# 2 Enduring Effects on Knowledge

The domain of knowledge we have been able to examine by secondary analysis contained 250 discrete items of information requested in American national surveys between 1949 and 1971. Since the influence of education on each item (with a few exceptions) is examined separately for each of four age cohorts, our fundamental findings involve about a thousand sets of comparisons of knowledge among several educational levels. How to present such massive evidence creates a severe problem. Compression and condensation are essential if the reader is not to become submerged and finally drown in the ocean of data. In a letter to the *New York Times*, one poor soul who had waded through the Coleman report, survived then to read Jencks's work, only finally to confront the recent multivolume report of the International Association for the Evaluation of Educational Achievement, put the problem poignantly: "The voice of reason is overwhelmed by the vast array of codified data" (9 June, 1973, p. 32).

We are alerted to rescue our reader from the vasty deep of our data. But if we condense too much and too quickly, we shall prevent his drowning only to leave him on the surface or in the shallows, barred from exploring our basic findings in depth. The compromise we have adopted is to present the detailed findings in lengthy tables that may appear formidable but provide, for the interested reader, a substantial portion, but *not all*, of the specific results from the analysis of each item of knowledge. These tables, however, are presented only in Appendix B rather than in the text in order not to burden readers who need only a summary of the detailed findings or who would feel "overwhelmed by the vast array" of the many thousands of numbers presented. In Appendix B, the two domains, knowledge of "public affairs" and "academic" knowledge, are treated in separate tables, and within each table the items have been grouped into more homogeneous categories of content. From the multiple findings for all items in each category, summary measures have been computed and also incorporated into the tables. Thus some order and simplification have been provided to encourage and help the reader to inspect and com-

prehend the many pages of details. Tables containing only summary measures are presented in Appendix A and present the basic findings for all readers in a compressed, but still quantitative, form. The findings and conclusions we have drawn from the detailed analyses are also summarized in the lengthy, but simpler and qualitative, text of this chapter. And the text also describes the nature and purpose of the various indexes and statistics employed to assess the effects of education, thus serving as a guide to the tables.

## FUNDAMENTAL FINDINGS IN THE DETAILED TABLES

The set of tables numbered 1.1 through 1.8 in Appendix B present the detailed data for the first period, the early 1950s. The sets prefixed by 2., 3., and 4. present the data for the late 1950s, early 1960s, and late 1960s, respectively. Within each of these periods, separate tables are presented for each of the four age cohorts. Thus tables 1.1 through 1.4 show the knowledge of public affairs of the four cohorts reaching the specified ages in the year each survey from the early 1950s was conducted, and tables 1.5 through 1.8 provide data on academic knowledge. Tables 2.1 through 2.8 present equivalent findings for the second period, and the remaining sets contain equivalent data for later periods. In the two periods in the 1960s, as earlier noted, there were unfortunately very few measures of "*academic* knowledge." Thus it was possible to consolidate the findings for the four age cohorts into one table for each time, tables 3.5 and 4.5, respectively. Tables 1.1–4.5 in Appendix B, taken together, thus present the detailed fundamental findings for the four periods between the early 1950s and the late 1960s. Detailed results for the four cohorts on each of the four items piggybacked on a 1974 survey to enlarge the number of tests of academic knowledge for a fifth—most recent—period are presented in table 5.1.

The clusters of items representing two specialized content areas mentioned earlier, knowledge of vocabulary and knowledge of tools and duties of occupations, are presented in separate tables in Appendix A, as are the cluster of eleven items dealing with "popular culture," in a set of four tables, one for each cohort.

Various indexes could be employed to show the extent of the influence of education on each item. Any single index, by its unique properties, would provide some special perspective on the question of effects, but it could also have some special limitation. To prevent arbitrariness, we have used various ways of gauging effects that are incorporated in the tables. In assessing the problem, the reader can follow any or all of the avenues opened for him, but the basic data presented also permit him to construct other preferred indexes of his

own. As essential background for understanding the various approaches chosen and for interpreting the general findings, we must make some brief prefatory remarks about the measurement of the two variables, education and knowledge, in the surveys.

Educational attainment is measured in the surveys in a series of fairly fine step intervals—generally six, but never fewer than five or more than nine, levels. Those who completed high school or college are always distinguished from those who did not complete the stage, and those whose education terminated *no later than* elementary school graduation are always distinguished from those who went on to secondary education. Except for occasional surveys—too few to cause worry—those who reported "no schooling" whatsoever are separated from those who had any schooling at all. It should be stressed that the most disadvantaged group have been so small a component of the white population of the United States during the periods studied that mixing them with those who had elementary schooling (in the "cruder" surveys, where this practice perforce was followed in the analysis) adds very little error to estimates of knowledge for the elementary school group. Although those who had no schooling could be and were isolated in the analysis of most surveys, no separate estimates of the level of knowledge of such individuals are presented because the size of the group in our samples is too small.[1] These are the usual six levels of educational attainment distinguished.

Sometimes, but not often enough for that refinement to be routinely applied to the analysis, those who did not complete elementary school are distinguished from those who graduated. Thus the knowledge attributed to the group labeled "elementary school" in our tables may be taken safely to reflect the influence of at least some quantum of school but represents the effects of from one to eight years of education.[2] At the higher levels of education, sometimes those who had some vocational or trade school in addition to regular high school are coded in a separate category, and, as noted earlier, sometimes those who had professional or graduate training in addition to college are also coded separately. In a considerable number of instances, when it was possible to make the distinction, the estimates of knowledge for the high school and college graduates apply to the purified categories of those who stopped at those points, but more of the time these two groups may in fact be reflecting the effects of some additional training that cannot be eliminated.

In contrast with the relatively refined measurement of educational attainment, the dependent variables, knowledge of discrete items, were generally measured by single questions which classified the individual as either having "correct knowledge" or not. Sometimes a more refined score was obtained: individuals were classified at more than

two points along an ordinal scale, as having "completely correct" knowledge, having "partially correct" or "vague" knowledge, or being incorrect or having no knowledge at all. Occasionally, an even more refined measurement was obtained. The discrete "item" was itself an index or scale based on a battery of related questions or on a complex question with subparts. In such cases, the scores sometimes could be construed as reflecting an interval scale—individuals having zero knowledge or having double, triple, etc., the knowledge of some multiplicity of facts—or the scores could be treated simply on an ordinal scale of lesser or greater knowledge rather than as precise quantities of knowledge. Many of the indexes could be treated certainly only in terms of ordinal measurement, with individuals being coded only into such categories as "high," "medium," or "low" in knowledge.

In the first approach to the data, in tables 1.1–4.5 in Appendix B, using the maximum refinement permitted by the particular instruments in each survey, we examined the relationship between education and each item of knowledge over the full range of the two variables. The results from this approach to gauging effects are summarized by two statistics in the last two columns of the detailed tables. A chi-square test indicates that the relationships are almost always, over the hundreds of discrete tests, significant. In most instances, the null hypothesis can be rejected. The simple symbols used to convey the findings in these and later tables are: "NS" when the chi-square value does not reach the .05 level, one asterisk when it reaches .05 but not .01, two asterisks when it is between .01 and .001, and three asterisks when it reaches or exceeds the .001 level.[3] To be sure, in making a thousand tests, an investigation is bound to find *one* where the differences are so big that they would occur by chance only once in a thousand times. But what we have found are several *hundred* tests where differences so great would occur only once in a thousand times. Running his eye down the column of symbols, the reader will observe that the findings are uniform. Significant differences occur equally frequently in both realms, public affairs and academic knowledge, and in all subareas of content. They are characteristic not only of youngish adults but of adults up to age *fifty*. The occasional tests where no significant relationship is observed have no special content, although items so easy that everyone knows the answer, or so esoteric or difficult that no one knows the answer, often fall in this grouping.

The 250 items may all be construed as referring to the same most general hypothesis, that education affects knowledge. Of course, all the items in one domain or particular content area do refer to a less general, but common, broad hypothesis. Thus the different tests may

be treated as replications. Since batches of items (on the average, 4–5 per survey) were carried on the same survey and asked of the same individuals, not all the tests are independent of one another. But a great many are. Obviously, findings from the respective surveys of the four periods are independent and each period also contains many separate surveys. For example, seventeen surveys are drawn upon for the tests in the early 1950s, and the smallest number implicated in any time period is nine in the late 1950s. Because of the additive property of chi-square, it should be stressed that the likelihood of obtaining a *sum* so high as would be yielded by adding chi-squares from nine or seventeen independent tests (most of them very large to start with, but including the occasional low values) would not be one in a thousand by chance alone but far, far less than that.

In contrast with the consistent run of findings for the two cohorts up to about age fifty, within the cohort aged forty-nine to sixty, a few more of the tests turn out to be nonsignificant. Table 5 in Appendix A summarizes the number of tests that did not reach the .05 level within each age-group, across all *four* periods. There is a suggestion that the effects occasionally wash out among the older individuals who have passed fifty. The change in pattern is perhaps too slight to mention. The overwhelming number of highly significant chi-square tests argue that the effects of education endure right up to age sixty. And if an overall test had been made by combining the few nonsignificant tests with the many significant ones, it would have been highly significant.

Among the oldest age-group, those sixty-one to seventy-two—whatever time period and specific generation they represent—there are enough nonsignificant tests to make one pause. The change in the pattern at that point is rather sharp. We must consider that effects of education are sometimes washed out by old age and whatever vicissitudes it has brought to the individual (put picturesquely, the senility hypothesis) or that the added years of experience have made up for the initial deficit of the uneducated (the "wisdom of age" hypothesis), or that the educational system has been *steadily* improving. (We shall examine these hypotheses with the aid of more rigorous data in the next chapter.) But changes in the pattern of the findings are not that frequent, and we should not take these ideas too seriously yet. Even among the very old, the great majority of tests are significant, many of them at the .001 level. Again, if one were to employ the additive property of chi-square, the many large chi-squares and the modest number of low chi-squares taken together would certainly yield a highly significant combined chi-square. And the negative findings may reflect the facts that the oldest are the smallest stratum in our samples and that the size of particular cells, e.g., the highly educated old,

is very tiny. Perhaps the most striking thing is how many of the educational differences remain intact, despite the afflictions that accompany old age.

The data presented in table 5.1 about the items of academic knowledge piggybacked on a 1974 survey are consistent with the findings for earlier periods. The differences in knowledge are highly significant on all four items for the three cohorts up to age sixty. With one exception, the chi-square tests reach the .001 level. For the oldest cohort, three tests are significant at the .001 level and one test is not significant.

The chi-square test by itself gives no indication of the magnitude or the direction of the differences across all the educational levels. This information is provided in the last column of the tables, where the gamma (a coefficient of association developed especially for ordinal variables) obtained for each item appears. As we shall review in detail later and as the reader can see for himself from other columns in the tables, the relationship between education and knowledge, although often not linear, is almost always monotonic. Every step upward over the whole range of education is accompanied by an increment in knowledge. The gammas also convey this. There are only a negligible number of instances where the sign is negative or the value hovers near zero. The magnitude of the coefficients rarely drops below .3; it often runs as high as .6 or .7 and occasionally higher yet. To summarize these hundreds of gammas, we computed the average value over all the items in a content area separately for each age cohort and period. They are presented in table 6.

Table 6 confirms some of the conclusions already presented. There is no indication that the average relationship declines in magnitude up to age sixty, no matter what generation is involved. The pattern is uniform across all the different spheres of content and the two domains of knowledge, although the effects of education do appear strongest in the tests on the humanities. (It should be noted, however, that the test items are much more difficult in the humanities area, and the level of difficulty as well as the content may contribute to the special finding.) Again, there is the suggestion of a decline in effect in old age. The mean coefficients suddenly drop in magnitude, in rare instances, in a few content areas among the oldest cohort in some periods. Again, we should take note but reserve our judgment.

A summary of the many findings on the effects of education with two such statistics certainly extracts important information from the more elaborate distributions and compresses it into a convenient form for the reader. But it robs him of much of the richness and informative value of the descriptive findings. It gives no picture of the actual extent of knowledge prevalent among adults from particular

educational levels and does not convey some of the complexities and curvilinearities of the relationships.[4] However, if we had presented the descriptive findings on each item for *all the levels* of education distinguished in the surveys, we would truly have confronted the reader with an enormous task. Our compromise has been to present, in the first three columns of the basic tables, detailed findings for the three levels that appear most strategic to examine. This is a second approach to gauging the effects.

Those who have *graduated* from high school or college have had the full benefit of those institutions. If one must choose, it would seem more important to describe the levels of knowledge among such individuals rather than among those who have not finished the course provided at the given level. The prevalence of knowledge—the percentage of each of the two groups informed on each item—is provided in the second and third columns of the tables for the four periods and age cohorts. The first column of the tables shows the prevalence of knowledge among those who have not gone beyond elementary school, although, as previously noted, some portion of the group may not have completed that level. The elementary school group provides a base line for assessing the gains from secondary and higher education. By using only graduates, the comparative findings address the question of the *maximum* enduring benefits yielded by such educational experiences when one has been exposed to the *complete* treatment.

The figures in parentheses are the bases or the number of cases used for the computation of each of the percentages. The reader, of course, will note that the base for estimating the prevalence of knowledge of a discrete item in particular groups is small; this is especially true of the better educated in the oldest cohort. The many replications, however, safeguard the conclusions. In totality, if one aggregates the cases in any particular cell over all the surveys from which tests were derived, the base is a most impressive number. Table 7 summarizes these aggregated sizes for the elementary school and college graduate groups within each cohort and period and the grand totals at each of these educational levels across all age-groups and time periods. The table may be interpreted in the following fashion. *At least one* estimate of knowledge about a discrete item is available for a sample of the size indicated of the specified group. For example, among those between twenty-five and thirty-six in the early 1950s who had not gone beyond elementary school, there is some evidence about the prevalence of knowledge for as many as 1,269 cases. (To simplify the table, the aggregated sample sizes for the high school graduates within the various periods and age cohorts are not pre-

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sented, since one may realize without such detail that these numbers would be considerably larger than the corresponding cells presented.) The final column provides background relevant to the earlier findings of the effects of education based on the analysis of *all levels* of the variable. Naturally, these aggregated sizes are much larger, since they also include the dropouts. It should be noted that the aggregated figures reported in table 7 include the surveys used to estimate knowledge in the several specialized areas mentioned earlier—e.g., about popular culture, about tools and duties of occupations—the findings from which are not incorporated in tables 1.1 through 4.5 but reported in separate tables. Table 7 was intended to provide definitive counts of the total samples drawn upon for the complete analysis.

We return to the general findings presented in the sets of basic tables 1.1 through 4.5. As one runs down the two columns that compare high school and college graduates, one sees that the benefits of *higher* education indeed seem substantial in magnitude, pervasive over all content areas, and persistent among the oldest cohorts, whatever time period and corresponding generation they represent. When one juxtaposes the knowledge of the elementary school group, presented in the first column, one finds the benefits of high school also to be substantial (though smaller), pervasive, and enduring into old age. To simplify the inspection of the hundreds of discrete comparisons, the reader may examine the *mean* percentage informed for the set of items in each content area, which is also entered into the basic tables. Table 8 consolidates all the means for the different areas and periods and cohorts.

Whether one inspects the means or the long array of findings on the discrete items, one reaches much the same basic conclusions. In general, knowledge is about 40 to 50 percent more prevalent among college graduates than among those adults who did not go beyond elementary school. The differences *frequently* run as low as 30 percent and/or as high as 70 percent. On very rare occasions, a difference may be as small as 10 percent, but there are counterbalancing instances, also very rare, where the difference is as large as 75 percent. Inspecting the means, which naturally iron out irregularities and unusual departures from the general run of findings, suggests that the differences are of about the same magnitude in all areas, except for academic knowledge—especially in the humanities—where the differences are most dramatic and much the same for the three age cohorts up to about age sixty, no matter what periods and corresponding generations they represent. There are a modest number of instances where the means suggest that the advantage of higher education has diminished by old age, whatever generation from whatever

period the cohort represents. But the differences between educational groups hold up amazingly well, despite age, in the majority of such comparisons.

When one compares all the means in table 8—by sheer accident, there are exactly 100 means for all the cohorts at *each* of the three specified levels of education—one finds not a single instance where the college graduates are not the most informed group, nor a single instance where the high school graduates do not fall between the two polar groups—being more informed than the elementary school group but less knowledgeable than the collegiate group. When we consider only these three levels of education and the pattern revealed by the *mean* scores, the relationship is without exception monotonic. There is an increment of every kind of knowledge with each step up the educational ladder that is preserved, no matter how old the individuals and no matter which of the four periods is examined. The mean scores for the four cohorts examined in 1974 (see table 5.1 in Appendix B) also show no exception to the rule. In this light, the previous observation that the difference in *magnitude* between the means is sometimes less among the *oldest* cohort should continue to be noted, but its importance should not be exaggerated. Any waning of the effect of education in old age that may occur never goes so far as to reverse or even equalize the superiority in knowledge of the better-educated groups.

Although the means convey a reliable picture of the general pattern, they do submerge the irregularities and deviations. Naturally, it is difficult for any reader to juggle mentally hundreds of comparisons of the knowledge about each discrete item prevalent at the three educational levels and then to sort out the pattern by cohorts. There is, however, a clear avenue elsewhere in the detailed tables leading the reader to such insight, although it sacrifices some of the detailed information.

The second set of three columns in tables 1.1 through 4.5, headed "index of effectiveness," are intended to serve a larger purpose which we shall review shortly. But they also incorporate a simple device which reveals the pattern of variation in knowledge among the three educational groups. A minus sign (or dash) in any of these columns indicates some reversal or decline in knowledge when a better educated group is compared with a lesser educated group. The sign in the *first* column denotes a drop when elementary and high school are compared; in the second column, a drop when high school and college are compared; in the third column, a drop when college and elementary school are compared. If there are *no* such signs, the pattern for the discrete item is monotonic with an increment of knowledge at each of these steps up in education. If there are three such signs, the

relationship is negative with the slope such that the college educated end with a lower level of knowledge than even the elementary school group. Other combinations of signs denote curvilinear patterns of different types depending on the columns in which they appear; all, however, involve a reversal that produces a "*doubling back*" of the curve rather than a curvilinearity which is merely a change in the *rate* at which knowledge is enlarged by education. The reader can scan these columns quickly for the presence and location of such signs. He will note that, even when the several hundred discrete items are examined, departures from the monotonic pattern revealed by the comparisons of the means are very rare. Such departures are most characteristic in the oldest cohort; they are most likely to follow a particular curvilinear pattern with the sign appearing in the middle column: the high school educated are most knowledgeable, superior to the elementary school group and the college group, but the college group rarely fall below the elementary group. These patterns are summarized in table 9. As tallied there, such reversals or declines occur in far fewer than 10% of the tests except among the oldest cohort, where they are more frequent but still rare. Most of those reversals show the collegiate group among the oldest who fall below the high school group but still remain superior to the elementary school group in knowledge. The average magnitude of the decline, as there noted, is small. Since the many gains in knowledge accompanying education average forty to fifty percentage points, the two to thirteen percentage point drops on the average are properly seen as not only rare but also relatively small.[5] The evidence in table 5.1 from the four items in the 1974 piggyback agrees with these general findings. In the cohort aged forty-nine to sixty, one of the tests shows a departure from the monotonic pattern. Knowledge declines four percentage points between the high school and college levels. But in the other fifteen tests made, knowledge increases with each step up in education—the gain often exceeding fifty percentage points.

We have dwelt on what may be the most striking feature of the general findings, the degree to which the advantages of education endure into *old* age. Whether individuals are sixty-five or twenty-five, they seem to have learned and not forgotten the kinds of bookish facts taught during their schooling, and the skills and inclinations that help them to master current knowledge of the world have also persisted through long years. These conclusions seem borne out by the two different modes of analysis thus far presented. We shall have additional types of evidence to present that will make the case stronger yet, but we should now underscore other more subtle, but equally important, features of the basic findings that have been noted only briefly.

If one turns one's attention away from the *oldest* cohort and focuses instead on the variations in effects of education by *time periods* for adults at any given age stage, one observes another dramatic uniformity. The individuals, although of constant age, represent different generations who experienced distinctive types of schooling and whose lives unfolded in distinctive environments. These factors seem to make little difference. It is as if the sheer benefit from more education—no matter what kind prevailed and no matter what had surrounded it in life—is so substantial that these other factors do not blunt it. The least schooled, even when their schooling may have been of higher quality and even when they lived in a more stimulating and enriching environment, do not seem to make up for their lack of education. The more educated—even if their high schools and colleges deteriorated in quality—still have a big advantage.

One can observe this pattern if one juxtaposes, for any given age stage, the differences in knowledge between educational levels for each of *two* time periods, or if one juxtaposes the prevalence of knowledge among the lesser educated from one time period with the knowledge of the better educated from another time period, again holding age constant. No matter what pairs of comparisons one examines, the pattern is the same (with minor exceptions, noted below). To be sure, it is assumed, when such comparisons across periods are made, that the tests of knowledge have been equally reliable and no more or less demanding in the two periods. Let us extract, from the basic tables, some sets of data that reasonably satisfy this assumption. We shall use the norms obtained from the aggregate national samples, aged twenty-five to seventy-two, for the stratum of individuals who did not go beyond *elementary school*, as an index of the difficulty of the battery of test items in some homogeneous content area.[6] If we restrict ourselves to areas where the battery is fairly lengthy, we can still find a number of spheres where the combined tests administered to two age cohorts born at least a dozen years apart are of equal difficulty.

Two content areas in the domain of public affairs satisfy the requirements nicely. The reader could locate the findings within the detailed tables, but a major feature of them is extracted and presented in table 10. In the domain of academic knowledge, as noted, there are very few items in the surveys of the last two periods. However, we can make a similar analysis in this domain for cohorts born about *seven* years apart by comparing the findings from batteries of equal difficulty asked in the early and late 1950s. These findings are also included in table 10.

To simplify the table, in the five sets of comparisons of the effect of education on equivalent knowledge in two periods, we show only the *difference* between the mean percent informed among *college* and *elementary school* adults. It is, of course, possible for knowledge to be inflated or deflated by some constant amount among individuals from a given period, no matter what their educational attainment. Such a historical change would not be revealed in the *difference* between means. The table also does not include any comparisons of *high school* graduates and does not provide any evidence on the extreme possibility, mentioned earlier, that the lesser-educated generation from one period might surpass the better educated from another. On such matters, the actual means in table 8 for the three educational levels must be examined, and the reader can inspect the detailed relevant entries corresponding to the time periods and five content areas to be examined in the tiers A-E of table 10. There is no indication of any marked lowering or heightening of knowledge in all members of one or another period. There are but two minor exceptions to the generalization that the lesser educated from one period and the schools of that time *never* surpass the knowledge of a better-educated group from another period. In the academic area of "geography," the *high school* graduates who were *forty-nine or older* in the late 1950s are on a par with the college graduates who had reached the same ages by the early 1950s. We shall not attempt any interpretation of these minor exceptions at this point. Some clarification will be contributed by the analysis to be reported in chapter 5, and we should not make too much of the finding. Certainly there is no indication that the elementary school pupils of any of the periods brought under scrutiny ever come near in knowledge to any of the high school groups, or that the college educated ever decline to the level of the elementary school groups or fall below the high school groups.

The four items of academic knowledge asked in 1955–57 that were repeated in the 1974 piggyback yield the set of comparisons presented in tier F of table 10. At each of four stages of aging, the effects of education on a pair of generations born twenty years apart provide a sixth, dramatic documentation that the education provided in widely separated times, however distinctive, generally produced similar effects.

All of the findings we have been reviewing, following the *second* approach to the basic data, are drawn from comparisons limited to *graduates* of high school and college. It may be argued that this is a serious limitation in drawing conclusions about the effects of education. Individuals who completed the course of instruction at either

level, in contrast with those who dropped out along the way, may have had some unusual blend of tenacity, resources, and passion for learning and social pressures which led them to continue in their education. That blend of factors as well as the instruction they received may contribute to the substantial differences in knowledge that have been demonstrated. The critic who argues this way with respect to *our data* should realize how heavy a burden he is taking upon himself, what potency he is assigning to that constellation of factors. It is plausible to argue that way when one examines individuals who are eighteen or twenty-two or even twenty-five, who are fresh out of school and college and still carrying the tenacity, passion, and pressures they presumably brought into the experience of being educated. It is not so easy to make the same argument about individuals of fifty or sixty, whose pressuring parents have long since departed, whose youthful passions for learning have cooled, whose resources may have dwindled through the misfortunes that some of them inevitably encountered. They would have to have the tenacity of bulldogs to have maintained throughout the years their earlier tenacious attachment to knowledge. We do not intend simply to rule the argument out, but it must be seen in the special light of our unusual kind of data. If it were truly the explanation of the results, that would be a serendipitous finding from the secondary analysis of surveys among *mature* adults—one to be treasured as an unusual large-scale demonstration of social psychological processes enduring over a lifetime.

We can confront the question, however, not only with logic but also with empirical evidence. Recall that the first approach to gauging the effects of education examined the complete distribution of knowledge over the *full range* of education. The high school and college dropouts thus were incorporated into that assessment. As we noted, the signs and the magnitudes of the coefficients, gamma, suggested that the relationships were monotonic. Knowledge tended to rise with each step up in the educational ladder, including the steps up to *some* secondary and *some* higher education. If the positive conclusions drawn from the second approach stemmed from the exclusion of those groups who were "turned off" by the institutions and the inclusion of only those who were "tuned in" to start with and especially "turned on" by the experience, the findings from the first approach would not have been in agreement.

Since those coefficients provide only an approximate picture of the pattern, the distributions of all 222 items of knowledge (in the public affairs and academic domains) were examined to determine exactly how many departures there were from a monotonic relationship over the *five* steps involved along the dimension of education.

(Given the laboriousness of the procedure, we examined only the aggregate distribution for all age groups rather than the separate distributions for all cohorts.) In 82% of the items, there was no departure at all from a perfect monotonic pattern created by the inclusion of those with some high school and those with some college.[7] They exhibited some superiority in knowledge over the group on the rung of the educational ladder below them but were inferior to the group on the next-higher rung.

Seven of the items that deviated from the monotonic pattern were peculiar or special in character. Some were so easy that practically everyone knew the answer, and any deficiency in knowledge reflected, so to speak, some strange quirk, e.g., not knowing the number of inches in a yard. Others involved some very difficult or exotic item where hardly anyone knew the answer unless he had some special interest, e.g., knowing the size of the Chinese army or the identity of Sam Lubell or of the county clerk. (For items so extreme that hardly anyone or almost everyone knows the answer, very small percentage differences that could arise simply from sampling error could produce departures from a monotonic pattern. These would not be a dependable source of evidence about the problem.) If we eliminate the seven items that conservatively would be diagnosed as offbeat or undependable, in only 15 percent of the tests was there any departure from a monotonic pattern across the five steps involved.

If we inspect the findings over the same five steps of the educational ladder for the four items in the 1974 piggyback, we find no departure whatsoever from a complete monotonic pattern. Adding these few later findings in with those for the many items in the earlier periods strengthens the overall conclusion. There is a gain in knowledge with each little increment of education for almost 90% of the items.

In light of all of this evidence, we see that the graduates do not appear to be *qualitatively* different in character from the dropouts, although they may have more of that undefined blend of factors that helps them to complete their course.[8] If the dropouts are diagnosed as utterly lacking in that unknown blend, then the findings can only mean that some fragmentary education can produce gains in knowledge even among those who are unreceptive.

These analyses do not answer a more fundamental question. Those who *begin* secondary or higher education, whether or not they complete the course, may still be a select group in contrast with those who never enter that next stage. We have to confront that big question. As suggested in our introduction, we shall control many of the factors that have been found to account for such selection in order to assess the net effects of education. These controls will automatically function to equate individuals at all levels of education, the *dropouts*

as well as the graduates, in many respects that would affect any constellation of resources and inner states and social pressures that could be hypothesized as a determinant of knowledge. Those analyses therefore will provide additional incisive evidence, but will be postponed until chapter 3 so that we may consider the third approach to gauging the general effects of education presented in the basic tables.

In the second set of three columns in the detailed tables 1.1–4.5, a special index of the "effectiveness" of education in increasing knowledge about each of the items is presented. This index, computed from the findings on the prevalence of knowledge among the elementary school group, high school graduates, and college graduates (already presented in the first set of columns), was intended to solve a number of problems.

As we reviewed in some detail in chapter 1, the various findings and inferences about the effects of education are dependent on the level of difficulty of the test items. If a great many of our items had been so easy that most adults, including the least educated, knew the correct answers, it would have been impossible for our tests to register the superiority in knowledge that the better-educated groups truly might have had. Fortunately, the test items are distributed over a fairly wide range of difficulty. Most of them are not easy for ordinary adults to answer, judging by the national norms the surveys provide. There is plenty of room for large gains to be registered. Using the empirical norms as our standard of difficulty, we find that the gain expressed in *absolute* percentage points among the higher groups is a meaningful index of effect. When an item has been found to be difficult, that number can become big and impressive and have much weight in the computation of means. That, from one point of view, provides a fair picture. If an item is difficult, a gain should be given much weight in our assessment. If it is very easy, why regard a gain in the kind of knowledge involved as worthy of much weight in our assessment? From this vantage point, the previous approach employed was meaningful.

From a technical point of view, however, a problem is presented by those particular items that turned out to be very easy. It is almost impossible for any gain to be registered. And as we have noted at various points in our discussion, comparisons across periods or between contrasted age-groups within a period also implicate the problems that different items are not equally difficult and that the *same* item may not be equally difficult at two time points or for two age groups. Such problems are reduced in the third approach we have taken to the data—the computation of an index of "effectiveness." Each gain in absolute percentage points when expressed in terms of its ratio to the *maximum* gain that is possible over the level of

knowledge exhibited by the less-educated group yields the index of effectiveness and translates the absolute gain into a relative or standardized measure. The index also helps in comparing the effects of high school and college. If knowledge is widely prevalent among most high school graduates, it is almost impossible for the college graduates to show any gain. In using this device, one should realize that a very *small* gain in absolute percentage points, for an item that is already widely known among the less educated, can become a very large index number. A gain in knowledge from 90 percent in one group to 98 percent in the next group yields an index of 80, but quite properly it means that the gain was 80 percent of the maximum gain that was possible.

Reckoning the effects of education by reference to such indexes gives a big weight to items that have been very easy for the least educated or for the high school educated. If the reader keeps this in mind, he will not be misled. In one way it is not misleading at all, since it overcomes the technical problem that the more educated are handicapped in such instances and cannot exhibit whatever superiority in knowledge they may truly have.

The first of these indexes in the second set of columns in the detailed tables express the gains in knowledge high school graduates make over the elementary school group; those in the second column express the gains college graduates make over high school graduates; those in the third column express the gains college graduates make over the elementary school group. Where there was no gain at all, but rather a decline in knowledge, the index need not and cannot be computed, and a minus sign is entered. These signs serve to indicate a complete lack of effectiveness. In addition, each set of them provides, as earlier noted, a convenient device to gauge the pattern of change. The means presented for each content area are not an average of the indexes for the discrete items. Since the items carrying a minus sign could not be entered into such a computation, such a mean would not be an accurate representation of the general effectiveness for that content area. Instead, it is the index of effectiveness computed from the *mean percent informed* on the set of items for each of the three educational groups, those means being presented at the bottom of the first set of columns.

The reader can inspect these summary indexes of the average effectiveness of various levels of education for various content areas and periods and age cohorts or inspect the long arrays of discrete indexes. Following this third approach to gauging the effects of education, the reader will see that occasionally college has 100 percent effectiveness or close to it, but most of the time it is only 30 to 60 percent effective. Its lasting accomplishments are only 30 to 60 per-

cent of what they might have been, given the gains that could have been registered over the ignorance that prevailed among the high school group. The indexes of effectiveness of high school or of college, relative to the level of ignorance among the elementary school educated, have a similar import. Although such an index may give undue weight to a small gain in absolute percentage points, it clearly conveys that education does not function at maximum effectiveness. The indexes of average effectiveness are presented for convenience in summary table 11.

The three approaches establish that high school education, even a fragmentary amount, has considerable effect in increasing knowledge; college education, even a fragmentary amount, is effective in increasing knowledge still further. These findings came from the basic data on the 222 test items in the two domains of "public affairs" and "academic" knowledge and in the various subareas of content. The findings can be broadened and strengthened and the limits upon the generalizability of the present conclusions tested by some additional evidence and analysis.

Table 12 presents additional data based on the special battery of vocabulary items asked in a 1966 survey. The six items used are chosen from various points along a larger steeply graded classic test, Thorndike's CAVD. The findings are often treated as a measure of verbal intelligence and therefore were not incorporated in the detailed tables, although they surely belong in the domain of academic knowledge.[9] These questions were put only to individuals up to age forty-five in the original survey. The findings therefore apply only to the two younger cohorts but are consistent with earlier conclusions about the substantial effects of education.

In table 13, parts 1–4, findings from the battery, mentioned in the introduction, on knowledge of the tools and duties of four occupations are presented for each of the four age cohorts.[10] Since the two occupations in the top half—boilermaker and metal caster—are industrial, the questions asked would be "academic," their answers known perhaps only vaguely and remotely, to the educated whose daily lives rarely bring them into close contact with blue-collar work. Thus, in these tests, the educated would be handicapped compared to the less educated for whom, as members of the working classes, these are concrete matters close to home about which they have much opportunity to learn. For the two occupations in the bottom half of the tables—personnel director and proofreader—the situation is reversed. Here the uneducated, by virtue of their usual class position, would be handicapped in learning about such white-collar and professional occupations. It turns out that the better educated are markedly more knowledgeable on the five questions relating to these occu-

pations, by all the indexes used to gauge the effects of education. The critic may simply say that this is to be expected and that the tests are unfair, because the respective classes have not had equal opportunity to learn the facts. But then, by the same argument, the uneducated should show a marked superiority on the first six tests, where they have been given an unfair advantage. Clearly this is not the finding. The differences between educational groups are generally nonsignificant and even a bit more likely to show a slight edge in knowledge for the *better educated*. The tables provide quite compelling evidence of the power of formal education, in contrast to what may be called the school of life. They suggest that our earlier findings are not limited to items that could putatively be labeled as loaded in the direction of middle-class culture.

The findings from the cluster of eleven items measuring knowledge of "popular culture" presented in table 14, parts 1–4, provide even more compelling evidence for the generalizability of our previous findings and for the powerful effects of formal education. In contrast with the tests of occupational knowledge drawn from a single survey in 1965, these are derived from half a dozen different surveys spread over a fifteen-year period. Thus any single age-group examined is not drawn from one homogeneous birth cohort or generation but represents several cohorts. These items clearly do not give the educated any unfair advantage. They do not tap high culture or highbrow knowledge. If anything, they deal with highly publicized matters that presumably have great appeal to the common man. They deal with sports, romance, popular heroes, and movie stars, and ought therefore to be of special interest to the young and the vigorous. Thus by examining the pattern among the old they should provide compelling evidence not only on sweeping but also on enduring effects of education.

Two of the items turned out to be terribly difficult. Bob Hope's and Loretta Young's newest movies in 1950 were *so* new that hardly a soul knew about them. In his essay on the "Vicissitude of Things," Francis Bacon stated correctly that "all novelty is but oblivion." Thus, these items can legitimately be set aside as insensitive and incapable of providing any information on our hypothesis. If we ignore them, the evidence, by any of our three approaches, documents the power of education. The gammas almost without exception are positive in sign and of considerable magnitude. Knowledge on the average is about 20 percent more prevalent among the most educated. The chi-square tests (leaving the two insensitive items aside) are for the most part highly significant. The findings are not limited to the young.

The items dealt with in tables 13 and 14 lent themselves to a kind of contest or race between the several groups that had a natural

"handicap" built into it. From our total pool of 250 items and from collateral measures in the surveys, we can set up some more races in which we can handicap the better-educated group to provide compelling tests of the power of education.

The first two columns of table 15 present comparisons of nine items, drawn from three surveys, that test knowledge relevant to organized labor, for college graduates and the elementary school group. By reference to other data in the survey, the college group is restricted to those individuals (both men and women) who are not members of union households and who therefore have less interest or opportunity to learn the answers. By contrast, the elementary school group has been restricted to members of union households, who therefore have been given an advantage in the race. The two groups have been raced nine times, and the handicapped college group has come out the winner every time, and by more than a nose.

Some spectators may not regard this as all that dramatic a contest. To be sure, the college graduates labored under a handicap; their advantage, however, in education was so large as perhaps to have evened the odds. The results of more dramatic races are presented to the spectator in column 3 and 1 of the table. A group with only a *moderate* level of education, high school graduates, have now been handicapped by being members of nonunion households and entered against the elementary school members of union households. The races are closer, but the handicapped group still wins seven out of nine times.

In table 16, three items from a 1955 survey dealing with knowledge of "manly" sports permit us to race the college and elementary school groups once more, under conditions where we have handicapped the better educated. By examining the pairs of columns comparing men and women of *equal* education, we see clearly that men are advantaged in learning such matters. Therefore, if we compare women who are educated with men who are uneducated (columns 2 and 3), we can test the power of education in broadening knowledge of this sphere of popular culture under handicapped conditions. Here we evidently have gone too far in creating an unequal match. Education does not override the obstacle introduced, but it does counterbalance it. If one now makes it a fair or equal race, comparing educated groups matched in sex (columns 1 and 3 or 2 and 4), one does replicate the earlier findings of table 14, under more precise and fair controls. The educated members of each sex are considerably more knowledgeable about these popular matters.

These many basic findings establish that the better educated have wider and deeper knowledge not only of bookish facts but also of many aspects of the contemporary world; that the differences override

obstructions and endure despite aging, and characterize individuals who represent several generations and several historical periods in the functioning of the schools. But, of course, we have only documented the differences and not proved that education is the cause of it all. We turn to this phase of the secondary analysis, following the steps outlined in our introduction.