CONTINUING EDUCATION, JOB TRAINING, AND THE GROWTH OF EARNINGS INEQUALITY

DAVE E. MARCOTTE

Although it is well established that changes in the value of formal education can partly explain the increase in earnings inequality in the United States during the past three decades, less attention has been paid to the possible role of post-school training. Using data from cohorts of the National Longitudinal Surveys, the author finds that young men entering the labor market beginning in the late 1960s and those entering in the early 1980s differed little in the average incidence of training or earnings premiums associated with training, but further analysis shows that shifts in training favoring more educated workers can account for more than 40% of the observed increase in college-high school earnings differences among young men. Changing patterns of continuing learning do not, however, help explain the growth in earnings differences within equally educated groups.

During the past several decades, there has been a sizable growth in inequality in workers' earnings in the United States. While this phenomenon is not fully understood, among the principal explanations is a dramatic shift in the types of skills that are important in the labor market. The advent of the information economy is thought to have placed a premium on cognitive and communication skills, and to have de-valued manual skills. Although the evidence is not settled about just how important this explanation is, by most accounts what workers know (and can say) is more important in the labor market now than ever before.

While much attention has focused on how changes in skill demands affect labor market outcomes, little work in this area has examined whether changes have occurred in the patterns of and returns to workers' attempts to acquire skills once in the labor market. Studying workers' efforts to upgrade their skills through continuing education and job training is important for several reasons. First, changes in the re-

*The author is Assistant Professor, Policy Sciences Graduate Program, University of Maryland, Baltimore County. For financial support, he thanks the National Academy of Education and the NAE/Spencer Foundation Postdoctoral Fellowship Program. For valuable comments, he also thanks seminar participants at Northern Illinois University, the University of Colorado–Boulder, and the University of North Carolina–Chapel Hill.

Requests for copies of computer programs and documentation of the data sets used to generate the results presented in this paper may be made directly to the author at Policy Sciences Graduate Program, University of Maryland, Baltimore County, Baltimore, MD 21250.

Industrial and Labor Relations Review, Vol. 53, No. 4 (July 2000).
0019-7939/00/5304 $01.00

turns to such learning may help explain increasing earnings differences between workers with different levels of education, if workers with more formal education are more likely to continue learning once in the labor market. Second, continuing learning may help explain the most poorly understood aspect of rising inequality, rising wage differences within groups of similar workers, and subsequently shed light on the importance of skills-based explanations. Finally, examining patterns of continuing learning can help identify supply side responses to any changing skill demands, and provide lessons for public policy about the usefulness of training and continuing education to help improve the earnings of those at the bottom of the distribution.

In this paper, I examine trends in the education and training workers undertake once they complete their formal schooling and enter the labor force. First, I review the basic features of the recent growth in inequality and suggest why continuing education and training may have played an important role in shaping wage trends. Next, I describe a unique data set that permits in-depth study of continuing education and training over time, and their effects on labor market outcomes. The main body of the paper is then devoted to an analysis of trends in continuing education and training. Here, I seek to identify changes in the incidence and value of such continuing learning during the past three decades. In particular, I assess whether changes in the amount of continuing learning in which workers engage, and in its value, have played a role in shaping the distribution of earnings. I do this, first, by examining the basic effects of continuing learning on the overall distribution of earnings; second, by examining whether differential patterns and premia of continuing learning explain some of the rapid growth in the value of post-secondary education; and, finally, by considering whether continuing learning can help us understand what remains one of the most puzzling aspects of growing inequality: the increase in inequality within groups of workers with similar levels of education and experience.

Background and Analytical Approach

The dimensions of the increase in earnings inequality in the United States are now well known. (See Levy and Murnane [1992] and Karoly [1995] for reviews of the evidence.) Beginning at least in the early 1970s, inequality began increasing *within groups* of workers with similar levels of education, experience, and other important characteristics. By 1979, differences in earnings began growing *between groups* defined by education and experience. These concurrent increases in within- and between-group inequality combined to generate a sharp increase in overall inequality during the 1980s.

Analysts have pointed to a number of factors as contributors to this increase in inequality. Among the most important explanations has been a demand shift in favor of highly skilled workers (see Bound and Johnson 1992; Katz and Murphy 1992). This demand shift has played a role in the growth of between-group wage inequality. Coupled with relative changes in the supply of workers with different levels of education and experience during the 1970s and 1980s, this demand shift in favor of the more skilled is the predominant explanation for the recent widening of wage differences between groups of workers with different levels of education and experience (Bound and Johnson 1992).[1]

A demand shift in favor of the highly skilled is also thought to be the principal

[1]Two principal supply side factors are thought to be at play here. First, during the 1970s, a growing relative supply of college-educated workers dampened growth in between-group inequality. However, during the 1980s, a relative decline in the supply of college-educated workers combined with the demand shift toward more skilled workers to bring about a rapid expansion of between-group inequality (Levy and Murnane 1992). Second, there is some evidence that the quality of a high school education has diminished over time, contributing to the rising between-group earnings differences. This concern is tempered somewhat by the fact that between-group earnings inequality has grown among age cohorts who completed schooling long ago.

explanation for growing within-group inequality. This explanation suggests that technical change has put a premium on skills that vary within age/education groups (Juhn, Murphy, and Pierce 1993). Some work has been done to identify skills of growing importance, such as Krueger's (1993) work on the growing importance of computer use, and Murnane, Willett, and Levy's (1995) work indicating that basic math skills are increasingly important. However, this evidence is still evolving and there remains a paucity of direct evidence about what skills are in demand and whether or how they could be provided to those whose real earnings are falling.

In the face of this important but not fully defined change in the structure of demand for skills in the labor market, more work needs to be done to assess how attempts to upgrade skills by those most effected by this change, adult workers, have influenced the wage structure. The only work to directly assess how the training workers obtain is affecting the distribution of earnings is that of Constantine and Neumark (1996). Using the January 1983 and 1991 Current Population Surveys (CPS), they examined the effects of changing investments in job training on between-group inequality. They found that training was quite valuable and that there had been important changes in the incidence of training. However, they concluded that training had had little effect on wage differences between education groups, largely "because the changes in the distribution of training were not sufficiently large to have substantial effects on the wage structure" (p. 509).

In this paper, I make use of a different data set, covering a much longer period than the CPS for present purposes, to conduct a more general assessment of the impact on the wage structure of trends in the distribution and returns to job training. I do this by comparing the experiences of two cohorts of young men from the National Longitudinal Surveys. The first cohort (referred to as the original or NLS-OC cohort) is a nationally representative sample of young men who were between the ages of 28 and 39 in 1981. The second cohort (referred to as the NLSY cohort) is a comparable nationally representative sample of young men between the ages of 28 and 36 in 1993. The first cohort entered the labor market in the late 1960s and early 1970s, the second in the early to mid–1980s. I assess trends in the amount of training and continuing education workers engaged in and the effect of such learning on earnings by comparing the experiences of these two cohorts.

My approach is to first examine patterns and earnings premia of continuing learning over time. I examine not only whether incidence of any type of training has changed between cohorts, but also whether there has been a change in the intensity and source of training each cohort receives.

I then document trends in continuing learning for workers with different levels of formal education. This is a first step toward developing a sense of whether continuing learning may have played a role in generating observed wage trends. Even without a change in its value, continuing learning may have affected the wage structure if there has been a relative shift in incidence between the two cohorts. Moreover, trends in the receipt of continuing learning could help us understand the observed increase in the relative value of post-secondary education. If continuing learning is increasingly concentrated among workers with higher levels of education, part of the observed premium for formal education may be a return to the continuing learning received by those with high levels of education.

The next step is to systematically analyze the effects of continuing learning on inequality, both between and within groups of workers defined by education level. To assess effects on between-group earnings differences, I estimate both the amount of and premium earned for continuing learning by different educational groups, among both the early and later cohorts. Then, I estimate the real wages the later cohort *would have* earned if they had received the same amount of continuing learning and the same earnings premium for such learning as did the earlier cohort. This analysis

decomposes changes in real wages between education groups into changes in quantities and returns to continuing learning versus other factors, and asks the counterfactual question, "How much more/less would inequality between education groups have grown if there had been no change in the amount or value of continuing learning received by each group?"

Finally, I consider whether trends in the access and returns to continuing learning can help explain the increase in inequality within groups with similar levels of education (and experience). I do this by decomposing changes in the distribution of earnings within groups into separate effects of changes in the participation in continuing learning, returns to different types of such education, and other factors. This analysis allows me to identify the portions of the overall and within–education group increases in inequality due separately to changes in the level and type of workers' continuing learning and to changes in the value of that learning.

Data

Sample Information

To understand the changing patterns and value of continuing learning and whether it has played a role in increasing wage inequality, I make use of data from the National Longitudinal Surveys from 1966 to 1981 and the comparable National Longitudinal Survey of the Labor Market Experiences of Youth from 1979 to 1994 (NLS, collectively). The NLS is an excellent source of information for the study of continuing learning and its effects. For each cohort, detailed information is available about work experience and about the amount and types of education and training workers engaged in after they completed their formal education. For example, workers were regularly asked to identify the types and duration of any continuing education or training in which they engaged between interviews. Moreover, these data provide information about *where* workers received their additional training (for example, at a community college, vocational institute, or the place of employment).

For my purposes, I examine the experiences of a sample of young men surveyed annually as part of the National Longitudinal Survey's original cohort of young men (NLS-OC). Beginning in 1966, the NLS-OC interviewed 5,225 men between the ages of 14 and 24. These men were interviewed in person or by telephone during all but four years until 1981, when their ages ranged from 28 to 39.

In order to examine changes in the pattern and value of continuing learning over time, I compare the experiences of young men from the original cohort during the early stages of their careers to the experiences of young men beginning their careers in the late 1970s and early 1980s. I draw this sample of younger men from the National Longitudinal Survey of the Labor Market Experiences of Youth (NLSY). Beginning in 1979, the NLSY surveyed 12,686 men and women whose ages ranged from 14 to 21. These men and women have been interviewed annually, in person or by telephone, each year since then.

For the purposes of my analysis, I restrict my focus to a comparably aged group of white men from each sample. I limit my analysis to men because dramatic changes in rates of labor force participation among women between the 1960s and early 1990s confound any inferences that can be drawn about the relationship between continuing learning and the earnings of women between these cohorts.

I restrict my analysis to whites because of a very high rate of sample attrition for blacks during the collection of the NLS-OC data. Overall, the NLS-OC had a retention rate of 64.9% by the final interview in 1981. This is lower than the 89.3% retention rate for the NLSY sample by the 1994 survey. While the overall rate of attrition was relatively high among the first cohort, the rate at which black respondents failed to be interviewed from year to year was especially high. As an illustration, among white respondents, 73% were interviewed in at least 9 of the 12 applicable years in the NLS-OC, and 82% completed at least 9 NLSY inter-

Table 1. Weighted Sample Means, NLS-OC and NLS. (Standard Deviations in Parentheses)

Variable	*NLS-OC*	*NLSY*
Annual Wage and Salary Income	33,360 (16,265)	31,773 (17,529)
Age	32.6	32.2
Proportion H.S. Dropouts	2.1 (0.007)	2.2 (0.008)
Proportion H.S. Grads	0.304 (0.012)	0.438 (0.013)
Proportion with Some College	0.246 (0.011)	0.190 (0.010)
Proportion with 4 or More Years' College	0.366 (0.012)	0.010 (0.011)
Proportion Married	0.755 (0.011)	0.645 (0.012)
Proportion in an SMSA	0.747 (0.011)	0.759 (0.011)
Proportion Living in the South	0.298 (0.012)	0.318 (0.012)
Proportion Veterans	0.388 (0.012)	0.139 (0.009)
Proportion Represented by Unions	0.303 (0.012)	0.192 (0.010)
Proportion Full-Year, Full-Time	0.795 (0.010)	0.799 (0.010)
Proportion Emp. in Manufacturing	0.277 (0.011)	0.247 (0.011)
Proportion Emp. in Construction	0/091 (0.007)	0.125 (0.008)
Proportion Emp. in Transp./Utilities	0.100 (0.008)	0.084 (0.007)
Proportion Emp. in Services	0.193 (0.010)	0.228 (0.011)
Proportion Emp. in Trade	0.162 (0.009)	0.178 (0.010)
Unweighted Final Sample Size	1,536	1,531

views; in contrast, among black respondents, the corresponding figures were, respectively, 56% and 89%. Because of the stark differences in rates of non-interviews for blacks between cohorts, I choose here to focus on white workers, for whom interview rates are more comparable from one cohort to the next.

I also eliminate observations from the poor white and military supplemental samples of the NLSY. The NLSY included a cross-sectional sample designed to be representative of the population 14 to 21 years old in 1979. The NLSY also included supplemental samples of poor youths and of young people in the military. These supplemental samples were designed to collect detailed information on populations that otherwise might be represented in numbers too small to explore certain research questions. The NLS-OC sample included no such over-sampling of poor youths or of those in the military, instead drawing a sample designed to be nationally representative of the population 14–24 years old in 1966. In order to ensure comparability, I use only those portions of the NLS-OC and NLSY samples designed to be nationally representative.

Furthermore, because the age range of the NLS-OC cohort is broader than that of the NLSY cohort, I drop sample members of a certain age from the NLS-OC cohort. The resulting samples are comparably aged (29–35 years old) in the final years under consideration (1981 for the NLS-OC and 1993 for the NLSY). I also eliminate from consideration individuals whose real earnings are less than $2,000. Finally, information about annual wage and salary income is top-coded at $50,000 for the original cohort, whereas it is not top-coded for the NLSY cohort. To improve comparability, I artificially top-coded the NLSY wage and salary information at the real value of the top-code imposed on the original cohort ($77,845).[2]

In Table 1, I present descriptive statistics on the NLS-OC and NLSY samples in 1981 and 1993, respectively. Two important differences between the cohorts are notable. First, members of the youth cohort are substantially less likely to have served in the armed forces than were members of the original cohort. Second, the original cohort is more educated than the youth cohort. It is important to understand these inter-cohort differences and their broader context. To this end, I present estimates of a variety of characteristics of men in comparable years, obtained from other sources in Table 2.

[2]The top-code affects 53 observations for the first cohort and 77 observations for the second cohort. How top-coding is handled does not affect the results.

Table 2. Estimates of Characteristics of the Population of Young Men from Various Sources, 1981 and 1993.

Characteristic	*1981 (%)*	*1993 (%)*	*Data Definition*	*Source*
H.S. Dropouts	13.9	13.2	Men aged 25–34	CPS: Census Bureau tabulations, various years.
H.S. Graduate	35.4	35.9	Same as above	Same as above
Some College	23.1	27.1	Same as above	Same as above
4 or More Years' College	27.5	23.8	Same as above	Same as above
Veteran of Armed Forces	33	12	Male veterans 30–34 years old, as percent of male civilians.	U.S. Veterans Administration, Annual Report
Married	74.7	62.4	Men aged 30–34	CPS: Census Bureau, Current Population Reports.
Represented by Unions	33.1†	17.6	Men aged 25–34	CPS: Bureau of Labor Statistics, *Employment and Earnings.*
Employment by Industry	—		All employed men.	CPS: Bureau of Labor Statistics, *Employment and Earnings.*
—Manufacturing	26.1	20.5		
—Construction	9.7	10.2		
—Transp./Utilities	8.5	9.4		
—Services	20.2	24.7		
—Trade	18.9	20.4		

†Estimate from 1980.

Inter-cohort differences observed in the NLS data mirror social and economic changes observed from other sources in many unremarkable ways, but also in one quite remarkable way: both the NLS estimates and data from the Veterans' Administration suggest that men in their early thirties were *much* more likely to be veterans in 1981 than in 1993. This difference is an artifact of the Vietnam War. The men in the NLS-OC original cohort were just coming out of high school during the peak years of Vietnam-era conscription. Indeed, 14% of the men in the first cohort report having been in combat.

While the inter-cohort differences in veteran status observed in the NLS are representative of a general phenomenon, they raise estimation issues. I attempt to account for these differences between cohorts by including controls for veteran status in all models estimated below. Furthermore, I include a dummy variable set to one for all members of the original cohort who report having served in combat.[3] To the extent there is any larger cohort effect due to the Vietnam War, these controls may be inadequate, and the reader is urged to interpret the results in the context of his or her own assessment of the impact of such an event on the learning and earnings of the respective cohorts.

Next, consider the inter-cohort changes in educational attainment reported in Tables 1 and 2. Both reflect a decline in the proportion of men in this age range who

[3]One might expect combat to affect earnings negatively, either due to lingering effects on productivity or because the measure of combat might pick up an important heterogeneity associated with the manner in which members of the armed forces are assigned to combat duty. While the coefficient on this variable is usually negative in earnings models, it is never statistically significant.

complete four years of college. This shift may be somewhat surprising, considering that educational attainment of the general population has been rising during the twentieth century. However, the flood of highly educated young people into the labor market as the baby boom left college during the 1970s bid down relative wages for more educated workers, especially among the young. It was this phenomenon that prompted Freeman's *The Overeducated American* (1976). This decline in relative returns during the 1980s is likely to have diminished college enrollment among those leaving high school.

Published estimates of education levels from the Current Population Survey reflect a slight decline in the proportion of men in their early thirties with at least four years of college education between the early 1980s and early 1990s. Clearly, the changes observed in educational attainment for the NLS cohorts examined here are more stark. The NLS cohorts reflect a larger and more general decline in college attendance than is reflected in the CPS estimates. It is not clear what accounts for the differences between published CPS estimates and the educational characteristics of the NLS cohorts used here. The descriptive statistics reported in Table 1 are based on a subset of the full NLS cohorts: sample members who are white and employed. The CPS estimates are based on a sample representative of the entire population of men in their early thirties. Thus, differences between trends in educational levels reported in Tables 1 and 2 may be the result of compositional differences. However, it is possible that they reflect real differences in the NLS and CPS samples. The reader is encouraged to keep these differences in mind when assessing the results presented below.

Information on Continuing Learning

To collect information on the continuing learning of the young men in each of the samples, I make use of their responses during the full series of interviews. During the course of the NLS-OC survey, respondents were routinely asked about the training courses or educational programs they had taken, whether at work or elsewhere, other than their regular schooling. Similarly, respondents to the NLSY surveys were routinely asked about the training they received other than regular schooling. In each case, respondents were asked only about the training they had engaged in since the last interview (with the exception of the first interview administered).

Both the NLS-OC and NLSY surveys provide information about the training respondents received. This information includes the source of training, such as vocational-technical and community colleges, training provided at the place of work by the employer or by an outside trainer, and government-sponsored training.[4] Respondents were also asked for other details about their training, such as its duration and frequency. From this information, I am able to construct a history of individuals' participation in training, including the type, frequency, and duration of the training in which they engaged over a period of more than a dozen years.[5] I limit my analysis to training that occurred during the thirteen-year period prior to the final interview, and to training that was reported in interviews subsequent to respondents' reporting having left formal schooling.

Results

Trends in Overall Incidence

In Table 3, I summarize the patterns of training reported by the NLS-OC and NLSY cohorts. During the course of their interviews, 71.6% of NLS-OC cohort members

[4]The primary battery of questions about training in the NLSY did not address government-sponsored training between 1979 and 1986. Instead, another battery of questions was administered to collect information on participation in government training programs.

[5]I restrict my analysis to civilian training. As a result, I examine training that, according to respondents' reports, neither was provided by the military nor occurred while respondents were on active duty.

Table 3. Incidence of Training.

Extent/Type of Training	*Original Cohort*	*NLSY Cohort*
Ever Participated in Training	71.6%	63.4%
Partic. in Short-Term Training	18.5%	25.9%
Partic. in Long-Term Training	53.1%	37.5%
Long Term Training Provided at Company[a]	37.1%	41.6%
Long-Term Training Provided at School[a]	38.7%	43.2%
Long-Term Training Provided Elsewhere[a]	33.1%	24.1%
Total Number of Years in Which Cont. Learning Occurred	1.81	1.79

[a]Calculated as number receiving particular type of long-term training, as a percentage of those receiving any long-term training.

reported participating in a training course or educational program other than regular schooling at least once. Among the NLSY cohort, 63.4% reported participation in training at some time. Clearly, for both cohorts, at least some level of participation in continuing learning is the norm.

Moreover, for each cohort long-term continuing learning is common. However, among the NLSY cohort, the continuing learning reported by workers appears to be shorter than that reported by their counterparts in the earlier cohort. 53.1% of those in the NLS-OC cohort reported participation in a continuing learning program that lasted at least one month, while 18.5% reported participating in a program lasting less than a month. Only 37.5% of the NLSY cohort reported receiving continuing learning lasting more than one month, while 25.9% reported shorter durations. Combined with the moderate decline in incidence, the fall in duration of training meant that the second cohort engaged in somewhat less training and continuing education than the first.

However, there appear to be no dramatic shifts in the source of training.[6] For the original cohort, those participating in long-term continuing learning were about equally likely to have received their training at a school (38.7%), at their company (37.1%), and at all other sources (33.1%). Among the second cohort, respondents who participated in long-term continuing learning were somewhat more likely to have received it at a school (such as a community college) or at their place of employment, and less likely to have received it elsewhere.

Trends in the Overall Earnings Premium for Continuing Learning

While the two cohorts differ somewhat in the incidence of continuing learning, the earnings premium for such training is about the same for both. In Table 4, I summarize the results of a series of models estimating the effects of past episodes of continuing learning on the log of real earnings of the first cohort in 1981, and of the second cohort in 1993. The first two columns in the table present the marginal earnings effects of age and educational status for each cohort. The second set of columns replicates the first model, but includes an indicator of whether or not a worker ever participated in continuing learning.[7]

[6]During some years, the NLSY asked detailed questions about training only for those reporting a duration of more than one month. In order to ensure comparability across years and cohorts, I restrict my analysis of the source of training to those who engaged in continuing learning in a spell of more than one month.

[7]For the purposes of estimating earnings models, I employ measures of individuals' training histories for all years prior to the year for which I examine earnings. That is, I omit from consideration any training in which workers engaged in the year during which earnings are measured.

Table 4. Returns to Training, NLS-OC and NLSY Cohorts. (Standard Errors in Parentheses)

	Model 1		*Model 2*		*Model 3*		*Model 4*		*Model 5*	
Indep. Variable	*NLS-OC Cohort*	*NLSY Cohort*	*NLS-OC Cohort*	*NLSY Cohort*	*NLS-OC Cohort*	*NLSY Cohort*	*NLS-OC Cohort*	*NLSY Cohort*	*NLS-OC Cohort*	*NLSY Cohort*
Intercept	7.902**	8.854**	7.964**	8.856**	7.967**	8.832**	8.051**	8.810**	7.963**	8.836**
	(0.199)	(0.197)	(0.198)	(0.196)	(0.198)	(0.198)	(0.200)	(0.196)	(0.199)	(0.199)
Age	0.047**	0.013**	0.042**	0.012**	0.042**	0.012**	0.040**	0.013**	0.043**	0.012**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
High School Dropout	−0.313**	−0.202**	−0.262**	−0.187**	−0.263**	−0.190**	−0.253**	−0.169**	−0.273**	−0.190**
	(0.051)	(0.047)	(0.051)	(0.047)	(0.051)	(0.047)	(0.051)	(0.047)	(0.051)	(0.047)
Some College	0.088**	0.141**	0.097**	0.133**	0.096**	0.134**	0.103**	0.115**	0.091**	0.131**
	(0.035)	(0.036)	(0.034)	(0.036)	(0.034)	(0.036)	(0.034)	(0.036)	(0.034)	(0.036)
College	0.313**	0.395**	0.324**	0.392**	0.322**	0.385**	0.337**	0.383**	0.316**	0.387**
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.036)
Ever Rec'd Training	—	—	0.140**	0.105**	—	—	—	—	—	—
	—	—	(0.028)	(0.027)	—	—	—	—	—	—
Duration										
Short-Term Training	—	—	—	—	0.156**	0.127**	—	—	—	—
	—	—	—	—	(0.038)	(0.035)	—	—	—	—
Long-Term Training	—	—	—	—	0.135**	0.086**	—	—	—	—
	—	—		—	(0.029)	(0.031)	—	—	—	—
Frequency: Number of Years in Which Training Occurred										
One Year	—	—	—	—	—	—	0.086**	0.086**	—	—
	—	—	—	—	—	—	(0.034)	(0.035)	—	—
Two to Three Years	—	—	—	—	—	—	0.141**	0.095**	—	—
	—	—	—	—	—	—	(0.032)	(0.035)	—	—
Four or More Years	—	—	—	—	—	—	0.220**	0.262**	—	—
	—	—	—	—	—	—	(0.041)	(0.042)	—	—
Source of Training:										
Short-Term Training	—	—	—	—	—	—	—	—	0.110**	0.125**
	—	—	—	—	—	—	—	—	(0.036)	(0.035)
Long-Term Training Rec'd at Company	—	—	—	—	—	—	—	—	0.086**	0.090**
	—	—	—	—	—	—	—	—	(0.034)	(0.038)
Long-Term Training Rec'd at School	—	—	—	—	—	—	—	—	0.010**	0.073**
	—	—	—	—	—	—	—	—	(0.033)	(0.037)
Long-Term Training Rec'd at Other Source	—	—	—	—	—	—	—	—	0.121**	0.065**
	—	—	—	—	—	—	—	—	(0.034)	(0.045)
R-square	0.3358	0.3792	0.3471	0.3853	0.3472	0.3851	0.3505	0.3950	0.3463	0.3858

Controls also include marital status, SMSA residence, residence in the South, union status, FYFT status, veteran status (and combat experience for the Original Cohort), and a set of industry of employment dummies.

**Statistically significant at the 5% level.

As expected, the value of formal schooling increased between cohorts. Young men in the first cohort who completed four years of college earned 31.3% more than their peers who received no schooling beyond high school. By the second cohort, college-educated workers were earning 39.5% more than their high school–educated peers. This

is consistent with a declining relative supply of college-educated labor market entrants, and a growing relative demand for college-educated workers and their skills.[8]

What is of particular interest here, however, is the value of the learning in which workers engage after they complete their formal schooling. For the first cohort, continuing learning resulted in an average earnings premium of 14.0%. The training premium for the second cohort was not significantly different, at 10.5%.

Besides its stability, the magnitude of the estimated training premium between the two cohorts is also noteworthy. A 10–14% premium for continuing learning is quite large. Indeed, these estimates suggest that continuing learning is about as valuable as formal post-secondary schooling that does not lead to a 4-year college degree. This result is consistent with CPS estimates of training returns: Constantine and Neumark estimated a 15% return to training to improve skills—which, according to their estimates, is more valuable than two additional years of formal schooling. Clearly, there is reason for optimism that encouraging training could improve the earnings of workers who are falling behind.

Table 4 also presents the results of three different ways of characterizing the relationship between continuing learning and earnings. The first two attempt to measure the effect of duration and frequency of continuing learning. The first of these models includes the basic controls for human capital, but includes two mutually exclusive measures of continuing learning: an indicator of whether a worker participated in continuing learning that lasted more than one month, and an indicator of whether a worker participated in continuing learning, but never in an episode of more than a month. Interestingly, for neither cohort did wage outcomes for longer-term training exceed those for short-term training. Shorter-term training was associated with a 15.6% earnings premium for the first cohort and a 12.7% premium for the second, while longer-term training was associated with 13.5% and 8.6% premia, respectively.[9] Possible explanations for this pattern are discussed below. As with the earlier results, there is no evidence that the premium for continuing learning increased from one cohort to the next.

The next model includes a series of variables that count the number of years in which a worker reports participating in continuing learning. For both cohorts, earnings rise most for workers who engaged in continuing learning during more than one year. For the first cohort, earnings for workers who participated in training during one year are 8.6% higher than the earnings of those who did not participate in training at all. However, for workers who participated in training during two or three years, earnings were 14.1% higher than for those with no training. The earnings of those participating in training during four or more years were 22.0% higher than the earnings of those without training. A similar pattern of very high earnings premia for those who participated in the most frequent training is observed among the second cohort.

The previous model suggested that during any one training episode, longer duration does not result in a higher payoff. However, frequent training spells seem to pay off very highly. Combined, these results suggest that workers who engage in multiple brief spells of continuing learning enjoy substantially higher earnings.[10]

[8]See Grogger and Eide (1995) for discussion of changes in skill demands and their effects on the rising college premium. See Levy and Murnane (1992) for discussion of changes in the relative supply of college-educated workers in the 1980s, and subsequent effects on earnings inequality.

[9]Inter-cohort changes in returns are not statistically significant for either type of training.

[10]One often cited explanation for this pattern of higher returns among those who participate in training is that the observed association between earnings and frequent training may have nothing to do with the training itself. Instead, workers who receive frequent training may do so because of frequent promo-

The final model attempts to measure the relative earnings impact of different sources of training. Because of data limitations, I am able to compare the source of training only for workers reporting training of more than one month in duration. Consistent with the results of Model 3, for both cohorts, short-term training is at least as valuable as long-term training, regardless of the source of long-term training. Among those who participated in long-term training, no one source of training stands out as particularly valuable. Moreover, there were only slight differences between cohorts.

Together, these results provide a picture of the effect of continuing learning on workers' earnings. The first lesson is that, on average, continuing learning matters—quite a bit. The second lesson is that workers who receive training of long duration do not fare better than those who receive shorter training. Rather, it is frequency, not the duration of any one spell, that most influences the earnings premium due to continuing learning. Finally, these patterns have not changed between cohorts.

The most interesting aspect of these patterns is the evidence that although continuing learning is quite valuable, long-term training is no more valuable than short-term training. A hopeful implication is that brief episodes of training can have a substantial pay-off. But what underlying mechanisms explain the high value for short-term training, and, relatedly, just what kinds of short-term training are so valuable?

There are several plausible explanations for the former question. First, perhaps brevity itself is a valuable feature of short-term training; that is, it may be that there are diminishing returns to investment in continuing learning. Indeed, there are many reasons to expect diminishing returns. Training occurs after entry into the labor market. Prolonged episodes of such training may have negative ancillary effects on productivity because of extended absence from (or inattention to) normal duties, or even from fatigue.

A different possible explanation for the absence of additional value for long-term training is that it somehow differs from short-term training in its content or its recipients. Long-term training may be more likely than short-term training to be remedial (serving workers who lack basic skills), or the content of such training may be different in some other way. Unfortunately, information that would allow comparison of the different types of training in which workers in short- versus long-term spells were engaged is often unavailable for the NLSY cohort. However, such information is available for the original cohort.

In Table 5, I present the distribution of all training spells reported by members of the original cohort between 1973 and 1981 by type and source of training. Clearly, short- and long-term training differed from each other both in content and in venue. First, short-term training spells were more likely to be aimed at improving managerial skills or technical/professional skills, and long-term spells were more likely to be designed to enhance manual, clerical, or sales skills. Second, short-term training was much more likely to be company-provided than was long-term training. Nearly 48% of all short-term spells were provided by respondents' employers, compared to just under 31% of long-term spells. Long-term training was more likely to be received through a vocational/technical institute, a community college or other school, or a correspondence course.

These differences may be part of the reason for the relatively high pay-off for short-term compared to long-term training

tions, with episodes of training accompanying their new jobs. Thus, some workers may be put on a "management track," and their frequent training could be a consequence of their new position and pay, rather than an antecedent to promotion.

Because I am able to observe individuals' work histories, I test the hypothesis that promotion, rather than frequent job training, accounts for this pattern of earnings. I find that controlling for the frequency of promotion has negligible effects on the estimated returns both for job training in general and for frequent job training. I interpret these results as confirmation that frequent job training has a high return, independent of any patterns of intra-firm job changes that may be associated with such training.

observed in Table 4. It has been widely suspected that skill-biased technical change is favoring workers with supervising, thinking, and technical skills over workers with manual craft skills. The higher pay-off for short-term training may therefore result from demand shifts that favor the managerial, technical, or professional skills that are disproportionately provided by such training over the manual skills that are more typically provided by longer-term training.

The relatively high value of short-term training may also be due to the fact that it is less likely to be provided by community or technical colleges than on-site by firms. Training at the work-site is likely to be particularly effective for at least two reasons: it provides learning in the context of work, so that applications of the training may be clearer; and compared to such institutions as schools, firms have more information about the types of training that affect productivity, or at least more incentive to acquire such information.

Table 5. Distribution of Short- and Long-Term Training Spells by Type and Source: NLS-OC Cohort, Training Received 1973–1981.

	Duration of Training	
Type/Source of Training	*Short-Term*	*Long-Term*
Type of Training:		
—Managerial	29.0%	14.0%
—Technical/Professional	49.8%	38.9%
—Skilled Manual	12.6%	25.6%
—Other (incl. sales, clerical)	8.7%	21.6%
	100.0%	100.0%
Source of Training:		
—Company	47.9%	30.6%
—School (incl. Voc. tech. institute, business, or community college)	23.8%	34.9%
—Correspondence Course	2.0%	12.4%
—Other (incl. union apprent.)	26.3%	22.2%
	100.0%	100.0%

Heterogeneity

Before going further, it is important to consider the possibility that these observed patterns are driven by worker or job heterogeneity. That is, training may be more common among better workers, or those in "better" jobs or matches, and these workers might enjoy higher earnings with or without training. Dealing with such heterogeneity has been a central concern for researchers attempting to estimate the returns to training and schooling.

The NLSY data offer a couple of ways to control for this problem through the use of direct measures of job and worker attributes thought to be correlated with both training and earnings. First, the NLSY includes measures of the number of employees working for each respondent's employer. Employer size is known to be correlated with the probability a worker receives training (Barron, Black, and Loewenstein 1987, 1989). Additionally, each of the NLSY sample members took the Armed Services Vocational Aptitude Battery (ASVAB) of tests.[11] From this battery, an Armed Forces Qualifying Test (AFQT) percentile score is calculated, which the U.S. Department of Defense uses as a general measure of trainability. The AFQT score has been used elsewhere as a measure of skill (for example, Neal and Johnson 1996), and offers promise as a control for the possibility that the higher earnings of workers participating in continuing learning are due to higher than average skill levels.

As an attempt to control for the possibility that more skilled or more trainable workers receive the most training, I estimate the earnings effect of continuing learning in a model that includes AFQT scores for the NLSY sample. Also, to limit the joint effect of job characteristics on training and earnings, I include an indicator of whether a

[11]The ASVAB includes 10 tests designed to measure skill and knowledge in areas including general science, arithmetic reasoning, word knowledge, and mechanical comprehension. (NLS Users' Guide 1995.)

Table 6. Returns to Training, Including Measures of Skill and Employer Size, NLSY Sample. (Standard Errors in Parentheses)

Independent Variable	*1*	*2*
Intercept	8.856**	9.025**
	(0.196)	(0.199)
High School Dropout	–0.187**	–0.101**
	(0.047)	(0.050)
Some College	0.133**	0.078**
	(0.036)	(0.038)
College	0.392**	0.273**
	(0.035)	(0.040)
Received Training	0.105**	0.084**
	(0.027)	(0.028)
Large Employer	—	0.138**
	—	(0.049)
AFQT Percentile Score	—	0.0038**
	—	(0.0006)

Controls also include marital status, SMSA residence, residence in the South, union status, FYFT status, experience, veteran status, and a set of industry of employment dummies.

**Statistically significant at the 5% level.

sample member worked for an employer with 1,000 or more employees. The results of this estimation are included in Table 6. The first column presents estimates of the earnings effects of the principal human capital measures, including job training. These are the results of Model 2 presented in Table 4. In the second column I present the results of the model that includes individuals' AFQT percentile score, and the firm size measure.

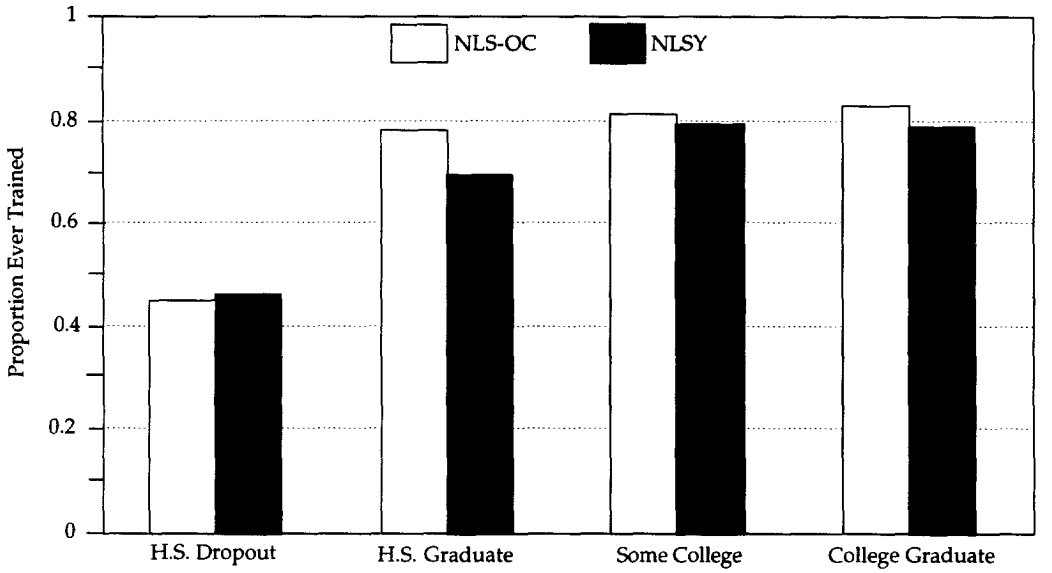
Both employer size and AFQT scores have statistically significant effects on earnings. In particular, AFQT percentile score is a powerful predictor of earnings. Each unit increase in percentile ranking on the AFQT score is associated with a 0.38% increase in earnings. This suggests that, after we control for other factors, a worker scoring in the highest percentile on the AFQT will earn 38% more than a worker scoring in the lowest percentile.

Even after these measures of skill and employer size are included, training appears to have a sizable effect on earnings. Using these direct controls for heterogeneity, workers participating in continuing learning are estimated to earn 8.4% more than workers who never engaged in continuing learning. This estimate is lower than the previous estimate, but not significantly so ($t = 0.52$). Interestingly, the inclusion of the AFQT and employer size measures has a more substantial effect on the estimated earnings effects of formal schooling. For example, the college premium falls significantly from 39.2% to 27.3% ($t = 2.25$). The earnings penalty for dropping out of high school also falls substantially upon inclusion of the skill and employer size measures, though the change is not statistically significant ($t = 1.26$). These results suggest that heterogeneity plays a marginal role in shaping observed returns to continuing learning for this group. This is consistent with several recent attempts to control for heterogeneity in the estimation of the earnings effects of training (see Constantine and Neumark [1996] for a review).

Unfortunately, the NLS-OC data do not provide similar information about employers and individuals that might permit a direct control for heterogeneity between those who do and do not participate in training. In order to assess the importance of heterogeneity for the NLS-OC sample, I made use of the longitudinal aspect of the NLS data, and estimated fixed-effects models of the impact of continuing learning on the earnings of both the NLS-OC and NLSY cohorts. For both cohorts, the fixed-effects estimates were similar in absolute and relative magnitude to the ordinary estimates reported in Table 4.

Together, these results suggest that heterogeneity played a minor role at most in determining observed earnings effects of training. Even after controlling for firm size, measurable worker skill, and unmeasured, time-invariant worker characteristics, participation in continuing learning results in high earnings premia that are similar in magnitude for both cohorts.

Figure 1. Incidence of Continued Learning, by Education and Cohort.



Training and Between-Group Earnings Differences

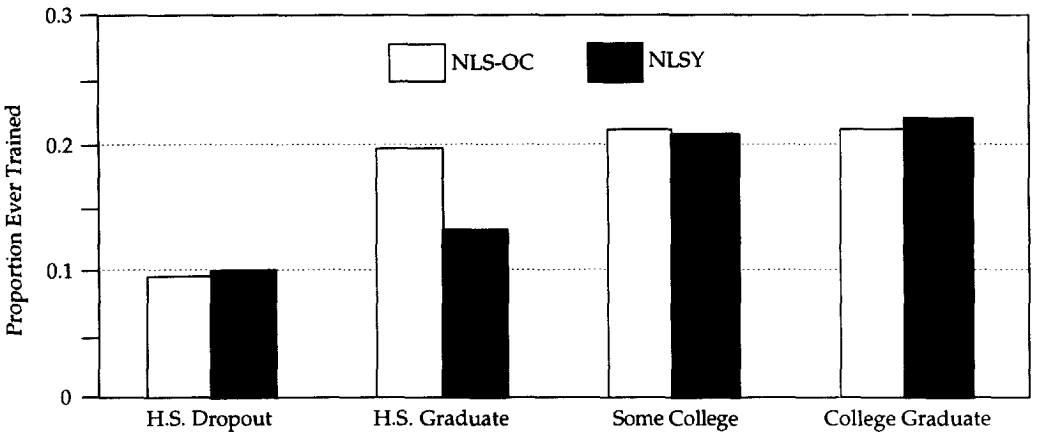
We have just seen that on average, the incidence of continuing learning was lower, but the earnings premium was similar, for the first cohort compared to the second. But to understand how continuing learning may have shaped the earnings distribution, we need to consider how patterns of and returns to continuing learning have changed at different points in the distribution. To begin doing so, I turn attention next to changes in the receipt of and returns to continuing learning between groups of workers with different levels of formal education.

For continuing learning to have played a role in increasing between-group earnings inequality, either the distribution of such learning must have shifted in favor of more educated workers, or the relative returns to continuing learning must have increased for more educated workers. In this section I examine each of these two possibilities in turn. I attempt to assess separately whether and how changes in the distribution of continuing learning between groups and changes in the relative earnings effects of such learning contributed to growing earnings differences between workers with high school versus college degrees.

As a first step, consider how patterns of continuing learning have changed. In Figure 1, I present the rate at which workers with different levels of education reported participation in continuing learning during their careers. For both cohorts, participation in continuing learning generally rises with education. However, an interesting change in the contours of the relationship between formal education and training incidence occurs between cohorts.

Among the first cohort, workers with a high school education participate in training at a rate comparable to that of their more educated peers. While incidence rises with education, for this cohort, rates are remarkably similar for all groups but high school dropouts, who were much less likely to participate in training. However, by the time the second cohort entered the work force, high school–educated workers' participation in training had begun to look more like dropouts' and less like the rates of those with some secondary education. Thus, the mild average decline in the incidence of continuing learning masks an in-

Figure 2. Incidence of Company-Provided Training.



teresting phenomenon: a decreasing concentration of continuing learning among workers with no post-secondary schooling.

At least part of this decline in participation is due to a decrease in the amount of on-site employer-sponsored training being concentrated on workers with a high school education or less. Figure 2 presents incidence rates for company-provided training for each cohort, by education group. Again, while high school graduates received training at rates comparable to those of their more educated peers in the first cohort, they saw a precipitous fall in the amount of training received at their places of employment, as did high school dropouts. By the time of the second cohort's interviews, post-secondary education had become an important determinant of whether or not a worker participated in job training at his or her company.

Next, consider trends in the earnings premium due to continuing learning for different educational groups. In Table 7, I present the real earnings premium for continuing learning for both high school and college graduates, by cohort. These rates are based on education-group-specific estimation of Models 2 and 4, with the full set of controls described earlier. The first four columns present results for high school–educated workers in both cohorts, and the last four columns present results for college-educated workers.

Among the high school–educated, the estimated premium for any job training fell from 17.3% among the first cohort to 13.1% among the second. At the same time, the premium for participation in job training rose between cohorts for workers with a college degree. For the more educated group, workers who participated in training earned 6.6% and 11.3% more than their non-trained counterparts in the first and second cohorts, respectively. The results from the group-specific estimation of Model 4 confirm a relative shift in the earnings effect of training that favored more educated workers, even among those who participated in training often.

This shift in relative returns favoring more highly educated workers, combined with the decline in incidence for less educated workers, suggests that continuing learning could have contributed to the increase in earnings inequality between groups of similarly educated workers. That is, both the incidence and relative value of continuing learning shifted in ways that increased the earnings of more educated workers relative to those of their less educated peers. To understand the implications of these shifts for between-group inequality, I next compare actual changes in between-group earnings differences to the changes

Table 7. Returns to Training for High School and College Graduates, NLS-OC and NLSY Cohorts. (Standard Errors in Parentheses)

	High School Graduates				*College Graduates*			
	NLS-OC		*NLSY*		*NLS-OC*		*NLSY*	
Independent Variable	*Model 2*	*Model 4*	*Model 2*	*Model 4*	*Model 2*	*Model 4*	*Model 2*	*Model 4*
Intercept	8.168**	8.264**	9.064**	8.949**	7.569**	7.611**	8.952**	8.928**
	(0.365)	(0.366)	(0.300)	(0.305)	(0.337)	(0.348)	(0.330)	(0.328)
Whether Married	0.099	0.096	0.165**	0.167**	0.080	0.074	0.143**	0.143**
	(0.055)	(0.054)	(0.043)	(0.043)	(0.048)	(0.049)	(0.049)	(0.049)
Union	0.211**	0.215**	0.130**	0.133**	0.010	0.009	−0.189**	−0.189**
	(0.049)	(0.049)	(0.047)	(0.047)	(0.057)	(0.058)	(0.076)	(0.076)
Age	0.031**	0.029**	0.006	0.010	0.073**	0.072**	0.023**	0.024**
	(0.011)	(0.011)	(0.009)	(0.009)	(0.010)	(0.011)	(0.010)	(0.010)
Veteran	0.038	0.033	−0.187**	−0.189**	−0.057	−0.051	−0.081	−0.071
	(0.053)	(0.053)	(0.057)	(0.056)	(0.055)	(0.055)	(0.095)	(0.094)
Served in Combat	0.076	−0.068	—	—	0.018	0.008	—	—
	(0.069)	(0.068)			(0.075)	(0.075)	—	—
FYFT	0.529**	0.516**	0.492**	0.479**	0.370**	0.373**	0.511**	0.514**
	(0.054)	(0.054)	(0.051)	(0.051)	(0.062)	(0.062)	(0.073)	(0.073)
Residence in South	−0.046	−0.050	−0.038	−0.034	0.021	0.022	−0.029	−0.021
	(0.053)	(0.052)	(0.045)	(0.045)	(0.044)	(0.044)	(0.048)	(0.048)
Resldence in SMSA	0.240**	0.223**	0.220**	0.228**	0.141**	0.141**	0.117	0.127
	(0.050)	(0.050)	(0.046)	(0.046)	(0.050)	(0.050)	(0.060)	(0.060)
Ever Received Training	0.173**	—	0.131**	—	0.066	—	0.113**	
	(0.051)		(0.041)		(0.046)		(0.046	
Frequency: Number of Years in Which Training Occurred:								
One Year	—	0.048	—	0.061	—	0.067	—	0.046
		(0.065)		(0.051)		(0.055)		(0.061)
Two to Three Years	—	0.205	—	0.140	—	0.039	—	0.063
		(0.061)		(0.052)		(0.053)		(0.060)
Four or More Years	—	0.225	—	0.223	—	0.133	—	0.245
		(0.067)		(0.064)		(0.075)		(0.072)
R-square	0.3242	0.3337	0.3179	0.3224	0.2718	0.2740	0.3344	0.3462

Controls also include a set of industry of employment dummies.
**Statistically significant at the 5% level.

that *would have* prevailed if there had been no change in the distribution of and returns to continuing learning between cohorts.

The results of this analysis are summarized in Table 8, which compares differences in mean earnings between college-educated and high school–educated workers. The first row shows this comparison among the first cohort; the second row, among the second cohort. From one cohort to the next, the earnings differential between college and high school graduates grew by $4,693. The next two rows estimate the college/high school earnings differential that *would have* prevailed among the second cohort if high school and college graduates in the second cohort had receive the same amount of continuing learning, and earned the same return, as their counterparts in the previous cohort. In the absence of changes in the distribution and relative returns to continuing learning, the college/high school earnings differential would have been $13,324 for the NLSY cohort. Clearly, regardless of patterns of access and returns to job training, the earnings differential between college- and high school–educated workers would have in-

Table 8. Actual and Counter-Factual Mean Earnings Differences for the Original and NLSY Cohorts.

Description	*College–High School Mean Earnings Difference*
Actual Earnings Difference—Original Cohort	$10,477
Actual Earnings Difference—NLSY Cohort	$15,170
Change in Actual Earnings Difference	$4,693
Counter-Factual Earnings Difference for NLSY Cohort	$13,324
Change between Original Cohort and Counter-Factual	$2,847
Percentage Reduction in Actual Wage Change Due to Imposition of Counter-Factual	0.3933

All dollars measured in 1993 terms.

creased between cohorts. However, had the relative distribution and returns to continuing learning by education group remained unchanged between cohorts, the differential that would have prevailed would have been substantially smaller. The average earnings differential between college and high school graduates would have grown by only $2,847 ($1,846 less than its actual growth). Thus, relative changes in access and returns to the job training workers engage in after entering the labor market account for almost 40% of the observed increase in the wage advantage enjoyed by college graduates over high school graduates.

Clearly, these results suggest that changes favoring more educated workers in the relative distribution and returns to continuing learning played an important role in shaping the increase in between-group earnings inequality for younger workers during the course of the 1980s and early 1990s. To be sure, between-group inequality would have grown, independent of the effects of continuing learning. However, a sizable part of the observed increase in relative earnings for more educated workers appears to be due to the growing disadvantage that the lack of post-secondary education imposes on workers in terms of access to valuable opportunities for training and continuing education.

Training and Within-Group Earnings Differences

Because each educational group saw changes in the premium they earned for participation in continuing learning, as well as changing patterns of incidence of such learning, these factors may have played a role in shaping patterns of earnings differences among groups of comparably educated workers. To examine this possibility, I decompose the observed changes in the spread of earnings between cohorts. In particular, I identify the contributions to the growth of earnings differences due separately to changes in the earnings premium and distributions of continuing learning within the groups of high school– and college-educated workers.

These decompositions are based on the structure of the earnings equations estimated above. To identify the effect of various dimensions of continuing learning on workers' earnings, I estimated a series of standard models of the form

$$(1) \qquad \ln w_{ig} = X_{ig}\beta_1 + C_{ig}\beta_2 + \varepsilon_i,$$

where $\ln w_{ig}$ measures the log of wage and salary earnings for individual i in education group g; X_{ig} is a vector measuring human capital and other factors affecting earnings; and C_{ig} is a vector measuring individual i's participation in continuing learning. This is the basic form of the equations estimated above, separately by education group.

The variance of the log of real earnings is a function of the parameters of that relationship, the distributions of the worker

Table 9. Decomposition of the Growth of Earnings Inequality within Groups of Similarly Educated Workers.

Description	*H.S. Graduates*	*College Graduates*
Observed Variance of Log Earnings (Original Cohort)	0.331	0.269
Change in Variance of Log Earnings between Cohorts	0.034	0.002
Amount Explained by Change in within-Group Returns to Continuing Learning	−0.045	0.005
Amount Explained by Change in within-Group Distribution of Continuing Learning	0.000	−0.001
Total Amount Explained by Changes in Continuing Learning	−0.045	0.005

and job characteristics of interest, and the variance of the residual.[12] More formally, assuming the relationship specified in equation (1) holds, the variance of log wages can be expressed as follows:[13]

$$(2) \qquad \sigma^2_{\ln w} = \beta_1^2\sigma_X^2 + \beta_2^2\sigma_C^2 + 2\beta_1\beta_2\sigma_{XC} + \sigma_\varepsilon^2.$$

As a result, changes in the variance of log earnings between cohorts can be decomposed into changes in the coefficient estimates, variances and covariances of the regressors, and the variance of the residual:

$$(3) \qquad \begin{aligned}\Delta\sigma^2_{\ln w} &= 2\beta_1\sigma_X^2\Delta\beta_1 + \beta_1^2\Delta\sigma_X^2 \\ &+ 2\beta_2\sigma_C^2\Delta\beta_2 + \beta_2{}^2\Delta\sigma_C^2 + 2\beta_2\sigma_{XC}\Delta\beta_1 \\ &+ 2\beta_1\sigma_{XC}\Delta\beta_2 + 2\beta_1\beta_2\Delta\sigma_{XC} + \Delta\sigma_\varepsilon^2.\end{aligned}$$

Using this decomposition of the change in the variance of log earnings, I estimate the portion of changes in wage inequality among the groups of high school– and college-educated workers that was due separately to changes in the earnings effect of continuing learning and to changes in the distribution of continuing learning within those groups.

In Table 9, I present the results of this analysis. For all intents and purposes, I find that none of the observed growth in earnings inequality can be attributed to changing patterns of continuing learning and average returns to such learning within groups of workers defined by level of formal education.

Among high school–educated workers, the variance of log earnings grew by 0.034 between the first and second cohorts. By itself, the declining earnings premium associated with continuing learning experienced by high school graduates would have *decreased* the variance of log earnings by 0.045. In other words, the observed increase in the inequality of earnings among young high school–educated men would have been smaller than actually observed if there had been no change in the returns to continuing learning between cohorts. The decline in training incidence had virtually no effect on within-group earnings differences. Nonetheless, the variance of earnings among the high school–educated would have fallen, rather than risen, if men in the second cohort had undertaken the same level of continuing learning, and received the same premium for it, as their counterparts in the first cohort.

This finding that patterns of continuing learning had a mitigating effect on inequality growth for the high school–educated is not surprising. The observed fall in the earnings premium due to such learning for this group will, by itself, decrease the overall difference in earnings among high

[12]I use the variance of the log of real annual wages here as a measure of earnings inequality. The growth of wage inequality has been found to be largely insensitive to the measure of inequality employed. See Levy and Murnane (1993) and Karoly (1992) for examples of trends in various inequality measures.

[13]For purposes of exposition, consider a simplified equation (1) in which X_{ig} and C_{ig} are scalars.

school–educated men. This is so because the fall in the earnings advantage due to training among this group means that high school–educated workers without such learning pay a smaller penalty.

Among the NLS samples of college-educated men, I observe a negligible increase in earnings inequality. Among this group, the observed increase in the premium due to continuing learning resulted in a mild increase in the growth of earnings inequality between cohorts, while changes in the distribution of those who received training within the group of college-educated workers mitigated this growth. On net, changes in the pattern and value of continuing learning served to dis-equalize earnings among college graduates, though both the effect of training and the observed pattern of within-group inequality growth were quite small.

For both college and high school graduates, changes in participation in continuing learning and its subsequent earnings effects do not appear to have had any major effect on increasing earnings inequality among similarly educated workers. Where continuing learning is observed to have had any effect, it has been among the high school–educated—apparently serving to brake the increase in inequality within this group.

Conclusions

Taken together, these analyses of continuing learning and its effects on earnings differences both between and within groups of comparably educated workers suggest that the training and continuing education in which workers engage after they leave their formal schooling can help us understand the recent increase in inequality. On average, the incidence of continuing learning declined slightly between the first and second cohorts examined here. At the same time, the wage premium associated with continuing learning did not change from one cohort to the next.

However, these small average changes mask fairly large and interesting trends in the relative incidence of and returns to continuing learning among groups of workers with different levels of formal schooling. Participation in continuing learning for workers with no post-secondary education fell relative to that of their more educated peers. Moreover, among workers with less education, the continuing learning in which they did engage was less valuable for the cohort that entered the labor market in the late 1970s and early 1980s than it had been for the earlier cohort. This shift away from continuing learning for the less educated along with the decline in the value of the continuing learning in which these workers did engage meant that among the second cohort, less educated workers were at a more substantial earnings disadvantage than workers without post-secondary education had been less than 15 years earlier. In fact, I estimate that the growth in the college–high school earnings gap among this group of young men would have been about 40% smaller if high school–educated workers had maintained their earlier levels of continuing learning and had been rewarded for such learning as before.

This shift in relative returns helps us understand what may appear to be a puzzle. We have seen that on average, the earnings premium associated with continuing learning remained stable between cohorts. This finding may seem at odds with the observed increase in the premium for formal schooling: since formal learning has become more important in the labor market, should we not expect training to have become more important?

One piece of evidence that may be pertinent to this question is the shift in the relative returns to training favoring more educated workers. The rising earnings premium associated with training for college-educated workers is consistent with a shift in demand for training—as long as that training occurs among workers who already have high levels of education. In this respect, any change in the demand for skills imparted by training may mirror broader demand shifts rewarding higher level skills.

But this pattern raises an important, highly policy-relevant question: since training is so valuable on average, why have

firms not shifted toward lower-cost high school–educated workers, and encouraged training among them? Several answers seem plausible. First, relative shifts in training returns may reflect a growing complementarity between formal schooling and job training. Previous research on training has consistently found a strong positive relationship between formal schooling, particularly four years of college, and participation in job training (Lillard and Tan 1986; Lynch 1992; Lynch and Black 1998). This pattern is consistent with complementarity between education and training, perhaps because formal schooling lays a substantive foundation upon which future training can build. Complementarity could also arise if schooling cultivates interest in learning, or even if, by exposing students to structured learning, it simply lowers reluctance to engage in future training.

The present findings suggests that any such complementarities may be growing more important. We might expect schooling and training to become greater complements if technological change is putting a larger premium on the cognitive and communication skills that are part and parcel of most post-secondary curricula. If so, formal schooling may provide an ever more important foundation for valuable additional training. Such a change may have shifted the focus of training toward more technical skills (like computer training) or toward more inter-personal skills (like management training), and shifted the focus away from craft or mechanical training.[14] Research to sort out whether the complementary relationship between formal schooling and less formal job training is changing and the reasons for any changes could provide important and useful insights into the relative decline in the amount and value of training received by less educated workers.

A different but related answer to the question about the shift away from valuable training among less educated workers focuses on what was an exceptional earnings premium for participating in training among high school–educated workers in the first cohort. A major aspect of the changing relative value of training was that by the time the second cohort was entering the work world, the reward for training among the high school–educated was merely average. The erosion of this large training premium earned by high school–educated workers may have been due to a decline in the substitutability of training for formal schooling once a worker was in the labor market. Possible reasons for this include technological change and inter-industry employment shifts. In the late 1960s and early 1970s, as the first cohort left high school, manual and craft skills were more valuable than they would later be. There is reason to believe that such skills are better learned on-the-job than in the classroom. If so, high school–educated workers may have been able to earn a higher return from training in the workplace than they could have realized by continuing in school. Moreover, as employment has shifted away from manufacturing, high school–educated workers may have lost access to union-sponsored apprenticeships or other valuable training opportunities. Better understanding the extent to which training is serving as a poorer substitute for additional schooling for high school–educated workers is clearly central to understanding the shift of valuable training opportunities away from less educated workers.

While changing patterns of access and returns to continuing learning help us understand the rapid increase in inequality between groups of workers with different levels of education, they do not help us

[14]Altonji and Spletzer (1991) illustrated that the relationship between schooling and training is due in part to higher levels of ability exhibited by the college-educated. Observed correlations between the two may therefore arise more from the fact that able individuals have lower costs for participating in each than from any pure complementarity between schooling and training. This raises the possibility that a shift of valuable training toward more educated workers results from a complementarity between training and some basic level of pre-existing skills.

make sense of the simultaneous increase in earnings differences within groups of similarly educated workers. Changes in the returns to and distribution of continuing learning across different education groups do not appear to have exacerbated within-group earnings inequality.

Finally, the results presented here offer some lessons for training and education policies that aim to improve workers' earnings. First, it appears that providing incentives to invest in continuing learning can be an effective mechanism for improving the economic position of workers. I estimate that the annual earnings premium for participation in job training and continuing education consistently exceeds 10%. Second, it also appears that the types of training that might help less educated workers fare well need not be long-term. This is a promising finding. It suggests that policies aimed at improving workers' skills and earnings need not encourage long training episodes—which may be expensive in terms of both direct instructional costs and the opportunity costs associated with time away from work—since shorter-term training appears to be equally valuable.

However, it is not clear why short-term training is observed to be as valuable as long-term training for these two cohorts. Possible explanations include diminishing returns to learning while working such that there is no significant marginal benefit to training that lasts much more than a month. But some evidence from the NLS-OC data suggests that the relatively high value of short-term training may have to do with the composition of such training. It appears that short-term training is more likely to be intended to improve managerial or professional or technical skills, while long-term training is more likely to be designed to improve manual skills. This pattern is consistent with the widely discussed skill-biased technical change in favor of workers with supervising, thinking, and technical skills over workers with primarily manual craft skills.

Second, it appears that short-term training is more likely to be provided on-site by firms, whereas long-term training is more likely to occur outside of work, at locations like local community or technical colleges. This pattern suggests that training at the work-site is particularly effective. There are a variety of reasons to expect this. On-site training may be more effective because learning is done in the context of work, so applications may be clearer. Second, company-provided training may be more effective because firms have more information about the types of training that affect productivity, or at least more incentive to acquire such information.

While short-term training is valuable, the findings do not imply that a little training is as good as a lot. The pattern of training that emerges as clearly the most advantageous is neither one short-term spell nor one long-term spell, but instead many short training classes over several years. This pattern is consistent with the conjecture that employees need minor but continual updating of skills. We know that formal education matters—as a means to build a base of knowledge and learning skills—but the results of this investigation suggest that periodic updating of skills and knowledge can also have a high pay-off.

REFERENCES

Altonji, Joseph G., and James R. Spletzer. 1991. "Worker Characteristics, Job Characteristics, and the Receipt of On-the-Job Training." *Industrial and Labor Relations Review,* Vol. 45, No. 1 (October), pp. 58–79.

Barron, John M., Dan A. Black, and Mark A. Loewenstein. 1987. "Employer Size: The Implications for Search, Training, Capital Investment, Starting Wages and Wage Growth." *Journal of Labor Economics,* Vol. 5, No. 1 (January), pp. 76–89.

____. 1989. "Job Matching and On-the-Job Training." *Journal of Labor Economics,* Vol. 9, No. 1, pp. 1–19.

Bound, John, and George Johnson. 1992. "Changes in the Structure of Wages during the 1980s." *American Economic Review,* Vol. 82, No. 3 (June), pp. 371–92.

Center for Human Resource Research. 1995. National Longitudinal Survey, *Users Guide.* Columbus: Ohio State University.

Constantine, Jill, and David Neumark. 1996. "Training and the Growth of Wage Inequality." *Industrial Relations,* Vol. 35, No. 4 (October), pp. 491–510.

Freeman, Richard. 1976. *The Overeducated American.* New York: Academic Press.

Grogger, Jeff, and Eric Eide. 1995. "Changes in College Skills and the Rise in the College Wage Premium." *Journal of Human Resources,* Vol. 30, No. 2, pp. 280–310.

Juhn, Chinhui, Kevin M. Murphy, and Brooks Pierce. 1993. "Wage Inequality and the Rise in Returns to Skill." *Journal of Political Economy,* Vol. 101, No. 3 (June), pp. 410–42.

Karoly, Lynn A. 1992. "Changes in the Distribution of Individual Earnings in the United States, pp. 1967–1986." *Review of Economics and Statistics,* Vol. 74, No. 1 (February), pp. 107–15.

Katz, Lawrence, and Kevin Murphy. 1992. "Changes in Relative Wages 1963–1987: Supply and Demand Factors." *Quarterly Journal of Economics,* Vol. 107, No. 1 (February), pp. 35–78.

Krueger, Alan B. 1993. "How Computers Have Changed the Wage Structure: Evidence from Microdata 1984–1989." *Quarterly Journal of Economics,* Vol. 108, No. 1 (February), pp. 33–60.

Levy, Frank S., and Richard J. Murnane. 1992. "U.S. Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations." *Journal of Economic Literature* (September), pp. 1332–81.

Lillard, Lee A., and Hong W. Tan. 1986. *Private Sector Training: Who Gets It and What Are Its Effects?* R-3331-DOL. Santa Monica, Calif.: Rand Corporation.

Lynch, Lisa M. 1992. "Private Sector Training and the Earnings of Young Workers." *American Economic Review,* Vol. 82, No. 1, pp. 299–312.

Lynch, Lisa M., and Sandra E. Black. 1998. "Beyond the Incidence of Employer-Provided Training." *Industrial and Labor Relations Review,* Vol. 52, No. 1 (October), pp. 64–81.

Murnane, Richard, John B. Willett, and Frank Levy. 1995. "The Growing Importance of Cognitive Skills in Wage Determination." *Review of Economics and Statistics,* Vol. 7 (May), pp. 251–66.

Neal, D., and W. Johnson. 1996. "The Role of Premarket Factors in Black-White Wage Differences." *Journal of Political Economy,* Vol. 104, No. 5 (October), pp. 869–95.

U.S. Census Bureau. 1996. "Years of School Completed by People 25 Years Old and over, by Age and Sex: Selected Years, 1940 to 1996." Washington, D.C.: GPO (url:http://www.census.gov/population/socdemo/education/tablea-01.txt).