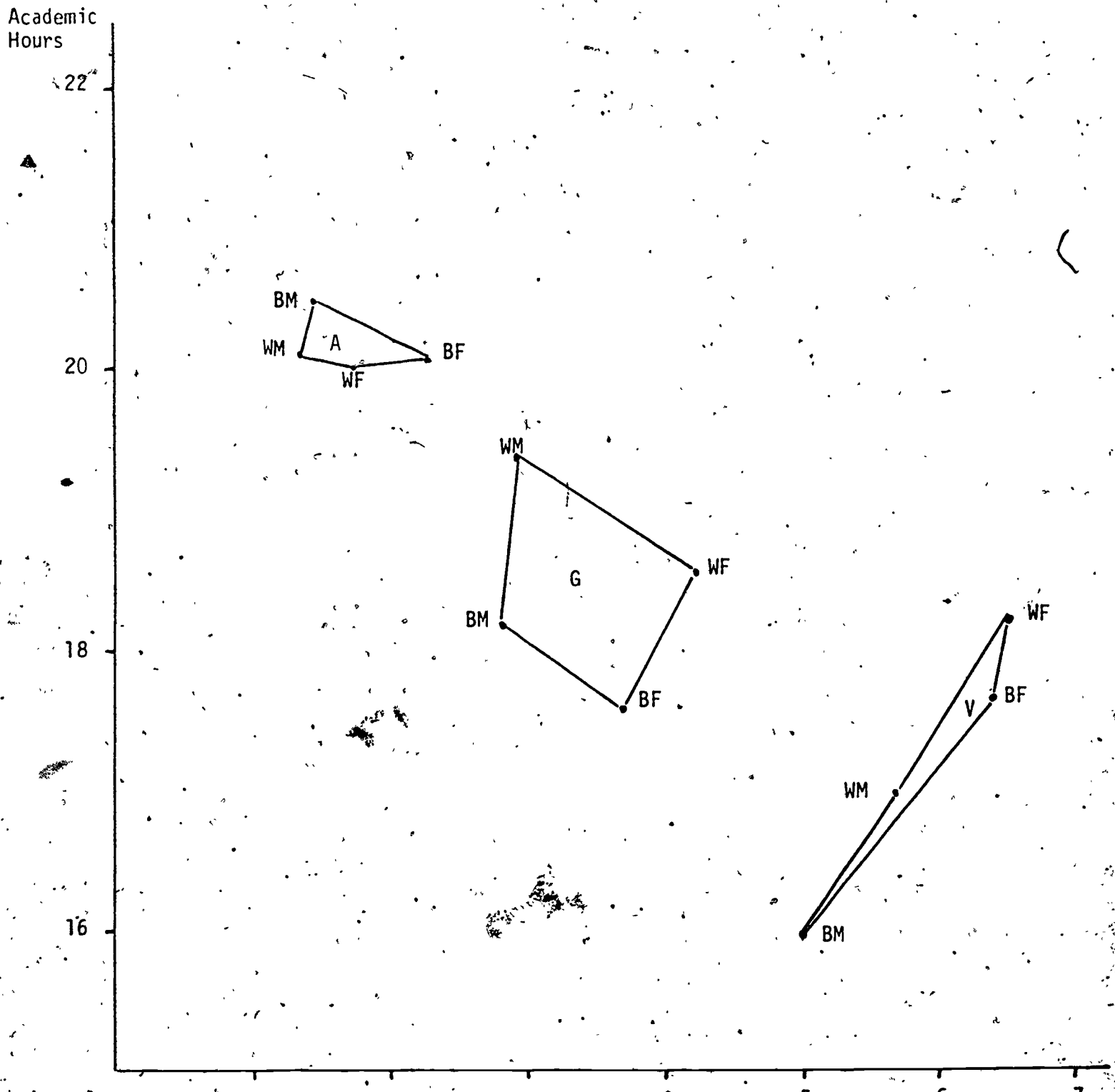
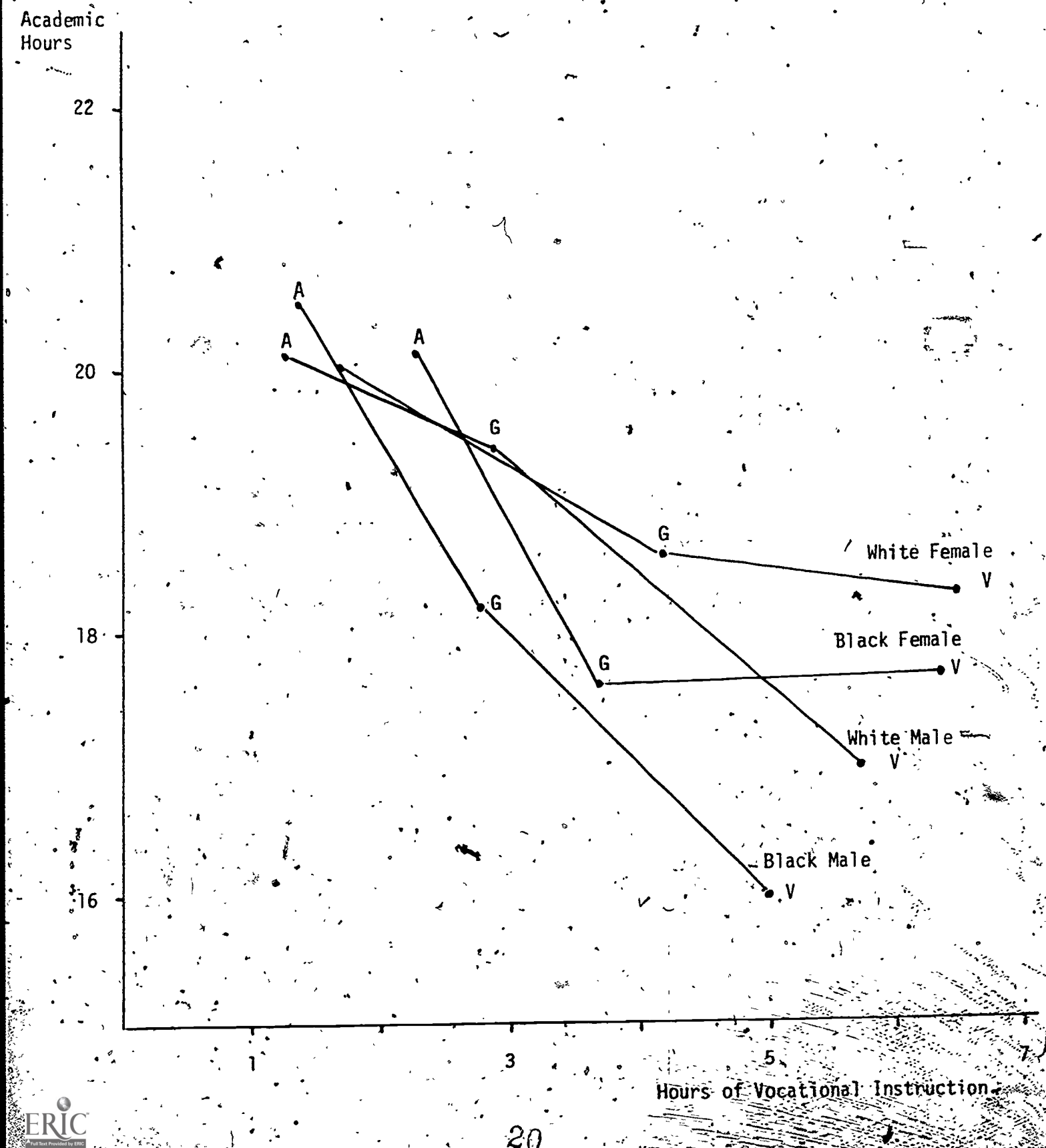


Figure 2. Hours of Academic and Vocational Instruction, by High School Program, Race and Sex, Version B.



sex (male, female). The alternative versions are graphed with race/sex groups linearly connected for each program (A) and the programs connected for each race/sex group (B). The first graph (A) clearly shows the program separations: None of the program figures are even remotely close to another. As one might expect, the hours of academic and vocational instruction are negatively related over programs, but not so across groups within programs. These negative relations are strongest for males, with females in academic and general curricula taking approximately equal amounts of academic instruction (B). In terms of total instruction, blacks are highest in the academic program, while whites are highest in the general. Within the vocational program, there is generally a positive relation of academic to vocational hours, white females ranking highest in both academic and vocational, followed by black females, white males and black males.

In summary, academic instruction averages about eighteen hours per week in the last three years of high school, but blacks lag about four to five percent behind whites, perhaps as much as an hour. Social background has very little effect on current academic instruction independent of program. That is, social background has its primary effect on hours of academic instruction via the process by which pupils are selected for particular high school tracks. Program differences (Academic minus Vocational, see Table 6) range from two to three hours (12 to 18% of the vocational means), but are greatest for black males (4½ hours or 29% of the vocational mean). In standard deviation terms, these differences average about 40 percent, but are only 25 percent of that value for white females and are 75 percent for black males. Thus, program differences in academic instruction are very large, especially for black males, and vary considerably across groups.

Table 6 Academic/Vocational Program Contrasts* in Hours Per Week of Work, Academic and Vocational Training, by Race and Sex.

	White Male	White Female	Black Male	Black Female
Academic Hours				
Raw Contrast (Hours)	2.91	1.67	4.58	2.37
Standard Deviation (Hours)	6.63	6.61	6.14	6.59
Percent Contrast (% of SD)	43.9	25.3	74.6	36.0
Percent of Vocational Mean	17.7	9.5	28.9	13.9
Vocational Hours				
Raw Contrast (Hours)	- 4.42	- 4.78	- 3.61	- 4.12
Standard Deviation	3.21	3.71	3.14	3.75
Percent Contrast (% of SD)	-137.7	-128.8	-115.0	-109.9
Percent of Vocational Mean	- 77.8	- 73.5	- 72.1	- 64.3
Percent in Excess of White Males				
Academic Hours	0	0.2	- 3.9	- 5.1
Vocational Hours	0	20.5	12.7	37.3

*Academic Hours - Vocational Hours/Total Standard Deviation.

The difference for black males is worth emphasizing. They are greatly separated in amount of academic training depending on whether they are in the academic or vocational track. The reason for this is that they are exposed to more academic course work than white males if they are in the academic program. On the other hand the white females are not widely separated in the amount of academic course work by program participation. This occurs primarily because they receive more academic exposure than white males when they are in a vocational program.

Vocational Instruction averages about three hours per week in the last three years of high school. Overall, black males generally get more vocational training than white males (+13%), but less if they are in the general (-4%) or vocational (-12%) programs. They are exposed to more vocational instruction than white males (+11%) if they are in the academic program. Thus, the primary reason for their greater amount of vocational instruction is the fact that they are proportionately more often than whites selected for vocational curricula. The females get more vocational instruction regardless of programs. But the largest differences, both racial and between the sexes, are in the academic program and the smallest are in the vocational.

3. The Allocation of Instructional Resources: Vocational Education

The patterns of experience which we have just discussed can be expressed from an alternative viewpoint. As we have chosen to develop them, and they are represented by averages of indices of pupil experience, and are most meaningful from the prospective of the pupil. From the perspective of the educational instruction providing services which contribute to those experiences, however, these averages do not correspond to the efforts expended nor to their distribution over relevant groups of pupils.

For example, suppose that pupils in vocational programs constituted 24 percent of all pupils and, therefore, pupils in non-vocational programs (academic, general) constituted 76 percent of all pupils. Suppose also that pupils in vocational programs received about 6.1 hours per week of vocational instruction, while pupils in non-vocational programs received only 2.6 hours of vocational instruction. Then, the total proportion of the instructional hours expended by the schools which went to vocational-program pupils would be:

$$\frac{(6.1)(.24)}{(6.1)(.24) + (2.6)(.76)} \cong 0.43$$

i.e., even though the rate of service received by vocational pupils was over twice the rate of receipt by non-vocational pupils [(6.1)/(2.6) $\cong$ 2.4], the fact that non-vocational pupils constituted more than three-fourths of the total population implied that they -- as a group -- received well over half (57%) of the instruction conveyed.

This result is, in fact, approximately correct. We have simplified the computation so that the concept is made clear and consequently the figures have been severely rounded. Below, we carry out these computations more accurately for a more finely segmented set of pupil sub-groupings. These sub-groupings are defined by the racial/ethnic group, sex, and curricular program of the pupil. And in order to accomplish the complete accounting of vocational instructional services delivered, we must expand our scope to include all pupils, not just whites and blacks.

Table 7 exhibits the total vocational hours of instruction for which pupils were registered over the last three years of high school. As before, these hours are expressed on a per week basis. Vocational pupils, in total, average -- as we indicated above -- about 6.1 hours per week. Pupils in the general program average about 3.5 hours and academic pupils about 1.9 hours. Blacks average about 3.6 hours, over-all programs, and whites about 3.2 hours. Females average 3.7 hours and males average 2.8 hours, a twenty-five percent difference. Table 8 displays the percentage of the total pupil population on which these means are based.

Table 7 Mean Hours of Vocational Instruction, by Racial/Ethnic Group, Sex, and High School Program.

Subgroups	Program			
	General	Academic	Vocational	Total (All Programs)
Males				
White	2.94	1.26	5.68	2.68
Black	2.81	1.40	5.01	3.02
Other	3.54	1.41	5.69	3.37
Total (All Males)	2.98	1.34	5.62	2.76
Females				
White	4.22	1.72	6.50	3.63
Black	3.67	2.29	6.41	4.00
Other	4.05	2.14	6.68	4.11
Total (All Females)	4.11	1.79	6.50	3.70
Total				
White	3.51	1.46	6.14	3.15
Black	3.29	1.92	5.80	3.58
Other	3.81	1.45	6.14	3.72
Total (All Subgroups)	3.51	1.93	6.11	3.23 (All Pupils)