

Overcoming the Language Barrier: The Literacy of Non-Native-English-Speaking Adults

Authors

Ying Jin
Joanna Kling

American Institutes for Research

June 2009

Contents

Introduction.....	1
Profile of Non-Native-English-Speaking Adults	3
Background Characteristics ..	3
Prose and Quantitative Literacy	4
Characteristics of Non-Native-English-Speaking Adults with Low and High Prose Literacy.....	5
Background Characteristics ..	5
Characteristics Most Associated with the Low Prose Literacy of the Non-Native-English-Speaking Adults	6
Summary.....	9
References.....	9
Appendix A: Methodology and Technical Notes	A-1
Descriptions of Background Variables	A-1
Statistical Procedures	A-2
Estimation of Literacy Proficiency	A-4

Introduction

Over the past few decades, the United States has experienced a substantial influx of foreign immigrants, who have accounted for much of the continued population growth in the nation (Surn, Kirsch, and Yamamoto 2004). The majority of the new foreign immigrants do not speak English as their native language. Findings from the 2003 National Assessment of Adult Literacy (NAAL) revealed that the average literacy level of U.S. non-native-English-speaking adults¹ was considerably below that of their native-English-speaking counterparts, even when English is learned shortly after starting school. As the non-native-English-speaking share of the population rises, knowing their literacy proficiency becomes important for identifying the potential need for public policies to address any English literacy and educational deficits that might impede their ability to be fully productive workers, parents, and citizens.

Using data collected from the 2003 NAAL assessment, this report examines the characteristics of the non-native-English-speaking adult population and compares their prose and quantitative literacy with the literacy of their native-English-speaking peers. This report also identifies characteristics that are most associated with low literacy non-native-English-language speakers, which can help policymakers and practitioners understand for whom services should be designed. Many of the background variables examined in this report are based on self-reported data, and because they are also related to one another, complex interactions and relationships among them cannot be explored. Therefore, readers are cautioned not to draw causal inferences based solely on the results presented here.

The 2003 NAAL assessed the English literacy of adults (ages 16 and older) in the United States for the first time since the 1992 National Adult Literacy Survey. The NAAL provided information on the literacy proficiency of approximately 18,000 adults living in households and 1,200 prison inmates. In the household sample, 2,807 adults did not speak English before starting school and formed the non-native-English-speaking analysis sample in this report. In addition to assessing the literacy skills of respondents, the NAAL gathered extensive background information on their demographic and socioeconomic characteristics (e.g., their age, gender, nativity status, schooling, labor force status, household income), as well as on their literacy practices.

The NAAL measured respondents' proficiencies on three literacy scales: *prose*, *document*, and *quantitative*. For each, proficiency was measured on a scale that ranged from 0 to 500. Scores on each of the three literacy scales were characterized in terms of four literacy proficiency levels: *Below Basic*, *Basic*, *Intermediate*, and *Proficient*.² Given the scope of this report, the analyses focused on the prose and quantitative literacy scales; in some sections, the analyses focused on the prose literacy scale only. A detailed description of background variables and methodology used in this report is provided in Appendix A: Methodology and Technical Notes.

¹ Non-native-English-speaking adults were defined in this report as adults who reported they did not learn to speak English before starting school.

² For an interpretation of the literacy scales and performance levels on the NAAL assessment, see Kutner, M., Greenberg, E., Jin, Y., Boyle, B., Hsu, Y., and Dunleavy, E. (2007). *Literacy in Everyday Life: Results From the 2003 National Assessment of Adult Literacy* (NCES 2007-48). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Table 1. Percentage distribution of native- and non-native-English-speaking adults by selected characteristics: 2003

Characteristic	Native-English-speaking adults	Non-native-English-speaking adults	Characteristic	Native-English-speaking adults	Non-native-English-speaking adults
Race/ethnicity			Computers with Internet access		
White	78	19*	None	30	45*
Black	13	3*	At least 1	70	55*
Hispanic	5	62*	Employment status		
Asian/Pacific Islander	2	15*	Employed full-time	48	52*
American Indian/Alaskan native	1	—	Employed part-time	13	12
Multiracial	2	#	Employed not at work	4	2*
Language (if not English) spoken before starting school			Unemployed	6	6
Spanish and other language	N/A	62	Out of labor force	30	29
Non-Spanish language	N/A	38	Reason out of labor force		
Age learned to speak English			In school	10	13
1-10	N/A	32	Keeping house	22	42*
11-15	N/A	16	Retired	35	23*
16-20	N/A	11	Doing volunteer work	2	—
21 or older	N/A	20	Other	9	9
Does not speak English	N/A	22	More than one of the above	22	14*
Country of birth			Occupation		
U.S.	96	17*	Service	18	24*
Other	4	83*	Professional and related	20	14*
Highest educational attainment			Office/Administrative support	15	12*
Still in H.S.	3	4	Production	7	12*
Less than/some high school	12	35*	Sales and related	11	10
H.S. grad/GED/equivalency	32	22*	Construction/Extraction	6	10*
Postsecondary but less than 4-year college	29	21*	Management/Business/Financial	13	7*
College grad/graduate studies/degree	23	18*	Transportation/Material moving	6	6
Age obtained high school diploma/GED			Installation/Maintenance/Repair	4	3*
19 or younger	93	87*	Farming/Fishing/Forestry	1	2*
20-24	4	9*	Weekly wage		
25 or older	3	4	Less than \$300	8	14*
Participation in English-as-a-second-language (ESL) class			\$300 - \$499	21	33*
Yes	N/A	38	\$500 - \$649	17	15
No	N/A	62	\$650 - \$849	17	13*
Computer literacy			\$850-\$1149	16	12*
At least some computer literacy	73	51*	\$1150 or more	22	13*
No computer literacy	27	49*	Participation in job training		
			Yes	42	26*
			No	58	74*

*Significantly different from native-English speakers at the significance level of .05.

— Sample size is insufficient to permit a reliable estimate.

Rounds to zero.

NOTE: Percentages may not sum to 100 because of rounding.

Profile of Non-Native-English-Speaking Adults

Background Characteristics

Demographic Characteristics

As presented in Table 1, a large percentage (62%) of non-native-English speakers was Hispanic and spoke Spanish before starting school. Nearly a third of the non-native-English-speaking adults reported they first learned to speak English at age 10 or younger, but 20 percent of these adults reported learning to speak English after age 21 and another 20 percent did not speak English at all.

Highest Educational Attainment and Computer Literacy

As shown in Table 1, more than a third of the non-native-English speakers lacked a high school diploma or a General Educational Development (GED) certificate. The high-school completion rate was lower among the non-native-English-speaking adults than among the native-English speakers. In comparison with the native-English speakers, a lower percentage (87%) of the non-native-English-speaking adults who completed at least high school or high school equivalency received their high school diploma or GED certificate at age 19 or younger. There were also fewer non-native speakers than native speakers who had received a bachelor's or graduate degree or had taken graduate classes. These data suggest that additional educational sources are needed to support non-native-English-speaking adults. Such services likely need to focus on academic content and ESL instruction.

Thirty-eight percent of the non-native-English-speaking adults had participated in an English as a Second Language (ESL) class in the United States (Table 1). One source of the needed additional services is likely to be through adult ESL classes. Despite relatively limited funding for such services across the nation as a whole, the fact that nearly 40 percent of non-native-English-speaking adults report

participating in these services demonstrates the interest and need they have in such classes, even though many are part-time evening classes.

Table 1 also shows that nearly half of the non-native-English-speaking adults lacked computer literacy (see Appendix A for information on how the computer literacy scale was constructed), in comparison with 27 percent of native-English speakers. As computer literacy continues to become an increasingly important skill for adults to possess, the fact that almost half of non-native-English-speaking adults characterize themselves as having no computer literacy indicates that ESL services for these adults should introduce and/or include this topic. Additionally, and perhaps in partnership with the One-Stop Career Centers administered through the U.S. Department of Labor, computer training can include vocational-based ESL. Examples of this provision of service with other skills and job training classes has demonstrated success.

There were fewer non-native speakers than native speakers who reported having at least one computer in their household with Internet access (55% vs. 70%).

As shown in Table 2, among both native- and non-native-English speakers, those with higher levels of educational attainment were more likely to be computer literate. For example, 82 percent of non-native-English speakers who did not complete high school lacked computer literacy, whereas only 8 percent of non-native-English speakers with college degrees lacked computer literacy. The percentage of non-native-English speakers having no computer literacy decreased to 51 percent among those who graduated high school or had received a GED or a high school equivalency credential. However, among adults who received less than a college degree, more non-native-English speakers lacked computer literacy than their native-speaking counterparts with the same level of education.

Table 2. Percentage distribution of native- and non-native-English-speaking adults, by education and computer literacy: 2003

Highest educational attainment	Native-English-speaking adults		Non-native-English-speaking adults	
	Some computer literacy	No computer literacy	Some computer literacy	No computer literacy
Less than/some high school	38	62	18	82*
High school grad/GED/equivalency	61	39	49	51*
Postsecondary but less than 4-year college	84	16	72	28*
College grad/graduate studies/degree	92	8	92	8

*Significantly different from native-English speakers with no computer literacy at the significance level of .05.

NOTE: Percentages may not sum to 100 because of rounding.

Employment, Earnings, and Job Training

As shown in Table 1, two-thirds of the non-native-English-speaking adults were employed compared with about 6 percent who were unemployed and 29 percent who were out of the labor force. The out-of-the-labor-force group included individuals who were classified as neither employed nor unemployed: students not looking for work, retirees, persons keeping house, and those who did not wish to work for other reasons. The rate of unemployment and out-of-the-labor-force were similar among the native-English speakers. However, compared with their native-English-speaking counterparts, more non-native speakers who were out of the labor force reported keeping house (42% vs. 22%) and fewer non-native speakers reported being retired (23% vs. 35%).

The occupation distribution in Table 1 shows that more non-native-English-speaking adults held jobs in *Service* (24%) than in any other occupational groups. Compared with the native speakers, fewer non-native speakers held jobs in *Professional and Related; Management, Business, and Financial; and Office and Administrative Support* occupations. In contrast, more non-native speakers held jobs in *Service, Production, and Construction and Extraction* than their native-speaking counterparts.

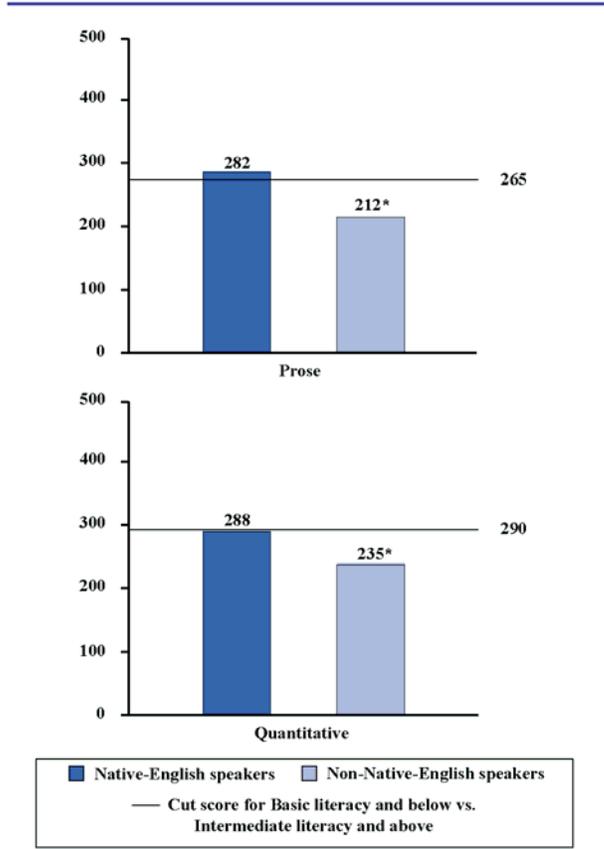
Table 1 also shows that the non-native speakers earned less weekly than their native-speaking counterparts. For example, 55 percent of the native-English speakers earned \$650 or more weekly in comparison to 38 percent of the non-native speakers. In contrast, 47 percent of the non-native speakers earned \$499 or less weekly in comparison to just 29 percent of the native speakers.

The NAAL respondents were asked whether, during the previous year, they had participated in any training or education, including courses, workshops, formal on-the-job training or apprenticeships, to help improve their job performance, get a promotion, or get a job. Fewer non-native-English speakers (26%) than native-English speakers (42%) reported participating in some type of job training (Table 1).

Prose and Quantitative Literacy

Estimates of the mean prose and quantitative literacy scores of non-native-English-speaking adults are displayed in Figure 1, along with estimates of the mean scores for native-English speakers. The average scores of non-native-English-speaking adults were quite low on both the prose and the quantitative literacy scales. There were substantial differences in mean literacy scores between the native- and the non-native-English-speaking populations.

Figure 1. Average prose and quantitative literacy scores of native- and non-native-English-speaking adults : 2003

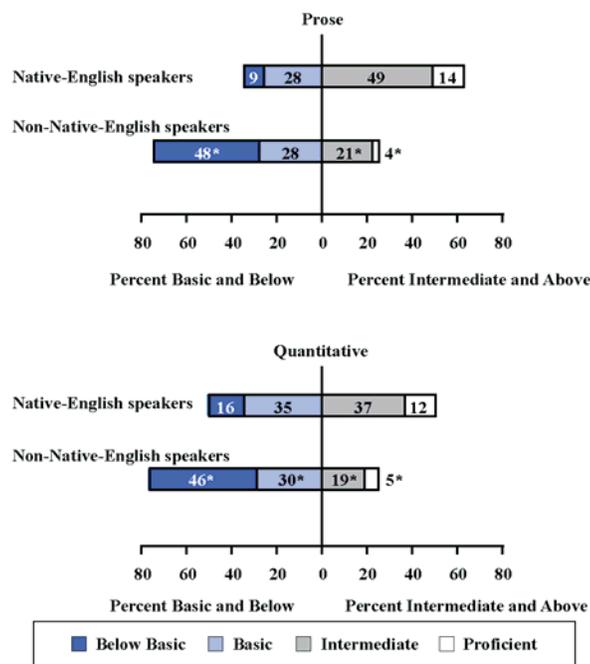


*Significantly different from native-English speakers at the significance level of .05.

The literacy scores can also be used to assign individuals to one of the four levels of literacy performance. The percentage distributions across proficiency levels on prose and quantitative scales are displayed in Figure 2. On both scales, a majority of the non-native-English-speaking adults had *Below Basic* or *Basic* literacy, indicating that their literacy proficiency was quite limited. More than three-quarters (76%) of the non-native-English speakers had *Below Basic* or *Basic* prose literacy compared with 37 percent of the native-English-speaking adults.

As was found in *Literacy of Everyday Life* (Kutner et al. 2005), among the non-native-English speakers, Spanish-speaking adults had lower prose and quantitative literacy than non-Spanish-speaking adults. Sixty-two percent of the Spanish speakers had *Below Basic* prose literacy, compared with 26 percent of the non-Spanish speakers with *Below Basic* prose literacy.

Figure 2. Percentage of native- and non-native-English-speaking adults in each prose and quantitative literacy level: 2003



*Significantly different from native-English speakers at the significance level of .05.

Characteristics of Non-Native-English-Speaking Adults with Low and High Prose Literacy

This section examines the characteristics of the non-native-English-speaking adults with the two lowest prose proficiency levels (i.e., *Below Basic* and *Basic*), as well as the characteristics of non-native-English-speaking adults with the two highest prose proficiency levels (i.e., *Intermediate* and *Proficient*). This report refers to adults with *Below Basic* and *Basic* proficiency levels as the lower literacy or less literate group, in contrast to those with *Intermediate* and *Proficient* prose literacy, who are referred to as the higher literacy or more literate group. Table 3 provides comparisons of native- and non-native-English-speaking adults with lower and higher prose literacy separately.

Additionally, this section discusses findings from multivariate analyses about characteristics significantly associated with lower prose literacy among non-native-English-speaking adults. The focus was on these adults because they were considered to be in greatest need of literacy interventions to improve their skills and employability.

Background Characteristics

Demographic Characteristics

As indicated in Table 3, there were more Hispanic adults among the non-native-English speakers with low literacy than native-English speakers with low literacy. Similarly, among adults with high literacy, there were more Hispanic and ‘Other’ non-native-English speakers than native-English speakers.

Educational Attainment and Computer Literacy

Table 3 also presents the highest educational attainment between native- and non-native-English-speaking adults by literacy level.

Relative to native-English-speaking adults with low literacy, a higher percentage of non-native-English-speaking adults with low literacy lacked a high school diploma or GED certificate. However, results for non-native-English speakers and native-English speakers with high literacy show little difference in attaining at least a high school diploma or GED certificate. Interestingly, a higher percentage of non-native-English-speaking adults with low literacy (10%) earned a college degree or completed graduate studies/degree than native-English-speakers with low literacy (7%).

A higher percentage of native-English-speaking adults with low literacy (51%) reported having at least some computer literacy compared to their non-native-English-speaking counterparts (39%). The majority of adults with high literacy reported having at least some computer literacy.

For adults with lower literacy, fewer non-native-English-speakers (45%) had computers with Internet access than native-English speakers (52%). However, among adults with higher literacy, a higher percentage of non-native-English-speakers reporting having at least one computer at home with Internet access than their native-English-speaking counterparts (Table 3).

Employment, Earnings, and Job Training

Table 3 shows that for both low and high literacy groups, non-native-English-speaking adults were more often employed full-time than their native-English-speaking counterparts. Conversely, for adults with low literacy, more native-English-speakers (42%) were out of the labor force than non-native-English-speakers (31%). The out-of-labor-force adults included homemakers, retirees, students, persons who were disabled, and those who did not wish to work at the time of the assessment for other reasons.

Among the non-native-English-speaking adults with lower literacy, the most frequently held jobs were in *Service* (28%), compared with the most frequently held jobs in *Construction and Extraction* (25%) among their native-English-speaking counterparts. Among adults with higher literacy, 36 percent of non-native-English speaking adults held jobs in *Professional and Related* occupations. For those with high literacy, more non-native-English speakers

with high literacy (12%) than native-English speakers (4%) held jobs in *Management, Business, and Financial* occupations.

Among lower-literacy adults, more than half of the non-native-English-speaking adults earned \$499 or less per week. Higher percentages (12% and 41%, respectively) of non-native-English-speaking adults with low literacy earned less than \$300 or \$300-\$499 per week than their native-English-speaking counterparts. In contrast to less literate non-native English speakers, higher percentages of native-English-speaking adults with low literacy earned \$650-\$849 or \$850-\$1149 per week. No differences were found in weekly wages between non-native- and native-English-speaking adults with high literacy.

More native-English-speakers with low literacy had participated in some type of job training (28%) compared to non-native-English-speakers with low literacy (19%). By comparison, nearly half of both native- and non-native-English-speaking adults with higher literacy had participated in some type of job training activities.

School Involvement and Public Assistance Participation

Parents of school-age children were asked whether they had been involved in their children's schools during the previous year in any of the following ways:

- Volunteered to help out at the school, including in the classroom, on a field trip, or at a school event such as a party or school fair
- Gone to a parent-teacher or other type of meeting at the school
- Spoken individually with a teacher to see how their children were doing in school
- Sent food or other items to share in the classroom

Among adults with low literacy, there was no difference in school involvement between native- and non-native-English speaking adults. Among adults with higher literacy levels, a lower percentage of non-native-English-speaking adults did not participate in any school activities than did native-English speakers. However, for those adults who did participate in school activities, more native-English-speaking adults participated in four activities over their non-native counterparts.

The majority of the native- and non-native-English-speaking adults, regardless of their literacy level, had never participated in public assistance programs such as Temporary Assistance to Needy Families (TANF). However, a higher percentage of native-English-speaking adults with low literacy had participated in public assistance than their non-native-English-speaking counterparts. This finding suggests that additional outreach efforts may be needed to draw this population to public services for which they qualify.

Characteristics Most Associated with the Low Prose Literacy of the Non-Native-English-Speaking Adults

To identify characteristics most associated with the low prose literacy of the non-native-English-speaking adults, we conducted multivariate analyses (see Appendix A for details on the methodology). Such analyses allowed us to disentangle differences in the characteristics among the non-native-English-speaking adults with *Below Basic*, *Basic*, and *Above Basic* (i.e., *Intermediate* and *Proficient*) prose literacy.

In general, Hispanic or Black non-native-English-speaking adults, adults who lacked a high school diploma or a GED certificate, adults who lacked computer literacy, and adults who never participated in job training or ESL classes were more likely to have low prose literacy.

For example, among non-native-English speakers, Black adults were five times more likely than White adults to have *Below Basic* prose literacy relative to *Above Basic* prose literacy. Similarly, Hispanic adults were nearly twice as likely as White adults to have *Basic* prose literacy over *Above Basic* prose literacy.

The results also showed that, as expected, the non-native-English-speaking adults lacking a high school diploma or a GED certificate were 1.5 times more likely to have *Below Basic* literacy relative to *Basic* literacy and nearly three times more likely to have *Below Basic* relative to *Above Basic* literacy, compared with those who had received postsecondary education.

Adults having at least some computer literacy were half as likely as those who were computer illiterate to have *Below Basic* prose literacy over *Above Basic* prose literacy. Those adults who had participated in job training were 0.7 times as likely as those who never participated to have *Below Basic* prose literacy over *Above Basic* prose literacy.

Table 3. Percentage distribution of native- and non-native-English-speaking adults with low prose literacy, by selected characteristics, and percentage distribution of native- and non-native-English-speaking adults with high prose literacy, by selected characteristics: 2003

Characteristic	Non-native-English-speakers with low prose literacy	Native English speakers with low prose literacy	Non-native-English-speakers with high prose literacy	Native English speakers with high prose literacy
Race				
White	15	67*	32	85**
Black	4	22*	2	7**
Hispanic	70	7*	35	4**
Other	12	5*	31	4**
Language (if not English) spoken before starting school				
Spanish and other language	71	N/A	36	N/A
Non-Spanish language	29	N/A	64	N/A
Age learned to speak English				
1-10	23	N/A	60	N/A
11-15	14	N/A	22	N/A
16-20	11	N/A	8	N/A
21 or older	23	N/A	10	N/A
Does not speak English	29	N/A	#	N/A
Country of birth				
U.S.	14	95*	27	97**
Other	86	5*	73	3**
Highest educational attainment				
Still in high school	4	4	4	3
Less than/some high school	45	26*	4	4
High school grad/GED/equivalency	24	42*	14	26**
Postsecondary but less than 4-year college	17	22*	33	34
College grad/graduate studies/degree	10	7*	45	33**
Age obtained high school diploma				
19 or younger	83	87	94	96
20-24	12	7*	5	3**
25 or older	5	6	1	2
Participation in English-as-a-second-language (ESL) class				
Yes	41	N/A	31	N/A
No	59	N/A	69	N/A
Computer literacy				
At least some computer literacy	39	51*	89	87
No computer literacy	61	50*	11	13
Computers with Internet access				
None	55	48*	12	19**
At least 1	45	52*	88	81**
Employment status				
Employed full-time	49	37*	60	54**
Employed part-time	12	11	11	13
Employed not at work	2	3	1	4**
Unemployed	6	8*	5	6
Out of labor force	31	42*	23	23

See notes at end of table.

Table 3. Percentage distribution of native- and non-native-English-speaking adults with low prose literacy, by selected characteristics, and percentage distribution of native- and non-native-English-speaking adults with high prose literacy, by selected characteristics: 2003—Continued

Characteristic	Non-native-English-speakers with low prose literacy	Native English speakers with low prose literacy	Non-native-English-speakers with high prose literacy	Native English speakers with high prose literacy
Occupation				
Service	28	7	13	16**
Production	15	9*	4	25**
Construction/Extraction	12	25	4	15
Office/Administrative support	10	12	15	11
Sales and related	9	13	11	16
Transportation/Material moving	8	1*	3	#
Professional and related	6	10	36	5
Management/Business/Financial	6	4	12	4**
Farming/Fishing/Forestry	3	11*	#	6
Installation/Maintenance/Repair	3	10	2	4
Weekly wage				
Less than \$300	17	12*	6	7
\$300 - \$499	41	32*	14	16
\$500 - \$649	16	19	12	16
\$650 - \$849	11	16*	18	18
\$850-\$1149	8	11*	22	17
\$1150 or more	8	10	28	26
Participation in job training				
Yes	19	28*	50	51
No	81	72*	50	49
School involvement				
No activities	12	12	5	9**
1 activity	12	16	13	10
2 activities	22	21	24	19
3 activities	30	26	37	29
4 activities	24	25	21	33**
Public assistance participation				
Never participated	94	90*	96	95
Had participated	6	10*	4	5

*Significantly different from non-native-English speakers with low literacy at the significance level of .05.

**Significantly different from non-native-English speakers with high literacy at the significance level of .05.

Rounds to zero.

NOTES: Percentages may not sum to 100 because of rounding. The "Other" category includes Asians, Pacific Islanders, Native Hawaiians, American Indians, Alaska Natives, and Multiracial adults.

Summary

This report, using the 2003 NAAL assessment data, examines the characteristics of non-native-English-speaking adults, as well as the relationship between various characteristics and literacy proficiency of this population group. The key findings in this report are as follows:

- A high percentage (62%) of the non-native-English speakers were Hispanic and spoke Spanish before starting school. Relative to their native-English-speaking peers with low literacy, non-native-English speakers with low literacy were more likely to be foreign born and be of Black or Hispanic race/ethnicity.
- More than a third of the non-native-English-speaking adults lacked a high school diploma or a GED certificate. Their high school completion rate was lower than that of the general adult population.
- Nearly half of non-native-English-speaking adults were not computer literate. Over half reported having at least one computer in their household with Internet access.
- Nearly half (49%) of non-native-English-speaking adults with low literacy were employed full-time, a higher percentage than their native-English-speaking peers with low literacy (37%).
- Nearly 30 percent of the non-native-English-speaking adults were out of the labor force. Among adults with lower literacy, fewer non-native-English-speaking adults were out of the labor force than native-English-speaking adults.
- More non-native-English-speaking adults held jobs in *Service* (24%) than in any other occupational groups. Among the non-native-English-speaking adults with lower literacy, the most frequently held jobs were in *Service*, compared with the most frequently held jobs in *Construction and Extraction* among their low literacy native-English-speaking counterparts.
- The average prose and quantitative literacy scores of the non-native-English-speaking adults were substantially lower than those of their native-

English-speaking counterparts. More than three-quarters of the non-native-English speakers had *Below Basic* or *Basic* prose literacy.

- Hispanic or Black non-native-English-speaking adults, adults who lacked a high school diploma or a GED certificate, and adults who lacked computer literacy were more likely to have low prose literacy.

References

- Allen, N.L., Carlson, J.E., and Zelenak, C.A. (1999). *The NAEP 1996 Technical Report* (NCES 1999-452). U.S. Department of Education. Washington, DC: National Center for Education Statistics.
- Kutner, M., Greenberg, E., Jin, Y., Boyle, B., Hsu, Y., and Dunleavy, E. (2007). *Literacy in Everyday Life: Results From the 2003 National Assessment of Adult Literacy* (NCES 2007-480). U.S. Department of Education, Washington, DC: National Center for Education Statistics.
- Mislevy, R.J. (1984). Estimating Latent Distributions. *Psychometrika*, 49(3): 359–381.
- Mislevy, R.J. (1985). Estimation of Latent Group Effects. *Journal of the American Statistical Association*, 80(392): 993–997.
- Mislevy, R.J. (1991). Randomization-Based Inference About Latent Variables from Complex Samples. *Psychometrika*, 56(2): 177–196.
- Surn, A., Kirsch, I., and Yamamoto, K. (2004). *A Human Capital Concern: The Literacy Proficiency of U.S. Immigrants*. Princeton, NJ: Educational Testing Services.
- Thomas, N. (1993). Asymptotic Corrections for Multivariate Posterior Moments with Factored Likelihood Functions. *Journal of Computational and Graphical Statistics*, 2(3): 309–322.

Appendix A: Methodology and Technical Notes

This section describes the background variables and statistical procedures used in this report. It also provides a brief explanation of the direct estimation method and the plausible values method used to estimate the NAAL proficiency scores. For information on survey methodology (e.g., sampling, data collection, weighting and variance estimation, scaling) for the NAAL, see *Literacy in Everyday Life: Results from the 2003 National Assessment of Adult Literacy* (Kutner, Greenberg, Jin, Boyle, Hsu, and Dunleavy 2007).

Descriptions of Background Variables

Age

All respondents were asked to report their birthdates, and this information was used to calculate their age. Age groups reported are 16 to 18, 19 to 24, 25 to 39, 40 to 49, 50 to 64, and 65 and older. Age groups were selected to correspond to key life stages of many adults:

- 16–18: Completion of secondary education
- 19–24: College or job training
- 25–39: Early career
- 40–49: Mid career
- 50–64: Late career
- 65 and older: Retirement

Race and Ethnicity

In 2003, all respondents were asked two questions about their race and ethnicity. The first question asked them to indicate whether they were Hispanic or Latino. Then, all respondents, including those who indicated they were Hispanic or Latino, were asked to choose one or more of the following groups to describe themselves:

- White
- Black or African American
- Asian
- American Indian or Alaska Native
- Native Hawaiian or other Pacific Islander

Individuals who responded “yes” to the first question were coded as Hispanic, regardless of their answer to the second question. Individuals who identified more than one group on the second question were coded as Multiracial. Respondents of Native Hawaiian or Pacific Islander origin were grouped with those of Asian origin.

Language Spoken Before Starting School

All respondents were asked what language or languages they learned to speak before starting school. Their responses were then used to divide respondents into five groups: English only, English and Spanish, English and other language, Spanish only or with other language, or other language(s). The English and Spanish category includes adults who spoke languages in addition to both English and Spanish.

Age Learned English

Respondents who spoke a language other than English before starting school were asked their age when they learned to speak English. They were classified into one of the following categories: 10 or younger, 11 to 15, 16 to 20, 21 or older.

Highest Educational Attainment

All respondents were asked to indicate the highest level of education they had completed. The following options were provided:

- Still in high school
- Less than high school
- Some high school
- GED or high school equivalency
- High school graduate
- Vocational, trade, or business school after high school
- College: less than 2 years
- College: Associate’s degree (A.A.)
- College: 2 or more years, no degree
- College graduate (B.A. or B.S.)
- Postgraduate, no degree
- Postgraduate degree (M.S., M.A., Ph.D., M.D., etc.)

Respondents who reported less than high school or some high school were asked how many years of education they had completed. For certain analyses, some of these groups were collapsed.

Age Obtained High School Diploma/GED

Respondents were asked to provide the year they graduated high school or obtained their GED. Their age was calculated on the basis of their birthday and the assumption that they obtained their degree in June. Respondents were grouped into the following categories: 19 or younger, 20 to 24, 25 or older, did not graduate.

Participation in English as a Second Language Instruction

Respondents who spoke a language other than English before starting school were asked whether they were currently enrolled in or had ever taken part in an ESL class in the United States. Respondents were then asked how long ago they last took a class to improve their English: within the last two years, 2 to 5 years ago, more than 5 years ago, currently taking an ESL class.

Computer Literacy

The NAAL background questionnaire collected data from respondents on using a computer to perform various activities. Specifically, respondents were asked *How often (every day, a few times a week, once a week, less than once a week, never) do you:*

- Send or receive an email message
- Write using a word processing program
- Use a spreadsheet program or use a financial program
- Look up information on a CD-ROM
- Find information on the Internet

On the basis of these questionnaire items, a computer literacy scale was created such that respondents who had never performed any of these five computer activities were considered to have no computer literacy, whereas those who had at least some experience with at least one of the five items were considered to have at least some computer literacy.

Labor Force Participation

The NAAL background questionnaire also collected information on respondents' labor force and employment activities at the time of the assessment and during the previous 12 months. Responses to the questions on current employment status at the time of the assessment were used to assign each respondent to one of the following labor force statuses: employed full-time, employed part-time, employed not-at-work, unemployed, and out-of-the-labor-force. The out-of-the-labor-force group included individuals who were classified as neither employed nor unemployed: students not looking for work, retirees, persons keeping house, persons who were disabled, and those who did not wish to work at the present time for other reasons.

Occupation

Respondents who had held a job within the past 3 years were asked to provide the title of their occupation and its most important activities and duties. This information was used to assign each occupation a 2000 Census Bureau code. The occupations were then collapsed into eight major occupational groups:

- Management, Business, and Financial
- Professional and Related
- Service
- Sales and Related
- Office and Administrative Support
- Construction and Extraction
- Installation, Maintenance, and Repair
- Production

Weekly wage

Respondents who were employed were asked to report their gross weekly wage or salary (before deductions) during the previous week. Some respondents were unable to report their weekly wage or salary before deductions. In these cases, the interviewers asked them to report their take-home pay and noted that fact. Some respondents reported their pay per hour, day, 2-week period, month, or year, rather than per week as requested. This was also noted by the interviewers, who asked a follow-up question to clarify the time-frame the respondents were using.

All reported pay was adjusted to approximate gross weekly wages or salaries. For respondents who reported their earnings in units other than weekly (e.g., per hour or per day), information on the number of hours worked per week (collected in a separate question) was used to compute weekly earnings. For respondents who reported take-home pay rather than gross pay, adjustments were made to the

wage or salary they reported by adding a FICA adjustment at a flat rate of 7.65 percent and an additional adjustment based on IRS withholding tables for single taxpayers in 2003. An additional 10 percent was added as a proxy for state taxes and miscellaneous deductions.

Participation in Job Training

Respondents were asked in separate questions whether during the past year they had participated in any training or education, including courses, workshops, formal on-the-job training, or apprenticeships, intended to help improve job performance, earn a promotion, or obtain a job.

School Involvement

Respondents were asked four questions to indicate the number of different types of activities they were involved in at their child's or grandchild's school. They were asked whether during the past year they had done the following:

- Volunteered to help out at their child's (one of their children's/grandchild/grandchildren) school(s), including in the classroom, on a field trip, or at school event such as a party or school fair?
- Gone to a PTA or other type of parent meeting at their child's (one of their children's/grandchild/grandchildren) school(s)?
- Spoken individually with their child's (one of their children's/grandchild/grandchildren) teacher(s) to see how he or she was doing in school?
- Sent food, or other items to share in their child's (one of their children's/grandchild/grandchildren) classroom(s)?

Respondents were grouped according to the number of questions that they answered "yes" as none, one, two, three, or four.

Participation in Public Assistance

Respondents were asked whether they or anyone in their household had received TANF, public assistance, or public welfare payments from the state or local welfare office during the previous 12 months or whether they had ever received public assistance in the past. Respondents were identified as never, past, or current participants in welfare.

Statistical Procedures

Tests of Statistical Significance

All comparisons discussed in this report have been tested for statistical significance using the *t* statistic. Statistical significance was determined by calculating a *t* value for the difference between a pair of means, or proportions, and comparing this value with published tables of values at a certain level of significance, called the alpha level. The alpha level is an a priori statement of the probability of inferring that a difference exists when, in fact, it does not. The alpha level used in this report is .05, based on a two-tailed test. Differences in the means and proportions between subgroups were calculated using the following *t* statistic:

$$t = \frac{(p_1 - p_2)}{\sqrt{(se_1^2 + se_2^2)}}$$

where p_1 and p_2 are the estimates to be compared and se_1 and se_2 are their corresponding standard errors. When a subgroup was compared with a total group, a modification of the standard error of difference was made to adjust for group dependence. The formula for the adjusted standard error of difference was as follows:

$$SE_{\text{Total-Subgroup}} = \sqrt{SE_{\text{Total}}^2 + SE_{\text{Subgroup}}^2 - 2pSE_{\text{Subgroup}}^2}$$

where p is the proportion of the total group contained in the subgroup.

Minimum Sample Sizes for Reporting Subgroup Results

In the NAAL reports, the sample sizes were not always large enough to permit accurate estimates of proficiency and/or background results for one or more categories of variables. For results to be reported for any subgroup, a minimum sample size of 45 was required. This number was arrived at by determining the sample size needed to detect an effect size of 0.5 with a probability of 0.8 or greater, using a design effect of 1.5. This design effect implies a sample design-based variance 1.5 times that of a simple random sample. The effect size of 0.5 pertains to the true difference in a given mean estimate (e.g., mean proficiency) between the subgroup in question and the total population, divided by the standard deviation of that estimate in the total population. An effect size of 0.5 was chosen following Cohen (1988), who classifies effect size of this magnitude as “medium” as well as to be consistent with what was done in the 1992 National Adult Literacy Survey (NALS).³

Multinomial Logistic Regression Analyses

Proficiency on the NAAL literacy scales (i.e., prose, document, and quantitative) is measured on a scale that ranges from 0 to 500. The performance of adults on the assessment can be reported as either mean scores on the scale or on the basis of the distribution of adults across the NAAL performance levels (*Below Basic*, *Basic*, *Intermediate*, and *Proficient*). Each performance level describes the abilities associated with score ranges on the NAAL scale.

In investigating the effects of multiple factors on low literacy for non-native-English-speaking adults, we conducted multinomial logistic regression analyses. Such analyses allowed us to disentangle differences between the characteristics of adults with *Below Basic* literacy and those of adults with *Basic* literacy, while holding constant a series of other explanatory variables. Similarly, it also allowed us to examine differences between the characteristics of adults with *Basic* literacy and those of adults with literacy levels in the next highest categories (*Intermediate* and *Proficient*).

³ Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (second edition). Hillsdale, NJ: Lawrence Erlbaum Associates.

Multinomial logistic regression is a form of regression used when the dependent variable is categorical with more than two classes and the independent variables are of any type.⁴ It allows the simultaneous comparison of more than one contrast (e.g., the probability of *Below Basic* vs. *Basic* literacy, *Basic* vs. *Above Basic* literacy, *Below Basic* vs. *Above Basic* literacy) and usually expresses the impact of predictor variables on dependent variables in terms of odds ratios.

The odds ratio for a given independent variable represents the factor by which the odds change in the dependent variable for a one-unit change in the independent variable. For example, if the odds ratio for success in a given performance test for females versus male is 3.5, and if this odds ratio is statistically significant, we would say that the odds of success for females are 3.5 times as large as for males.

The statistical significance of the odds ratio estimates are indicated by the confidence interval for the odds ratio. If the confidence interval around the odds ratio contains the value of 1.0, then the change in the value of the independent variable is not associated with change in the odds of the dependent variable. Thus, that independent variable is not considered a useful predictor in the logistic model.

In our multinomial logistic regression analyses, the outcome measure was the NAAL literacy performance level: *Below Basic*, *Basic*, and *Above Basic* (i.e., *Intermediate* and *Proficient* combined). Using the literacy levels rather than the NAAL scale scores as the dependent variables in the model made the analyses more easily interpretable. If the continuous NAAL scale scores had been used, the results would need to be discussed in terms of unit changes on the NAAL scale per unit change in an independent variable. The impact of specific variables would be more difficult to grasp in this approach, given the abstract nature of the NAAL scale. The predictor variables in the model were age, sex, race/ethnicity, country of birth, age when first learned to speak English, educational attainment, participation in ESL class, IT certification, computer literacy, employment status, participation in job training, participation in basic skills training, and oral passage reading scores as measured in the Fluency Addition to NAAL.⁵

Table A-1 reports the odds ratio estimates from the multinomial regression of the prose literacy performance level on the set of predictor variables described above.

⁴ For more information on multinomial logistic regression, see Hosmer, D., and Lemeshow, S. (2004). *Applied Logistic Regression*. New York: John Wiley & Sons.

⁵ As part of the NAAL assessment, adults were asked to read a series of short passages aloud. Their responses were recorded and later scored for accuracy and speed.

Table A-1. Odds ratio estimates from multinomial regression analyses

Effect	Below Basic vs. Basic			Basic vs. Above Basic			Below Basic vs. Above Basic		
	Point Estimate	95% Wald Confidence Limits		Point Estimate	95% Wald Confidence Limits		Point Estimate	95% Wald Confidence Limits	
Race/ethnicity: Black vs. White	--	--	--	3.00	1.46	6.23	4.94	2.16	11.36
Race/ethnicity: Hispanic vs. White	--	--	--	1.82	1.14	2.92	--	--	--
Race/ethnicity: American Indian/Alaskan native vs. White	--	--	--	1.94	1.02	3.75	--	--	--
Education: Less than high school vs. postsecondary	1.54	1.10	2.15	1.77	1.21	2.58	2.71	1.79	4.11
Education: High school/GED vs. postsecondary	--	--	--	1.96	1.34	2.87	2.34	1.50	3.64
ESL class participation: Yes vs. No	--	--	--	--	--	--	1.49	1.00	2.22
Computer literacy: Some vs. None	--	--	--	--	--	--	0.52	0.34	0.81
Job training participation: Yes vs. No	--	--	--	0.63	0.44	0.89	0.66	0.45	0.98
Oral passage reading score	--	--	--	0.99	0.99	1.00	0.98	0.97	0.98

-- Estimates not significant and not shown.

Note: Results are shown only for predictors with significant odds ratio estimates.

Estimation of Literacy Proficiency

The NAAL used a complex assessment design that allowed maximum coverage of the broad domain of literacy while minimizing the time burden on any one respondent. Under this design, the NAAL administered only a fraction of the assessment items on each literacy scale to each respondent. Although individual respondents were required to take only a small portion of the entire pool of assessment questions, the aggregate results across the entire assessment allowed broad reporting of literacy for the targeted population. However, because respondents did not receive enough literacy tasks to provide reliable information about individual performance, traditional test scores for individual respondents would have resulted in biased estimates of population characteristics and therefore were not appropriate to use for estimates of population statistics.

To obtain unbiased estimates of population statistics (e.g., subgroup means or percentages in each proficiency level), the NAAL used methods derived from Marginal Maximum Likelihood (MML) estimation. Such MML estimation procedures were available with AM software.⁶ Estimates for average literacy scores and percentages in each literacy proficiency level in this report were all obtained using the

⁶ For more information on direct estimation methodology followed for NAAL and the use of AM, see Baldi, S. (Ed.) et al. (Forthcoming). *Technical Report and Data File User's Manual for the 2003 National Assessment of Adult Literacy*. U.S. Department of Education. Washington, DC: National Center for Education Statistics.

direct estimation method with AM. The multinomial logistic regression analyses could not be conducted using MML direct estimation because the procedure is not available in AM. Instead, an alternative estimation procedure called plausible values methodology was used for the multinomial logistic regression analyses. Plausible values were initially developed for the National Assessment of Educational Progress (NAEP; Mislevy 1984, 1985, 1991; Thomas 1993) to allow secondary users to estimate statistics derived from individual data. Plausible values are multiple imputations randomly drawn from a distribution derived from the MML parameter estimates for an extensive conditioning model (Allen, Carlson, and Zelenak 1999).

It is important to recognize that plausible values are not test scores for individual, and they should not be treated as such. Plausible values are randomly drawn from the distribution of scores that could be reasonably assigned to each individual. As such, the plausible values contain random error variance components and are not optimal as scores for individuals.

In our multivariate analyses, five plausible values for each adult were obtained as estimates of scores on the prose literacy scale. These plausible values were then used to assign each individual to one of the NAAL performance levels. Five sets of multinomial regression analysis were conducted, using each of the five plausible values. The reported odds ratio estimates are the average of the five odds ratio estimates using each of the five plausible values. It should be noted, however, that the standard errors used in

the significance tests for the reported odds ratio estimates were not adjusted for variation among the five sets of results given the complexity of the computations and the unavailability of an estimation procedure in the statistical software. Therefore, the confidence limits around the odds ratio estimates might be narrower than they would be, had the standard errors been corrected.