Some Aspects of Measuring Education

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Education is one of the most important variables in social science research (Davis, 1979; Siegel, 1991; Braun and Mueller, forthcoming). First, education is probably the most frequently used variable in Sociology. Sociological Abstracts includes 11,317 entries under "education(al)/school(s)" and education is the most often used variable in the National Opinion Research Center's General Social Survey (GSS) (Smith, 1992). Second, it is a central variable in most social science theories from stratification and the attainment process, to socio-political participation, to value formation and attitude holding. Third, education exerts an effect on a wide range of dependent variables. In an analysis of the net effect of age, education, occupational prestige, race, region, religion, and gender on 49 attitudes Davis (1979) found that education was significantly related 90% of the time, more than for any of the other independent variables.

Yet despite its prominence and centrality, education is not a well-defined and well-measured concept. As Braun and Mueller (forthcoming) observe:

> (T)his concept is rather poorly understood, perhaps precisely because its use is so conventional and self-evident. In population surveys education is generally included as one

> of the so-called "background variables" without much concern about why and how it should be measured. It is a variable for all purposes, and therefore - in the best case - researchers stick to some more or less established standards concerning the way this variable is conventionally measured...

This paper examines 1) what elements and facets are covered by the concept of education and how they are measured, 2) how the key concept of the amount or quantity of educational attainment is measured and what impact alternative measures have on relationships with various dependent variables, 3) the reliability and accuracy of measures of the amount of educational attainment, and 4) problems related to the measurement of education across time.

Conceptualizing and Measuring Education

Education is the action or process of providing schooling (i.e. instruction in school) or of developing mentally or morally, especially by instruction. Instruction indicates training or teaching that is designed to cause a student/trainee to learn or know a subject or gain knowledge or understanding about a topic. Measures of education should assess relevant aspects of this process. This would include ascertaining the quantity, quality, content, and organization of this teaching/learning process. It should also include information relating to the two parties involved, the instructing agency (usually a school) and the instructee (usually a student).

The main aspects of education are 1) the quantity or amount of education, 2) the quality of education, 3) the content of education, and 4) the type of education.

The quantity or amount of schooling measures the length and scope of one's educational experience and the highest level of schooling obtained. In the United States length is usually measured in terms of either number of years of regular schooling either attended or completed and highest degree obtained. By standard convention pre-school attendance (kindergarten, nursery school, Head Start, etc.) and schooling and courses not part of a program to ultimately obtain a high school or college degree are not counted.

In Britain the approximate equivalents are school-leaving age and examinations (O and A levels) passed. Degree conferring examinations do not play a general role in America, but they do play three significant, but more limited, roles. First, many high school degrees are awarded by passing high school equivalency exams (usually the GED or test of general educational development) rather than by attending either standard high school classes or night school. Second, for a number of fields passing an examination after completing a formal course of study is mandatory in order to practice a given occupation (e.g. the bar exam for lawyers) or to claim a certain specialization (e.g. board-certified physicians). Third, admission into college and later into graduate or

professional school is determined in part by scores on privately administered standardized tests such as SATs, GREs, LSATs, etc. In addition, in recent years a number of states have instituted graduation exams for high school students.

Quality of schooling can refer to the school, a particular program or major, specific courses and instructors, and the amount of learning a student actually achieves (Bidwell, 1989; Spilerman, and Lunde, 1991; Ishida, 1990). At the institutional level it refers to differences between schools in their academic rigor and standards. This is most often measured on the college level by the degree of "selectivity" in accepting students or by collective, subjective judgments of the prestige or status of schools. Sometimes the type of college (junior/community, four-year, university, research university) is used as a surrogate for quality. Rankings of the quality of high schools are less common (mostly as the result of their large numbers and the lack of comparable data), but they can be ranked on various quality criteria such as drop-out rate, % of graduates going on to college, and average scores on standardized tests.

Such rankings are usually obtained by asking the name of the specific school attended and/or graduated from and then coding the individual schools into various quality levels. Of course by coding the names of particular high schools and colleges one can then include various other attributes of the school which may be related to quality or some other dimension (e.g. enrollment, student-to-teacher ratio, year founded, athletic division and conference).

Quality can also be measured for particular disciplines. These are also often measured by reputation, by the highest level in which a degree is conferred for a particular topic, or by quantitative measures such as the ratio of faculty to students in a field.

Quality might also be measured on the instructor level, possibly by looking at scores on state teacher competency exams, by the degrees that teachers hold, or by the publication record of professors. Such scores could be aggregated either at the school level, a departmental level (and thereby become a measure of either general, school quality or disciplinary quality) or unique scores could be calculated for each student based on his or her mix of courses and instructors.

At the individual level quality of education can mean an assessment of the quality of the educational inputs (as in the above example of a quality weighted evaluation of courses taken). However, it usually takes on a different meaning as a measure of the level of mastery and amount of knowledge that a student has obtained. This can be measured by grade point averages, grade-related graduation designations (e.g. summa cum laude, salutatorian), class rank, standardized test scores, admission to honor programs, and taking advance placement courses.

Another major aspect of education is its content. Content, or what is being taught, refers to ones course of study, to other non-course elements of schooling, and to the particular substance of specific courses and programs. Content may in effect define the type of education one receives and this is considered in the next

section. Most American high schools have general, vocational, and college/academic tracks or curriculums and associate degrees are classified by the Census as academic or occupational programs. At the college and graduate school level course of study is indicated by majors and minors. More completely, course of study is assessed by either transcripts of all courses taken or self-reported counts of number of courses in various key categories (e.g. number of years of math in high school).

The next aspect of content is the number, sequence, and nature of courses and other elements (e.g. practicums, internships, student teaching) that make up a program (e.g. either requirements for a academic track high school degree or those for a particular college major).

Both the content of courses and the course content of programs varies across jurisdictions, societies, and types of schools. For example, in the United States high school requirements vary across states and within each state's history requirements there are special units on local and sometimes regional history. Between nations and especially across socio-political systems, the differences are of course even greater with not only considerable different emphasis across and within such subjects as history, civics, literature, language, and religion, but also impacts that show up in even math and the natural sciences (Wenger, 1987; Weil, 1985).

In addition, schools include various activities that extend beyond formal courses. These include both formal involvements in sanctioned activities such as school sports, student government, school trips, and clubs and informal interactions such as student-teacher contacts, peer group friendships, etc.

Finally, type of schooling consists of several distinct classification systems. The various types overlap with elements of the quantity, quality, and content of education. Among the major distinctions are level, form, and governance/sponsorship. First, schooling is divided into a hierarchy of levels. The division into primary/elementary, secondary, and tertiary schooling, of junior and senior high, and undergraduate and graduate education is mostly just a simplified version of amount of schooling. However, since many other aspects of education are specified or organized by these standard levels, they are important in distinguishing various other educational types.

Second, regular or academic schooling, vocational training, and other non-academic, non-vocational education distinguishes 1) schooling oriented towards the granting of a high school or college degree, 2) extra-school, vocational programs that teach specific and applied occupational skills and knowledge and consist of a) trade schools (e.g. beauty and business schools), b) apprenticeship programs, c) formal, on-the-job training programs, d) informal, on-the-job learning, and e) other programs (e.g. internships, self-study) that do not confer an academic degree, and 3) various other educational experiences such as a) mostly short courses and programs with no degree goal or specific vocational objective such as adult educational classes sponsored by high schools and colleges, self-improvement seminars and workshops, lecture series,

etc., b) religious instruction such as Sunday school and Bible study groups, c) structured group learning programs such as Great Books, d) independent programs of learning such as reading all of Shakespeare, learning a foreign language from tapes, regularly watching Nova on PBS, and d) indirect, unstructured learning in the "college-of-life" from personal interactions, reading the daily paper, playing the stock market, etc. (Whether the latter in particular should be considered as part of education is questionable, but it is included here to indicate the range of possible educational types.)

Third, within the academic sector many other distinctions are made. Most American high schools are comprehensive schools covering several courses of study (see above), but particularly in larger school districts there are also specialized high schools. Vocational schools are by far the most common. Others include schools specializing in the fine arts and elite academies in math and science. Similarly, most colleges and universities are general in scope, but some have particular focuses or specializations such as in the liberal arts, the fine arts, applied or vocational fields, military and service academies, or the sciences and engineering. Also, at the college level, schools are typically divided by highest degree conferred into two-year/junior/community colleges, four-year colleges, universities, and research universities.

Fourth, schools can also be grouped by their governance and operation as public and private; the private schools as church-related and others; and the church schools by denomination (most typically Catholic and Protestant)(Wanner, 1986; Burgess, 1986; Greeley and Rossi, 1966).

Finally, numerous other classifications are possible. These include such distinctions as boarding vs. community schools, coed vs. single-sex schools, and various pedagogical approaches (e.g. Montessori, progressive, back-to-basics).

Of course these various aspects of education are not rigid and mutually exclusive classifications. Rather than neat and tidy, most educational aspects are mixed and messy. Some aspects of education appear in various forms and types. For example, vocational education shows up as a) separate from regular schooling, b) separate types of schools within regular schooling, c) separate tracks or majors within comprehensive high schools and colleges, and d) particular courses or classes. Or quantity and quality can be blurry distinctions. A student with good grades from a good school may be "better" educated than a student with poor grades from an average school even if the latter student attended school for more years. Or the interaction of aspects might be of particular importance. Bidwell (1989), for example, cites the value of examining how intensity of curriculum specialization varies by amount of education.

While these various, complex aspects of education are often considered extensively in the education research literature and the multifaceted nature of education is acknowledged by social scientists (Wanner, 1986; Bidwell, 1989; Burgess, 1986; Olneck, 1985), most are typically ignored in general, social science

research using education. The vast majority of sociological work with education relies on measures of educational quantity and omits all other aspects.

Neglecting various other aspects of education may misspecify the impact of education in a wide range of models. Net of quantity of education, other factors often play an important role in various relationships. A few examples of various aspects of quantity, quality, content, and type of education will illustrate this:

GEDs: Those who pass a high school equivalency examination are less successful than those who earn high school degrees through regular class attendance (Cameron and Heckman, 1993).

College quality: Spilerman and Lunde (1991) and Ishida (1990) report that more gains are accrued by those who attend elite or selective schools.

GPA and Courses: High school grades and college preparatory courses predict political efficacy and participation in collective action (Paulsen, 1991).

College major: Program of study helps to predict promotion opportunities (Spilerman and Lunde, 1991) and explains a range of attitudes, behaviors, and information (See below).

College level: undergraduates who enroll in two-year colleges, four-year colleges, and universities differ on a large number of background, behavioral, ability, and attitudinal variables (Astin, Dey, Korn, and Riggs, 1991).

Vocational education: In Germany (Braun and Mueller, forthcoming) combining vocational and regular schooling into a composite measure improves educational prediction of SES, attitudes, knowledge, and political interest. Vocational training also helps to understand high school success and staying in school (Kulik, 1994 and Rasinski and Pedlow, 1993).

Public/church/private schools: Coleman (Coleman, Hoffer, and Kilgore and Coleman and Hoffer, 1987) finds that student achievement is greater in non-public high schools.

Three examples from the General Social Survey (GSS) will more specifically illustrate the importance of non-quantity aspects of education. The first examines the impact of college major on knowledge, attitudes, and behaviors; the second the impact of educational content on science knowledge; and the third the differences between a domestic and foreign education.

College Majors

Among the college educated knowledge, attitudes, and behaviors vary by major. As Table 1.A shows four groups of majors (Humanities, Social Sciences, Natural and Physical Sciences, and Business/Vocational) are significantly related to a range of knowledge, attitudinal, and behavioral items net of years of schooling. In half of the 20 relationships college major is a significant predictor beyond what is explained by years of schooling. Years of schooling does generally produce higher associations than the single major variables (in 8 of 10 cases), but major adds significant independent predictions that make substantive sense (Table 1.B). For example, more years of schooling leads to more attendance of art museums/galleries and of concerts and being a humanities major increases attendance even more, while being a business/vocational major depresses attendance. Likewise, being a natural science major improves knowledge of science and being a social science major increases political liberalism.

Educational Content

As noted above, educational content varies across school systems and especially across nations. This is illustrated by the distinctive American response to a science knowledge item on evolution (True/False: Human beings developed from earlier species of animals). American understanding of this item is much lower than in Britain, Germany, or Norway and the American - European knowledge difference is much greater than on any of other 11 items on science and the environment (Smith, 1994). Only 45.3% of Americans knew this item compared to the European average of 73.0% for a difference score of -27.7 points. For 9 of the 12 science knowledge items Americans on average knew more than Europeans and on the two other items on which Americans knew less than Europeans the differences were much smaller (-10.4 and -14.0 points).

These differences probably come from the strength of Fundamentalists in American society. They have both restricted and watered-down the teaching of evolution in the public schools and have opposed evolutionary theory in religious instruction and preaching. The former reduces knowledge of evolution for the general population (Fundamentalists and non-Fundamentalists alike). Thus, even non-Fundamentalists Americans are less informed about evolution than Europeans are (respectively 54.2% to 73.0% for a difference of -18.8 percentage points). The latter creates a barrier to learning among the Fundamentalists in particular. As a result while 54.2% of non-Fundamentalists know that humans evolved from other species, only 27.6% of Fundamentalists know this.

Moreover, Fundamentalism creates a hinderance to education increasing knowledge about evolution. Among those in non-Fundamentalist denominations, 44.7% of those with less than a high school education correctly answer the question and 67.8% of those with a college degree know the answer. Among Fundamentalists 30.6% with less than a high school education know the answer and only 39.8% of the college educated answer correctly. Thus, higher education increases the knowledge of non-Fundamentalists by 23.1

points, but adds only 9.3% points for Fundamentalists.

Thus, different religious situations in America and Europe lead to different educational content and in turn these factors produce a much lower knowledge of evolutionary biology in the United States than in Europe.

Foreign Education

On the GSS and the Census those educated in foreign school systems are coded to their closest American equivalence (Davis and Smith, 1993; Siegel and Kominski, 1986). This procedure is complex and often less than perfect. Even when the "translation" into American levels has been done in the most appropriate manner, differences remain because of differences in the quality and content of educational systems (Shavit and Kraus, 1990). In addition, differences in customs and languages of those with foreign educations present a barrier and filter to the transmitting of educational attainment into dependent conditions, knowledge, behaviors, and attitudes.

Table 2 shows that for SES variables associations are similar for the foreign and domestically educated. However, with one exception, which we will take up later, the associations between educational attainment and knowledge are substantially lower for the foreign educated. We speculate that variability in English proficiency and other cultural differences decrease the association with vocabulary scores and, to a lesser extent, newspaper reading and interviewer ratings of comprehension. The link between educational attainment and science and environmental knowledge may also be attenuated by language difficulties. In addition, the scientific knowledge differs across countries (Smith, 1994) and may not relate to education in the same way (e.g. much technical knowledge in Germany is taught in apprenticeship programs that would not count as regular education under the American educational system, Braun and Mueller, forthcoming).

The exception is that among the foreign educated more schooling is more strongly associated with knowing the identity of various political leaders, similarly among the foreign educated educational attainment is slightly more related to political activism than it is among the American educated. However, educational attainment is unrelated to voting among the foreign educated. Education may play a somewhat stronger role among the foreign educated than among the American educated, because knowledge and activism are more determined by other factors such as personal, community ties and family political history. Voting is unrelated to education because only citizens can actually vote. Since most of the foreign educated are immigrants, they must first become citizens before they can vote. Unless gaining citizenship is strongly related to level of foreign education, the citizenship requirement would largely remove the association between more educational attainment and voting.

Finally, both of the tolerance measures are less strongly related to education among the foreign educated. As Weil (1985) observed in the case of anti-Semitism, strong and persistent

associations between education and tolerance in the US are often not found in other countries because the class and social ideologies and values stressed by the educational systems and the social groups that excel are often different from those typical in America. In particular, the item on the legality of Black-White inter-marriage may tap a peculiar American issue that has little relevance in many foreign societies and their educational systems.

Education is a complex and complicated concept with many facets and nuances (Wanner, 1986; Bidwell, 1989). It cannot be adequately measured with the simple yardstick of years of schooling As Bidwell (1989) notes "At the least, simple years of education completed is not likely to be theoretically appropriate whatever the research agenda (see also Braun and Mueller, forthcoming)." While it is not known whether various other aspects of education predict as well across as many variables and models as does quantity of education, the heavy emphasis on education in social science theory, its widespread use in actual analysis, and the breath of examples cited above argue for their greater, and perhaps regular, inclusion in both surveys and analysis.

Measuring Quantity of Education

Amount or quantity of education is typically measured in terms of either years or levels of school attended/completed, highest degree obtained, or some combination. Among these alternatives the most common choice has been years of schooling. As Kominski and Siegel (1987) observed, "Ask any social scientist or policy-maker the basic way of measuring schooling and the standard answer is 'years of schooling, completed'." From 1940 until recently the Census asked a two-part question on years of schooling "What is the highest grade or year of school ___ has ever attended? Did ___ complete the grade?" A similar years of schooling item was used on Occupational Change in a Generation I and II (OCGI and II). In 1990 the Census switched to a hybrid years of schooling/highest degree question (What is the highest level of school ___ has completed or the highest degree ___ has received?" Less than 1st grade/1-4th, 5-6th, 7-8th, 9th, 10th, 11th, 12th NO DIPLOMA, High School Graduate- high school DIPLOMA, or the equivalent (For example: GED), Some college but no degree, Associate degree in college-Occupational/vocational program, Associate degree in college-Academic program, Bachelor's degree, Master's degree, Professional School Degree, Doctorate degree) and the Current Population Survey (CPS) made the switch in 1992 (Siegel, 1991; Kominski and Siegel, 1993). Other studies such as the American National Election Studies and the GSS ascertain both facets of educational attainment. For example, the GSS asks a six-part question that separately measures both years of schooling (EDUC) and highest degree obtained (DEGREE):

> 1. What is the highest grade in elementary school or high school that you finished and got credit for?
> IF FINISHED 9TH-12TH GRADE OR DON'T KNOW:

2A. Did you ever get a high school diploma or
a GED certificate?
2B. Did you ever complete one or more years of
college for credit - not including schooling
such as business college, technical, or
vocational school?
IF "YES" TO 2B:
2B1. How many years did you complete?
2B2. Do you have any college degrees?
IF "YES" TO 2B2:
2B3. What degree or degrees? CODE HIGHEST
DEGREE EARNED.

While there is a strong association between years of schooling and highest degree obtained (r=.85 in the GSS), the match is far from perfect. For 71.8% the highest degree obtained matches the number of years of schooling typically associated with that degree (e.g. high school degree and 12 years of schooling). A few people (3.1%) report fewer years than are usually required for a degree, while 25.2% have "extra" years of schooling. The match is best at the low and high ends with 95% of those with no degree reporting less than 12 years of schooling and with 93.5% of those with a post-graduate degree having 5 or more years of college. In the middle the match is less close. Only 59.3% of those with a high school degree have exactly 12 years of schooling, 66.5% of associate degree holders have two years of college, and 75.2% of bachelor degree holders have four years of college.

The main measurement issues concerning amount of education center on the comparative advantage of years of schooling vs. the highest degree obtained. Table 3 examines the performance of these two measures of educational attainment and of various transformations and hybrids. These are described below. The number at the end in parentheses is the number of categories into which

DEGREE=Standard GSS variable measuring highest degree obtained
(5)
DEG1=DEGREE with each degree recoded in mean years on EDUC (5)
DEG2=DEGREE with each degree recoded into modal years on EDUC (5)
DEG3=DEGREE with each degree recoded into mean years on EDUC
and EDUC substituted if no degree obtained (17)

EDUC=Standard GSS variable measuring years of schooling
completed (21)
EDC1=EDUC with those with a degree recoded as having at least
the modal number of years associated with that degree
(e.g. If DEGREE=high school and EDUC less than 12, then
EDC1=12) (21)
EDC2=Same as EDC1, but mean used rather than mode (25)
EDC3=EDUC with cases that are outliers on the EDUC by DEGREE
crosstabulation recoded to the means as in EDC2. Outliers
are a small number of cases in which education is high on
DEGREE and low on EDUC or vice versa. (21)
EDC4=EDUC with cases that are outliers on the EDUC by DEGREE

crosstabulation recoded to the nearest non-extreme value (e.g. IF DEGREE=high school and EDUC less than 9, then EDC4=9) (21)
EDC5=Same as EDC4, but more cases are considered outliers (21)
EDC6=EDUC recoded to match DEGREE categories (5)

education is coded and/or recoded. The various transformations generally use information from the parallel educational attainment item to either adjust the scale values on the other item or to eliminate possibly erroneous outliers.

In most cases the difference in correlations are minor. In five cases the range in Pearson's r across the 11 educational attainment measures is less than 0.03, in five cases between 0.03 and 0.049, in three cases 0.06-.089, and in one case .161. While the choice of the exact way of operationalizing educational attainment does not usually make much difference, in about a third of the cases difference are notable.

While mostly small, the differences in associations do show patterns that are substantively meaningful. Looking first at the untransformed years and degree measures, we see that years of schooling has stronger associations with all five knowledge and both tolerance measures, highest degree has higher correlations with all three stratification variables, and participation is mixed (two higher on degree, one on years). Looking across all 11 educational attainment versions shows a similar pattern. The three SES and three participation items have their highest association with versions like degree that have only five categories. The six knowledge and two tolerance items have their strongest associations with versions that have 17+ categories. This pattern suggests that knowledge and tolerance increase with more years of schooling and each additional year on average boosts knowledge and tolerance. For SES and to a lesser extent participation, degree produces slightly higher associations. This suggests that gains in occupational prestige and income are closely tied to the step increases associated with degrees rather than the incremental increases represented by years of schooling. Participation probably has a similar pattern because more involvement is largely a function of higher SES.

Table 3 also indicates that at least among these 11 variants of education there is no generally superior measure. Only EDC3 (recoding outliers to the mean) fails to at least tie at producing the strongest association for at least one of the 14 comparisons. DEG3 (degree expressed in mean years with years substituted for those without a high school degree) leads the pack with three top associations, DEGREE follows with 2.5, and so on down to EDUC with one three-way tie for first place (.33).

The advantage of degree over years in five of the 14 comparisons is surprising since degree only differentiates education into five levels and clearly is less discriminating especially among those with less than a high school degree and those with some college education, but no degree beyond high school. That measuring educational attainment in terms of highest degree obtained can overcome this disadvantage to outscore years of

schooling in associations with SES and some other variables indicates that degrees have some special importance beyond that captured by years completed.

The independent contributions of years and degree are investigated in Table 4. It examines the nine of 14 variables in Table 3 that had enough cases to permit simultaneous controls for both measures of educational attainment. Table 4 shows that in eight of nine comparisons years of schooling and highest degree obtained are both independent predictors. Years of schooling is always significantly associated and only for newspaper readership does none of the four dummy variables for degree have a significant relationship. Including both years of schooling and highest degree obtained in a regression always increases the variance explained over what is explained by each educational attainment measure alone and in some cases the gains are notable. For example, years of schooling has an r2 of .270 with occupational prestige and adding the degree variables increases r2 to .312, an increase in variance explained of 4.2 percentage points. Similarly, degree alone has a r2 of .222 with the vocabulary test, while the combined r2 is .272. A similar analysis of the prediction of earnings from the 1990 CPS (Siegel, 1991) finds that "the differences between them [the degree and year variables] clearly suggest that overall, years of schooling leaves more to be explained by degrees than vice versa!"

The independent association of degree net of years of schooling with SES has been seen by some as evidence of "credentialism" (Kominski, 1989; Kominski and Siegel, 1993; Boylan, 1993; Arrow, 1973; Bills, 1988; Bills, 1992; Collins, 1979; Bidwell, 1989, Hunter and Leiper, 1993). At its minimum "credentialism" is taken to mean that additional rewards are being gained beyond that measured by the amount of education one has received. Often it is taken to mean that the gains are unearned because the bonus accruing with the degree does not reflect a true increase in human capital and job relevant skills. From the credentialism perspective degree may be only a marker of higher status and any gains related to them may in effect be a misguided reward for "mere credentials." Table 5 examines eight cases in which a person completed a normal amount of education associated with obtaining a degree and either did or did not receive the appropriate degree by two measures of knowledge and verbal ability and two SES measures. Among those completing 12 years of school, high school graduates have higher vocabulary scores and higher comprehension evaluations. They also score higher on occupational prestige and earnings. Similarly, among those with 16 years of schooling those earning a bachelor's degree have higher verbal scores and higher SES than those without this degree. For these groups it can be argued that higher occupational prestige and greater earnings associated with the obtaining of a degree are consistent with and possibly justified by their higher verbal skills. This would of course undermine the credentialism argument because it indicates that there are real differences in skills between degree holders and those with the same number of years of schooling, but without degrees.

For those with 14 or 15 years of schooling and either a high

school degree or an associate degree the situation is rather different. Among those with 14 years of schooling, associate degree holders have less verbal ability (but not significantly so), have more prestigious occupations and earn less (but not significantly) than those with only a high school degree. Thus, obtaining this degree is not associated with greater ability and leads to limited SES gains. For those with 15 years of schooling, associate degree holders have lower vocabulary scores and do not differ on comprehension compared to those with high school degrees. However, they have higher status and better paying jobs. This situation supports the credentialism critique that argues that rewards are given for diplomas that are not associated (as far as our limited measures go) with higher skill levels.

Probably one should not be surprised by the distinctive pattern shown by associate degrees. These degrees are not a way-station or prerequisite for a higher degree (as a bachelor's degree is for a master's or a master's for a doctorate). Instead they are often part of a separate, lower, and terminal track of college education.

The Reliability and Accuracy of Measures of Educational Attainment

Usually educational attainment is seen as a simple, straight-forward, and easy to measure (Siegel and Kominski, 1986; Kominski and Siegel, 1987; Braun and Mueller, forthcoming). Setting aside the varied questions about what should be measured, we here consider how reliably and accurately are the standard measures of years of schooling and highest degree obtained. Overall, the picture is rather mixed. Small test/retest studies conducted by the GSS in the 1970s founded educational attainment (both degree and years) to be very reliable with 96-98% reporting the same level over a three-week period, and Pearson r's of .90-.95 (Smith and Stephenson, 1979). Similarly, the OCGII test/retest correlation over a three-week period was .92 for non-Black males (Bielby, Hauser, and Featherman, 1977a and 1977b). Also, a comparison of the self-reports of married people to proxy reports by their spouses found that in the aggregate there are very small and statistically insignificant differences in both years of schooling and highest degree obtained (Smith, 1985).

In contrast, when a neighborhood sample was interviewed a year later (Haberman and Sheinberg, 1966) only 62% gave consistent responses. Similarly, the 1980 and 1990 Content Reinterview Surveys of the Census found respectively 69% and 72% giving consistent responses among the whole population and 72.5% and 72% for adults over 25 (US Bureau of the Census, 1986; US Bureau of the Census, 1993; Siegel and Kominski, 1986). Moreover, the index of inconsistency was higher for years of schooling than for many other Census demographics (US Bureau of the Census, 1986 and 1993). However, most inconsistencies are small. In 1990 of the 28% with inconsistent answers, 65% (18.3% of all) disagreed by only a single category (US Bureau of the Census, 1993).

Part of education's relatively low reliability on the Census

results from the fine-grain distinctions that are made between years attended and years completed. In addition, educational reports are typically given by one person for all household members and that informant may well differ from the Census to the reinterview. Also, in 1980 there was a tendency for the reinterview to report more education apparently because people reported on educational gains since the Census (the reinterview occurred after the end of the school year), even though they were asked to report on their education at the time of the Census (Kominski, 1985). This reflects a problem in implementation of the reinterview design and not an intrinsic defect in the measurement of educational attainment.

Even considering these differences in methods (which would lead to lower measured reliability on the Census compared to the GSS and OCGII), it is hard to fully reconcile the very reliable reports from the GSS and OCGII and the lower levels reported by the Census. Moreover, it is not known to what extent the unreliability comes from cognitive difficulties associated with the complexity of measuring education or perhaps variable reporting due to social desirability.

In respect to reliability of reports of parental education the GSS (Smith and Stephenson, 1979) finds that it is generally consistently reported in test/retest studies (% giving same response both times= father's degree .94-.97; father's years of schooling .95; mother's degree .93; mother's years of schooling .91) -- although not as high as for self. Blau and Duncan (1967) conclude that "OCG data on father's educational attainment are subject to relatively minor biases." This conclusion is supported by OCGII data and other sources (Bielby, Hauser, and Featherman, 1977a and 1977b; Borus and Nestel, 1973; and Looker, 1989).

Measuring Education Over Time

Implicit in most studies of changes in the educational distribution of the population is the assumption that a unit of education then is equivalent to a unit now (e.g. that 10 years of schooling in 1930 equals 10 years of schooling in 1950, 1970, or 1990). In fact, however, changes over time in the structure, content, and quality of education have occurred and these complicate trend and inter-generational studies (Siegel, 1985; Wanner, 1986; Collins, 1979; Burgess, 1986).

First, while there have been no fundamental changes in the structure of American education over the last 50 years, there have been a number of important shifts in the organization of schools. These changes include the virtual elimination of "one-room schoolhouses," the transformation of teacher colleges or normal schools into colleges and universities, the switch of nursing training from hospital-based to college-based, and the expansion of associate degrees compared to bachelor degrees.

Second, there is now less match between years of schooling completed and highest degree obtained than there used to be. As a result "'Years of schooling completed' does not connote the same thing now that it did in 1940.... To use the old item today and

attribute the 1940 meaning to the results would be misleading, and the problem would become more serious with each passing year (Kominski and Siegel, 1993; see also Olneck, 1985)."

Third, content has changed in a wide variety of ways. Once common courses such as Latin and Rhetoric have been dropped or transformed, while new offerings such as social studies and computers have been added. Moreover, the content of specific courses has changed. History courses not only naturally cover more history, but also have shifted away from ancient, European, and political history to contemporary, non-Western, and social history. Science classes not only cover recent scientific discoveries, but also emphasize different areas such as the environment. And of course there's been a general movement to make content across all courses less sexist and racist.

Fourth, there is a lively debate as to whether the quality of education has declined. Without addressing the issue as to whether the quality of education actually has risen, fallen, or remained the same (see Smith, 1993; Whittington, 1991), let's consider the implication of the hypothesized decline in quality. If the association between earnings and educational attainment appeared to decrease over time, it might mean that education had become less predictive of income (perhaps because it was less occupationally oriented than previously) or that a unit of education (either a year completed or a particular degree obtained) no longer reflected as much human capital accrued. In constant educational units ("deflated" for the drop in value per current educational unit) the earnings return might be as strong as ever.

Finally, if the increases in educational levels over time are real (and not totally off-set by a decline in quality), then one might consider whether comparisons should be based on absolute educational attainment, or relative educational positioning. For example, if a parent born in 1920 got a bachelor's degree and a child born in 1950 achieved the same, then their educational attainment would be equivalent. However, among the parent's cohort only about 8% were college graduates, while among the child's cohort about 22% held college degrees. The parent was thus in a much more exclusive educational group than the child and perhaps at more advantage in terms of occupational prospects because of the restricted supply of college graduates.

Intergenerational Measures of Education

In addition, there are some special and different problem that relate to another way of studying change over time, inter-generational educational mobility. While intergenerational attainment models are quite popular and respondent's and parental education are used in most models, this research typically devotes little attention to how education is measured for respondent or parents. The main problem is that parental educational information is incomplete and less reliable than for self.

As an analysis of the 1972-1992 GSSs shows, sample inclusion and case base can be notably changed by the adoption of various conventions (Table 6, Part 1). If one wants to separately measure

both years of schooling and highest degree obtained for respondent and both parents (Condition A), then only 65.2% of the cases will remain in the analysis. If these criteria are relaxed in various ways, sample size and sample coverage both increase. For example, if one settles for highest degree obtained for all three people (Condition C), then 73.2% are retained. If one wants to maximize coverage by accepting either years of schooling or highest degree converted into years of schooling and use mother's or father's education alone if only one is known, then fully 93.9% are included. (For 5.9% there is no parental information, for 0.1% no respondent information, and for 0.1% no parental and no respondent information.) Thus, there is nearly a 29 percentage point gain from minimum to maximum inclusion.

Moreover, the shift in inclusion can alter the analytical results. Creating an intergenerational change variable by subtracting parental years of schooling from respondent's, shows about the same magnitude of educational gain across inclusion levels (Table 6, Part 2). Under minimum inclusion 74% of respondents exceed the average years of schooling of their parents, while under maximum inclusion 73% of respondent's exceed the (average) years of schooling of their parent(s). The mean gains are respectively + 2.69 years and + 2.62 years.

Similarly, there is little difference in educational change for males and females by method. But for race method makes a difference. Under minimum inclusion Blacks gain 0.44 years of schooling more than Whites, but under maximum inclusion the Black edge falls by 75% to only 0.11 years. This occurs because a) Black gains are reduced from 3.07 to 2.70 years when coverage is expanded, while White gains are hardly affected (dropping from 2.63 to 2.59) and b) because changing the method increases the number of Blacks included by 88.5% (as opposed to only 35% for Whites). In effect, this means that there are more Blacks than Whites from single-parent families and that in terms of the intergenerational transmission of education, Blacks from single-parent families differ more from Blacks from two-parent families than Whites differ by intactness of parental household. Additionally, in the case of the big city/suburb comparison the direction of the relationship is actually changed by the method used.

As this example illustrates, how researchers implement an analysis of intergenerational educational change can appreciably affect results. Other ways of operationalizing intergenerational educational attainment such as using highest degree obtained rather than years of schooling, taking the highest parental education level rather than the average, or using the educational level of the parental head of household could produce a range of other results. Similar differences presumably occur in more elaborate models of intergenerational mobility.

Conclusion

The old proverb, "If a thing is worth doing, it is worth doing well," applies with special relevance to the measurement of education. Education is among the most important variables in

social science. It fits into more models and explains more variation than any other single concept. The standard way of measuring education by assessing years of schooling or highest degree obtain probably captures the single most important aspect of education, but it both rarely measures that aspect thoroughly and also almost totally neglects other important aspects.

Education should be measured in a more complete and detailed manner than is now typical. First, this will clarify and refine our understanding of education's relationship to other variables (earnings, tolerance, etc.). Second, in all likelihood, well-measured education will explain significantly more than crudely and one-dimensionally measured education. We are likely to gain more explanatory power by measuring education more fully and precisely than by throwing in an array of miscellaneous, non-educational variables into most social science models.

While the exact combination of aspects that should be routinely measured is uncertain, there is ample evidence that important dimensions are now being omitted. The Census review for the 1990 Census of what aspects of education should be assessed provides a good starting point (Friedman, 1989). It proposed that the following educational aspects be covered in the 1990 Census:

High Priority

- Enrollment by level
- Highest degree received
- Field of postsecondary degree beyond associate level
- Vocational or occupational training
- Report separately persons achieving high school graduation through an equivalency test

Medium Priority

- Field of vocational or occupational training
- Field of associate-level degree

Low Priority

- Control of school (public/private)
- Attainment by grade categories for elementary school

Unfortunately none of these recommendations were acted upon and the 1990 Census instead merely created a new, hybrid years/degree question to replace its traditional years of school item. One small step, at best.

Table 1

The Relationship of College Major to Knowledge, Attitudes, and Behaviors

A. Pearson's r, Net of Years of Schooling

	Human-	Social	Natural	Business/

	ities	Sciences	Sciences	Vocational
Science Test	.029	.059	.109**	-.115**
Approval of Homosexuality	.096*	.124**	-.036	.057
Political Orientation	-.042	-.109**	.064	.115**
Attend Concert	.098**	.036	.052	-.097**
Visit Art Museum	.140**	.024	-.026	-.082**

*=probability <.05
**=probability <.01

B. Regression of Major and Years of Schooling, Standardized Coefficient/Probability

	Years of Schooling	Human-ities	Social Sciences	Natural Sciences	Business/ Vocational
Science Test	.312/.000			.104/.003	
Science Test	.309/.000				-.110/.002
Homosexuality	.234/.000	.094/.031			
Homosexuality	.220/.000		.122/.006		
Pol. Orient.	-.060/NS		-.109/.002		
Pol. Orient.	-.062/NS				.081/.024
Attend Concert	.225/.000	.093/.007			
Attend Concert	.215/.000				.095/.007
Visit Art	.210/.000	.137/.000			
Visit Art	.205/.000				-.081/.020

NS=not statistically significant at .05 level

Source: 1993 GSS

Science Test=Additive scale of five items on science knowledge (SCITEST1-SCITEST5)
Approval of Homosexuality=What about sexual relations between two adults of the same sex--do you think it is always wrong, almost always wrong, wrong only sometimes, or not wrong at all? (HOMOSEX)
Political Orientation=I'm going to show you a seven-point scale on which the political views that people might hold are arranged from extremely liberal--point 1--to extremely conservative--point 7.

Table 1 (continued)

Where would you place yourself on this scale? (POLVIEWS)
Attend Concert and Visit Art Museum=Next I'd like to ask about some leisure or recreational activities that people do during their free time. As I read each activity, can you tell me if it is something you have done in the past twelve months? Visit an art museum or gallery (VISITART)? Go to a classical music or opera performance, not including school performances (GOMUSIC)? Coded so attending is

the high value.
Humanities=English, Literature, Foreign Languages, Fine Arts, Other Humanities
Social Sciences=Economics, Psychology, Government/Civics, Other Social Studies
Natural Sciences=Mathematics, Science, Engineering
Business/Vocational=Business, Other Vocational

Note: Note in this and subsequent tables all multi-regression analysis with dependent dichotomies was also run as logistic regressions. All coefficients reported as statistically significant in the OLS regressions were also significant in the logistic regressions.

Table 2

Correlation of Various Educational Attainment Variables with Selected Items by Place of Education

(Pearson's r)

	Years of Schooling		Highest Degree	
	USA	Other	USA	Other - a
SES				
Occ. Pres70	.520	.531	.539	.603
Occ. Pres80	.508	.476	.541	.561
Income	.337	.286	.365	.369
Knowledge				
Vocab. Test	.526	.347	.495	.303
Green Test	.359	(.054)	.338	(.012)
Sci. Test	.416	.305	.423	.252
Officals	.071	(.204)	.125	(.410)
Int. Scale	.404	.349	.300	.271
Newspaper	.237	.169	.193	.160
Participation				
Memberships	.352	.224	.355	.239
Pol. Active	.213	(.254)	.230	(.272)
Voted	.224	(-.014)	.246	(-.015)
Tolerance				
Free Spch.	.380	.254	.337	.270
Miscegen.	.319	.097	.268	.105

Source: 1984-93 GSS

(---)=not statistically significant at .05 level

a - People living outside the US at age 16 are counted as having been educated in another country.

Table 3

Correlation of Various Educational Attainment Variables with Selected Items

(Pearson's r)

	DEGREE	DEG1	DEG2	DEG3	EDUC	EDC1	EDC2	EDC3	EDC4	EDC5	EDC6
SES											
Occ. Pres70	.543	.533	.533	.508	.519	.522	.533	.521	.521	.523	.541
Occ. Pres80	.542	.527	.537	.498	.505	.509	.508	.510	.508	.510	.538
Income	.365	.347	.369	.333	.331	.331	.330	.330	.331	.334	.352
Knowledge											
Vocab. Test	.471	.490	.443	.496	.508	.510	.509	.508	.509	.510	.492
Green Test	.306	.314	.293	.319	.331	.339	.340	.332	.332	.332	.320
Sci. Test	.402	.400	.393	.393	.402	.406	.406	.401	.402	.403	.406
Officals	.177	.189	.163	.190	.178	.180	.180	.177	.178	.180	.171
Int. Scale	.287	.337	.240	.401	.395	.395	.394	.394	.396	.397	.304
Newspaper	.189	.202	.173	.238	.232	.231	.230	.231	.232	.233	.186
Participation											
Memberships	.346	.341	.339	.327	.343	.343	.343	.343	.344	.344	.354
Pol. Active	.230	.230	.225	.213	.214	.209	.207	.209	.213	.215	.224
Voted	.223	.226	.213	.206	.208	.207	.208	.208	.209	.206	.226
Tolerance											
Free Spch.	.342	.360	.316	.374	.392	.392	.391	.392	.393	.393	.368
Miscegen.	.294	.321	.263	.333	.345	.343	.342	.344	.345	.345	.316
Number of High -est Correla- tions	2.5	1.0	1.0	3.0	0.33	1.5	1.5	0.0	0.83	0.83	1.5

Probability: All correlations are statistically significant at least the .01 level.

Source: 1984-93 GSS

Educational Attainment Variables

DEGREE=Standard GSS variable measuring highest degree obtained
DEG1=DEGREE with each degree recoded in mean years on EDUC
DEG2=DEGREE with each degree recoded into modal years on EDUC
DEG3=DEGREE with each degree recoded into mean years on EDUC and EDUC substituted if no degree obtained

Table 3 (continued)

EDUC=Standard GSS variable measuring years of schooling completed
EDC1=EDUC with those with a degree recoded as having at least the modal number of years associated with that degree (e.g. If DEGREE=high school and EDUC less than 12, then EDC1=12)
EDC2=Same as EDC1, but mean used rather than mode.
EDC3=EDUC with cases that are outliers on the EDUC by DEGREE crosstabulation recoded to the means as in EDC2. Outliers are a small number of cases in which education is high on DEGREE and low on EDUC or vice versa.
EDC4=EDUC with cases that are outliers on the EDUC by DEGREE crosstabulation recoded to the nearest non-extreme value (e.g. IF DEGREE=high school and EDUC less than 9, then EDC4=9).
EDC5=Same as EDC4, but more cases are considered outliers.
EDC6=EDUC recoded to match DEGREE categories.

Dependent Variables

Occ. Pres70=Occupational prestige based on 1970 Census codes for occupation (PRESTIGE)
Occ. Pres80=Occupational prestige based on 1980 Census codes for occupation (PRESTG80)
Income=Respondent's earned income in real dollars (REALRINC)
Vocab. Test=score on 10-item vocabulary test (WORDSUM)
Green Test=score on seven items on knowledge of environment (GRNTEST1-7), asked only in 1993
Sci. Test=score on five items on knowledge of science (SCITEST1-5), asked only in 1993
Officals=knowing who is governor, US representative, and head of school board (GOVERNOR, USREP, SCHLHEAD), asked only in 1987
Int. Scale=interviewer rating of the comprehension of respondent (COMPREND)
Newspaper=frequency of reading newspaper (NEWS)
Memberships=number of voluntary groups belonging to (MEMNUM)
Pol. Active=number of organizational activities engaged in (SERVEGRP,LEADGRP,GIVEGRP,ATTNDGRP,WRITEGRP,LOBBYGRP), asked only in 1987
Voted=voted in most recent presidential election (VOTE80,84,88,92)
Free Spch.=willing to allow Communist, atheist, racist, militarist, and homosexual make speech (SPKCOM,SPKATH,SPKRAC,SPKMIL, SPKHOMO)
Miscegen.=against laws prohibiting marriage of Blacks and Whites (RACMAR)

Table 4

Multiple Regression of
Years of Schooling and High Degree Obtained
by Various Items

Dependent Variables	Years of Schooling	Degree HS	Assoc.	Bach.	Masters	r2
Occ. Pres70	.243	.116	.105	.256	.319	.312
Income	.112	(.035)	.034	.169	.286	.148
Vocab. Test	.354	.161	.061	.202	.138	.272
Int. Scale	.422	.162	.049	(-.002)	-.062	.190
News	.239	(.029)	(.007)	(.005)	(-.009)	.055
Memberships	.196	.056	.146	.044	.163	.130
Voted	.047	.115	.093	.182	.143	.052
Free Spch.	.308	.077	.059	.086	.051	.144
Miscegen.	.268	.115	.068	.086	(.031)	.102

(---)=not statistically significant at .05 level

Source: GSS, 1984-93

Table 5

Differences in Knowledge and SES by
Years of Schooling and Highest Degree Obtained

Educational Level	Vocab. Test	Int. Scale	Occ. Pres70	Income
12 years				
No Degree	4.8 (54)	1.51 (103)	34.3 (79)	$15306 (46)
HS Degree	5.7 (2418)	1.17 (4213)	37.6 (3214)	$16665 (2502)
14 years				
HS Degree	6.5 (564)	1.10 (950)	41.4 (687)	$20455 (602)
Assoc. Deg.	6.3 (264)	1.08 (416)	43.2* (305)	$19569 (297)
15 years				
HS Degree	6.8 (255)	1.07 (442)	44.1 (297)	$17076 (264)
Assoc. Deg.	6.3* (76)	1.05 (133)	47.9* (102)	$20687* (93)
16 years				
HS Degree	6.7 (59)	1.12 (84)	41.7 (55)	$15069 (52)
Bach. Deg.	7.4 (781)	1.06 (1292)	49.8 (927)	$27221 (877)

Probability: All differences between No Degree and HS Degree and HS Degree and Bach. Deg. are statistically significant at least at the .03 level. Associate Deg. differences that are statistically significant at the .05 level are noted with an asterisk (*).

Source: 1984-1993 GSS

Table 6

Intergenerational Educational Comparisons

1. Inclusion in Analysis	% of All Cases
A. Complete Information (Respondent's, Mother's Father's years of schooling and highest degree)	65.2
B. Respondent's, Mother's, and Father's years of schooling	67.2
C. Respondent's, Mother's, and Father's highest degree	73.2
D. Respondent's, Mother's, and Father's years of schooling or highest degree	75.4
E. Respondent's and Mother's and/or Father's years of schooling	87.5
F. Respondent's and Mother's years of schooling or highest degree	89.5
G. Respondent's, Mother's and/or Father's years of schooling or highest degree	93.9
	(27075)

2. Measures of Educational Change (Respondent's Education - Parent's Education)

	Complete Information (A)	Maximum Coverage (G)
% Gain in Education	74.0%	72.9%
Mean Change		
All	+2.69	+2.62
Whites	+2.63	+2.59
Blacks	+3.07	+2.70
Males	+2.80	+2.76
Females	+2.60	+2.60
12 Large Central Cities	+2.87	+2.73
Suburbs of 12 Largest Central Cities	+2.81	+2.80

Source: 1972-92 General Social Surveys

References

Arrow, Kenneth J., "Higher Education as a Filter," Journal of Public Economic, 2 (July, 1997), 193-216.

Astin, Alexander W.; Dey, Eric L.; Korn, William S.; Riggs, and Ellyne R., The American Freshman: National Norms for Fall 1991. Los Angeles: Cooperative Institutional Research Program, 1991.

Beck, E. M., Horn, Patrick M.; and Tolbert, Charles M., II, "Stratification in a Dual Economy: A Sectoral Model of Earnings Determination," American Sociological Review, 43 (October, 1978), 704-720.

Bidwell, Charles E., "The Meaning of Educational Attainment," Research in the Sociology of Education and Socialization, 8 (1989), 117-138.

Bielby, William T.; Hauser, Robert M.; and Featherman, David L., "Response Errors of Black and Nonblack Males in Models of Intergenerational Transmission of Socioeconomic Status," American Journal of Sociology, 82 (May, 1977a), 1242-1288.

Bielby, William T.; Hauser, Robert M.; and Featherman, David L., "Response Errors of Nonblack Males in Models of the Stratification Process," Journal of the American Statistical Association, 72 (December, 1977b), 723-735.

Bills, David B., "Credentials and Capacities: Employers' Perceptions of the Acquisition of Skills," Sociology Quarterly, 29 (1988), 439-449.

Bills, David B., "The Mutability of Educational Credentials as Hiring Criteria," Work and Occupations, 19 (February, 1992), 79-95.

Blau, Peter M. and Duncan, Otis Dudley, The American Occupational Structure. New York: John Wiley & Sons, 1967.

Borus, Michael E. and Nestel, Gilbert, "Response Bias in Reports of Father's Education and Socioeconomic Status," Journal of the American Statistical Association, 68 (December, 1973), 816-820.

Boylan, Ross D., "The Effect of Number of Diplomas on Their Value," Sociology of Education, 66 (July, 1993), 206-221.

Braun, Michael and Mueller, Walter, "Measurement of Education in Comparative Research," unpublished ZUMA report, May, 1994.

Burgess, Robert G., "Education," in Key Variables in Social Investigation, edited by Robert G. Burgess. London: Routledge & Kegan Paul, 1986.

Cameron, Stephen and Heckman, James, "Nonequivalence of High School Equivalents," Journal of Labor Economics, 11 (January, 1993), 1-47.

Coleman, James S. and Hoffer, Thomas, Public and Private High Schools: The Impact of Communities. New York: Basic Books, 1987.

Coleman, James S.; Hoffer, Thomas; and Kilgore, Sally B., High School Achievement: Public, Catholic, and Private Schools Compared. New York: Basic Books, 1982.

Collins, Randall, The Credential Society: An Historical Sociology of Education and Stratification. New York: Academic Press, 1979.

Davis, James A., "Background Variables and Opinions in the 1972-1977 NORC General Social Surveys: Ten Generalizations about Age, Education, Occupational Prestige, Race, Religion, and Sex, and Forty-Nine Opinion Items," GSS Topical Report No. 2. Chicago: NORC, 1979.

Davis, James A. and Smith, Tom W., General Social Surveys, 1972-1993: Cumulative Codebook. Chicago: NORC, 1993.

Faia, Michael A., "Selection by Certification: A Neglected Variable in Stratification Research," American Journal of Sociology, 86 (March, 1981), 1093-1111.

Friedman, Kathy V., 1990 Census of Population and Housing Content Determination Reports: Education. Washington, DC: Bureau of the Census, 1989.

Greeley, Andrew M. and Rossi, Peter H., The Education of Catholic Americans. Chicago: Aldine, 1966.

Haberman, P.W. and Sheinberg, J., "Education Reported in Interviews: An Aspect of Survey Content Error," Public Opinion Quarterly, 30 (Summer, 1966), 295-301.

Halaby, Charles N., "Overeducation and Skill Mismatch," Sociology of Education, 67 (January, 1994), 47-59.

Hauser, Robert M., "On 'Stratification in a Dual Economy'," American Sociological Review, 45 (August, 1980), 702-712.

Himmelstein, Jerone L. and McRae, James A., Jr., "Social Issues and Socioeconomic Status," Public Opinion Quarterly, 52 (1988), 492-512.

Hunter, Alred A. and Leiper, Jean McKenzie, "On Formal Education, Skills, and Earnings: The Role of Educational Certificates in Earnings Determination," Canadian Journal of Sociology, 18 (Winter, 1993), 21-42.

Ishida, Hiroshi, "Educational Credentials and the Labor Market in Japan: A Cross-National Comparison with the United States and Britain," International Journal of Comparative Sociology, 31 (Sept./Dec., 1990), 139-155.

Kominski, Robert, "Education and Earnings: Empirical Findings from Alternative Operationalizations," 1988 Proceedings of the Social Statistics Section, American Statistical Association. Washington, DC: ASA, 1989.

Kominski, Robert, "Evaluation of the 1980 Decennial Census Education Questions," Preliminary Evaluation Results Memorandum No. 104. Bureau of the Census, May, 1985.

Kominski, Robert and Siegel, Paul M., "Measuring Educational Attainment in the 1990 Census," Paper presented to the American Sociological Association, Chicago, August, 1987.

Kominski, Robert and Siegel, Paul M., "Measuring Education in the Current Population Survey," Monthly Labor Review, 116 (September, 1993), 34-38.

Kulik, James A., "High School Vocational Education and Curricular Tracking," Unpublished report, University of Michigan, 1994.

Looker, E. Dianne, "Accuracy of Proxy Reports of Parental Status Characteristics," Sociology of Education, 62 (October, 1989), 257-276.

Olneck, Michael R., "Critique of Questions Pertaining to Education in SIPP," Journal of Economic and Social Measurement, 12 (December, 1985), 299-304.

Paulsen, Ronnelle, "Education, Social Class, and Participation in Collective Action," Sociology of Education, 64 (April, 1991), 96-110.

Rasinski, Kenneth A. and Pedlow, Steven, "Using Transcripts to Study the Effectiveness of Vocational Education, Journal of Vocational Education, forthcoming.

Shavit, Yossi and Kraus, Vered, "Educational Transitions in Israel: A Test of the Industrialization and Credentialism Hypotheses," Sociology of Education, 63 (April, 1990), 133-141.

Siegel, Paul, "High School Graduates in Census Data," Bureau of the Census Memorandum, February 6, 1985.

Siegel, Paul, "Note on the Proposed Change in Measurement of Educational Attainment in the Current Population Survey," Unpublished report, Bureau of the Census, February, 1991.

Siegel, Paul M. and Kominski, Robert, "The Quality of Census Data on Educational Attainment," Paper presented to the Census Advisory Committee on Population Statistics, Arlington, October, 1986.

Smith, Tom W., "An Analysis of the Accuracy of Spousal Reports," GSS Methodological Report No. 35. Chicago: NORC, 1985.

Smith, Tom W., "College Dropouts: An Analysis of the Psychological Well-being and Attitudes of Various Educational Groups," Social Psychology Quarterly, 45 (1982), 50-53.

Smith, Tom W., "The Relationship of Age and Education Across Time," Social Science Research, 22 (1993), 300-311.

Smith, Tom W., "Who, What, When, and Why: An Analysis of Usage of the General Social Survey, 1972-1991," GSS Project Report No. 18. Chicago: NORC, 1992.

Smith, Tom W., "Knowledge of Science and the Environment in Germany, Great Britain, Norway, and the United States," Paper presented to the Midwest Association for Public Opinion Research, November, 1994.

Smith, Tom W. and Stephenson, C. Bruce, "An Analysis of Test/Retest Experiments on the 1972, 1973, 1974, and 1978 General Social Surveys," GSS Methodological Report No. 8. Chicago, NORC: 1979.

Spilerman, Seymour and Lunde, Tormod, "Features of Educational Attainment and Job Promotion Prospects," American Journal of Sociology, 97 (November, 1991), 689-720.

U.S. Bureau of the Census, Content Reinterview Study: Accuracy of Data for Selected Population and Housing Characteristics as Measured by Reinterview. PHC80-E2. Washington, DC: Bureau of the Census, 1986.

U.S. Bureau of the Census, Content Reinterview Survey: Accuracy of Data for Selected Population and Housing Characteristics as Measured by Reinterview. 1990 CPH-E-1. Washington, DC: Bureau of the Census, 1993.

Van Dusen, Roxann A. and Zill, Nicholas, Basic Background Items for U.S, Household Surveys. Washington, DC: Social Science Research Council, 1975.

Walberg, Herbert J. and Weinstein, Thomas, "Adult Outcomes of

Connections, Certification, and Verbal Competence," Journal of Educational Research, 77 (March/April, 1984), 207-212.

Wanner, Richard A., "Educational Inequality in Twentieth-Century Canada and the United States," Comparative Social Research, 9 (1986), 47-68.

Weil, Frederick D., "The Variable Effects of Education on Liberal Attitudes: A Comparative-Historical Analysis of Anti-Semitism Using Public Opinion Survey Data," American Sociological Review, 50 (August, 1985), 458-474.

Wenger, Morton G., "The stratification of Higher Education in Contemporary America: Dimensions and Consequences," Humanity & Society, 11 (May, 1987), 137-151.

Whittington, Dale, "What Have 17-Year-Olds Known in the Past?" American Educational Research Journal, 28 (Winter, 1991), 759-780.

Zucker, Lynne G. and Rosenstein, Carolyn, "Taxonomies of Institutional Structure: Dual Economy Reconsidered," American Sociological Review, 46 (December, 1981), 869-884.

In addition, there may be non-scholastic gains either of a psychological nature (improved self-image, more self-esteem, etc.)

Or college major is partly indicated by degrees obtained (e.g. BA and MA vs. BS and MBA) and courses taken.

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16 years

HS Degree	6.7	(59)	1.12	(84)	41.7	(55)	$15069 (52)
Assoc. Deg.	6.4	(23)	1.04	(36)	51.2	(20)	$21666 (20)
Bach. Deg.	7.4	(781)	1.06	(1292)	49.8	(927)	$27221 (877)

Census specialists also see advantage in measuring both degree and years, but adopted an hybrid approach as a compromise (Siegel and Kominski, 1986) REVIEW REPORT

Transforming the variables rarely adds or subtracts greatly from the raw years and degree variables.

Similarly, traditionally, but perhaps not any longer, Catholic high schools were seen as weak on science.

--- It is not that Fundamentalism primarily succeeds in teaching so-called creation science. The % of Fundamentalists who say that the statement is false is actually slightly lower than among non-Fundamentalists (17.3% vs 22.5%). The difference is that a majority of Fundamentalists (55.2%) say they Can't Choose compared to only 23.2% among non-Fundamentalists. Even among the college educated

46.9% of Fundamentalists say they Can't Choose compared to only 17.4% of non-Fundamentalists.