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AUTHOR Kaplan, David; Venezky, Richard L.

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ABSTRACT

A study explored the contribution of selected literacy, demographic, and sociopolitical variables on registering to vote and on voting, using as a database a subset of the respondents to the Young Adult Literacy Survey, administered in 1985 to a stratified national sample of 21- through 25-year-olds. Three sets of independent variables were explored: demographic characteristics, political participation, and literacy practices and proficiencies. When a bivariate probit regression model with sample selection was applied to these data, only the amount of hard news read and years of education were significant predictors of voting, given registration. For registration, these variables, plus ethnicity/race, television viewing, and the degree to which one keeps up with governmental affairs were all significant predictors. The conclusion was that increased education and increased attention to hard news reading within school and adult education curricula could lead to increased propensities to vote. Appendixes include five data tables. Contains 6 endnotes and 24 references. (Author/YLB)

NATIONAL CENTER ON ADULT LITERACY

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NATIONAL CENTER ON ADULT LITERACY
UNIVERSITY OF PENNSYLVANIA
3910 CHESTNUT STREET
PHILADELPHIA, PA 19104-3111
PHONE (215) 898-2100 FAX (215) 898-9804

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Abstract

This paper explores the contribution of selected literacy, demographic, and sociopolitical variables on registering to vote and on voting, using as a database a subset of the respondents to the Young Adult Literacy Survey (YALS), administered in 1985 on a stratified national sample of 21- through 25-year-olds. Three sets of independent variables were explored: demographic characteristics, political participation, and literacy practices and proficiencies. When a bivariate probit regression model with sample selection was applied to these data, only the amount of hard news read (e.g., governmental affairs) and years of education were significant predictors of voting, given registration. For registration, these variables, plus ethnicity/race, television viewing, and the degree to which one keeps up with governmental affairs were all significant predictors. We then conclude that increased education as well as increased attention to hard news reading within school and adult education curricula could lead to increased propensities to vote.

INTRODUCTION

Since the ratification of the U.S. Constitution in 1789-90, American political leaders have taken great pride in the American style of participatory democracy. Central to this political process is the exercise of voting rights by all those who are eligible to vote, and since the early 1790s, these rights have been extended to a wider and wider proportion of the population. First with the removal of property ownership requirements (beginning in 1807 in New Jersey), then with Emancipation (1863) and the Fifteenth Amendment (ratified in 1870), women's suffrage (1920), the Voting Rights Act of 1965 (plus the 1982 amendment), the lowering of the voting age to 18 (1971), and the recent Motor Voting Act, more and more citizens have become eligible to vote and more and more barriers to registration and voting have been removed. Since 1960, however, fewer and fewer persons eligible to vote have exercised this right. This trend continued through the 1988 presidential election, which had the lowest voter turnout since the 1920s. The recent presidential election, in which 55.4% of the eligible voters actually voted, may have marked the end of this 28-year decline, although the percentage turnout did not exceed that of 1968 (Cook, 1993). Analysis of demographic and sociopolitical characteristics have provided some insights into why this decline occurred. Nevertheless, much remains to be learned about the factors that influence voting behavior. This paper is a contribution to this exploration, examining in particular the relationship of literacy and certain literate behaviors to voting.

DEMOGRAPHIC FACTORS

Voting is a form of political participation that is characterized by being highly accessible to the average citizen and requiring low resource expenditure (time, money, motivation, etc.) (Kleppner, 1982). Unlike other forms of political participation such as campaigning, contributing to political parties or candidates, or belonging to political clubs, voting can be done with a minimum of time, money, and effort. Yet a complex set of factors appears to influence whether or not an eligible citizen will actually vote.

Studies of voter turnout (e.g., Kleppner, 1982; Lipset, 1981; Teixeira, 1987; Verba & Nie, 1972) have generally focused on two sets of individual variables: demographic (education, occupation, income, age, residential mobility, marital status, race, geographic region, and sex) and sociopolitical (partisanship, political efficacy, and campaign newspaper reading). Among the core SES demographic variables, higher education, income, and occupational status have been associated with higher tendencies to vote. Causal links between these variables and voting behavior have generally been argued from logical analysis. According to Teixeira (1987), for example, the nonmanual occupations provide greater intellectual stimulation than the manual occupations, giving therefore greater access to information about registration and voting processes and about voting issues. Similarly, a higher income implies more discretionary time and emotional energy for nonessential activities such as voting. Educational levels could affect voting behavior through a number of different mechanisms. Greater education might lead to greater awareness of one's responsibilities as a citizen, or it might, like the informal education gained

from nonmanual occupations, provide increased ability to handle the mechanics of registration and voting.

Older citizens have exhibited higher turnouts than younger citizens, a difference that holds true when adjustments in voting rates are made for education, income, and sex. In the 1984 presidential election, for example, persons in the 55-64 age bracket had nearly twice the self-reported voting rate as persons in the 18-20 bracket (72.1% vs. 36.7%). Age, together with residential mobility and marital status, comprise a *rootedness* factor that relates positively to voting behavior. Older persons have more voting experience than younger persons and, therefore, presumably find voting to be an easier task. Married persons living with their spouses tend to vote at higher rates than single persons or married persons living alone, perhaps because of the sharing of the physical costs of voting and of information about the candidates and their positions. High residential mobility implies a higher need for reregistration and reestablishment of political ties, costs that tend to drive down the probability of voting.

In contrast to the rootedness variables, race, region of the country, and sex have comprised in the past a *political distancing* grouping. Those who felt they were on the inside (white, male, nonsouth) tended to vote at higher rates than those who felt they were on the outside. Male turnout in the past tended to exceed female turnout, but this difference has been gradually disappearing. Similarly, white turnout rates have been higher than black rates, but a large proportion of this gap is due to differences in education and income, and has been narrowed (Leighly & Nagler, 1992).

SOCIOPOLITICAL FACTORS

The main sociopolitical factors that have been investigated in voter turnout studies have been partisanship, political efficacy, and campaign newspaper reading, all of which index a form of engagement. Partisanship and political efficacy are probably closely related. Partisanship relates to identity with a specific party candidate or issue, while political efficacy relates to the degree to which persons feel they have any influence over governmental activities. In times of high cynicism, voter turnout tends to drop. Conversely, individuals who have strong partisan identifications tend to be more likely to vote (Teixeira, 1987).

Campaign newspaper reading, which is highly related to turnout, is an indicator of intellectual engagement and of understanding. It derives, however, from more stable, year-round habits of media usage. Chaffee and Yang (1990) found a difference in voting habits between those who gained their political knowledge solely from TV and those who read newspapers for this same end. TV-dependent citizens were found to vote less, understand less, and be less involved in political campaigns, and to be less likely to have well-formed reasons for their political choices. Analyses of media coverage of campaigns have found newspapers to present the greater range and depth of issues, to have more partisan bias, and to require the readers to engage themselves more actively and more creatively. In contrast, TV coverage is more structured and less intellectually demanding, requiring little initiative by the viewer (Shaffer, 1981).

Graber (1976) found TV images of candidates and issues to be simpler and easier to grasp than those presented in the press; similarly, appraisals of candidates tended to be more positive. "The reader who finds press coverage confusing as well as depressing can thus turn to television for a simpler, clearer, and more encouraging image of the unfolding electoral scene" (Graber, 1976, p. 302). However, newspaper reading of all types has been declining for at least three decades (Barnhurst & Wartella, 1991). Presidential election surveys for the period 1960 to 1976 show a decline in the percentage of people who reported regular reading of newspaper articles about campaigns, from 46.4% in 1960 to 26.6% in both 1972 and 1976 (Shaffer, 1981). Adult daily newspaper reading declined overall from 1961 (80%) to 1984 (65%). Among 18-24-year-olds, the decline over this same period was from 74% to 58% (Cobb, 1986). This decline has occurred over a period during which the mean amount of education increased, thus, it cannot be attributed to decreases in educational levels, nor can it, according to Chaffee and Choe (1981), be explained by media competition. Parallel declines in confidence and interest in politics and government may be better explanations.

In a study of college students, Barnhurst and Wartella (1991) found that most of their subjects became interested in newspapers through early exposure to the comics. Gradually they widened their interests to include other parts of the newspaper, but did not, in general, take an interest in politics or issues related to state or municipal government. They found these irrelevant to their lives. The majority defined themselves as consumers in a consumer society rather than as citizens in a democracy.

Most children first become aware of politics through television. Those who become newspaper readers generally make the crossover in early adolescence (Chaffee & Yang, 1990). For many people, reading habits evidenced as early as fourth grade, when the elementary reading load increases sharply, remain stable into adulthood. Newspaper reading habits, however, may shift over time for individuals. The most stable readers are those who access regularly both *hard news* (international news; national, state, and local politics) and *soft news* (news about people in the community, home and garden, crime and accidents). People who abandon newspaper reading tend to have lower hard news scores than either stable readers or those who adopt newspaper reading after adolescence (Chaffee & Choe, 1981).

Relative Strengths of Predictors

A number of studies have attempted to compare the relative strengths of different sets of turnout predictors, the most common contrasts being between systemic and individual factors. Examples of systemic factors include campaign mobilization, registration laws, union membership, and the closeness of an election. Typical of these studies is Patterson and Caldeira (1983), which concluded from an analysis of gubernatorial elections that systemic factors were the primary determinants of voter turnout, and Leighly and Nagler (1992), which concluded for the 1984 presidential election that individual factors, particularly education, were the primary determinants of turnout.

Registration and Voting

In the Young Adult Literacy Study (YALS), hard news reading was found to relate positively to voting as was literacy level (Kirsch & Jungeblut, 1986).

However, no attempt was made to control for age, education, sex, race, or other potential explanatory variables, nor was the selection bias caused by registration considered. Registration, a necessity for voting, has also been ignored in most voter turnout studies. Although the motivations for registering to vote and actually voting must have a large overlap, some factors may be unique to each or more important to one than to the other. If the determinants of both registration and voting were examined separately, systemic factors like closeness of registration closing date to election date and union membership might be found to be stronger determinants of registration than of voting. Other factors, such as the perceived closeness of an election contest, are related to individual factors like political efficacy. The closer an electoral contest appears to be, the more important one's vote appears to be. Then, residential mobility, for example, probably affects registration more than it does voting because the effort required for registration usually exceeds that for voting.

In the present study, the role of various systemic and individual factors are examined in relation to both registering to vote and to voting. Moreover, as will be discussed below, this paper statistically incorporates registration in the model for voting. That is, among the population of those eligible to vote by virtue of age and citizenship status, only those who actually register to vote can vote. This means that the subsample of those who vote are a nonrandom sample of the eligible population.

The data for this analysis were obtained from a survey of the literacy abilities of young adults, ages 21-25, carried out in 1985 (Kirsch & Jungeblut, 1986). In the original survey, the percentage of young adults who registered to vote and the percentage of those who voted increased with increasing education.[1] For voting, 24.8% of those with only an elementary school education voted, while 31.7% of those with some high school, 59.3% of the high school graduates (without college), and 80.2% of those with a degree from a two-year or four-year college claimed to have voted (Venezky, Kaestle, & Sum, 1987). Those who were registered to vote scored, on the average, about one half a standard deviation higher on the literacy scales than those who were not registered, but when education is controlled for, these differences disappear.[2]

A Statistical Model for Voter Registration and Voting

A review of the methodologies employed in the studies cited above suggests that the dominant statistical method for understanding the predictors of voting is discriminant analysis. Although discriminant analysis is an appropriate methodology for studying the factors that predict voting and nonvoting groups, in almost all cases where it and other methods were employed, no account was taken of the role that registration plays in the voting process and in no case was registration explicitly used as a selection

factor in models of voting. In this section, we outline the statistical model that we use to estimate the impact of literacy practices, literacy proficiencies, and demographics on the outcomes of voter registration and voting.

As noted in the previous section, participants in this study could not have voted unless they were registered to vote. Therefore, those individuals likely constitute a nonrandom subsample of all individuals eligible to vote by virtue of their age and citizenship status. Unlike previous research in this area, the statistical model employed in this study corrects for the bias in the coefficients attached to the predictors of voting due to the nonrandom selection mechanism for those who vote. The model also recognizes that there are, quite probably, common and hence correlated, omitted variables related to registration and voting.

Statistically correct approaches to the problem of selection bias derive from Heckman's (1979) seminal work on two-stage estimation in nonrandom samples. Heckman gives examples of the problem in the context of estimating earnings of various subpopulations. To take one of Heckman's examples, one may be interested in estimating the earnings of manpower trainees; however, the estimated parameters for such an equation would be biased if they did not take into account the wages of nontrainees had they opted to become trainees (Heckman, 1979, p. 153). In this and other examples, the equation of interest predicts a continuous endogenous variable (e.g., earnings), which in this selection equation is usually dichotomous and may not be of substantive interest (e.g., opting to become a trainee). In this study, by comparison, the equations for registration and voting both have dichotomous responses and the selection equation predicting registration is of substantive significance. Thus, we argue that the appropriate model in this context is a *bivariate probit regression with sample selection*. This model has been used elsewhere (see e.g., Van De Ven & Van Praag, 1981) and is discussed in Greene (1990).

To fix ideas, this paper considers the observed dichotomous responses to whether or not an individual is registered to vote and votes as representing an underlying propensity, or tendency, to register and to vote. Let y^*_R represent the i^{th} respondent's ($i = 1, 2, \ldots, N$) propensity to register to vote given that the respondent is eligible to register and let y^*_V be the corresponding propensity of the i^{th} respondent to vote. In this study, all respondents are over eighteen years of age and are U.S. citizens, hence are eligible to register and vote. Each response propensity is unobserved, but is assumed to be continuous and normally distributed. Denote by y_R and y_V the observed dichotomous responses to the questions of whether a respondent was registered to vote and whether he/she voted. Then, the observed responses to the registration and voting questions can be related to their respective response propensities by separate probit regression equations. For the i^{th} respondent, the registration equation can be written as

$$y_R = \beta'_R \mathbf{x}_R + u_R, \qquad (1)$$

where β'_R is a vector of unknown parameters, $\mathbf{x}_R$ is a vector of predictors, u_R is the i^{th} disturbance which, under the assumption that the model is correctly specified, is assumed to have a conditional mean of zero and variance of one.

The relationship between the observed response y_R and response propensity y^*_R can be represented as

$$y_R = \begin{cases} 0 \text{ if } y^*_R \le 0, \\ 1 \text{ if } y^*_R > 0, \end{cases} \tag{2}$$

Similarly, the voting equation for the i[th] respondent has the form

$$y_V = \beta'_V \mathbf{x}_V + u_V, \tag{3}$$

where

$$y_V = \begin{cases} 0 \text{ if } y^*_V \le 0, \\ 1 \text{ if } y^*_V > 0, \end{cases} \tag{4}$$

and where u_R and u_V may have elements in common.

As noted above, both models may have omitted predictors in common resulting in a nonzero covariance between the disturbance terms u_R and u_V. Moreover, it is also the case that there is nonrandom selection of respondents answering the voting question owing to the fact that one cannot vote unless one is registered to vote. Thus, the voting equation is missing a predictor related to the probability of observing an affirmative response to the registration question. As a result, the conditional mean of u_V given the predictors does not equal zero, as required by ordinary application of probit regression. The separate application of probit regression to the voting response would ignore these problems leading to incorrect inferences of the relationship of registration and voting to literacy practices and demographics. This problem is addressed by application of the bivariate probit regression model with sample selection. This model takes the separate probit regressions and adds the assumption that u_R and u_V are realizations of a bivariate normal distribution with marginal means of zero, variances σ^2_R and σ^2_V, and covariance σ_{RV}, and that y_V and x_V are observed only when $y_R = 1$. Note that separate application of probit regression would yield unbiased estimates only if $\sigma_{RV} = 0$. If, however, $\sigma_{RV} \neq 0$, then the population regression function for the subsample of respondents who registered to vote can be expressed as

$$E\left(y_V \middle| \mathbf{x}_V, y^*_R > 0\right) = \beta'_V \mathbf{x}_V + E\left(u_V \middle| \mathbf{x}_V, y^*_R > 0\right), \tag{5}$$

$$= \beta'_V \mathbf{x}_V + E\left(u_V \middle| u_R > -\beta'_R \mathbf{x}_R\right). \tag{6}$$

The second term on the right hand side of (6) can be expressed as

$$E\left(u_V \middle| u_R > -\beta'_R \mathbf{x}_R\right) = \beta_\lambda \lambda, \tag{7}$$

where $\beta\lambda = \sigma_{RV}/\sigma_R$ is a scalar value population regression coefficient and λ is the inverse of Mill's ratio.[3] Note that (5) through (7) show that when the

nonrandom sampling mechanism is not made explicit, the conditional mean of the disturbances given the predictors is not zero. The nonzero relationship between the predictors and the disturbances is a violation of standard regression assumptions. What is required is that the nonrandom selection mechanism given in (6) be made explicit. Utilizing the expression in (6), the voting equation can be modified by adding an estimate of λ thus yielding the sample regression function

$$y_V \left| y_R^* > 0 = \beta_V' \mathbf{x}_V + \beta_\lambda \lambda + \tilde{u}_V, \right. \tag{8}$$

where now

$$E\left(\tilde{u}_V \left| y_R^* > 0\right.\right) = 0, \tag{9}$$

thus satisfying the assumption that the conditional mean of the errors is zero in the population.

METHODOLOGY

PROCEDURE AND SAMPLE

As described above, bivariate probit regression was used to explore the relative strengths of different predictors of both registration and voting. The data for this study were derived from the responses of 1,705 young adults, ages from 21 to 25, who were among those who responded to the Young Adult Literacy Survey (Kirsch & Jungeblut, 1986). Respondents were whites and African Americans selected from the total subject pool on the basis of being U.S. citizens and thus, given the age range of the respondents, were eligible to register to vote. The dependent measures in this study were dichotomous responses to the questions: "Are you registered to vote?" and "Have you ever voted in a public election in the U.S.?" These variables were labeled REGIST and VOTE, respectively.

DEMOGRAPHIC MEASURES

Demographic measures in this study included SES and political distancing variables. No rootedness variables were included because marital status and residential mobility were not asked in the YALS questionnaire and age covered too narrow a band (21-25 years) to provide meaningful variability. SES variables included

- education level (EDGRADE; coded 1 = *0 to 8 years*, 2 = *some high school*, 3 = *high school graduate*, 4 = *trade/vocational*, 5 = *less than 2 years of college* 6 = *associates degree*, 7 = *less than 4 years of college*, 8 = *college graduate),*

- mother's educational attainment (MAED; coded as EDGRADE),
- father's educational attainment (FAED; coded as EDGRADE),
- personal income (INCOME; ranges recoded to midpoint values $5,000, $7,500, $12,500, $17,500, $25,000, $35,000, $45,000, $50,000), and
- occupation dummy vectors (OCC1 coded 1 = *managers, professionals, and technical workers*, 0 = *unemployed*; OCC2 coded 1 = *salespersons, clerical workers, and craftsmen*, 0 = *unemployed; OCC3 coded* 1 = *operatives, service workers, and laborers*, 0 = *unemployed*).

Political distancing variables included

- sex (coded 1 = *male* and 0 = *female*),
- ethnicity (ETHNIC, coded 1 = *White*, 0 = *African American*), and
- region (REGION, coded 1 = *Northeast*, 0 = *Southeast, Central, West*).

Political Participation Measures

Two political participation variables were initially considered for the model: whether the respondent belongs to a political organization (coded 0 = *no*, 1 = *yes*) and whether the respondent keeps up with government affairs (coded 1= *most of the time*, 2 = *some of the time*, 3 = *only now and then*, 4 = *hardly at all*). These variables were labeled POLIORG and KEEPUP, respectively, and correspond roughly to more traditional measures of partisanship and of campaign newspaper reading. However, preliminary analyses indicated that too few respondents answered *yes* to POLIORG to obtain a stable solution. Thus, it was decided to drop POLIORG from further analyses.

Literacy Practices and Proficiencies

The Young Adult Literacy Survey (YALS) contains a number of questions that gauge the amount of reading of particular types of literatures that respondents engage in. This paper focuses on television viewing, book reading, and newspaper reading. With respect to television viewing, YALS asked respondents to estimate the number of hours of television viewing that they engage in during the day. This variable was labeled TV.

With respect to book reading, respondents were asked whether or not they read, in the last six months, any of seven different kinds of books: (a) fiction, (b) entertainment, (c) history, (d) religion, (e) science, (f) reference, or (g) manuals. Responses to each category were coded 1 = *yes*, 0 = *no*. Exploratory factor analyses of the tetrachoric correlation matrix[4] utilizing the LISCOMP software program (Muthen, 1987) were performed testing a one-factor, two-factor, and three-factor model. Preliminary analyses suggested that science books loaded in a complex fashion. Thus to obtain a cleaner solution for the purposes of scale development, the science question was

dropped. The one-factor model did not fit the data ($\chi^2_9 = 66.761$, $p < .0001$). A two-factor model did not fit the data either ($\chi^2_4 = 10.934$, $p < .05$), but it was a significant improvement in fit over the one-factor model ($\Delta\chi^2_5 = 55.827$, $p < .05$).[5] The three-factor model resulted in an inadmissible solution. It was decided to select the two-factor model as representing the structure underlying these questions. The results of the final two-factor model are shown in Table 1 (see Appendix). The first factor was named BOOKFUN and the second factor was named BOOKTECH. Scales were formed by summing with unit weights the variables that loaded on each factor.

In addition to book reading, YALS also assessed the amount of newspaper reading that respondents engage in, as well as the sections of the newspaper that they read. With respect to amount, YALS asked each respondent to indicate the amount of newspaper reading that the respondent engaged in during the week. This variable was labeled READNEWS. With respect to the sections of newspapers respondents read, *yes/no* responses were obtained to questions regarding whether they read (a) national news, (b) state or local news, (c) sports, (d) women/society sections, (e) editorials, (f) financial sections, (g) comics, (h) classified sections, (i) advertisements, (j) TV listings, (k) movie reviews, or (l) horoscope. Preliminary analyses suggested that the sports question loaded in a complex fashion. Thus, for the purposes of a clean solution for scale development, the sports question was dropped from the analysis. The results of an exploratory factor analysis of these data utilizing LISCOMP revealed that a one-factor model did not fit the data ($\chi^2_{44} = 391.133$, $p < .0001$). Specification of a two-factor model also did not fit the data ($\chi^2_{34} = 147.849$, $p < .0001$), but it resulted in a significant improvement in fit over the one-factor model ($\Delta\chi^2_{10} = 243.284$, $p < .0001$). The three-factor model yielded an uninterpretable solution. It was decided to select the two-factor model as representing the structure underlying these questions. The results of the two-factor model are displayed in Table 2 (see Appendix). These factors were labeled HARDNEWS and SOFTNEWS. Scales were formed by summing with unit weights the variables that loaded on each factor.

Variables that assessed the literacy proficiencies of the respondents were also included in this study. These included the scale score measures of prose, document, and quantitative literacy (Kirsch & Jungeblut, 1986), labeled PROSE, DOC, and QUANT, respectively. The prose literacy scale measures the ability of respondents to match information with corresponding text, produce and interpret text information, and generate a theme from text information. The document literacy scale measures a respondent's ability to match information to corresponding information from various documents. The quantitative literacy scale measures a respondent's ability to utilize simple mathematical operations, separately or in combination, to solve problems embedded in printed material (Kirsch & Jungeblut, 1986).

RESULTS

Table 3 (see Appendix) presents descriptive statistics for the variables used in this study, divided according to whether respondents were (a) registered to vote and voted, (b) registered to vote but did not vote, or (c) not registered to vote. A preliminary bivariate probit regression with sample selection was performed using the software program LIMDEP (Greene, 1992). Specifying the same complete set of predictors for both registration and voting resulted in serious problems of convergence. It was decided, therefore, to specify separate equations for registration and voting, based on a backward removal process whereby only those predictors that were significant at $p < .001$ were retained. This analysis was performed using the software program PROC LOGISTIC (SAS Institute, Inc., 1990). The results of the separate probit regressions are shown in Table 4 for comparative purposes (see Appendix). It can be seen that the probit models for registration and voting are statistically significant and all predictors of registration and voting are significant at $p < .01$. Of course, as noted above, these results do not take into account the nonrandom sampling mechanism that generates an affirmative voting response, nor the fact that both equations have correlated omitted variables. The resulting equations for registration and voting were comprised of the same predictors ETHNIC, KEEPUP, TV, HARDNEWS, and EDGRADE. Note that in both equations, the background demographics (OCC1-OCC3, MOED, FAED, and INCOME), literacy proficiencies (PROSE, DOC, and QUANT), and the literacy practice variables (BOOKFUN, BOOKTECH, SOFTNEWS, and READNEWS) were found not to contribute to the prediction of registration or voting.

The results of the bivariate probit regression with sample selection using LIMDEP are shown in Table 5 (see Appendix). Three points should be noted when inspecting this table. First, the correlation between the disturbances of these equations ($r_{RV} = -0.91$) suggests that selection bias is a serious problem in this study.[6] Second, we find that when the term reflecting the nonrandom selection of individuals who registered to vote is incorporated into the voting equation (see Equation 7), all but two predictors of voting (HARDNEWS and EDGRADE) become nonsignificant. This suggests, within the constraints of the variables chosen, that numerous factors contribute to the probability of registering to vote, but once registered, the amount of serious news that the individual reads and the educational level of the individual are the most salient predictors of actual voting.

By applying a simple rescaling of the probit regression coefficients (see footnote in Table 4), we can convert the probit-based regression coefficients into logistic-based regression coefficients. By exponentiating the logistic-based regression coefficients, we can obtain odds ratios for each predictor variable (see Hosmer & Lemeshow, 1989). The odds ratios are given in the last column of Tables 4 and 5. From the final model, we find that the more serious (hard) news items that an individual reads, the greater the odds that the individual will vote. Also, higher levels of education are associated with greater odds of voting.

CONCLUSIONS

A unique feature of this study was the application of an appropriate statistical methodology for modeling the nonrandom selection mechanism that gives rise to an affirmative voting response. We found that a separate univariate probit regression applied to the voting response would lead to the conclusion that ethnicity, keeping up with political affairs, and television viewing significantly predict voting behavior. When we explicitly took into account the fact that one cannot vote unless one is registered to vote, and then incorporated that fact into our statistical model using a bivariate probit model with sample selection, we found that only the amount of serious news read and the education level of the respondents predicted voting. It should be noted again, however, that the effects of specification errors shared by both equations are magnified via the selection modeling process. Nevertheless, with the availability of software programs such as LIMDEP (Greene, 1992), future studies of voting behavior should recognize and correctly model the intrinsically nonrandom nature of voting behavior data.

With all of the customary precautions attendant to studies of a subset of the total U.S. population, we can offer two implications of the results reported here for educational policy. The first, which has been made in many other studies, is that increased years of education lead to increased propensities to register to vote and to vote. What cannot be determined, however, from this study is whether the influence of education derives from explicit learning about the voting process, from increased awareness of the importance of political participation in a democracy, from a more indirect influence whereby increased education leads to greater ability to understand social and political issues and therefore to more partisanship on candidates and campaign issues, or from some other causal chain. Without a causal theory, we cannot be confident that simply keeping people in school for more years will lead to higher voting rates. That is, we have no evidence for assuming that if potential dropouts are coerced into staying in school, their voting propensities will increase.

The second implication is that voting rates might be increased if schools and adult literacy programs stressed keeping up with government affairs through newspaper reading. This claim assumes a causal relationship between the reading of hard news and voting—that the more one reads in-depth about local, national, and international affairs, the more one is motivated to vote. General facts about these events might be acquired from TV; however, only the newspaper offers in-depth coverage on a daily basis and, if Shaffer (1981) is correct, only the newspaper requires active, creative engagement with the news. One possible explanation for the mechanism through which newspapers act on individual propensities to vote is that by encouraging the reader to be active and autonomous, newspapers lead readers to more intellectual engagement with campaign issues and therefore to a greater sense of involvement with political and social issues, which then leads to a higher propensity to vote. Television appears to distance the viewer from what is presented, discouraging active engagement. Therefore, the viewer gains little ownership of the issues and, consequently, little added motivation to vote. Admittedly, these speculations take us beyond the specific focus of the present study. They do, however, point

to research issues that need to be resolved if voting behavior is to be understood.

These conclusions need to be tempered by several limitations of the present study. First, the backward removal process used to develop the separate equations might reflect chance features of the data. Thus, it is essential that these results be replicated. Nevertheless, this paper should be considered as an initial attempt to correctly model the relationship between literacy and voting. Second, specification error in the form of omitted variables may also be a problem. For example, no rootedness variables were entered into the regression equations. As noted earlier, marital status and residential mobility questions were not included in the YALS background questionnaire, and the age range of the YALS population was only 21–25—too narrow a range for meaningful variability. The limited age range probably also constrained both occupational status and income, in particular, limiting the upper ends of each distribution. Finally, the actual questions asked by YALS on registration and voting could have led to an overidentification of persons registered to vote on the last occasion for voting. However, we do not believe this bias, if it exists, to be large enough to influence the results reported here.

For future literacy surveys, we strongly recommend that respondents be asked explicitly if they were eligible to vote at the time of the last occurring election, if they had registered to vote, and if they voted. In addition, we recommend that income be obtained either as a continuous variable or in a larger number of income ranges than were represented in the YALS background questionnaire, that occupation and newspaper reading continue to be included, and that residential mobility be questioned.

ENDNOTES

1 Respondents were asked if they were currently registered to vote and if they had voted in a national, state, or local election in the last five years. Although 82% of those who had voted claimed to have voted in 1984, some who were currently registered may not have been eligible to vote in the 1984 (or earlier) election and some who had voted in the past may not have been registered when the survey was done.

2 Literacy ability in the Young Adult Literacy Survey (YALS) was reported for three separate scales, prose literacy, document literacy, and quantitative literacy.

3 The expression $\beta_\lambda = \sigma_{RV}/\sigma_R$ reflects the degree to which selection is a problem. The important term is the cross-equation covariance σ_{RV}. If selection is not occurring, then this term will be zero and the effects of selection disappear. The inverse of Mill's ratio is often referred to as the *hazard rate* and can be interpreted as the likelihood (or hazard) of not being selected into the observations that comprise the voting equation by virtue of not having registered to vote (see Berk & Ray, 1982).

4 The tetrachoric correlation matrix is a matrix of correlations for dichotomous variables where it is assumed that underlying each dichotomous response is a continuous and normally distributed latent response propensity. Observed dichotomous responses result when a respondent's propensity is greater than or less than a threshold. Analysis of this

matrix has the advantage of not resulting in the occurrence of "difficulty" factors that are often encountered when analyzing Pearson product-moment correlations among dichotomous variables.

5 The difference between two chi-square statistics is distributed as chi-square with degrees of freedom equal to the difference in degrees of freedom of the comparison models. The difference chi-square statistic is typically denoted as $\Delta\chi^2$.

6 Berk and Ray (1982) state that correlations over 0.80 suggest serious selection problems. However, it is difficult to disentangle from this correlation the component due to selection from the component due to correlated omitted variables. Moreover, classical omitted variable problems become magnified via selection modeling (Berk & Ray, 1982, p. 384).

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APPENDIX: TABLES

Table 1

Final Oblique Factor Loading Matrix of Book Reading Activities

Variable	Factor 1	Factor 2
Fiction	0.382	-0.0
Entertainment	0.393	0.085
History	0.802	-0.092
Religion	0.279	0.038
Reference	0.155	0.413
Manuals	-0.095	0.969
Factor Correlation	0.470	

Table 2

Final Oblique Factor Loading Matrix of Newspaper Reading Activities

Variable	Factor 1	Factor 2
National	0.812	-0.150
State/Local	0.459	0.225
Women/Society	0.123	0.500
Editorial	0.565	0.138
Financial	0.550	-0.073
Comics	0.167	0.401
Classifieds	-0.226	0.514
Advertisement	0.216	0.607
Television	-0.001	0.531
Movies	0.210	0.440
Horoscope	-0.285	0.667
Factor Correlation	0.321	

Table 3

Descriptive Statistics of Initial Set of Variables[a]

Variable	Registered and Voted	Registered and Did Not Vote	Neither Registered nor Voted
	(N=1,178)	(N=162)	(N=365)
% Female	53.3	57.4	54.8
% African American	26.0	30.2	18.9
% POLIORG	6.5	1.2	0.0
KEEPUP	1.8	2.1	2.2
READNEWS	1.8	1.9	2.1
TV	3.6	4.1	4.2
BOOKFUN	1.8	1.5	1.4
BOOKTECH	1.2	1.0	1.0
HARDNEWS	2.3	1.8	1.7
SOFTNEWS	3.4	3.4	3.3
% Northeast	77.1	73.4	68.2
% Managers	26.7	15.4	19.1
% Sales	38.1	37.7	38.1
% Operatives	33.4	45.1	39.7
EDUCATION	5.0	4.1	3.7
MOMED	4.3	3.7	3.3
FAED	4.6	3.7	3.3
INCOME	10422.3	9891.9	10828.8
PROSSAVG	305.6	286.1	285.5
QUANSAVG	305.7	286.0	291.7
DOCSAVG	301.6	288.2	291.2

[a] See text for description of variables.

Table 4

Separate Univariate Probit Regression Results for Registration and Voting

Variable	Coefficient	Std. Error	Wald Test[a]	Odds Ratio[b]
		Registration		
Intercept	0.764	0.206	13.700	
ETHNIC	-0.568	0.093	37.505	0.403
KEEPUP	-0.139	0.042	11.075	0.800
TV	-0.076	0.024	10.191	0.886
HARDNEWS	0.115	0.036	10.088	1.202
EDGRADE	0.180	0.019	87.806	1.334
$\chi^2_{(5)} = 220.606, p < .001$				
		Voting		
Intercept	0.336	0.191	3.084	
ETHNIC	-0.442	0.084	27.872	0.493
KEEPUP	-0.153	0.040	15.024	0.783
TV	-0.080	0.023	12.641	0.879
HARDNEWS	0.136	0.034	16.331	1.243
EDGRADE	0.179	0.017	105.850	1.332
$\chi^2_{(5)} = 267.671, p < .001$				

[a] All coefficients are significant at $p < .001$.

[b] Odds ratios are calculated using the expression odds ratio = $e^{1.6(\beta)}$ where β is the probit coefficient and 1.6 is the recommended constant for obtaining logistic coefficients from probit coefficients (see Amemiya, 1981).

Table 5

Bivariate Probit Regression With Sample Selection Results for Registration and Voting

Variable	Coefficient	Std. Error	Wald Test[a]	Odds Ratio
	Registration			
Intercept	0.781	0.206	14.448***	
ETHNIC	-0.575	0.090	41.306***	0.563
KEEPUP	-0.140	0.041	11.628***	0.869
TV	-0.076	0.024	10.214***	0.927
HARDNEWS	0.110	0.035	9.866**	1.116
EDGRADE	0.180	0.019	85.156***	1.197
	Voting			
Intercept	1.025	0.237	18.758***	
ETHNIC	-0.030	0.104	0.080	0.970
KEEPUP	-0.058	0.050	1.329	0.944
TV	-0.027	0.028	0.878	0.973
HARDNEWS	0.083	0.042	3.944*	1.087
EDGRADE	0.068	0.022	9.684**	1.070
ρ_{RV}[b]	-0.913			

[a] *** $p < .001$, ** $p < .01$, * $p < .05$

[b] The correlation of u_V and u_R.