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ABSTRACT

This paper offers recommendations to the National Center for Education Statistics (NCES) on the development of the background questionnaire for the National Assessment of Adult Literacy (NAAL). The recommendations are from the viewpoint of a researcher interested in applying sophisticated statistical models to address important issues in adult literacy. The paper focuses on five issues, each of which is the subject of a section of the paper: sampling; selection bias; measurement; policy modeling; and gauging cohort effects. Each section considers the scope of the issue and then makes recommendations to NCES. These recommendations include providing all appropriate sampling weights in NAAL data; examining contextual effects on the distribution of literacy ability in the population; considering relevant auxiliary variables that would constitute the selection equation; considering the hypothesized number of factors and including at least four variables measuring each factor in the questionnaire; obtaining retrospective data on general and job-specific literacy-related activities; and exploring the possibility of linking NAAL with existing longitudinal surveys. (Contains 21 references.) (YLB)

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Working Paper Series

Secondary Statistical Modeling With the National Assessment of Adult Literacy: Implications for the Design of the Background Questionnaire

Working Paper No. 2000-05 March 2000

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U. S. Department of Education
Office of Educational Research and Improvement

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The Working Paper Series was initiated to promote the sharing of the valuable work experience and knowledge reflected in these preliminary reports. These reports are viewed as works in progress, and have not undergone a rigorous review for consistency with NCES Statistical Standards prior to inclusion in the Working Paper Series.

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This project was an activity of the Education Statistics Services Institute.

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Abstract

With the advent of simple-to-use advanced statistical software packages, it is becoming increasingly easy to specify and estimate complex statistical models for addressing substantive questions in adult literacy and other areas of education. Such problems as the role of literacy in voting behavior or the job market experiences of individuals with GEDs, can be addressed with relative ease. However, a thoughtful application of statistical models to educational data leads to the recognition that certain assumptions must be met for the model estimates to be useful for theoretical explanation and/or policy analysis. The purpose of this paper is to offer recommendations to the National Center for Education Statistics on the development of the background questionnaire for the National Assessment of Adult Literacy. The recommendations presented in this paper are from the viewpoint of a researcher interested in applying sophisticated statistical models to address important issues in adult literacy. This paper will focus on five issues: (1) sampling, (2) selection bias, (3) measurement, (4) policy analysis, and (5) cohort effects.

Introduction

With the advent of simple-to-use advanced statistical software packages, it is becoming increasingly easy to specify and estimate complex statistical models for addressing substantive questions in adult literacy as well as other areas of education. However, a thoughtful application of statistical models to educational data leads to the recognition that certain assumptions must be met for the model estimates to be useful for theoretical explanation and/or policy analysis. These assumptions concern the sampling of respondents, measurement of constructs, and selection bias, to name a few.

Pursuant to the Call for Papers on the National Assessment of Adult Literacy (NAAL), this paper provides technical recommendations to the National Center for Education Statistics (NCES) as it plans for and executes the NAAL. These recommendations specifically take into account the application of advanced statistical modeling of secondary public use data.

The technical suggestions provided in this paper are guided by many of the recommendations summarized in NCES Working Paper No. 98–17 entitled "Developing the National Assessment of Adult Literacy: Recommendations from Stakeholders" (hereafter referred to as NCES 98–17). Specifically, this paper emphasizes the utility of the background questionnaire for basic research and policy studies. This report addresses the following five issues: (1) sampling, (2) selection bias, (3) measurement, (4) policy modeling, and (5) cohort effects.

1. Issues of Respondent Sampling

The issue of sampling discussed in this section concerns the ability to draw accurate inferences about the population of adults. Fortunately, solutions to this problem are relatively straightforward. Specifically, many national educational surveys employ multistage clustered sampling with schools sampled first, followed by the sampling of students and teachers within those schools. Drawing proper inferences from data generated from such sampling designs not only requires proper statistical modeling, such as multilevel modeling, but also requires the incorporation of sampling weights.

The issue of sampling weights also applies to data drawn from other multistage cluster designs, such as the household survey sample that will be utilized for NAAL. As noted in NCES 98–17, there is a desire to assess underrepresented groups based on specific policy needs. These groups include rural adults, adults in welfare-to-work programs, Native Americans, blacks, and Hispanics, to name a few. The issue of oversampling is subtle, but clearly important if one wishes to make accurate inferences about underrepresented populations.

In the context of advanced statistical modeling, it is essential that oversampled groups not exert undue influence on statistical estimates or conclusions of model adequacy. To mitigate this problem it will be essential to provide the sampling weights for all respondents in the survey. Many statistical software packages allow for the incorporation of sampling weights in regression-based methodologies.

1.1 Issues in Clustered Sampling and Multilevel Modeling

With the use of multilevel modeling for the analysis of hierarchical data (Bryk and Raudenbush 1992), great flexibility now exists to study educational issues in the context of the organizational structure of education. Surveys sponsored by the NCES, such as the NELS:88, sample respondents in ways that reflect the natural structure of educational organizations, viz., students nested in schools. Indeed, relative to the early discussion, such datasets also contain appropriate weights at each level and utilize software programs such as hierarchical linear modeling (HLM) (Bryk 1996).

With regard to the structure of the NAAL background questionnaire, the question is whether the proposed sampling design yields natural organizational structures that might lend themselves to the application of multilevel modeling. For example, the National Adult Literacy Survey (NALS) defined a four-stage stratified sampling design in which primary sampling units (PSUs) consisted of geographic clusters of one or more adjacent counties (first stage). This was followed by Census blocks within counties (second stage), households within Census blocks (third stage), and finally, adults within households (fourth stage). To the extent that these PSUs represent groups of substantive importance to issues of literacy, it may be useful to examine variation in respondent literacy as a function of demographic characteristics, such as poverty levels, captured by the PSUs.

An application of multilevel modeling to the NALS data was recently reported by Sheehan-Holt and Smith (1999). In their analysis, they used census blocks (segments) as the contextual, or level-two, unit of analysis. They argued that census blocks, as defined in the NALS sampling design, could serve as a proxy for neighborhood, but noted that census block level variables were not collected. In their case, they created a "neighborhood average income" based on the income reported by respondents within the segments.

1.2 Recommendations to NCES

Recommendations for NCES in the construction of the NAAL survey are twofold. First, it is crucial that the public-use NAAL data contain all appropriate sampling weights in order for accurate inferences based on advanced secondary statistical analyses to be made. The literature is clear regarding the problem associated with inaccurate inferences when sampling weights are ignored. Every effort should be made to encourage the use of sampling weights in secondary analyses.

Second, there is no doubt as to the importance of examining contextual effects on the distribution of literacy ability in the population. In terms of the design of the next background questionnaire, every attempt should be made to link the NAAL survey to census-based surveys so that more detailed neighborhood variables can be collected. Indeed, recent research by Archbald, Kaplan, and Nakib (conducted under OERI grant # R308F60010, 1996-1998) showed how it was possible to link the National Assessment of Educational Progress (NAEP) to census data and ultimately to the district data codebook. This allowed for the incorporation of data at the level of the school district to be merged with data from the NAEP background questionnaire for the purposes of multilevel modeling. We strongly recommend that the NAAL provide similar links to allow for the development of contextual models of adult literacy.

If interest centers on the variation of respondent literacy as a function of group-level characteristics, such as GED programs, then it is required that a different form of sampling be employed. For example, some form of clustered sampling of programs followed by respondents within programs would allow application of multilevel modeling methods. If such a sub-study is of relevance to the larger goals of NAAL, then the questionnaire should capture as many features of the group-level variables as possible. With regard to sampling weights, these should be made available at both the group and respondent levels.

One practical recommendation that comes from a consideration of sampling weights is that very clear guidelines regarding their use should be provided. That is, NCES should make available in their NAAL documentation clear instructions on how to incorporate sampling weights in secondary analyses of the data.

2. Issues of Selection Bias

The issue of selection bias refers to problems of inference that arise from the nonrandom participation of respondents and their assignment to groups. A recommendation that appeared in NCES 98–17 was that background data should provide information regarding participation in adult education programs as well as participation in citizenship activities. However, in both cases, individuals are not randomly assigned to groups that either participate or do not participate in these activities. As an example, consider the problem of literacy and voting (Kaplan and Venezky 1994; Venezky and Kaplan 1998). Before being able to study the impact of literacy on voting behavior, it is first necessary to recognize that the lack of random assignment into voting and non-voting groups hinder attempts to make claims about the role of literacy on voting behavior.

The difficulty with asserting claims in this case arises from the fact that those who state that they have voted are not a random sample of the general population who are eligible to vote. Thus, we need a model for estimating the probability of observing an affirmative response to the voting question. After accounting for age and citizenship requirements, it is clear that one cannot vote unless one is registered to vote. However, the probability of registering to vote is dependent on many factors that are not necessarily related to voting. Thus, without a voter registration question (and relevant predictors of registration) in the background questionnaire, it would be virtually impossible to account for nonrandom selection mechanisms within a statistical model of voting behavior. Although the Young Adult Literacy Survey (Kirsch and Jungeblut 1986) included a question on voter registration, the previous NALS background questionnaire did not include such an item.

The example of literacy and voting behavior is only one of a number of possible examples where selection bias can occur. As another example, consider a comparison of those who obtain General Educational Development (GED) credentials with high school graduates. In this case, while it may be reasonable to assume that high school graduates are a relatively representative group, it is clear that those who enroll in the GED program and obtain the

GED are not. That is, of those who do not obtain their high school diplomas, a nonrandom sample of those respondents will enter a course leading to the GED and still another nonrandom sub-sample of that group will earn GED credentials. Thus, a model that predicts the probability of obtaining a GED is needed to account for nonrandom assignment to these groups.

2.1 *Methods for Modeling Selection*

For completeness, it is useful to consider the variety of statistical approaches available to secondary users who wish to account for selection bias. Perhaps the most popular approach to the problem of nonrandom selection into treatment groups is the analysis-of-covariance (ANCOVA). With ANCOVA, the investigator is required to choose one or more concomitant variables (covariates) to be used in the analysis. In the GED example given above, one possible covariate might be a measure of the family socioeconomic status of the respondent—the argument being that only certain individuals with somewhat higher levels of family SES can afford to return to school to study for the GED. Scores on, say, document literacy, are adjusted for their relationship to the covariate(s) and the analysis-of-variance is conducted on the adjusted scores (Kirk 1995).

Although ANCOVA represents a classic approach to the problem of selection bias, it does have certain limitations. The most important limitation concerns the ANCOVA assumption of homogeneity of regression. Homogeneity of regression refers to the requirement that the relationship between the outcome and the covariate be the same for all groups under study. This is difficult from a practical standpoint since, as the number of covariates increases, it becomes increasingly unlikely that this assumption will be satisfied.

Another approach to selection modeling that has its roots in econometrics is the two-step approach of James Heckman (1976). The conceptual idea behind two-step modeling is that a substantive equation of interest is misspecified if it is missing a variable that accounts for the probability of observing the data. In the voting case, one may be interested only in the relationship between document literacy and educational level for those who voted. A regression model to study this question would be misspecified because the process of selection creates a disturbance term with a mean that is no longer zero and which is correlated with the predictor.

To correct for the specification error, two regression equations are specified: a selection model equation and a substantive model equation. In the selection model equation, a probit regression is conducted, regressing a qualitative group membership variable (voted/did not vote) on a set of variables assumed to predict group membership. A new variable is then formed for each person. Referred to as the hazard rate (Heckman 1976)[1], this variable represents the likelihood that an individual will be excluded from the sample. Next, the hazard rate is added to the substantive equation of interest and a standard ordinary least squares regression analysis is conducted.

Although Heckman's approach is a classic methodology for dealing with selection bias, it is known to suffer from statistical problems arising from the incorporation of the nonlinear based hazard rate into a linear equation. An approach that derives the conceptual benefit of the Heckman approach without the computational problems, and that is similar in many respects to ANCOVA, is the propensity score approach (Rosenbaum 1995; Rosenbaum and Rubin 1983).

The propensity score was proposed by Rosenbaum and Rubin as a means for balancing treatment and control groups with respect to covariates in nonrandomized experimental studies. The propensity score is based on the conditional probability of assignment to a treatment group given a set of observed covariates.

In a typical application of this approach, each observation is associated with a propensity to be assigned to the treatment group. The distribution of propensity scores is then usually divided into strata at the quintile points of the distribution and analyses of treatment group differences are conducted within strata[2]. Comparisons of treatment group differences within and across strata provide evidence for whether or not the bias due to nonrandom selection into treatment groups has been accounted for by the propensity score adjustment. If, for example, groups are found to differ by a constant amount across quintiles, this can be taken as evidence that the groups differ beyond what can be explained by the process that assigned individuals to those groups. If, on the other hand, groups do not differ across quintiles, this can be taken as evidence that the selection mechanism is accounting for the group differences. Finally, if the size of the differences between groups varies across strata, this can then be taken as evidence that selection

[1] The hazard rate is derived from the expression of the conditional expectation function under truncation (Goldberger 1981). This expectation can be written as $E(y|\mathbf{x}) = \mathbf{x}'\beta - \omega\lambda(z)$. In this expression $z = (c - \mathbf{x}'\beta)/\ \omega$, where c is a truncation point, $\mathbf{x}$ is a vector of predictors, β is a vector of regression coefficients, and ω is the standard deviation of the disturbances. The hazard rate $\lambda(z)$ is the ratio of the probability density of z to the cumulative distribution of z (Berk and Ray 1982).

[2] For continuous distributions, strata sub-classification at the quintile points has been found to remove at least 90 percent of the bias due to nonrandom selection effects.

characteristics are interacting with group differences yielding differential effects on the outcome of interest. This is a classic example of the selection by treatment interaction.

A review of the substantive literature suggests that the propensity score approach has been used in such diverse fields as sociology, medicine, psychiatry, and economics. Recently, Hoffer (1994) used the propensity score approach in an analysis of educational tracking and Kaplan (in press) recently extended the propensity score approach to latent variable models.

2.2 *Recommendations to NCES*

Considering the ubiquity of selection bias in social and behavioral science research, it is essential that care be taken to consider relevant auxiliary variables that would constitute the selection equation. The examples of participation in adult education or citizenship activities are prototypical, but it would be relatively straightforward to generate other more subtle examples. The ANCOVA, Heckman two-step, and propensity score approaches for addressing selection bias have one thing in common—they require the measurement of concomitant variables. Thus, as consideration is given to the development of background items for NAAL, it is recommended that, for each question that categorizes respondents into groups, thought be given as to how respondents were allocated to those groups. Furthermore, auxiliary measures that predict that allocation should be included.

3. Issues of Measurement

It is often the case that behaviors and attitudes of respondents are desired. For example, in the NALS, questions were posed regarding individuals' self-perceptions of literacy ability. It may be of interest to determine the number of factors underlying self-perception of literacy ability. Such underlying factors, if they exist, will be fewer than the original set of variables used to measure those factors, and could be used in more parsimonious models linking self-perception to actual literacy skills as measured by the literacy assessments. The development and assessment of underlying constructs representing behaviors and attitudes constitutes an important part of secondary statistical analysis.

If the goal is to validate a set of underlying behaviors and attitudes, then it is essential that multiple measures, or observed variables, of those attitudes or opinions be obtained. Generally, the methodology used to validate the existence of underlying dimensions is *factor analysis*. From the point of view of utilizing factor analysis, a number of statistical issues need to be raised to help inform thinking about the development of the NAAL background questionnaire.

First, it is necessary to consider the issue of the identification of an underlying factor. The concern here is the extent to which a hypothesized factor could, in principle, be rejected on the basis of the observed data. Factor analysis requires that, for any given factor, at least three measured variables load on that factor. With respect to degrees-of-freedom, such a "three-variables-one-factor" model is just-identified—meaning that the factor loadings can be estimated, but the hypothesis of a single underlying factor cannot be formally tested. For the purpose of rejecting the hypothesis of a single underlying factor, at least four measured variables are required. In multiple-factor models, the situation is a bit less constrained, and it is possible to reject, say, a two-factor model as long as there are at least two measured variables per factor and the factors are allowed to correlate. In general, the principle is that in the development of a set of items that are hypothesized to measure an underlying set of factors, the more observed, or measured variables per factor that can be developed, the better.

The second issue concerns the metric of the measures. Typical metrics include five-point or seven-point *Likert scales*. The decision regarding the number of scale steps should be made on the basis of substantive considerations and a knowledge of the sample of respondents[3]. From a statistical point of view, a general principle is that the more scale steps comprising a measure, the better. However, it is no longer entirely necessary that items be measured on five-point or seven-point scales. Indeed, developments in factor analysis over the past 15 years allow for factor structures to be tested on measures that are dichotomous, ordered categorical (e.g., Likert scales), continuous, as well all combinations of these types (Muthén 1978, 1984).

The statistical requirement pertaining to the scale steps is that there be a hypothesized underlying response propensity for each measure. For example, consider the case where one wishes to assess reading habits. The NAAL questionnaire could ask respondents whether they read newspapers at least once a week, with the response choice being "yes" or "no". To incorporate this and other similar items into factor analysis, it is assumed that underlying the dichotomous response is a propensity to respond "yes." The actual observation of a "yes" response occurs after a threshold is exceeded.

When considering the factor analysis of a correlation matrix based on, say, dichotomous response variables, it is not correct to simply analyze the Pearson product-moment correlation matrix of the data. Indeed, such an analysis could result in the extraction of so-called "difficulty factors"[4]. Instead, it is necessary to calculate different types of correlations that account for the scale type under the assumption of the underlying response propensity. For example, the correlation between two dichotomous variables with an underlying normally distributed response propensity is referred to as a *tetrachoric correlation*. Similarly, the correlation between two Likert-scale variables assuming a continuous response propensity underlying each variable is referred as a *polychoric correlation*. Under the assumption of the underlying response propensity, the analysis of these (and other similar) types of correlations provide accurate assessment of the underlying factor structure of the data.

In the context of confirmatory factor analysis or structural equation modeling, more complicated estimation procedures are necessary for the analysis of these types of correlation matrices. A discussion of these estimation procedures is beyond the scope of this paper. It is sufficient to say that, without these specific estimation methods, which require very large sample sizes, the results may be quite inaccurate.

3.1 Recommendations to NCES

From the standpoint of a literacy researcher using NAAL secondary data, the issue of scale type is less important than the number of items needed to measure the factor. This is particularly true given the large sample size proposed for NAAL. Therefore, when building scales to measure underlying attitudes or behaviors, consideration

[3] For example, in developing opinion or attitude items for young children, dichotomously scored items might be chosen because they would be easier for the child to understand.

[4] The problem of "difficulty factors" is a classic psychometric problem arising from the factor analysis of dichotomous variables. The Pearson correlation between two such items is referred as the phi-coefficient. The problem is that if the dichotomous variables exhibit unequal response frequencies, a factor analysis of such data will yield a factor that is an artifact of the unequal responses.

should be given to the hypothesized number of factors and that at least four variables measuring each factor be included in the questionnaire.

4. Issues Pertaining to Policy Modeling

In this section, consideration in given to the use of NAAL data for policy studies. It is clear from a perusal of NCES 98–17 that a major purpose of NAAL is to inform federal and state policy on issues of adult literacy. Generally, policy-relevant information is conveyed through the use of accurate descriptive statistics and cross-tabulations as well as linkages to other relevant data for the purpose of measuring trends in literacy. A discussion of linking the NAAL to other existing databases was discussed earlier in the context of respondent sampling.

Another approach to providing policy-relevant information is the use of advanced statistical models to simulate changes in policy-relevant variables and observe the effects of those changes on literacy outcomes of interest. I refer to such an exercise as *policy simulation modeling*, which can be defined as a method by which a statistical model is used for prediction purposes that have policy relevance. The use of advanced statistical models for policy studies has had a long tradition in economic modeling, but has been lacking in educational research. Generally speaking, any statistical model can be used for the purpose of policy simulation modeling. However, the conventional approach to statistical modeling in education has been to develop a model, estimate its parameters, test the statistical significance of components of the model, and then interpret it. In the case of structural equation modeling applied to educational data, it is often found that a process of model modification occurs in an effort to bring models that do not fit in line with the data. Rarely, if ever, is the final form of these models used to simulate alternative policy or clinical scenarios. Likewise, rarely are models judged on the basis of whether the results gleaned from alternative policy scenarios make any substantive sense.

Recently, Kaplan and Elliott (1997) argued for such an approach and demonstrated policy simulation modeling in the context of validating education indicators. In that analysis, Kaplan and Elliott determined a number of important issues that are relevant to the development of the NAAL questionnaire. These issues concern obtaining predictor, or exogenous, policy-relevant variables and the metric of policy-relevant variables, both of which will be discussed, in turn, below.

4.1 *Obtaining "Exogenous" Policy-Relevant Variables*

In consideration of the use of statistical models for policy simulation modeling, it is helpful to distinguish between the entire set of all possible predictor, or exogenous, variables and a subset of those predictor variables that may be viewed as policy-relevant. To a certain extent, this discussion is tempered by the fact that NAAL will be a cross sectional, as opposed to a longitudinal, study. In any case, it is clear that within the set of exogenous variables, certain variables (e.g., age) cannot, in principle, be manipulated by the investigator, while others (e.g., number of hours spent in literacy related activities), in principle, can.

A subtle feature of the problem is the extent to which variables that are considered policy-relevant are truly predictive. To a certain extent, the question of the *exogeneity* of a variable is an empirical one (Richard 1982). Not all variables that are termed exogenous truly are, and there are advanced exogeneity tests that allow this assumption to be assessed. However, in policy simulation modeling it is important that thought be given to the selection of variables that have policy relevance. This selection should only be guided by theory and the interaction of literacy policy specialists with survey research specialists and psychometricians.

4.2 *Natural Metrics of Observed Variables*

Another concern that emerges from a consideration of policy simulation modeling is the metric of the policy-relevant variables. If secondary statistical modeling is to be used for developing policy-relevant prediction models, then it is essential that observed variables be measured in their natural metrics. To be specific, many national surveys code sensitive variables into categories that render them almost useless for policy simulation modeling. For example, an important variable in an analysis of literacy outcomes is income. Understandably, income is a sensitive question. However, in collapsing income into large and arbitrary categories we render this variable useless for policy modeling.

It is understood that such advice may conflict with confidentiality issues. Nevertheless, it is important that this issue be discussed in designing the background questionnaire and that the statistical ramifications be understood.

Two possible approaches for addressing this issue would be to 1) develop more refined codes and/or 2) create restricted use datasets.

4.3 Recommendations to NCES

The issue discussed in this section concerns using secondary public-use data for basic policy research. If such an endeavor is deemed valuable, then it is essential that policy analysts and researchers supplement descriptive statistics with theoretically guided models that have policy relevance. The advanced statistical models are ripe for this use but require serious consideration of the types of variables and their metrics to be included in the background questionnaire. Thus, it is advised that, in the development of the background questionnaire, policy analysts in the field of adult literacy should meet with survey and measurement specialists to consider the development of policy-relevant variables for use in policy simulation modeling.

5. Issues Relating to Gauging Cohort Effects

Finally, it is important to develop measures that assess the extent of cohort effects. As justification for this, consider that a simple analysis of NALS data shows that there is a precipitous decline in literacy skills after the age of forty-five. This could very well be due to a differential growth rate in literacy for different age cohorts. Yet, with cross-sectional data, this differential growth rate hypothesis is hard to test. The section to follow will consider two approaches to aid in assessing cohort effects: obtaining retrospective background questions and linking NAAL with existing longitudinal surveys.

5.1 Obtaining Retrospective Background Questions

Considering that NAAL will be based on a cross-sectional design, the first approach which may be the most feasible would be to include retrospective questions in the background questionnaire. Such questions should be directed at ascertaining literacy related activities as well as job histories at key points in the lifecycle of respondents.

For example, it may be of interest to probe the job histories of respondents and to ascertain the literacy demands required for each job.

Retrospective questions have a number of serious problems that must be kept in mind (Bijleveld and van der Kamp 1998). First, it should be noted that the very nature of the response to a retrospective question is nonrandom. That is, what is being observed, or measured, are the responses of individuals who can reflect back on their histories. Even if the design had been longitudinal, attrition for any number of reasons would render the resulting sample of respondents a nonrandom sample.

Additional problems with retrospective designs relate to the unreliability of the responses. Such unreliability stem from the following sources: (1) *memory loss,* in which respondents simply forget specific events in their life histories. To mitigate against this problem, some have advocated the use of checklists to aid in recalling possible events; (1) *telescoping,* wherein respondents tend to report events as having happened more recently than they actually happened; and (3) *modification to fit a coherent scheme*, wherein respondents tend to interpret events to fit current perceptions of themselves (Bijleveld and van der Kamp 1998).

These problems render retrospective reports of questionable validity. However, the problems are mitigated by asking respondents to describe factual events to the extent possible. That is, assessments of job histories and literacy activities are more reliable than retrospective assessments of feelings and attitudes. So, instead of asking someone how he felt about reading when he was 10 years old, ask instead, "What was your first job?" "Did the job require reading?" "What types of material were you required to read on your first job?", etc. Although such detailed probing questions will not eliminate these biases, the strategy is known to mitigate them.

5.2 Linking NAAL With Existing Longitudinal Surveys

In the absence of conducting a longitudinal survey, a second approach to gauging cohort effects would be to consider linking a sub-sample of NAAL respondents to an ongoing longitudinal survey, such as the NCES National Educational Longitudinal Survey (NELS), the NCES High School and Beyond (HSB), or the U. S. Department of Labor's National Longitudinal Survey (NLS). To be certain, the feasibility of such a proposal is unclear. In addition, the literacy assessment contained in NAAL is not available in other surveys. Yet, with the development of longitudinal statistical methodologies such as growth curve modeling (Muthen and Curran 1997) it is possible to examine growth in one domain (e.g., reading achievement) as it pertains to the prediction of a distant outcome such as document literacy. Moreover, linkages to other surveys would not require excessively large sample sizes. The benefits of seriously considering such linkages is that surveys such as NELS or NLS contain information regarding reading practices and other schooling measures. In addition, surveys such as NELS contain background parent questionnaire data that might be useful in examining predictors of adult literacy.

5.3 Recommendations to NCES

To gauge the extent of cohort effects, it is suggested that the NAAL background questionnaire obtain retrospective data on general and job-specific literacy related activities. It is advisable to construct retrospective questions that will prompt factual information to the fullest extent possible. Moreover, it is advisable to include possible checklists to aid in the recall of historical events. In addition, NCES should explore the possibility of linking a sub-sample of the NAAL respondents to existing surveys sponsored by NCES or the U.S. Department of Labor (e.g., NELS, HSB, NLS). Finally, NCES should explore the possibility of obtaining a sub-sample of each age cohort of the NALS survey and include these in the NAAL survey.

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Listing of NCES Working Papers to Date

Working papers can be downloaded as pdf files from the NCES Electronic Catalog (http://nces.ed.gov/pubsearch/). You can also contact Sheilah Jupiter at (202) 502-7444 (sheilah_jupiter@ed.gov) if you are interested in any of the following papers.

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Baccalaureate and Beyond (B&B)		
98-15	Development of a Prototype System for Accessing Linked NCES Data	Steven Kaufman
Beginning Postsecondary Students (BPS) Longitudinal Study		
98-11	Beginning Postsecondary Students Longitudinal Study First Follow-up (BPS:96-98) Field Test Report	Aurora D'Amico
98-15	Development of a Prototype System for Accessing Linked NCES Data	Steven Kaufman
1999-15	Projected Postsecondary Outcomes of 1992 High School Graduates	Aurora D'Amico
Common Core of Data (CCD)		
95-12	Rural Education Data User's Guide	Samuel Peng
96-19	Assessment and Analysis of School-Level Expenditures	William J. Fowler, Jr.
97-15	Customer Service Survey: Common Core of Data Coordinators	Lee Hoffman
97-43	Measuring Inflation in Public School Costs	William J. Fowler, Jr.
98-15	Development of a Prototype System for Accessing Linked NCES Data	Steven Kaufman
1999-03	Evaluation of the 1996-97 Nonfiscal Common Core of Data Surveys Data Collection, Processing, and Editing Cycle	Beth Young
Decennial Census School District Project		
95-12	Rural Education Data User's Guide	Samuel Peng
96-04	Census Mapping Project/School District Data Book	Tai Phan
98-07	Decennial Census School District Project Planning Report	Tai Phan
Early Childhood Longitudinal Study (ECLS)		
96-08	How Accurate are Teacher Judgments of Students' Academic Performance?	Jerry West
96-18	Assessment of Social Competence, Adaptive Behaviors, and Approaches to Learning with Young Children	Jerry West
97-24	Formulating a Design for the ECLS: A Review of Longitudinal Studies	Jerry West
97-36	Measuring the Quality of Program Environments in Head Start and Other Early Childhood Programs: A Review and Recommendations for Future Research	Jerry West
1999-01	A Birth Cohort Study: Conceptual and Design Considerations and Rationale	Jerry West
2000-04	Selected Papers on Education Surveys: Papers Presented at the 1998 and 1999 ASA and 1999 AAPOR Meetings	Dan Kasprzyk
Education Finance Statistics Center (EDFIN)		
94-05	Cost-of-Education Differentials Across the States	William J. Fowler, Jr.
96-19	Assessment and Analysis of School-Level Expenditures	William J. Fowler, Jr.
97-43	Measuring Inflation in Public School Costs	William J. Fowler, Jr.
98-04	Geographic Variations in Public Schools' Costs	William J. Fowler, Jr.
1999-16	Measuring Resources in Education: From Accounting to the Resource Cost Model Approach	William J. Fowler, Jr.
High School and Beyond (HS&B)		
95-12	Rural Education Data User's Guide	Samuel Peng
1999-05	Procedures Guide for Transcript Studies	Dawn Nelson
1999-06	1998 Revision of the Secondary School Taxonomy	Dawn Nelson
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1999-05	Procedures Guide for Transcript Studies	Dawn Nelson
1999-06	1998 Revision of the Secondary School Taxonomy	Dawn Nelson

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Integrated Postsecondary Education Data System (IPEDS)		
97-27	Pilot Test of IPEDS Finance Survey	Peter Stowe
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National Assessment of Adult Literacy (NAAL)		
98-17	Developing the National Assessment of Adult Literacy: Recommendations from Stakeholders	Sheida White
1999-09a	1992 National Adult Literacy Survey: An Overview	Alex Sedlacek
1999-09b	1992 National Adult Literacy Survey: Sample Design	Alex Sedlacek
1999-09c	1992 National Adult Literacy Survey: Weighting and Population Estimates	Alex Sedlacek
1999-09d	1992 National Adult Literacy Survey: Development of the Survey Instruments	Alex Sedlacek
1999-09e	1992 National Adult Literacy Survey: Scaling and Proficiency Estimates	Alex Sedlacek
1999-09f	1992 National Adult Literacy Survey: Interpreting the Adult Literacy Scales and Literacy Levels	Alex Sedlacek
1999-09g	1992 National Adult Literacy Survey: Literacy Levels and the Response Probability Convention	Alex Sedlacek
2000-05	Secondary Statistical Modeling With the National Assessment of Adult Literacy: Implications for the Design of the Background Questionnaire	Sheida White
National Assessment of Educational Progress (NAEP)		
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97-29	Can State Assessment Data be Used to Reduce State NAEP Sample Sizes?	Steven Gorman
97-30	ACT's NAEP Redesign Project: Assessment Design is the Key to Useful and Stable Assessment Results	Steven Gorman
97-31	NAEP Reconfigured: An Integrated Redesign of the National Assessment of Educational Progress	Steven Gorman
97-32	Innovative Solutions to Intractable Large Scale Assessment (Problem 2: Background Questionnaires)	Steven Gorman
97-37	Optimal Rating Procedures and Methodology for NAEP Open-ended Items	Steven Gorman
97-44	Development of a SASS 1993-94 School-Level Student Achievement Subfile: Using State Assessments and State NAEP, Feasibility Study	Michael Ross
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95-06	National Education Longitudinal Study of 1988: Conducting Cross-Cohort Comparisons Using HS&B, NAEP, and NELS:88 Academic Transcript Data	Jeffrey Owings
95-07	National Education Longitudinal Study of 1988: Conducting Trend Analyses HS&B and NELS:88 Sophomore Cohort Dropouts	Jeffrey Owings
95-12	Rural Education Data User's Guide	Samuel Peng
95-14	Empirical Evaluation of Social, Psychological, & Educational Construct Variables Used in NCES Surveys	Samuel Peng
96-03	National Education Longitudinal Study of 1988 (NELS:88) Research Framework and Issues	Jeffrey Owings
98-06	National Education Longitudinal Study of 1988 (NELS:88) Base Year through Second Follow-Up: Final Methodology Report	Ralph Lee
98-09	High School Curriculum Structure: Effects on Coursetaking and Achievement in Mathematics for High School Graduates—An Examination of Data from the National Education Longitudinal Study of 1988	Jeffrey Owings
98-15	Development of a Prototype System for Accessing Linked NCES Data	Steven Kaufman
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96-21	1993 National Household Education Survey (NHES:93) Questionnaires: Screener, School Readiness, and School Safety and Discipline	Kathryn Chandler
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96-30	Comparison of Estimates from the 1995 National Household Education Survey (NHES:95)	Kathryn Chandler
97-02	Telephone Coverage Bias and Recorded Interviews in the 1993 National Household Education Survey (NHES:93)	Kathryn Chandler
97-03	1991 and 1995 National Household Education Survey Questionnaires: NHES:91 Screener, NHES:91 Adult Education, NHES:95 Basic Screener, and NHES:95 Adult Education	Kathryn Chandler
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97-05	Unit and Item Response, Weighting, and Imputation Procedures in the 1993 National Household Education Survey (NHES:93)	Kathryn Chandler
97-06	Unit and Item Response, Weighting, and Imputation Procedures in the 1995 National Household Education Survey (NHES:95)	Kathryn Chandler
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98-03	Adult Education in the 1990s: A Report on the 1991 National Household Education Survey	Peter Stowe
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National Longitudinal Study of the High School Class of 1972 (NLS-72)		
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National Postsecondary Student Aid Study (NPSAS)		
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98-15	Development of a Prototype System for Accessing Linked NCES Data	Steven Kaufman
2000-01	1999 National Study of Postsecondary Faculty (NSOPF:99) Field Test Report	Linda Zimbler
Private School Universe Survey (PSS)		
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96-27	Intersurvey Consistency in NCES Private School Surveys for 1993-94	Steven Kaufman
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94-03	1991 Schools and Staffing Survey (SASS) Reinterview Response Variance Report	Dan Kasprzyk
94-04	The Accuracy of Teachers' Self-reports on their Postsecondary Education: Teacher Transcript Study, Schools and Staffing Survey	Dan Kasprzyk
94-06	Six Papers on Teachers from the 1990-91 Schools and Staffing Survey and Other Related Surveys	Dan Kasprzyk
95-01	Schools and Staffing Survey: 1994 Papers Presented at the 1994 Meeting of the American Statistical Association	Dan Kasprzyk
95-02	QED Estimates of the 1990-91 Schools and Staffing Survey: Deriving and Comparing QED School Estimates with CCD Estimates	Dan Kasprzyk
95-03	Schools and Staffing Survey: 1990-91 SASS Cross-Questionnaire Analysis	Dan Kasprzyk
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95-10	The Results of the 1991-92 Teacher Follow-up Survey (TFS) Reinterview and Extensive Reconciliation	Dan Kasprzyk
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96-10	1998-99 Schools and Staffing Survey: Issues Related to Survey Depth	Dan Kasprzyk

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96-12	Predictors of Retention, Transfer, and Attrition of Special and General Education Teachers: Data from the 1989 Teacher Followup Survey	Dan Kasprzyk
96-15	Nested Structures: District-Level Data in the Schools and Staffing Survey	Dan Kasprzyk
96-23	Linking Student Data to SASS: Why, When, How	Dan Kasprzyk
96-24	National Assessments of Teacher Quality	Dan Kasprzyk
96-25	Measures of Inservice Professional Development: Suggested Items for the 1998-1999 Schools and Staffing Survey	Dan Kasprzyk
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1999-13	1993-94 Schools and Staffing Survey: Data File User's Manual, Volume IV: Bureau of Indian Affairs (BIA) Restricted-Use Codebook	Kerry Gruber
1999-14	1994-95 Teacher Followup Survey: Data File User's Manual, Restricted-Use Codebook	Kerry Gruber
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96-22	1995 National Household Education Survey (NHES:95) Questionnaires: Screener, Early Childhood Program Participation, and Adult Education	Kathryn Chandler
98-03	Adult Education in the 1990s: A Report on the 1991 National Household Education Survey	Peter Stowe
98-10	Adult Education Participation Decisions and Barriers: Review of Conceptual Frameworks and Empirical Studies	Peter Stowe
1999-11	Data Sources on Lifelong Learning Available from the National Center for Education Statistics	Lisa Hudson
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95-13	Assessing Students with Disabilities and Limited English Proficiency	James Houser
97-29	Can State Assessment Data be Used to Reduce State NAEP Sample Sizes?	Larry Ogle
97-30	ACT's NAEP Redesign Project: Assessment Design is the Key to Useful and Stable Assessment Results	Larry Ogle
97-31	NAEP Reconfigured: An Integrated Redesign of the National Assessment of Educational Progress	Larry Ogle
97-32	Innovative Solutions to Intractable Large Scale Assessment (Problem 2: Background Questions)	Larry Ogle
97-37	Optimal Rating Procedures and Methodology for NAEP Open-ended Items	Larry Ogle
97-44	Development of a SASS 1993-94 School-Level Student Achievement Subfile: Using State Assessments and State NAEP, Feasibility Study	Michael Ross
98-09	High School Curriculum Structure: Effects on Coursetaking and Achievement in Mathematics for High School Graduates—An Examination of Data from the National Education Longitudinal Study of 1988	Jeffrey Owings
Beginning students in postsecondary education		
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95-11	Measuring Instruction, Curriculum Content, and Instructional Resources: The Status of Recent Work	Sharon Bobbitt & John Ralph
98-09	High School Curriculum Structure: Effects on Coursetaking and Achievement in Mathematics for High School Graduates—An Examination of Data from the National Education Longitudinal Study of 1988	Jeffrey Owings
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International comparisons		
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94-07	Data Comparability and Public Policy: New Interest in Public Library Data Papers Presented at Meetings of the American Statistical Association	Carrol Kindel
97-25	1996 National Household Education Survey (NHES:96) Questionnaires: Screener/Household and Library, Parent and Family Involvement in Education and Civic Involvement, Youth Civic Involvement, and Adult Civic Involvement	Kathryn Chandler
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