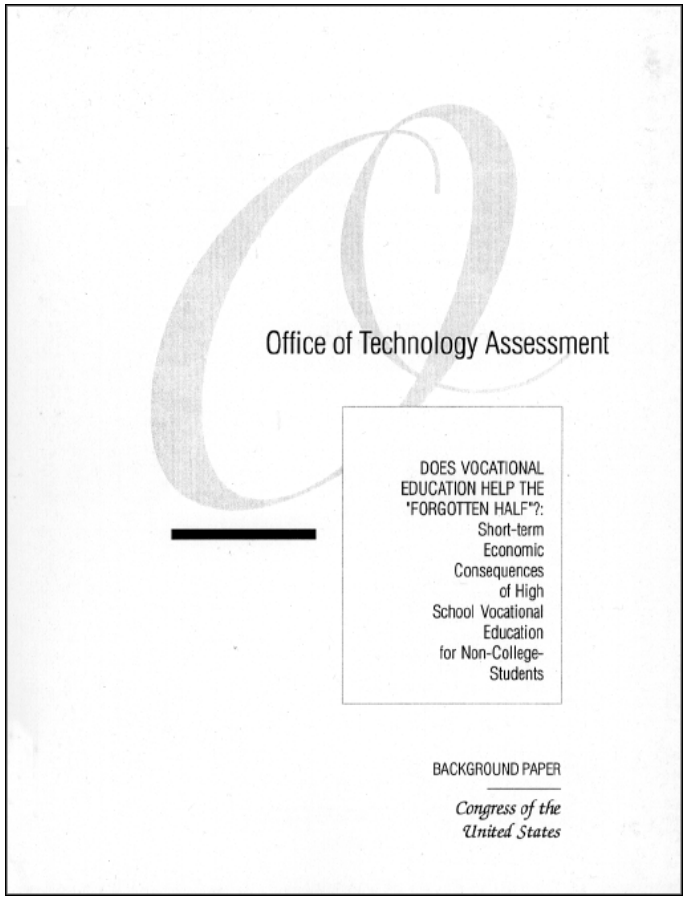
Does Vocational Education Help the "Forgotten Half"?: Short-term Economic Consequences of High School Vocational Education for Non-College Students

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Foreword

High-school-level vocational education—which is supported to a small degree by federal funds—is perennially subject to scrutiny. Given the changing nature of employers' demands, one important question is whether those young men and women who take vocational education courses in high school and go to work rather than to college or other postsecondary education are better off economically if they take some types of vocational courses instead of others. This background paper uses very recent data to address that question for individuals just one year out of high school. The background paper was requested by the Senate Labor and Human Resources Committee (Senator Edward M. Kennedy, then-Chairman of the Committee, now Ranking Minority Member).

For young males who took vocational education courses in high school, worked for pay and were not enrolled in postsecondary education in 1993, three kinds of courses are related to entry-level earnings that were higher than average for their vocational education counterparts: marketing; technical communications; and consumer home economics. For young females who took vocational education courses in high school, worked for pay and were not enrolled in postsecondary education in 1993, only vocational coursework in the health area was related to higher than average entry level earnings. This background paper also presents data on the types of occupations that these young people engage in, and rough statistical correlations between those occupations and types of high-school-level vocational coursework. More than half the young people in this sample engaged in clerical, services, and laborer type entry-level jobs immediately after high school. Finally, females in this sample earned considerably less than their male counterparts, both hourly and annually.

Does Vocational Education Help the "Forgotten Half"?: Short-Term Economic Consequences of High School Vocational Education for Non-College Students was prepared under contract to the Office of Technology Assessment (OTA) by Kenneth Rasinski, Bernard Dugoni, and Robert Meyer of the National Opinion Research Center (NORC) and the University of Chicago. OTA thanks the contractors and the individuals who reviewed early drafts of the background paper, but accepts full responsibility for the background paper.

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Does Vocational Education Help the "Forgotten Half"?: Short-Term Economic Consequences of High School Vocational Education for Non-College Students

Vocational education has been criticized for preparing students for low-wage jobs with minimal career prospects. This background paper examines the relationships between vocational coursetaking and entry-level occupations and earnings among high school students who do not pursue postsecondary education. The research was conducted by the National Opinion Research Center (NORC) under contract to the Office of Technology Assessment (OTA) of the United States Congress using data from the National Education Longitudinal Study of 1988 Eighth Graders (NELS:88 (15)).

SUMMARY OF FINDINGS

- On average, the females in this national sample who got jobs right out of high school instead of going on to postsecondary education (e.g., college, technical school) earned more if they have concentrated on vocational, rather than academic, coursework. For the males, the "track" taken during high school doesn't make a difference.

- For males in the sample who did not go on to postsecondary education, three (out of 12) specific vocational course areas were positively related to having higher than average total earnings the year after leaving high school, independent of most other factors considered. These three vocational course areas were: marketing, technology/communications, and consumer home economics.

- The only specific course area that gave females an advantage over the average female in this sample was the health area.

- On average, females who get jobs right out of high school instead of going on to postsecondary education earned overall and hourly wages that are considerably lower than those of their male counterparts.

- The analysis was not able to determine whether having taken courses in a specific vocational area influenced the kinds of work that the students engaged in soon after high school (appendix A).

POLICY RELEVANCE

High school vocational education is currently receiving careful scrutiny by American leadership. On the one hand, the present administration and recent Congresses have indicated interest in sponsoring an extensive modernization of vocational education, through greater attention to the school-to-work transition (14) and greater emphasis on teaching basic academic skills in vocational programs (Public Law 101-329, The Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990). On the other hand, there is support within Congress to scale down federal government involvement in vocational education, by turning the responsibility and the funding over to individual states. This political tension is superimposed upon another tension already

faced by educators, namely, the challenge of accommodating differences in high school students' abilities while preparing them for a labor market that demands increasingly higher skill levels.

Young people who have recently left high school but have not gone on to postsecondary education—the so-called "forgotten half"—are, perhaps, most at risk of economic loss in the current economy (7). Many of them seek entry-level employment and may be in a position to capitalize on employment-related skills and training obtained from vocational education courses they took while in high school.

Does high school vocational training received by young people who do not go on to postsecondary education after high school provide an advantage in the employment market? Such an advantage might come as the ability to enter an occupational field of choice, the ability to command higher wages, or both. (Box 1 summarizes some of the previous research addressing this question.)

BOX 1: Previous Research on the Effects of High-School-Level Vocational and Academic Education on Earnings of Non-College-Bound Youth

Bishop recently reviewed the research on the effects of high school-level vocational education on post-high-school (1). Bishop cited the research of Meyer and Wise, who used data from the National Longitudinal Survey of the 1972 High School Seniors (10) and the more recent, but still dated, findings of Campbell, Basinger, Dauner, and Parks (4). Meyer and Wise found that high school vocational or industrial training was not significantly related to post-high school wages. Campbell, Basinger, Dauner, and Parks, on the other hand, found a 7 percent benefit in monthly earnings of vocational education at age 29 for those with training-related jobs.

In 1994, Gamoran reviewed the literature of the effect of *academic* courses taking on wages for the non-college bound (5). He concluded that the best available evidence suggests that academic courses in high school provide only small benefits to wages and earnings in the first few years after high school.

The analysis in this background paper uses the most current data available (from 1993). It focuses on the economic utility of vocational courses, but also considers the relationship of earnings to academic coursetaking.

SOURCE: U.S. Congress, Office of Technology Assessment, 1995, based on sources as shown. Full citations are in the list of references at the end of this background paper.

DATA SOURCES AND ANALYTIC APPROACH

Data Sources

As stated above, the data used in this background paper are from the National Education Longitudinal Study of 1988 Eighth Graders (NELS:88), which is sponsored by the U.S. Department of Education's National Center for Education Statistics (15). NELS:88 began with a national probability sample of more than 24,000 8th grade students selected from about 1,000 schools in 1988. Students, their parents, their teachers, and their school principals were questioned about the students' motivations, abilities and learning environments. In addition, students took academic achievement tests to assess their competence in several academic areas, including reading and mathematics. Reinterviews were conducted in 1990 (NELS first followup), 1992 (NELS second followup), and 1994 (NELS:88/94, the third followup). In 1992 transcripts were collected for the entire high school period, which for most students covered the academic years 1988/1989, 1989/1990, 1990/1991, and 1991/1992 (9th thru 12th grades). In 1994, information was gathered about post-

secondary education attendance, employment, occupation and earnings in 1993, the first full year after expected high school completion.

This background paper uses data from the combined 1988-1994 dataset. The 14,915 respondents in this combined dataset are a subset of the original 24,599 sampled in 1988 for whom data from the base year, and first, second, and third followups are available. The analyses in this report utilize data from the 3,432 respondents from whom high school transcripts were available but who had not attended postsecondary education between 1992 and 1993 and who had reported some employment during the 1993 calendar year.[1] Both high school graduates and nongraduates were considered in these analyses. The analyses also use reading and mathematics test scores from 1988.

General Analytic Approach

The general approach to the analysis was to compare the immediate post high-school (1993) earnings of young people who had followed different courses of study while they were in high school. The comparisons were made in two steps. First, the earnings of young people were compared according to whether their course-taking patterns were academic, vocational, or general. Second, earnings were compared among 12 major fields of vocational education.

In each case, males and females are examined separately.[2] The measure of earnings, which was the critical dependent value in the analysis, was the response to the NELS survey question, "What were your total earnings from all the jobs you had [during the time period January 1993 through December 1993]?" In some analyses, regional variations in earnings are also examined. Different aspects of this analysis required some additional methodological adjustments. These different approaches are described more fully in the respective sections of this background paper.

WHICH PAYS MORE IN THE SHORT-TERM: VOCATIONAL, ACADEMIC, OR GENERAL EDUCATION?

One question of interest to education, parents, student, and policy-markets is whether, overall, high school students from vocational programs who enter the labor market directly after high school and do not attend postsecondary education have higher earnings than similar students from nonvocational high school programs (i.e., academic [college preparatory] or “general”. To examine this issue, high school transcripts were used to categorize respondents into academic, vocational, or general tracks.[3] Average earnings for those who reported working full or part-time for at least a month during the 1993 calendar year were calculated (tables 1 and 2).

Table 1 shows 1993 reported earnings in 1993 by program type and geographic region and table 2 shows such earnings by program type and student gender. Overall, students who did not go on to postsecondary education reported average

[1] All analyses were conducted using the case weight F3TRSCWT. This weight is the inverse of each respondent's probability of selection at various stages of the longitudinal research, adjusted for nonresponse at each round and for unavailability of transcript data. This procedure yields sample statistics that reflect the characteristics of the population of 1988 8th graders as they exist in 1994. Because of missing responses to some items, the number of respondents may differ in some analyses.

[2] Appendix A, tables A-2 through A-5, shows the vocational courses taken by males and females in 14 different occupational groupings.

[3] Curricular program type was determined using the NELS:88/94 variable F2RSPFLG labeled, "Transcript Indicated High School Program." This variable is based on criteria from the National Assessment of Educational Progress (NAEP) to define program types from the type and number of courses taken as indicated on the student's transcript. A student was classified into the academic track if he or she had earned at least 12 Carnegie Units in English, social studies, science and mathematics. A student was classified into the vocational track if he or she did not meet the criteria for academic track but had earned three or more Carnegie Units in one of the eight substantive vocational areas. A student who did not meet either the academic or vocational criteria was classified into the general track.

TABLE 1: Average Self-Reported 1993 Annual Earnings (in dollars) of 1988 Eighth Graders Who Did Not Attend Postsecondary Education in 1993, by High School Program Type and U.S. Geographic Region

Region	Type of statistic	High School Program Type			Overall average
		Academic	Vocational	General	
Northeast	Average	**$8,388.63**	**$9,216.02**	**$9,258.24**	**$8,804.60**
	Standard error[1]	976.09	1,386.46	1,629.74	844.45
	n[2]	204	46	113	363
Midwest	Average	**$8,379.59**	**$10,605.96**	**$9,203.68**	**$9,165.19**
	Standard error	517.71	929.65	632.68	424.52
	n	282	137	396	815
South	Average	**$9,257.64**	**$10,275.04**	**$8,977.80**	**$9,241.36**
	Standard error	511.91	1,004.76	590.03	359.08
	n	465	125	427	1,017
West	Average	**$8,494.85**	**$8,525.20**	**$7,898.99**	**$8,158.73**
	Standard error	487.68	783.66	823.45	506.05
	n	231	27	264	522
Total	Average	**$8,757.55**	**$10,127.12**	**$8,800.25**	**$8,924.09**
	Standard error	314.79	566.87	406.41	245.71
	n	1,182	335	1,200	2,717[3]

[1] The standard error is a measure of the probable difference, due to sampling, between a sample value (i.e., an "estimate") and a population value.

[2] n = number of survey respondents in the category.

[3] The sample size reflects missing data for the earnings and region variables.

SOURCE: U.S. Department of Education, Office of Education Research and Improvement, National Center for Education Statistics, Washington, DC, unpublished data from the National Education Longitudinal Study (NELS), 88/94.

TABLE 2: Average Self-Reported 1993 Annual Earnings (in dollars) of 1988 Eighth Graders Who Did Not Attend Postsecondary Education in 1993, by High School Program Type and Gender

Gender		High School Program Type			Overall average
		Academic	Vocational	General	
Males	Average earnings	**$10,408.43**	**$10,830.08**	**$10,413.36**	**$10,464.52**
	Standard error[1]	480.10	710.34	490.20	322.08
	n[2]	687	243	804	1,734
Females	Average	**$6,658.44**	**$8,013.80**	**$6,013.55**	**$6,427.38**
	Standard error	299.25	592.46	427.84	259.16
	n	504	104	532	1,140
Total	Average	**$8,802.63**	**$10,058.09**	**$8,691.00**	**$8,878.37**
	Standard error	316.39	523.31	370.34	236.42
	n	1,191	347	1,336	2,873

[1]The standard error is a measure of the probable difference, due to sampling, between a sample value (i.e., an "estimate") and a population value.
[2] n = number of survey respondents in the category.
[3]The sample size reflects missing data for the earnings variables.

SOURCE: U.S. Department of Education, Office of Education Research and Improvement, National Center for Education Statistics, Washington, DC, unpublished data from the National Education Longitudinal Study (NELS), 88/94.

annual earnings of about $8,900 (tables 1 and 2). Respondents' earnings did not differ by geographic region. **When respondent gender is not considered, students from vocational programs did not report earnings that were statistically significantly different from earnings of those from academic and general programs** (tables 1 and 2). However, women from vocational and general programs reported significantly higher earnings than women from academic programs. Overall, **men's reported earnings were higher than those of women**, with an average difference of $4,037.14 (table 2). Men's earnings did not differ by program type (table 1).

The substantial gender gap in earnings for this group is greater than the average gender gap for high school completers ages 25 to 64 in the United States, as reported by the U.S. Department of Labor[4] (16). The reasons could not be fully investigated for this background paper, but there are some suggestive indications. Women in this sample did have lower levels of labor market participation than men did[5]. However, lower hourly wages for women than for men constitutes a greater source of the gender difference in earnings. The estimated hourly wage was $5.61 for males and $4.44 for females, a difference that is statistically significant.[6] [7] [8]

DOES TAKING SPECIFIC TYPES OF VOCATIONAL COURSES PAY OFF IN THE SHORT RUN?

Are short-term postsecondary earnings related to taking specific types of vocational courses? That question is addressed in this section. Multiple regression analysis was used to estimate the independent effect of each vocational course area on earnings for former students who took a particular pattern of vocational and academic courses and met a typical socio-demographic profile. Multiple regression permits the examination of the effects of one factor (in this case, coursetaking in each vocational area) while holding the effects of other factors (e.g., coursetaking in other vocational areas, coursetaking in academic areas) constant.

Two of the control variables deserve special mention. One was the potential relationship between earnings and dropping out, rather than graduating from, high school. High school dropouts usually have lower earnings than high-school graduates (16). The other was a measure of socioeconomic status that was constructed from the data. Family socioeconomic status is usually positively related to future earnings.

Of the 3,432 individuals in the total sample, 69 percent were high school graduates and 31 percent were non-graduates (including dropouts and recipients of the General Educational Development certificate [GED]). The measure of socioeconomic status was constructed from the following information: father's education level; mother's education level; father's occupation; mother's occupation; and family income. Each of the component variables was standardized, and nonmissing components were averaged. More information can be found in the data file user's manual for NELS (9).

Separate analyses were conducted by gender because coursetaking, labor market participation,

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[4] Data for ages 25 to 64 are for the year 1992.

[5] Females reported working, on average, fewer hours per week than did males (36.15 hours per week for females and 42.27 hours per week for males, $t=9.07$, $p<.001$), and were employed for fewer weeks out of the year than males (40.37 weeks employed for females and 45.49 weeks employed for males, $t=5.60$, $p<.001$).

[6] An estimated hourly wage variable was calculated by first multiplying the number of weeks employed in 1993 by the reported average hours worked per week to obtain an estimate of the total number of hours worked during the year. Next, reported 1993 earnings was divided by this estimate of total hours worked to obtain an estimate of hourly wage.

[7] $t=5.64$, $p<.001$

[8] Appendix A provides information on the types of jobs held by women. However, the available data are not substantial enough to tell whether women tended to take jobs that required lower skills, and thus could pay lower wages.

and earnings were different, on average, for men and women in this sample.[9] As in the previous section, the analyses in this section were conducted using only those NELS:88 respondents who had reported working for at least one month in 1993 and who were not attending a postsecondary educational institution (e.g., college, technical school). Many students take vocational education courses regardless of whether they are formally enrolled in a vocational education program; the analyses in this section included all students who took any Carnegie units of a vocational education course.

Methodological Considerations

The nature of the data and the research design required that three methodological adjustments be made. First, an adjustment was made to avoid problems created by the way earnings are distributed. Typically, earnings data do not resemble the kind of normally-distributed (bell-shaped) pattern that standard multiple regression analysis requires. Earnings can never be less than zero, and a few people in almost every sample may report very high earnings relative to the others. As a correction, the logarithm of earnings was used as the dependent or predicted variable in the analysis.[10]

Second, a correction was needed to adjust for the fact that students (or their guidance counselors) "select" themselves into courses of study, that is, they are not assigned randomly irrespective of academic ability and other considerations. If general academic ability is positively associated with taking certain vocational courses (e.g., courses in technical/communication), and general academic ability is also positively related to earnings, the relationship between coursetaking and post-high-school earnings would be overstated if a measure of ability were not included in the equation. A combination of 8th grade reading and mathematics test scores was included in the equation as a measure of general academic ability.

Similarly, individuals are not assigned randomly to the workforce irrespective of the local demand for labor. Child care responsibilities, availability of transportation, availability of alternative sources of income, illness, disability, and other factors potentially affect labor force participation. A third attempt at a methodological adjustment for this so-called selection bias included an analysis of labor-force selection using Heckman's recommended two-stage procedure (8). However, results from this procedure on earnings are highly sensitive to certain assumptions about the underlying relationships of the variables. The data in this analysis probably did not meet those assumptions; therefore, the Heckman adjustment was used as a test of the robustness of the results rather than to generate estimates of the effects of vocational education.[11] In any event, adjustments

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[9] Appendix A, tables A-1 through A-5, shows the different coursetaking patterns of males and females. The previous section showed that, on average, males earn more than females.

[10] The logarithmic transformation was successful in improving the distribution of earnings. For untransformed earnings, the skewness was 9.19, compared to -1.16 for log-earnings. The kurtosis was 305.01 for the untransformed earnings variable, compared to 2.00 for the log transformed version.

Transforming earnings data using logarithms has the effect of shrinking the distance from the lowest to the highest earnings. The shrinkage is greater as the earnings become higher, thus the right tail of the earnings distribution is pulled in. While this often improves the data for statisticalinter analysis, it adds an extra step in the presentation. Normally, in a multiple regression analysis, the coefficient for a predictor variable represents the increase in the predicted variable (earnings) for every one unit increase in the predictor variable. So, for example, a coefficient of 250.75 for a vocational coursetaking variable would mean that for each increase of one Carnegie unit (about two courses) in that course area, earnings increase on average, by $250.75. When the logarithm of earnings is used instead, the coefficient represents one increase in log-dollars for each increase of one Carnegie unit. This can be transformed back in onto dollars by raising the number e to the power of the coefficient. (The number e is the value of x for which the natural logarithm of x equals 1. The value for e is approximately 2.71828.)

[11] The standard remedy involves including a variable in the earnings analysis that predicts labor market participation from other variables in the earnings analysis. According to Heckman, this correction is necessary because the impact of a predictor variable on earnings is attenuated by labor

such as Heckman's to nonexperimental, noncontrolled data do not compensate for the fact that individuals in this data were not randomly assigned to participate in the labor force or not.

Finally, it is important to note that the results of multiple regression analyses are highly sensitive to the variables that are included in them. Other models, using different sets of potentially explanatory variables, could show different results. While academic achievement, regional difference in pay, ethnicity, and socioeconomic status are usually found to be predictive of earnings, the prediction of earnings (especially for a group without prior earnings) is an inexact science. For example, the models whose results are summarized in tables 3 and 4 were able to predict only 9 percent of the variance in earnings for females; and 12 percent of the male variance.

Results

Which Courses are Related to Earnings?

For males in the sample who were 8th graders in 1988, had worked at least one month in 1933, and indicated no postsecondary education attendance in 1993, courses in the areas of marketing, technology/communications, and consumer home economics had a significant positive effect on earnings (table 3). **For females in the sample who had been 8th graders in 1988, had worked at least one month in 1993 and reported no postsecondary education, only health occupation courses had a significant positive effect on earnings** (table 4).

For males, in addition to the apparent contributions of taking specific types of vocational courses, being from the southern U.S. and scoring relatively high on the 8th grade reading and math tests, were both positively associated with higher entry-level earnings, even when an adjustment for labor market participation was added to the statistical model (table 3). Further, African-American males continued to have lower earnings than white males.

Including the attempt at an adjustment for self-selection into the labor market did not affect females' earnings. Females' earnings were, however, higher for graduates than for high school dropouts (table 4).

How Much of a Difference in Entry Level Annual Earnings Might Taking Specific Courses Make?

The analyses in tables 3 and 4 show which factors were positively or negatively (or not at all) associated with 1993 earnings. This section reports the results of illustrative analyses designed to predict the possible increase in dollar earnings for varying intensities of vocational coursetaking (figure 1).[12] This analysis is limited to those four

force selection. The following example may help clarify how this operates. Say that the results indicate that vocational courses in the health area are positively related to increased earnings for young women. However, some young women who have taken health courses chose not to enter the labor market. The impact of health care courses on earnings of those who have entered the labor market does not take into account what the non-working women who took health courses would have made if they had chosen to take a job. By making strict assumptions about the error structure (i.e., the part of earnings that are not predictable from the predictor variables of socioeconomic status, region, race, test scores, coursetaking and graduation status) of the earnings model the effect of the selection can be corrected preceding labor force status from the same variables used to predict earnings, and using predicted labor force status in the earnings equation to predict earnings. All of the variable sin our 1993 earnings regression were used to predict 1993 labor force status. Results from this procedure on earnings are very sensitive to the assumption of linearity in the earnings equation.

[12] In calculating predicted earnings for both males and females , the NORC analysts assumed that the student was white, living in the eastern part of the country, from a family with average socioeconomic status (0 on the standardized socioeconomic status composite) and had an average score (50) on the 8th grade math and reading test. NORC analysts further assumed the following coursetaking pattern for both sexes: two years of mathematics, one year of science, three years of English, two years of social studies, and no fine arts or foreign languages. For the male marketing predictions they assumed the student had taken one year of general labor market preparation (e.g., a work-study program in his senior year), one year of business, two years of

TABLE 3: Vocational Courses and Other Factors Related to Males' Total Earnings in 1993[1]

Variables	Coefficient[2]	Standard error[3]	t[4]	p[5]
Intercept[6]	8.329	0.324	25.717	0.00
Academic courses				
Mathematics	-0.071	0.035	-2.035	*0.04
Science	0.046	0.044	1.046	0.29
English	0.015	0.038	0.390	0.70
Social studies	0.035	0.036	0.959	0.34
Fine arts	-0.049	0.019	-2.583	*0.01
Foreign language	-0.085	0.065	-1.305	0.19
Vocational course types				
Consumer home economics	0.095	0.041	2.305	0.02
General labor market preparation	0.016	0.035	0.451	0.65
Agriculture	0.029	0.025	1.154	0.25
Business	-0.030	0.045	-0.672	0.50
Marketing	0.112	0.028	3.972	*0.00
Health	-0.508	0.324	-1.567	0.12
Occupational home economics	-0.155	0.193	-0.804	0.42
Trade/industrial	0.019	0.018	1.079	0.28
Technology/communications	0.132	0.043	3.041	*0.02
Specific labor market preparation other	-0.026	0.051	-0.514	0.60
Census region				
Midwest	0.185	0.126	1.474	0.14
South	0.351	0.112	3.125	*0.00
West	0.177	0.129	1.375	0.17
Socioeconomic status	0.150	0.056	2.686	*0.01
Ethnicity				
Asian/Pacific Islander	-0.195	0.184	-1.062	0.29
Hispanic	-0.210	0.117	-1.796	0.07
Black	-0.448	0.121	-3.696	**0.00
Native American/Alaskan Native	0.220	0.126	1.741	0.08
Academic achievement				
Eighth-grade reading and math test composite	0.011	0.006	2.004	*0.045
Graduate (v. dropout)	0.042	0.111	-0.381	0.70

Multiple R-squared = .1238 (p<.001).

Key:
*Statistically significant, even when an adjustment was attempted for self-selection into the labor market.
**These results did not remain statistically significant when the adjustment for self-selection into the labor market was attempted.

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[1]The analysis shown in the table represents the regression of log-transformed earnings from longest-held job in 1993 on vocational and academic coursetaking, background characteristics, and eighth-grade test scores for 1988 eighth-grade females who did not attend a postsecondary institution in 1993. These tables present results not controlling for self-selection into the labor market selection. When the NORC analysts reviewed the results of using the labor market participation (self-selection) adjustment, they felt that the fairly constrained statistical assumptions that Heckman's model requires were probably not met in their data (see text). Therefore, they decided that including participation in the model was more a test of the robustness of the model (i.e., did any major conclusions change?) rather than a procedure to get better estimates. Differences between results obtained using and not using the participation variable are explained in the footnotes marked with "*" or "**."

[2]The intercept is the predicted log-earnings when all of the predictor variables have the value∅.

[3]The standard error is a measure of the probable difference, due to sampling, between a sample value (i.e., an "estimate") and a population value.

[4]The t-value is a statistic used to assess the probability that the difference between two sample estimates reflects a true (non-zero) difference in the population.

[5]The p value is an indicator of the statistical significance level of the t-statistic. It is the probability that a true difference in the population does not exist when the t-statistic indicates it does.

[6]The coefficients for the coursetaking variables (both vocational and academic) represent the change in log-dollars of earnings in 1993 for each additional Carnegie unit in the particular course area, when all other factors shown are held constant.

SOURCE: Based on U.S Department of Education, Office of Education Research and Improvement, National Center for Education Statistics, Washington, DC, unpublished data from the National Educational Longitudinal Survey: 88/94.

TABLE 4: Vocational Courses and Other Factors Related to Females' Total Earnings in 1993[1]

Variables	Coefficient[2]	Standard error[3]	t[4]	p[5]
Intercepts	7.232	0.327	22.093	0.000
Academic courses				
Mathematics	0.012	0.049	0.242	0.81
Science	0.071	0.061	1.167	0.24
English	-0.030	0.046	-0.649	0.52
Social studies	-0.051	0.051	-1.001	0.32
Fine arts	0.008	0.029	0.264	0.79
Foreign language	-0.022	0.044	-0.508	0.61
Vocational course types				
Consumer home economics	-0.033	0.044	-0.756	0.45
General labor market preparation	0.034	0.040	1.868	0.39
Agriculture	0.126	0.077	1.637	0.10
Business	-0.024	0.038	-0.612	0.54
Marketing	-0.081	0.095	-0.853	0.39
Health	0.112	0.035	3.231	0.00*
Occupational home economics	-0.028	0.028	-1.010	0.31
Trade/industrial	0.047	0.042	1.130	0.25
Technical/communications	0.123	0.081	1.522	0.13
Special labor market preparation	0.068	0.031	2.663	0.03**
Census region				
Midwest	0.079	0.151	0.522	0.60
South	0.230	0.150	1.534	0.12
West	0.164	0.171	0.964	0.34
Socioeconomic status	0.019	0.075	0.247	0.80
Ethnicity				
Asian/Pacific Islander	-0.166	0.193	-0.860	0.39
Hispanic	-0.115	0.156	-0.739	0.46
Black	-0.377	0.134	-2.809	0.01**
NativeAmerican/Alaskan Native	-0.367	0.398	-0.920	0.43
Academic achievement				
Eighth-grade reading and math test composite	0.022	0.006	3.665	0.00**
Graduate (v. dropout)	0.272	0.138	1.962	0.05*

Multiple R-squared = .0985 (p<.001).

Key:

*Statistically significant, even when an adjustment was attempted for self-selection into the labor market.
**These results did not remain statistically significant when the adjustment for self-selection into the labor market was attempted.

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[1]Regression of log-transformed earnings from longest-held job in 1993 on vocational and academic coursetaking, background characteristics, andeighth-grade test scores for 1988 eighth-grade females who did not attend a postsecondary institution in 1993. These tables present results not controlling for self-selection into the labor market selection. When the NORC analysts reviewed the results of using the labor market participation (self-selection) adjustment, they felt that the fairly constrained statistical assumptions that Heckman's model requires were probably not met in their data. Therefore, they decided that including participation in the model was more a test of the robustness of the model (i.e., did any major conclusions change?)rather than a procedure to get better estimates. Differences between results obtained using and not using the participation variable are explained in the footnotes marked with "*" or "**."

[2]The coefficients for the coursetaking variables (both vocational and academic) represent the change in log-dollars of earnings in 1993 for each additional Carnegie unit in the particular course area, when all other factors shown are held constant.

[3]The standard error is a measure of the probable difference, due to sampling, between a sample value (i.e., an "estimate") and a population value.

[4]The t-value is a statistic used to assess the probability that the difference between two sample estimates reflects a true (non-zero) difference in the population.

[5]The p value is an indicator of the statistical significance level of the t-statistic. It is the probability that atrue difference in the population does not exist when the t-statistic indicates it does.

[6]The coefficients for the coursetaking variables (both vocational and academic) represent the change in log-dollars of earnings in 1993 for each additional Carnegie unit in the particular course area, when all other factors shown are held constant.

SOURCE: Based on U.S Department of Education, Office of Education Research and Improvement, National Center for Education Statistics, Washington, DC, unpublished data from the National Educational Longitudinal Survey: 88/94.

vocational courses (three for males, one for females) associated with higher 1993 earnings when all other factors are accounted for, including selecting oneself into the labor market.[13] [14]

For each of the four gender/vocational course area combinations the biggest increase is from taking no courses in a given area to taking a one-semester course (.5 Carnegie units) (figure 1). For example, for males fitting the hypothetical profile, taking a one-semester course in technology/communications is worth $534 in additional earnings. Taking a one-semester course in marketing is worth $461 and taking two semesters of consumer/home economics is worth $447. For females fitting the hypothetical profile, one course in the health area is worth $316 in additional earnings.[15]

CONCLUSION

This background paper focuses on relationships between vocational education coursetaking and entry-level wages for males and females who had finished their high school education, through graduation or dropping out, but who did not participate in postsecondary education. An appendix examines evidence on the relationship between type of vocational course-taking and entry level occupation (appendix A).

The NELS:88/94 data allowed an assessment of the economic utility of specific coursetaking patterns. Positive results were found for three specific vocational areas for men (marketing; technical/communications, and consumer/home economics) and in only one specific area for women (health). Taking a largely vocational program gave the women an economic advantage over their female counterparts who took a "general" program of study. On average, the males in a vocational track didn't benefit economically compared to the males in largely academic or general curriculum areas.

Certain caveats apply to these results. The results should not be used to suggest, for example, that for any specific individual, taking just one particular course will give him or her an economic edge over his or her non-college-bound peers. Because of the small number of NELS respondents fitting the criteria for this analysis, large numbers of possibly very disparate courses were bundled together to create 10 "areas" suitable for analysis. Thus, it is impossible to say from this analysis whether just any course in health, or just a particular type of course, might make the difference for any particular female.

Similarly, readers should not infer from the data in appendix A that taking courses in agriculture, for example, will result in a position in the farming industry. It is impossible to use retrospective, uncontrolled data and adjust convincingly for individuals "selecting" themselves into both the courses and the occupations. For example, a male from a farming family might know that he will be working on the family farm

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trade and industry courses, a year of technical/communications courses and a year of the specific labor market preparation (other) courses. For the male technology/communications predictions, they assumed the student had taken a year of general labor market preparation, a one year of business, two years of trade and industry courses, a year of marketing and a year of specific labor market preparation (other) courses. For the female health occupation courses they assumed the student had taken one year of general labor market preparation, one year of consumer home economics, a year of occupational home economics, one year of business, a half year each of trade/industrial and technology/communications, and a year of specific labor market preparation (other) courses.

[13] 1,412 males and 948 females were included in this analysis.

[14] This is obtained by assigning values to the independent (predictor) variables in the earnings equation, calculating the sum across variables of the value for the variable multiplied by its coefficient and then exponentiating the sum, that is, raising *e* (approximately 2.178) to the power of the sum. The analyses predict the following base earnings, that is, earnings assuming no courses in the targeted vocational course area. For marketing (males) the base earning is $8,250; for technology/communications males) the base earning is $8,062; for health occupations (females) the base earning is $4,654. Note that these base earning figures are based on three slightly different coursetaking patterns.

[15] The difference in earnings between one course and four courses is largest for males taking technical/communications courses ($2,366). For males taking marketing courses the difference is $2,006. For females taking health occupation courses the difference is $1,377 or about 58 percent of the difference for the male-technical/communications combination, and about 69 percent of the difference for the male-marketing combination, and about 75 percent for the male-consumer home economics.

right after high school. Consequently, he might tend to take high school courses in agriculture to better prepare himself. In this case, the data in this background paper would show a relationship between having taken courses in agriculture and having a farm-related occupation after high school; the relationship is not causal.

The analyses in this background paper indicate the persistence of some potentially disturbing differences in earnings. Earnings for this entry-level, non-college-attending group of people were low and, as usual, females earned less than males—a difference of about $4,000 on average, of which only some portion could be accounted for by lower market participation.

This investigation was limited in scope in that it considered only those not participating in postsecondary education and examined only earnings from early labor market participation. Further investigations might examine the effect of vocational education courses on the employment and earnings of those electing to attend postsecondary education. Additional studies could also examine academic success rates in postsecondary vocational education as a function of high school vocational coursetaking. As the NELS:88 cohort matures, and as more extensive information on careers, jobs, and earnings become available in future rounds, these and other interesting issues can be addressed.

Some other findings suggest other possible relationships with earnings. The nature of this analysis was such that additional tests would be needed to confirm these tentative relationships. These include:

- For males in the sample:
    - the apparent negative relationships between entry-level earnings and: 1) taking mathematics courses, 2) taking fine arts courses, and 3) African-American rather than white ethnicity even when numerous other factors are considered;
    - the apparent positive relationship, when numerous other factors are considered, between entry-level earnings and 8th grade academic test scores (this finding is not troubling, but deserves to be confirmed for this noncollege-bound group of workers); and
    - the apparent lack of a relationship, when numerous other factors are considered, between having been graduated, rather than dropping out, from high school.
- For females in the sample, the apparent positive relationship, when numerous other factors are considered, between graduation from high school and earnings. (Again, this finding is not troubling, but deserves to be confirmed for this noncollege-bound group of workers.)

POLICY IMPLICATIONS

Federal support for high-school-level vocational education is relatively small in terms of dollars. However, vocational education is an area in which relatively small amounts of federal support, distributed throughout the country, have been important to the continuation of such programs.

As do other programs and policies, vocational education deserves scrutiny in terms of whether it "works" or not. Given the breadth and variability of the program, its numerous goals, the numerous other factors in young people's lives that affect how much they earn right out of high school, and the lack of any evaluations using rigorous research designs, the question of vocational education's effectiveness and value is very difficult to answer. Several national assessments have been devoted to this and other questions concerning vocational education. This background

paper provides new data, not available to previous evaluators, to suggest that, *in some specific cases*, vocational education may be making an economic difference to individuals. It may be that these results are not long-lasting (i.e., it may be that all students benefit more by focusing on academics in high school and vocational studies in postsecondary education), and it may be that they could be enhanced by improvements in the structure and practice of secondary education related to later work (e.g., through additional emphasis on work-based learning).

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Appendix A: Relationships Between Vocational Course-Taking and Entry-Level Occupations

ANALYSIS

Coursetaking in vocational areas was examined for the NELS:88/94 respondents who indicated that they were not enrolled in a postsecondary educational program, that they had been actively in the workforce in 1993 and that they had taken at least one vocational education course. Types of vocational education courses for which respondents in different occupations had earned on average at least one half Carnegie unit (one full-time semester) of credit were included in the analysis. Respondents were classified by gender and occupation; average Carnegie units earned were calculated in each of the 10 vocational course areas defined in the *Secondary School Taxonomy* (SST) (6), using the 1992 high school transcripts collected as part of the NELS:88 second followup.[1]

Occupational categories were derived from the 30 occupation categories of the *NELS:88/94 Occupation Codeframe*, which in turn was based on the occupation codes used by the U.S. Department of Commerce, Bureau of the Census (11). The NELS:88/94 codes were condensed to 14 categories by combining subcategories that existed for some classifications when subcategories had only a small number of cases. Table A-6 provides further definitions of the occupational categories.[2]

Limitations

The biggest limitation of this analysis is that it is impossible to tell from available data whether there is a causal relationship between the types of vocational courses students take and their entry-level occupations. Because students (presumably with the help of guidance counselors, parents, and teachers), choose specific courses and specific occupations, it is difficult to separate the influence of the courses themselves on

[1] A Carnegie unit is a standardized measure of coursetaking. One Carnegie unit is earned for every course that meets for five 50-55 minute periods per week for an entire school year. Thus, a one semester-course would earn one-half unit.

[2] The three clerical categories: financial, secretarial, and "other," were combined into a single clerical category; the five management categories: governmental, manufacturing, retail, sales/purchasing, and "other," were combined into a single management category; the six professional categories: arts, engineer, legal, medical, physician, and "other," were combined into a single professional category; the three proprietor categories: manufacturing, retail, and "other," were combined into a single proprietor category; and the two technical categories: computer related and non-computer related, were combined into a single technical category; the categories "not working" and "homemaker-not working outside the home" were dropped from the analysis.

subsequent jobs from other influences. Strong and persistent associations between courses taken and subsequent occupations can suggest that having concentrated in a specific course area helped a student obtain a job in that area, but the analysis is not definitive.

Another limitation of the analysis is that specific courses (as opposed to course areas) cannot be tied to specific jobs. Because of limitations in the sample size both the course areas and occupational areas had to be grouped very broadly. For example, the occupational category "professional" includes everyone from photographers (who could presumably be recent high school graduates) to physicians and judges (who probably aren't recent high school graduates).

A third limitation is that the occupational titles are not consistent with the vocational course titles. For example, "trade and industrial" is a vocational course area, but not an occupational title. These limitations are inherent in the data source.

Results

Table A-1 confirms that most high school graduates and dropouts who do not attend postsecondary school take relatively low-level jobs. Taken together, more than half the NELS sample were in clerical (631 respondents), service (563 respondents), or laborer (500 respondents) occupations (table A-1). Tables A-3 through A-5 show the average Carnegie units earned in 10 types of vocational education courses, by postsecondary occupation and by gender.

Marked differences in vocational course-taking were observed between males and females. It was relatively rare for males in this sample to take more than half a unit in any vocational education area other than trade/industrial and general labor market preparation. There were only two major occupations in which the males' transcripts showed coursetaking above the .5 unit level for four or more vocational course areas. Males in "technical" positions took courses in general labor market preparation as well as trade/industrial, "other specific labor market preparation," and agriculture. Male owner/proprietors' coursetaking patterns included on average more than one-half Carnegie unit of business/management, consumer services, and agriculture, in addition to trade/industrial and general labor market preparation.

The observed pattern of vocational education courses included courses in areas that may be related to the occupation. For example, owner/proprietors were likely to take business/management and consumer services courses. On average, farmers and farm managers took more agriculture courses.[3]

Female respondents tended to sample more widely than males from the vocational education areas. Women in all but one occupational category (owner/proprietor) showed coursetaking above the half-unit average in three or more vocational areas: business/management, consumer services, and general labor market preparation.[4] As did the males, females who had jobs in farming had taken courses in agriculture.

DISCUSSION

If vocational education courses are to be viable they must serve the needs of an economy with a growing service sector and an increasing demand for a technically sophisticated work force. The U.S. Department of Labor, Bureau of Labor

[3]The agriculture course category also shows up in a number of other occupational areas that could exist in an agricultural context (e.g., skilled operative, manager/administrator, proprietor, and technician). For example, skilled operatives may be involved with the use of heavy machinery/equipment. However, the available data cannot be used to determine the specific context of any occupation.

[4]That one exception may be spurious because there were only four female owner/proprietors in the sample.

Statistics (BLS) predicted relatively little demand in 1988 through 2000 for minimally-educated clerical workers in office settings and manual workers in manufacturing and production settings[5] (3,12). BLS projections for 1990 through 2005 predict that one out of every three new jobs will be in the service industries. In particular, the health, social science, and legal industries are all expected to grow twice as fast as other industries. Other service industries such as finance, insurance, securities, and commodities are predicted to demand increasing technical knowledge. Over half of the young people in this sample appeared to haverelatively low level jobs. Even if many were in the growing service occupations (e.g., clerical jobs, other service occupations), it remains to be seen whether their technical skills and wages will rise. in coming years, and how they would fare in relation to their classmates who attend postsecondary education.

[5]Bishop and Carter argue that the methodological procedures used by BLS in the 1980s to extrapolate changes in future employment growth resulted in underestimates of growth in high-skill professional, technical, and managerial occupations and overestimates of in low-skill occupations such as operatives, laborers, and non-technical service workers (9 percent actual compared to 34 percent predicted growth in these occupation) (2).

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