

# EDUCATION AND AUTOMATION\*

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## RESUMEN

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Mucho se ha escrito acerca de las "necesidades de la industria moderna para educar" a sus trabajadores: muchos escritores han sugerido—cuando no lo han dicho explícitamente—que las personas que no han alcanzado a terminar la escuela superior no tienen el entrenamiento o la capacidad suficiente para desempeñar a cabalidad trabajos en la moderna economía tecnológica de hoy día.

De acuerdo a lo anterior, nosotros deseamos determinar cuánta educación (formal) han tenido los trabajadores empleados en 1950 y en 1960, y relacionar tales datos con el cambio tecnológico, medido este, como el promedio anual de cambio en el rendimiento por trabajador durante la década del 50-60. Si un mínimo de graduación en la escuela superior es necesario, entonces aquellas industrias las cuales experimentaron cambios tecnológicos relativamente grandes, deben emplear en su mayor parte solo graduados en la escuela superior.

Todas las industrias de los Estados Unidos fueron estudiadas: ellas fueron ordenadas por cambios en rendimiento por trabajador durante de década 50-60. También se obtuvieron estadísticas sobre educación en las industrias por medio de una muestra del uno por mil de los datos censales.

En 1960, más de la mitad de todos los trabajadores manuales incluyendo los de aquellas industrias las cuales habían experimentado grandes cambios tecnológicos no habían completado la escuela secundaria; de un medio a un tercio de los empleados de oficina ocupando bajos cargos, no habían completado la escuela secundaria. Entre 1950 y 1960 casi no hubo relación entre cambios en educación y cambios en rendimiento por trabajador. La única posible observación, es que aquellas industrias que incrementaron rápidamente el número de empleados entre 1950-60, fueron las mismas que tendieron a tener menos trabajadores sin escuela secundaria completa tanto en 1950 como en 1960.

Esta hipótesis fue probada ulteriormente calculando la movilidad neta de trabajadores masculinos, por educación y nivel de cambios en rendimiento por trabajador y por industria. No se encontró tendencia significativa en el sentido de que los trabajadores mas educados fueran a las industrias con mayor incremento en su productividad durante la década 1950-60.

Estos resultados fueron corroborados por estudios individuales en plantas, los cuales han mostrado que la introducción de nueva maquinaria y los procesos necesarios para su manejo, no siempre requieren que los trabajadores tengan mas educación formal. Los mismos trabajadores con unas pocas semanas de entreamiento sobre las máquinas pueden generalmente aprender a operar el nuevo equipo.

## INTRODUCTION

### PURPOSE

Much has been written about the "needs" of modern industry for "educated" workers; many writers have implied, if not made explicit, that persons who have failed to graduate from high school do not have the *training or capacity* for holding down jobs in today's modern technological economy. They are frequently doomed to a life on welfare, or to under-

employment, unless they can be retrained and educated.

Our purpose, then, is to determine just how much education—that is, formal schooling—employed workers had in 1950 and 1960, and to relate such data to technological change, as measured by average annual changes in output per worker during the 1950's. We emphasize that our concern is with the amount of schooling or training *needed* for the job rather than with the level of education demanded by employers or personnel men when hiring workers.

We assume that, if a man is employed, he performs sufficiently well on the job so as to be able to retain it; employers rarely keep workers on the payroll out of a sense of charity. Hence, the amount of

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schooling which such workers have is a clue to the amount of formal schooling actually needed for the job. Now, if modern technology requires well-educated workers, as some advocates claim, we should find that in those industries in which there have been very great increases in output per worker the educational level of the workers generally should have risen significantly. Conversely, in industries which experienced little, if any, increase in output per worker, presumably there was no "need" for the employed workers to have any increased amount of schooling.

#### DATA AND METHODOLOGY

Information on average annual changes in output per worker during the 1950's, for each of over 60 industries comprising the entire United States labor force, was available from an earlier study of ours.<sup>1</sup> Data on the educational level of the workers were obtained from one-in-a-thousand sample tapes of the 1950 and 1960 United States population censuses. We cross-tabulated number of years of schooling completed, by industries classified by changes in output per worker, and by changes in employment between 1950 and 1960—for white-collar and manual workers separately and for men and women.

In addition, we calculated industrial mobility between 1950 and 1960 for men by educational level. For this purpose we used the procedures described in Jaffe and Carleton.<sup>2</sup> The industries were classified into six categories, those in which output per worker increased less than 2 percent per year during the 1950's, those in which it increased from 2.0 to 3.9 percent, and those experiencing a 4.0 percent or more increase per year. Each of these three groups was then subdivided into two categories—the slower-growing industries,

that is, those having employment increases of less than 15 percent between 1950 and 1960; and the faster-growing one, that is, employment increased 15 percent or more.

Most of the men aged 25 and over in 1950 had already completed their formal schooling. On the other hand, there is comparatively little job mobility among men aged 50 and over (i.e., little in comparison with younger men). Therefore it is pertinent to ask about the mobility of men aged 25-49 in 1950. Did the better educated tend to move into the industries in which output per worker increased most rapidly during the 1950's?

We must also note that the numbers of cases in our analyses, derived as they are from one-in-a-thousand samples, tend to be small. We have tried to have a minimum of 200 cases for each distribution which we wish to analyze, although we were not always able to adhere to this limitation. Accordingly, we feel that differences of 1 or 2, or perhaps even 3, percentage points could have resulted from the small number of cases. Hence, the results to be presented should be viewed with this limitation in mind.

#### FINDINGS

##### MORE EDUCATION FOR EVERYONE

Over the years, all segments of the American population are receiving more formal schooling. (This point needs no further elaboration in this paper.) As a result, the labor force had more schooling in 1960 than in 1950. The median years of education for employed persons in 1950 and 1960 are as follows:

	1950	1960
Men.....	9.5	11.0
Women.....	11.3	12.0

Virtually every occupational group experienced an increase during this period.

The labor force becomes progressively more educated by the simple fact that youngsters who enter have had more schooling than the older workers, especially those who retire. This can be seen in the accompanying tabulation.

<sup>1</sup> Published in the report of hearings before the Senate Subcommittee on Employment and Manpower of the Committee on Labor and Public Welfare, September 26, 1963, Part 5, pp. 1596-1610.

<sup>2</sup> A. J. Jaffe and R. O. Carleton, *Occupational Mobility in the United States, 1930-1960* (New York: King's Crown Press, 1954).

	Median years of schooling	
	Men	Women
New entries, age 20-24 in 1960	12.3	12.5
Persons who entered between about 1945 and 1955, age 25-34 in 1960	12.2	12.3
Persons in the labor force in 1950 and 1960; i.e., had completed schooling by 1950, age 35-64 in 1960	10.5	11.7
Persons who retired between 1950 and 1960, age 55+ in 1950	8.4	8.9

In the generation or more between the new entries and those who retired, the median number of years of schooling increased by almost four years. This pattern appears for every major occupational group except the professionals; among these workers the median number of years of education has been 16 or more for some time.

Even among laborers who presumably need brawn rather than brain, the median education for male new entries was 11.3 years; this may be compared with the 6.9 years of those who retired since 1950. In short, whether or not American industry really wants workers with more education, it is getting them (see Table 1).

Nevertheless, as of 1960, at least half of the employed were "dropouts," persons who had not graduated from high school. Among male professional workers there were virtually none; among managers and other white-collar workers, a little over one-third were not high school graduates; and among manual workers, two-thirds or more were dropouts. Even among employed craftsmen 65 percent were dropouts.

Among employed women (in 1960) about the same proportions of dropouts were observed. Among professional women there were practically none; among managers, officials, and clerical workers about one-third were dropouts, and among sales-

women about half. Among women manual workers some three-quarters had not graduated from high school.

#### EDUCATION IN RELATION TO OUTPUT PER WORKER

Comparison of the educational levels of employed persons in 1950 and 1960 reveals that there is little, if any, relationship between changes in output per worker and changes in educational levels. This generalization holds true for men and women and for clerical and sales workers as well as manual workers (see Table 2).

*Clerical and sales workers.*—These people had more education than did the manual workers. Further, there may be some question as to the extent to which increases in output per worker may have actually affected these white-collar workers. The most outstanding observation is that those industries which increased in employment most rapidly were the ones which tended to have fewer dropouts both in 1950 and 1960.<sup>3</sup> The only exception is women employed in industries in which output per worker increased 4 percent or more per year; among these women there were about the same proportions of dropouts in 1960—25 percent—as among

<sup>3</sup> Why this is so, we do not know. One possibility is that these faster-growing industries had been faster growing in earlier decades also and therefore had attracted more of the younger and better-educated workers.

Table 1.—MEDIAN NUMBER OF YEARS OF SCHOOLING COMPLETED BY OCCUPATION, AGE, AND SEX, 1960 AND 1950: UNITED STATES

	Males Age 1960				Age 1950	Females Age 1960			Age 1950	
	20,21	22-24	25-34	35-64		20,21	22-24	25-34		
	New entries					New entries				
Professional, Tech. & Kindred Workers	16.3 <sup>a</sup>	16.5 <sup>b</sup>	16.4	16.3	16.0	16.1 <sup>a</sup>	16.0 <sup>b</sup>	16.1	16.0	15.5
Farmers & Farm Managers	12.2	12.2	12.1	8.7	8.2	-	11.7	11.6	8.8	8.5
Mgrs., Officials & Proprs., ex. Farm	12.6	12.8	12.8	12.4	11.1	12.6	12.7	12.5	12.3	11.8
Clerical & Kindred Workers	12.6	12.6	12.6	12.2	10.4	12.6	12.6	12.5	12.4	12.1
Sales Workers	12.7	12.8	12.8	12.4	10.6	12.4	12.3	12.2	11.6	10.1
Craftsmen, Foremen & Kindred Workers	12.2	12.2	12.0	9.8	8.5	12.3	12.3	11.9	10.5	8.9
Operatives & Kindred Workers	12.0	11.6	10.5	8.8	8.2	11.4	11.1	10.4	8.9	8.3
Service Workers	12.3	12.1	11.8	8.9	8.2	12.1	11.6	10.7	8.9	8.4
Farm Laborers & Foremen	10.0	8.7	8.0	6.4	6.0	9.2	9.1	8.8	8.4	7.9
Laborers, ex. Farm & Mine	11.3	10.8	9.3	8.0	6.9	11.7	11.2	10.4	8.7	8.1
Total	12.2	12.3	12.2	10.5	8.4	12.5	12.5	12.3	11.7	8.9

<sup>a</sup>Age 25-29.

<sup>b</sup>Age 30-34.

Sources: 1960 Decennial Census, experienced labor force, PC(2)5B, table 8. 1950 Decennial Census, employed persons, PE, No. 5B, table 11.

Table 2.—PERCENT OF EMPLOYED WORKERS HAVING TWELVE YEARS OR MORE OF SCHOOLING, BY SEX, BROAD OCCUPATIONAL GROUPS, AND SELECTED INDUSTRY CHARACTERISTICS, 1950 AND 1960: UNITED STATES

	Men		Women	
	Clerical & Sales	Manual Workers	Clerical & Sales	Manual Workers
Average annual increase in output per worker and per cent increase in employment, 1950-1960				
<u>Increase in Output per Worker under 2%</u>				
Increase in employment under 15%	1950 1960	23 28	66 66	21 28
Increase in employment 15% or more	1950 1960	26 32	78 76	22 26
<u>Increase in Output per Worker 2.0 to 3.9%</u>				
Increase in employment under 15%	1950 1960	21 26	58 57	22 21
Increase in employment 15% or more	1950 1960	25 32	64 65	26 32
<u>Increase in Output per Worker 4% or more<sup>a</sup></u>				
Increase in employment under 15%	1950 1960	17 24	77 <sup>b</sup> 78	9 21
Increase in employment 15% or more	1950 1960	39 50	65 75	40 <sup>b</sup> 40 <sup>b</sup>
Public Administration <sup>c</sup>	1950 1960	35 47	83 81	83 <sup>b</sup> 85 <sup>b</sup>

<sup>a</sup>Excluding agriculture, forestry, and fisheries.

<sup>b</sup>Under 200 cases in the sample.

<sup>c</sup>Rise in output N.A.

Source: See text.

women in fast-growing industries but in which output per worker increased under 2 percent per year.

*Manual (including service) workers.*— Among both men and women workers (excluding agriculture), there is little, if any, relationship between changes in educational level (1950–60) and changes in output per worker. Among employed men we find that in those industries in which output per worker increased by less than 2 percent annually (and employment increased under 15 percent), 77 percent of the employed workers were dropouts in 1950, as compared with 72 percent in 1960. At the other extreme, among those industries in which output per worker increased by 4 percent or more per year (and employment increased under 15 percent), the proportion of dropouts fell from 83 percent in 1950 to 76 percent in 1960.

Analysis of data for specific industries reveals exactly the same lack of relationship. For example, in the industry "local and highway passenger transportation," in which change in output per worker was less than 1 percent per year, the proportion of dropouts remained unchanged, being 76 percent in 1950 and 75 percent in 1960. In "printing, publishing, and allied industries," in which increase in output per worker was also low, averaging between 1 and 2 percent per year, the proportion of dropouts fell from 66 percent in 1950 to 54 percent in 1960.

On the other hand, in "coal mining,"

where average annual increase in output per worker was high, being over 5 percent per year, exactly 87 percent of the employed workers were dropouts in 1950 and 1960. In the "chemical and allied products (manufacturing)," in which output per worker was also over 5 percent per year, 75 percent of the workers were dropouts in 1950 as compared with 59 percent in 1960. Clearly, there are no consistent relationships between changes in output per worker and changes in years of formal schooling.

Among employed women manual workers, there is also no indication that increased output per worker rates were related significantly to increases in educational level. The largest increase in education was observed for women in industries in which output per worker increased 4 percent or more per year. Nevertheless, in 1960 in these industries 79 percent of the women were dropouts; this proportion is as large as, or larger than, any observed in industries with slower rates of increase in output per worker.

For both men and women—perhaps more marked for the men—there was a tendency for industries which grew more rapidly in employment to have somewhat fewer dropouts than did the industries in which employment increased less than 15 percent during the decade. This phenomenon can be explained, apparently, in terms of differential age and occupational composition; the rate of change in output per

Industry class	% White-collar workers	% of workers under age 35
Change in O/W under 2%		
Increase in emp. under 15%	36	37
Increase in emp. 15+%	50	38
Change in O/W 2.0 to 3.9%		
Increase in emp. under 15%	33	36
Increase in emp. 15+%	54	41
Change in O/W 4.0+%		
Increase in emp. under 15%*	24	34
Increase in emp. 15+%	53	43

\* (excluding agriculture).

worker may be simply an incidental factor insofar as the proportion of dropouts is concerned. In general, younger workers and white-collar workers tend to have more education than do older manual workers; the industries rapidly growing in employment tend to have more younger and white-collar workers, as shown in the accompanying tabulation. Unfortunately, the data are not in such form that it is practical to standardize educational composition while holding constant age and occupational composition. Exploration of the possible relationship between occupational composition and the rate of increase in employment is outside the scope of this paper.

In summary, we should note that even in those industries which apparently were undergoing the most rapid technological changes (as measured by changes in output per worker), half to three-quarters of the manual workers were dropouts. Clearly, these data do not prove that modern advancing technology necessarily requires that its workers have more formal schooling.

#### MOBILITY BY EDUCATION

Is there any evidence that better-educated workers moved from industries which experienced little increases in output per worker to industries which had large increases? It is theoretically possible that there was a significantly large movement of such workers, despite the fact that our previous observations showed no particular relation between changes in educational composition and changes in output per worker (between 1950 and 1960). In order to test this, we calculated net mobility for men<sup>4</sup> by education and for industries classified by rates of growth in employment and rates of change in output per worker.

This analysis was limited to men between the ages of 25 and 49 in 1950; we calculated their net mobility between 1950 and 1960. The reasons for excluding

<sup>4</sup> Using the procedures described in Jaffe and Carleton, *op. cit.*

younger and older men are as follows. Many men under age 25 in 1950 were likely to have continued their formal schooling into the 1950's. To the extent that this happened, the resulting data would not have indicated actual mobility among the several types of industries. Among men over 50, there is comparatively little net mobility; therefore the inclusion of relatively immobile with mobile men would have obscured our analysis.

Even among men 25-49 years of age in 1950, a small portion continued their schooling into the 1950's. Hence, the actual amount of mobility for the several educational levels (as shown in Table 3) is slightly too great; we estimate that some 4-5 percent of the net mobility shown is the result of continuation of schooling rather than of men shifting from one industry to another.<sup>5</sup>

*Agriculture.*—Employment in this industry decreased between 1950 and 1960,

<sup>5</sup> In addition to the problem created by continuation of schooling, there is also the problem of possible errors in the reporting of years of schooling completed, in the two censuses. Although there may be such reporting errors, it is unlikely that they could have affected our mobility data, since the medians for each cohort remained virtually unchanged, as follows:

AGE		MEDIAN NO. YEARS SCHOOLING COMPLETED	
1950	1960	1950	1960
25-29	35-39	12.0	12.1
30-34	40-44	11.4	11.6
35-39	45-49	10.3	10.3
40-44	50-44	9.4	9.4
45-49	55-59	8.9	8.7

Source: 1960 *Population Census*, "United States Summary," PC(1)ID, Table 113; and 1950 *Population Census*, "United States Summary," P-CI, Table 115.

Of course, the medians could have remained unchanged even though individuals reported their education differently in the two censuses; those who erred in one direction should be balanced by those who erred in the opposite if the median is to remain largely unchanged. That this type of error would have affected the interpretation of our mobility analysis, however, is unlikely. To do so, there would have to be a high relationship between the direction of the error and the type of industry (as shown in Table 3).

Table 3.—NET MOBILITY OF MALE LABOR FORCE (AGED 25-49), BY EDUCATION AND TYPE OF INDUSTRY, 1950 TO 1960: UNITED STATES  
(Numbers in Thousands)

	Education								Total	
	Less than High school		High school graduate		Some college or more					
	Mob.	% <sup>a</sup>	Mob.	% <sup>a</sup>	Mob.	% <sup>a</sup>	Mob.	% <sup>a</sup>	Mob.	% <sup>a</sup>
<b>Ages 25-49</b>										
Agriculture	-736	-29.9	-130	-25.5	-21	-13.8	-890	-28.5		
Construction	+142	+8.6	+30	+7.5	+34	+16.5	+206	+9.2		
Public Administration	+97	+19.4	+90	+22.5	+88	+25.9	+274	+22.1		
<u>Increase in Output per Worker under 2%</u>										
Increase in employment under 15%	-187	-9.3	-116	-14.8	-86	-20.0	-387	-12.0		
Increase in employment 15% or more	+448	+19.4	±0	-	+248	+18.3	+697	+14.1		
<u>Increase in Output per Worker 2.0 to 3.9%</u>										
Increase in employment under 15%	-278	-12.4	-136	-16.9	-74	-19.0	-488	-14.2		
Increase in employment 15% or more	+400	+19.5	+80	+8.3	+152	+17.5	+631	+16.2		
<u>Increase in Output per Worker 4% or more</u>										
Increase in employment under 15%	-258	-22.1	-19	-5.6	+29	+20.1	-249	-15.1		
Increase in employment 15% or more	+77	+19.7	+37	+13.0	+85	+40.5	+200	+22.6		

<sup>a</sup>Net mobility as a per cent of the numbers in that category in 1950.

Source: See text.



and the average annual rate of change in output per worker was over 4 percent. Men at all educational levels moved out, although the largest rate of out-mobility<sup>6</sup> was for the dropout group—that is, those who had not completed high school.

This higher rate of out-mobility among the more poorly educated men in large part reflects the great outpouring of farm laborers rather than farm owners, in particular from the South. About twice as many farm laborers as farm owners and managers left agriculture between 1950 and 1960. Among farm laborers the out-mobility rate was 72 percent, as compared with an estimated 18 percent for farm owners. As we saw previously (Table 1), farmers and farm managers, as a group, had completed more years of schooling than had farm laborers.

*Construction.*—There was about a 13 percent increase in employment in this industry between 1950 and 1960, and output per worker increased at a rate of between 2.0 and 3.9 percent per year. There was considerable net in-mobility at all educational levels. The largest absolute net mobility was among the dropouts—142,000 net in-movement. The largest rate, on the other hand, was among those who had some post-high school education or had graduated from college; there was a net in-movement of some 34,000 such men, for a rate of 16.5 percent.

*Public administration.*—The total number employed in federal, state, and local governments (excluding teachers) increased by almost one-third during the decade. We have no information about changes in output per worker for this industry. There was considerable net in-mobility at all educational levels.

*Other industries.*—Almost three-quarters of the men were in the “other” industries; these are classified by changes in output per worker and increases in employment between 1950 and 1960. There was net out-mobility from the slower-

growing industries—that is, those in which employment increased by less than 15 percent between 1950 and 1960—at all educational levels. Conversely, there was net in-mobility at all educational levels into the faster-growing industries. (There is only one exception to this finding; there was net in-mobility among the slower-growing industries in which output per worker was 4+ percent per year among men who had at least some college.) In short, it was the rate of growth of employment opportunities rather than the rate of technological change that was most important in inducing mobility. And where employment opportunities increased the most, there were opportunities for dropouts as well as Ph.D's.

#### SUMMARY OF FINDINGS

Our findings conform to those of other students, including Bright and Fine,<sup>7</sup> who analyzed specific jobs in a number of industries and found that generally the workers needed no more schooling after a job was highly mechanized than they had needed before. Sometimes the training time for the new job was longer than it had been for the previous one, but such additional training time was a matter of a few weeks on the job. Workers did not have to return to school and get a high school diploma in order to operate or repair the new machines.

Another indication that extensive formal schooling is not required in order to perform most of the jobs associated with modern machines and technology is seen in the fact that technologically modern firms are established in the underdeveloped parts of the world. There they generally employ relatively unschooled work-

<sup>7</sup> James R. Bright, *Automation and Management* (Cambridge: Harvard University Graduate School of Business Administration, 1958), especially chap. 12, “The Impact of Automation on the Work Force.”

S. A. Fine, *The Nature of Automated Jobs and Their Educational and Training Requirements* (McLean, Va.: Human Sciences Research, Inc., 1964).

<sup>6</sup> Net out-movement as a percent of the number in that industry and educational level in 1950.

ers for all but the managerial jobs.<sup>8</sup> Clearly, if we are to say that dropouts in our society cannot operate modern technology for lack of sufficient education, then we must deny the existence of modern technology in the poorly educated countries of the world. Very likely, the poorly educated workers in these countries require longer on-the-job training than may be needed by the better-educated American or Japanese or western European workers; if so, this "longer" training is a matter of several weeks or a few months.

#### SOME IMPLICATIONS

Insofar as the United States economy is concerned, there are plenty of jobs in our economy in which dropouts can perform at least satisfactorily enough to hold down the jobs; not less than half the jobs were in this category (in 1960). (Whether dropouts earn as much as high school graduates within a given industry and occupation, we cannot say from our present data.) Hence, the higher unemployment rate among dropouts of all ages must be attributed to lack of sufficient job vacancies, to discrimination in hiring practices, or to other reasons. Now, since the supply of labor at all educational levels (except perhaps the very highest) during the 1950's and to the present, is somewhat greater than the demand, employers can be more selective and do have higher edu-

<sup>8</sup> In Puerto Rico, for example, we find the following distribution of male workers by number of years of schooling completed (in 1955):

	Under 5 Years	5-9 Years	10 Years and Over	Total
Total.....	52	26	22	100%
Manufacturing.....	40	33	27	100
Transportation, communica- tions, and public utilities.	37	34	29	100
Government.....	14	19	67	100
All other.....	60	25	15	100

Calculated from A. J. Jaffe, *People, Jobs, and Economic Development* (Glencoe: Free Press, 1959), p. 206, Table 11.2.

In the two sectors of manufacturing and transportation, communications, and public utilities, the technology used is quite modern, much—if not most—of it having been installed since 1950. It is evident that the great majority of the workers are dropouts by United States standards.

cational requirements (than they have during period of labor shortage), whether or not such increased schooling is required for the performance of the job.

One study of temporary workers in New York City found that 41 percent of the personnel men (in the firms surveyed) had a minimum educational requirement; "in the majority of cases they mentioned high school."<sup>9</sup> Most of these temporary workers were hired for "general office work," that is, they were white-collar laborers. What is most significant is that over half the personnel men were concerned largely with the applicant's previous work experience; if he could do the work, he was hired. There was no indication in this study that the personnel men who demanded a high school education had jobs which were any different from those in firms in which there was no educational requirement.

It is sometimes argued that in the United States, even though dropouts may be able to perform well on many jobs, the numbers of jobs suitable for them are rapidly disappearing from our economy. Presumably the kinds of jobs which, supposedly, they can fill are those in the manual categories, particularly operatives, service workers, and laborers (both farm and non-farm). As we saw previously, dropouts also can and do hold down the majority of craft jobs. Accordingly, let us examine the occupational composition of the employed American labor force, 1950-65 (see Table 4).

In 1950, 58.3 percent of all employed men were in nonagricultural manual work or were farm laborers; there were almost 24 million so employed. In 1965, 56.6 percent of all employed men were engaged in these jobs; there were over 26 million thus working. Among women, there were about 7½ million employed in these occupations in 1950 and 10½ million in 1965. In short,

<sup>9</sup> Federation Employment and Guidance Service, *Survey of Practices and Attitudes of Personnel Officers Regarding the Hiring of Temporary and Part-Time Workers* (215 Park Avenue South, New York, N.Y. 10003), 1964, pp. 11 ff.

Table 4.—PERCENTAGE DISTRIBUTION OF EMPLOYED MEN AND WOMEN, BY MAJOR OCCUPATION, 1950 TO 1965 (APRIL): UNITED STATES

Major occupation	Men				Women			
	1950		1960		1965		1965	
	1950	1960	1960	1965	1960	1965	1960	1965
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
White-collar, total	31.3	36.4	36.4	38.8	57.4	57.4	57.4	57.1
Professional and technical Managers, officials, proprietors Sub-total	7.5 10.7 18.2	10.8 11.1 21.9	10.8 11.1 21.9	12.0 13.7 25.7	13.7 3.9 17.6	13.7 3.9 17.6	13.7 3.9 17.6	13.5 4.5 18.0
Clerical workers	6.6	7.3	7.3	7.2	31.5	31.5	31.5	31.5
Sales workers	6.5	7.2	7.2	5.9	8.3	8.3	8.3	7.6
Sub-total	13.1	14.5	14.5	13.1	39.8	39.8	39.8	39.1
Manual, total	53.5	55.1	55.1	53.8	40.7	40.7	40.7	40.2
Craftsmen and foremen	18.9	20.5	20.5	18.6	1.3	1.3	1.3	1.1
Operatives	20.4	21.0	21.0	20.6	16.3	16.3	16.3	14.8
Service workers	6.1	6.4	6.4	6.9	22.6	22.6	22.6	23.8
Nonfarm laborers	8.1	7.2	7.2	7.7	0.5	0.5	0.5	0.5
Sub-total	34.6	34.6	34.6	35.2	39.4	39.4	39.4	39.1
Farm workers, total	15.3	8.6	8.6	7.5	1.8	1.8	1.8	2.8
Farmers and farm managers	10.5	5.7	5.7	4.7	0.6	0.6	0.6	0.6
Farm laborers and foremen	4.8	2.9	2.9	2.8	1.2	1.2	1.2	2.2

Source: Data for 1950 and 1960 from U. S. Decennial Censuses of Population, adjusted for occupation not reported; April 1965 data from U. S. Department of Labor, Employment and Earnings (monthly).

it is clear that the number of jobs suitable for dropouts has increased over the past fifteen years. Furthermore, there is no evidence that the proportion of all jobs suitable for dropouts is decreasing significantly. Clearly, all the evidence suggests that the numbers of jobs which dropouts can do are increasing more rapidly than are the number of dropouts.<sup>10</sup>

In recent years the large increases have been in professional and technical jobs, for both men and women. Nevertheless, these jobs, which generally (but not always) require completion of at least four years of college, include but one in eight of all workers. If in the next generation there should be a tremendous expansion of such professional and technical jobs, this category will still contain not over one-quarter of all workers.

Pearce<sup>11</sup> in his study of New York State, used a broader definition and included managerial and craft jobs in addition to professional and technical. He wrote:

<sup>10</sup> See also Walter Adams, "Education, Employment, and Technological Change," paper presented at the annual meeting of the American Statistical Association, Philadelphia, Pa., September 9, 1965.

<sup>11</sup> C. A. Pearce, "Need for Manpower Information in the Field of Occupational Training and Education" (a talk given at Interstate Conference on Labor Statistics, Storrs, Conn., June 15-18, 1965). See also *Technical Manpower in New York State*, Special Bulletin 239 (December 1964), especially Vol. I (New York State Department of Labor, Division of Research and Statistics, in co-operation with the State Education Department and the State University of New York).

An example of inadequate reading of the data is found in assertions that automation, space-age technology, and so on, are rapidly carrying us into a situation where high-school education will no longer suffice as preparation for a job; that practically everyone will need some sort of post-secondary education or else specialized, protracted job training. . . .

Actually, we figure that jobs of higher skill did not account for much more than one-third of the employed labor force in New York in 1964, and probably won't amount to over 38 percent or so in 1975. I include here professional, technical, managerial, and craftsman jobs. The situation in the nation as a whole probably is not much different.

In conclusion, then, we wish to emphasize our belief that education is valuable for its own sake, and we hope that it makes people into better citizens. It is not, however, a mandatory requirement for actually performing the major part of the work in a so-called modern technological society. Everyone need not have a college education; indeed, large numbers do not even need a high school diploma. Therefore, to sell schooling because "modern technology requires it," especially to those uninterested or unable to continue their education (for whatever reasons), is doing education and the people a grave injustice.

Furthermore, having everyone graduate from high school is not a cure for unemployment. Keeping the economy growing at a sustained rate of at least 5 or 6 percent per year, year after year (with no relapses), is the only sure cure for unemployment.