The Effects of Adult Literacy and Demographics on Eighth Grade Mathematics and Language Arts Literacy Scores

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Abstract

The purpose of this study was to determine the effects of environmental conditions of adult literacy and demographics prevalent during infancy and early childhood on mathematics and language arts literacy scores on eighth grade achievement tests. This study collected published scores for eighth grade math and language literacy from public schools in Arkansas using the 2003 administration of the Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) and the adult literacy estimates for Arkansas counties as determined by the National Institute for Literacy (NIFL) using indicators of population size, employment, education level, and race from the 1990 US Census. Data collected from NIFL reports, school enrollments, and grand means of scaled literacy and math scores were entered by county in SPSS (v. 12.0) software for analysis. Bivariate correlations were used to determine relationships between ACTAAP scores, adult literacy and demographic variables. Multiple regression analysis was performed to determine relative influence of adult literacy, unemployment, dropout rates, and ethnicity on ACTAAP scores. Unemployment and underemployment among adults in 1990 were linked to low levels of education; dropout rates and unemployment were linked to racial minority status, reinforcing findings of the National Adult Literacy Study. Eighth grade test scores showed strong correlations to adult literacy especially at the lowest levels and moderate correlations to unemployment and dropout rates. The correlation between 2003 eighth grade scores and adult ethnicity in 1990 was stronger than for any other demographic or literacy variables, accounting for 57% of the influence on math scores and 42% of the influence on literacy scores. Early childhood experiences, as evidenced

by the impact of conditions in1990 have a significant impact on today's student achievement and programs should be developed to address literacy from a family or community perspective. (Contains 2 figures, 5 tables, and 2 appendices).

Introduction and Statement of Problem

The "No Child Left Behind" amendments to The Elementary and Secondary Education Act (Title I) established sweeping changes in the federal government's standards of school quality and the measures the government can take to enforce those standards. The stated purpose of the amended act is "to ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging State academic achievement standards and state academic assessments" (Sec. 1001). This act adds to, but basically supersedes, similar state acts by applying the considerable weight of the federal funding formula to pressure schools to raise student achievement scores.

No Child Left Behind stresses accountability, particularly school and teacher accountability for poor performance by students. However, many factors besides schools and teachers are responsible for the level of student performance and most of those are completely outside the control of the school. Many environmental factors such as the educational level, employment status, or racial composition of the surrounding community have a grave impact on student expectations and attitude. Parental literacy levels have a direct impact on their children's probability of high achievement. "A parent is a child's first and most influential teacher" (Memphis Literacy Council, 2003), and if parents lack the knowledge and skills basis from which to teach adequately, the children start out behind and often never catch up.

Review of Related Research

Adult literacy in America. The definition of literacy has changed dramatically in recent years from its long-standing representation as the ability to read and write. The Literacy Volunteers of America defines adult literacy as "the ability to read, write, and speak English proficiently, to compute and solve problems, and to use technology in order to become a life-long learner and to be effective in the family, in the workplace and in the community" (FAQs web page). This perspective on literacy has become sweeping and all inclusive and is the basis behind much of the current pressure by federal, state, local, and citizen groups to improve the standards of education in this country.

Very few American adults are actually illiterate when illiteracy is defined as the inability to read or perform mathematical operations (Literacy Volunteers of America, FAQs web page). Instead there are many adults in America whose low literacy skills do not give them sufficient foundation to find or keep decent jobs, act as partners in their children's education, or to participate as active voting citizens in the community (Literacy Volunteers of America, FAQs web page). For many, this amounts to a functional illiteracy, because reading and computation become so frustrating and time-consuming that they simply give up or find ways to cope without addressing the issue at all. Although they have some of the most basic literacy skills, they are not effective at a level to adequately function in a reading, writing, and computing world.

In 1992, The National Adult Literacy Study (NALS) measured the prose, document, and quantitative literacy of 13,000 adults randomly selected to represent the entire U.S. population, 1000 adults each from 12 participating states, and 1,100 state and federal prison inmates (Jenkins & Kirsch, 1994, Kirsch, I., et. al., 2002). Responses were measured in five levels, assigning

Level I to scores from 1-225 and Level II to scores from 226-275 with a maximum score at Level V of 500.

Twenty-one to 23 percent of American adults demonstrated Level I literacy. Level I prose literacy required a reader to read short passages to locate a single piece of information identical or synonymous with information in the question. If there was plausible incorrect information it was not placed near the correct information. Level I document literacy required a reader to either find an exact match or enter information from personal knowledge onto a document with little or no distracting information present. Level I quantitative literacy (numeracy) required readers to perform a single arithmetic operation with the numbers and operation given. Level I literacy does not describe zero literacy as such, although it does include respondents at that level. Respondents at Level I ranged from those with such limited skills that they could not respond at all to much of the survey to those who were able to perform simple and brief reading or computation tasks.

Twenty-five to 28 percent of American adults demonstrated Level II literacy skills. Level II prose literacy required readers to find a piece of information with distractors or plausible incorrect information present, or to make low-level inferences, perhaps integrating or comparing two pieces of information according to a given criterion. Level II document literacy required respondents to match information in a document with distractors present or make low-level inferences or integrate information from parts of a document. Level II quantitative literacy involved single-operation problems with numbers and operations either given in the task or easily located in the material.

When compared by demographic characteristics, respondents over 65, those with fewer years of education, those of racial or ethnic minority groups, immigrants, and adults in prison

were all more likely to perform at the lower levels of literacy proficiency. Individuals with higher levels of literacy were more likely to be employed, worked more weeks in a year, and earned higher wages than those at lower literacy levels (Jenkins & Kirsch, 1994, Kirsch, I., et. al., 2002).

Parental literacy and the development of literacy in children. "Parents can form a vital link to literacy and later school success by encouraging literacy and language modeling in their daily communication with children." (Halsall & Green, 1992). Children begin to experience and develop literacy long before they enter school. Children in a literacy-rich home environment acquire a wealth of literacy input through natural learning in daily experiences: opportunities to make choices and explore, take risks within bounds of safety, pretend to write a letter, tell a story like one in a book that has been read to them, engage in dramatic "let's pretend" play and many other developmental activities. They observe their parents in daily literacy activities that have nothing to do with formal teaching, but everything to do with ordinary literacy experiences that children see, such as reading the newspaper or magazines, writing grocery lists, balancing a checkbook or measuring for a recipe. These kinds of everyday literacy experiences form scaffolding on which the very young child can build a formal literacy in and out of school (Genisio & Drecktrah, 1999).

The experience of trust and safety in the parent –child bond also has a strong influence on an early toddler's literacy experiences. In a study exploring the influences of security and attachment in the child-parent relationship, Bus, et. al.(1997), found that differences in the book-reading routines of parents reading to their toddler children depended strongly on the socio-emotional context of adult support. Children insecurely attached to their mothers were more distracted and mothers reading to them were more engaged in disciplining instead of reading

than more securely attached pairs. These mothers were less willing to let their toddlers explore books, to simply play with them at an early age, so the toddlers lost interest in books.

The approach to books and the type of reader-book interaction in the home also factors into the home influence on a child's literacy experiences. Parent readers with lower reading proficiency tend to engage in book-focused interactions preferring highly predictable texts with repetitive language, rhyming, and other forms that make the reading easier and more enjoyable for them. These parent-reader pairs interact more with narrative text. The predictability, repetition and rhyming appears to act as scaffolding for the active participation in reading with their children, where parents with greater reading proficiency are more at ease with reading and without the necessity of such scaffolding engage more freely in the exploratory and associative book talk that encourages richer literacy experiences (Newman, 1996).

Pellegrini (1991) says that this difference in reader-book interaction reflects a cultural orientation and that it is inaccurate to refer to these children as "at risk." He points out that families in the mainstream culture interact with "trade" books (school type books) in the same ways that schools do, engaging in specific reading prompting strategies that allow children to participate in reading at a higher level. Non-mainstream families interact with "trade" books in a stiff, formalized style with interactions focused on reading the story straight through with little associative conversation. When these non-mainstream reader pairs interacted in familiar contexts, such as with advertisements or toys, they behaved in much the same way as the mainstream families with formal books.

The family literacy movement. Working with the Head Start Home-Based Reading Project, Halsall and Green (1992) found that differences in the ways parents rear their children had more of an effect on pre-school reading ability than level of parent education, income level

of families, or occupation. Specifically, they focused on the impact of parents reading to their children. Parents that feel more confident can better implement the read-aloud strategies that encourage children to become good readers when the parents are capable readers themselves. Halsall and Green highlight the importance of "shared literacy" as a family activity, quoting previous work that showed parents themselves learning to read while reading children's literature to their children. As the mothers became more confident in their reading abilities, so did the children, and the enjoyment of the shared experience had a dramatic positive effect on reading attitudes for both parent and child

The Memphis Literacy Council states that "A strong literacy influence at home is one of the greatest gifts a parent can give to a child" (2003, no page number). Family literacy is being increasingly employed by local educational administrations as a strategy to attract the "hard-to-reach" parents, such as immigrants and refugees, in order to help the adults and children both acquire literacy skills (Adele, 1995). Adele says "In viewing the child and adult caregiver as a learning unit, this type of family literacy intervention strategy has been considered equally effective for both adults and children." (1995, p. 20). Federally-funded programs like Head Start and Even Start are bringing this two pronged approach to family literacy to communities all over the country. Their mission of these programs is to "break the cycle of poverty and illiteracy by improving educational opportunities for…low-income families" (Redwood City School District, no date or page).

Statement of Purpose

The purpose of this study is to investigate the math and language arts literacy of eighth graders in 2003 enrolled in Arkansas public schools in relation to the adult literacy from the time period in which those students were born. This was accomplished by comparing published

Arkansas Comprehensive Testing and Accountability Program (ACTAAP) test data for eighth grade students administered in spring of 2003 and estimated rates of adult literacy as determined by the National Institute for Literacy (NIFL) using demographic indicators from the 1990 U.S. Census. The indicators used included data of population size, employment, educational level attained, and race.

Research Questions

Question 1: How many students took the ACTAAP test in Arkansas public schools by county in 2003 and what were their mean scaled scores?

Question 2: What were the rates of adult literacy in 1990?

Question 3: What were the demographic characteristics of adult respondents in the 1990 U.S. Census by county in Arkansas and how are those characteristics related to one another?

Question 4: What was the relationship, if any between student scores and adult literacy rates?

Question 5: Does student literacy on the ACTAAP test have any relationship to individual demographic indicators used to estimate adult literacy by the NIFL?

Significance

Schools are under tremendous pressure to increase student scores, even though many of the factors that affect this outcome are beyond their control. Remedial education is incredibly expensive and puts a huge drain on society, both financially and socially. The entire Title I budget for FY 2004 is $12.35 billion and covers a whole array of compensatory programs to try to overcome the cumulative and disabling effects of the cycle of poverty and illiteracy, including $175,000,000 for Even Start. In FY 2002 and FY 2003, Title I allocated $250,000,000 for Even

Start and its subsidiary programs. The federal funding process is only now beginning to address the importance of family literacy, but compared to the entire Title I program this is just a tiny percentage of overall funding.

Blaming the school and holding teachers accountable for environmental factors in the community is politically tempting, but will not do much to improve education. Identification and recognition of the connection between adult literacy and children's test scores and demographic factors related to literacy can provide a foundation to break the cycle of poverty and illiteracy that is at the root of our current dilemma in education.

Methodology

Study design. This study was conducted using existing data sets published on public-access web sites. The study was comprised of two non-equivalent groups, the adults in Arkansas aged 16 and over surveyed in the 1990 U.S. Census and the Arkansas eighth grade students who took the ACTAAP test in the spring of 2003, to determine levels of literacy in the two groups. Adult literacy estimates and indicators for the year 1990 were transcribed from the National Institute for Literacy (NIFL) website, and ACTAAP scores of eighth grade students in 2003 were transcribed from the National Office for Rural Measurement and Evaluation Systems (NORMES) web site, hosted at the University of Arkansas.

Sampling procedures. The target population of this study included all adults reported in the 1990 U.S. Census of Arkansas and all eighth grade public school children tested in the 2003 administration of the Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) in Arkansas. The 1990 U.S. Census surveyed 1,800,056 adults in Arkansas aged 16 and over, collecting a wide range of personal demographic data. NIFL used selected census data as indicators to model predictions of adult literacy and reported these data and

predictions by county. In spring 2003, every school in Arkansas was required by law to administer the ACTAAP test to all eighth grade students. Using the Arkansas Education Directory (2003-2004) to sort schools and districts by county, a combined population of 27,701 public school students were chosen for this study from a reported state-wide general population total of 28,033. Currently, the organization of school districts in Arkansas is rapidly changing with school consolidations, and various lists on various sites are inconsistent. There were 337 schools with eighth grade students in 305 school districts that could be assigned to a county using the Arkansas Education Directory as a reference, discounting state-wide districts such as the Arkansas Department of Corrections, Arkansas Schools for the Blind, and the Academics Plus Charter School.

Instrumentation. The testing instrument for the adult group was the "synthetic estimate" of literacy used by the NIFL according to "a model that predicted NALS literacy from Census-like variables about adults' demographic characteristics, level of education, ability to speak English, and so forth" (National Institute for Literacy, FAQs, p.2). The original procedures of the NALS (1992), measured a combined math and reading literacy in five levels, and the NIFL data sets include modeled predictions for rates of Level I and combined Level I & II adult literacy and a mean adult literacy level. The testing instrument for the eighth grade students, the ACTAAP test, measured two types of literacy: language arts literacy including both reading and written expression, and math literacy including computation, reading and written expression components, which are reported as mean scaled scores by district.

Data collection and reporting procedures. NIFL synthetic estimates of literacy, reported by county for Arkansas, were tabulated with demographic data from the 1990 U.S. Census as reported on the NIFL web site. The categories of data collected for this study were the total

count of 1990 adult population aged 16 and over, synthetic estimates for mean adult literacy, percent adult literacy level I and level II, percent unemployed, percent "not in the work force," percent with less than a ninth grade education, percent with a ninth-twelfth grade education, and percent reporting other than white under race. One county, Calhoun County, was not reported because it had a population under 5,000 and was too small to be modeled according to NIFL criteria. Census data for this county were compiled directly from the 1990 U.S. Census reports, but no synthetic estimates of literacy could be determined.

A complete listing of schools by county and by district was obtained from the Arkansas Department of Education (ADE) web site (ADE/As-Is>School Directory). All the schools with eighth grade students were tabulated by district and by county. Student counts of those taking the 2003 ACTAAP test were transcribed from listings by county, by school district, or by individual school on the ADE web site (ADE>As-Is>indicators). The enrollment figures for the Bruno-Pyatt School District, in the process of consolidation and unavailable on the ADE>As-Is> Indicators website, were transcribed from an eighth grade general population spreadsheet obtained through a Google web search. Mean scaled (language arts) literacy scores and mean scaled math scores for eighth grade students were transcribed on a school district by school district basis from the NORMES web site, hosted at the University of Arkansas. ACTAAP test scores are reported in several formats by district, the two most common aggregated formats being the "general population" by district, which excludes some groups such as high-mobility and special education students, and "all students" by individual school, which includes all sub-groups taking the test. This study used district scores for the general population. Mean scaled student scores by district and enrollments by district were used to compute grand mean scores by county so both sampling populations, the adult population in 1990 and the eighth grade student

population in 2003 would be in the same sampling base units, the 75 individual Arkansas counties.

Data analysis and reporting procedures. All items collected from the NIFL estimated adult literacy reports, census data for Calhoun County, enrollments of eighth grade students, and computed grand mean scaled literacy and math scores were entered by county in SPSS for analysis. A frequency distribution was developed to determine the range and mean of the adult literacy variables, the 1990 unemployment, education, and ethnicity variables, and the 2003 ACTAAP literacy and math test score variables. Bivariate correlations were used to determine if any linear relationships existed between 2003 ACTAAP test scores and 1990 adult literacy rates and if any linear relationships existed between 2003 ACTAAP test scores and the individual 1990 demographic literacy indicators of unemployment, education, and ethnicity. Multiple regression analysis was performed to see to what degree 2003 ACTAAP test scores were influenced by 1990 adult literacy at levels I or II, 1990 unemployment, high school dropout rates, or ethnicity.

Results

Data collected and tabulated from 2003 ACTAAP test scores of Arkansas eighth grade students in public schools are presented by county in Appendix 1. Data from NIFL estimates of adult literacy and the selected census data that were used as indicators are presented by county in full in Appendix 2.

Eighth-grade enrollment by county ranged from a minimum of 40 students in Lincoln County to a maximum of 3,143 students in Pulaski County with a mean of 369.35 (*sd* = 451.442) and a median of 220. Small schools far outnumbered the few large ones in more urbanized areas. Mean scaled math scores varied from a minimum of 135.1 in Lee County to 189.4 in

Stone County with an average mean scaled math score of 166.909 (*sd* = 12.6432). The true weighted grand mean was 165.239. Mean scaled language arts literacy scores ranged from a minimum of 166.0 in Lincoln County to a maximum of 209.7 in Independence County, with an *average* mean scaled language arts literacy score of 190.885 (*sd* = 9.3292) and a true weighted grand mean of 188.1161. A histogram of distribution with a mean curve is presented in Figure 1 for mean math scaled scores and in Figure 2 for mean scaled language arts literacy scores.

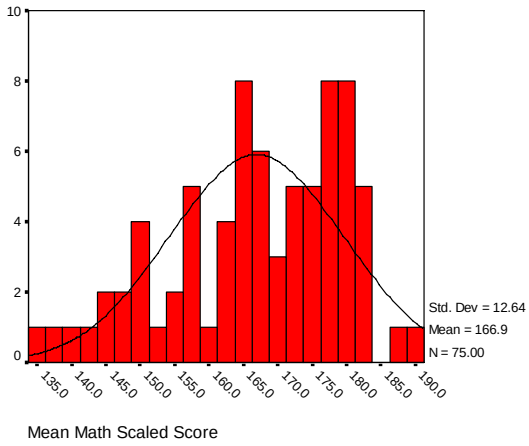

Figure 1. Distribution of mean scaled math scores.

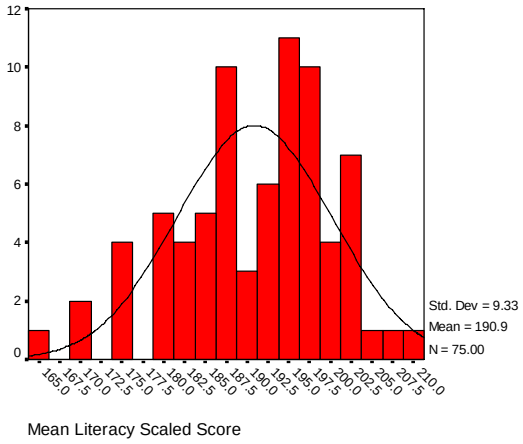

Figure 2. Distribution of mean scaled literacy scores.

The adult literacy rates and the 1990 Census data means and ranges are displayed in Table 1. Note that the adult mean literacy proficiency ranged from a minimum score of 215 in Lee County to a maximum of 279 in Washington County, with an average mean of 251.74 (*sd* =

13.111). The mean for the State of Arkansas as estimated by the NIFL was 260. The NALS definition of level II adult literacy is a score between 226 and 275, and level III is from 276 to 325. Level I literacy ranged from a minimum of 13% in Washington County to a maximum of 45% in Lee County and an average mean of 24.70% (*sd* = 6.951). The NIFL state-wide estimate was 22%. Level II adult literacy ranged from a minimum of 26% in Pulaski County to a maximum of 46% in Lincoln and Poinsett Counties and an average mean of 37.61% (*sd* = 3.951). The NIFL state-wide estimate was 34%. Washington County had the lowest combined Level I & II literacy at 43% and Lee County had the highest at 88%.

Table 1

Adult literacy and demographics by county (1990).

	N	Minimum	Maximum	Mean	Std. Deviation
Adult Mean Literacy Proficiency	74	215	279	251.74	13.111
Adult Literacy Level I	74	13	45	24.70	6.951
Adult Literacy Level II	74	26	46	37.41	3.738
Adult Literacy Level I & II	74	43	88	62.11	9.485
% Unemployed	75	2	7	4.24	1.125
% Not in Work Force	75	33	60	43.77	5.466
% < 9th Grade Education	75	7	30	16.87	4.858
% 9th-12th Grade Education	75	15	28	20.89	2.764
Race	75	0	58	16.21	16.670
Valid N (listwise)	74				

Unemployment ranged from a minimum of 2% in Benton, Madison, and Montgomery Counties to a maximum of 7% in Chicot, Lee, and St. Francis Counties, with an NIFL listed state-wide average of 4%. Those “not in the work force” ranged from a minimum of 33% in Pulaski County to a maximum of 60% in Lincoln County, with an NIFL listed state-wide average of 40%. Those with an education of less than ninth grade ranged from a minimum of 7% in

Pulaski County to a maximum of 30% in Clay County, with an NIFL listed state-wide average of 14%. High school dropouts, those with an education between ninth and twelfth grades, ranged from a minimum of 15% in Craighead, Pulaski, and Washington Counties to a maximum of 28% in Lee County, with an NIFL listed state-wide average of 19%. The percentage of non-white population ranged from a minimum of 0% in Clay County to a maximum of 58% in Lee County, with an NIFL listed state-wide average of 17%.

Before beginning discussion of the relationship between eighth grade literacy in 2003 and adult literacy in 1990, it is useful to compare the relationships between the various levels of measurement of adult literacy (see Table 2). Adult literacy Level I and the combined adult literacy Level I & II corresponded almost exactly with adult mean literacy (r = -.922 and r = -.993 respectively; p <.01). As Level I literacy and the cumulative Level I & II literacy rates rose, the mean literacy fell at almost a 1:1 ratio. Level II showed noticeable differences in correlations with the others, with Level I at r = .532, with Level I & II combined at r = .784, and with the mean adult literacy at r = -.806 (all p <.01). This represents a moderately strong trend showing that counties with a higher Level I literacy rate also had a higher Level II literacy rate (and vice versa). A stronger positive relationship held true between the Level II rate and the rate of Level I & II combined. The effect was slightly stronger still comparing Level II and the mean literacy, but in reverse; as Level II rates rose, the mean declined strongly, but not as strongly as it did when Level I rates rose. Of course low scores would be expected to bring cumulative and mean scores down, but Level II rates had somewhat less of an effect on this phenomenon than Level I, probably because Level II, the mean, and the cumulative Level I & II all measured very similar levels of proficiency.

Table 2.

Correlations between levels of adult literacy in 1990.

		Adult Mean Literacy	Adult Literacy Level I	Adult Literacy Level II	Adult Literacy Level I & II
Adult Mean Literacy	Correlation	1	-.922(**)	-.806(**)	-.993(**)
	Sig. (2-tailed)	.	.000	.000	.000
Adult Literacy Level I	Correlation	-.922(**)	1	.532(**)	.943(**)
	Sig. (2-tailed)	.000	.	.000	.000
Adult Literacy Level II	Correlation	-.806(**)	.532(**)	1	.784(**)
	Sig. (2-tailed)	.000	.000	.	.000
Adult Literacy Level I & II	Correlation	-.993(**)	.943(**)	.784(**)	1
	Sig. (2-tailed)	.000	.000	.000	.

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The mean adult literacy and cumulative Level I & II literacy were almost identical both in scores and relationships to other variables. However, using Level I and Level II measures of adult literacy to make correlations damped out some of the statistical effects of the real-world implications of looking at education in blocks of less than high school and high school dropout levels. Discussions of correlation between eighth grade literacy in 2003 and adult literacy in 1990 will focus on the relationships between student literacy and adult Level I and Level II to draw the sharpest comparisons.

Other correlations in the adult data are important to future discussion. Adults in 1990 with no high school and those who did not finish high school were moderately correlated with both the unemployed and those “not in the work force,” almost uniformly between all four groups. Adults with no high school education correlated $r = .401$ with the unemployed and $r =$

.464 with those "not in the work force." Adults who did not finish high school correlated r = .386 with the unemployed and r = .397 with those "not in the work force." All these correlations were at the significance of $p < .001$. This reinforces the findings of NALS and many other studies linking unemployment and underemployment to low levels of education.

The relationship between race, employment and education showed remarkable differences, though. Adults with less than a high school education and those who were "not in the work force" did not correlate with race at all (r = .083, p = .481 and r = .079, p = .502, respectively). Adults who had some high school but did not finish and those who were unemployed both showed moderately strong correlations at extremely high significance to those who of were non-white races (r = .540 and r = .600 respectively, both at p <.000). Again, this underscores previous studies that link dropout rates and unemployment to racial minority status.

When eighth grade math and language arts scores from the 2003 ACTAAP test were compared with 1990 adult literacy rates, they showed parallel trends, but the relationships between math scores and adult literacy were slightly stronger than those for language arts and adult literacy. In both cases, the student scores were much more strongly correlated to Level I adult literacy and at a much greater statistical significance than to Level II adult literacy. Math scores of eighth grade students in 2003 correlated to Level I adult literacy in 1990 at r = -785 (p < .001) and to Level II adult literacy in 1990 at r = -.236 (p = .017). Language arts scores of eighth grade students in 2003 correlated to Level I adult literacy in 1990 at r = -.707 (p = <.000) and to Level II adult literacy in 1990 at r = -229 (p = .050). Where the percentage of adults who were at low levels of literacy in 1990 increased, the scores of eighth grade students in the same counties 13 years later decreased and the lowest level showed a much stronger relationship, with no ambiguity. The correlation between Level II adult literacy, a measure of literacy that does not

differ greatly from the mean in Arkansas counties overall, showed a weak relationship with less statistical significance, but is still not a factor to discount in the study of current literacy issues.

Math and language arts scores of eighth grade students in 2003 also show moderate and significant correlations with adults in 1990 who were unemployed and those who did not finish high school, as shown in Table 3. Math scores of eighth grade students in 2003 correlated with adult unemployment in 1990 at $r = -.536$ ($p < .001$) and with adults who did not finish high school in 1990 at $r = -.529$ ($p < .001$). Language arts scores of eighth grade students in 2003 correlated with adult unemployment in 1990 at $r = -.526$ ($p < .001$) and with adults who did not finish high school in 1990 at $r = -.478$ ($p < .001$). When the percentage of 1990 adult unemployment and "dropout" rates increased, math and language arts scores of eighth grade

Table 3

Correlations between ACTAAP scores in 2003 and adult demographic variables in 1990.

		Mean Math Scaled Score	Mean Literacy Scaled Score
% Unemployed	Correlation	-.536(**)	-.526(**)
	Sig. (2-tailed)	.000	.000
% Not in Work Force	Correlation	-.192	.245(*)
	Sig. (2-tailed)	.099	.034
% < 9th Grade Education	Correlation	-.197	-.160
	Sig. (2-tailed)	.090	.171
% 9th-12th Grade Education	Correlation	-.529(**)	-.478(**)
	Sig. (2-tailed)	.000	.000
Race	Correlation	-.820(**)	-.711(**)
	Sig. (2-tailed)	.000	.000

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

students in the same counties 13 years later decreased with moderately strong correlations and very strong statistical significance. Similar, but much weaker relationships existed between eighth grade math and language arts scores in 2003 and the percentage of adults in 1990 who were "not in the work force" or who did not go to high school at all (see Table 3).

The correlation between math and language arts scores of eighth grade students in 2003 and the race of adults in 1990 is much stronger than any other adult demographics or literacy variables in the study. Math scores of eighth grade students in 2003 correlated with the percentage of non-white adults in 1990 at $r = -.820$ and language arts scores with the percentage of non-white adults at $r = -.711$, both with significance of $p < .001$. Counties with the highest percentage of non-white adults in 1990 had eighth grade students 13 years later with significantly lower math and language arts scores, with this trend showing somewhat stronger in math than language arts.

In order to test the degree to which the variables of adult literacy, unemployment, high school dropout rate, and the race of adults in 1990 affected math and language arts scores of eighth grade students in the same counties 13 years later, multiple regression analyses were run for both math scores and language arts scores. All variables were well within the recommended limits of +1 to -1 skewness and kurtosis and all variables were entered by SPSS in all comparisons at each level of adult literacy. The clearest results were for adult Level I literacy, the lowest level of adult proficiency. The comparison of math scores with adult Level I literacy and demographics resulted in an *R square* value of .695 and that of language arts scores with adult Level I literacy and demographics resulted in an *R square* value of .554. For the comparison of the coefficients from these analyses see Table 4 and Table 5.

Table 4

*Coefficients from multiple regression analysis of the effects of adult Level I literacy and demographics in 1990 on eighth grade **mathematics** scores in 2003.*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	189.209	7.627		24.807	.000
	Adult Literacy Level I	-.465	.323	-.254	-1.443	.154
	% Unemployed	-.230	.983	-.020	-.234	.815
	% 9th-12th Grade Education	-.134	.455	-.029	-.294	.769
	Race	-.434	.106	-.571	-4.091	.000

a Dependent Variable: Mean Math Scaled Score

Table 5.

*Coefficients from multiple regression analysis of the effects of adult Level I literacy and demographics in 1990 on eighth grade **language arts** scores in 2003*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	208.950	6.780		30.819	.000
	Adult Literacy Level I	-.324	.287	-.241	-1.131	.262
	% Unemployed	-.977	.874	-.118	-1.118	.267
	% 9th-12th Grade Education	-.106	.404	-.031	-.262	.794
	Race	-.237	.094	-.424	-2.511	.014

a Dependent Variable: Mean Literacy Scaled Score

Multiple regression analysis showed that approximately 70% of the variance in eighth grade math scores and 55% of the variance in eighth grade language arts scores on the 2003

ACTAAP is explained by the rates of 1990 Level I adult literacy, unemployment, high school "dropout," and race. Of these four variables, about 25% of the influence on math scores was due to adult Level I literacy rates, almost none from unemployment and high school "dropout" rate, and 57% from race. The projected influence of adult Level I literacy was marginally significant at $p = .154$, but the influence of race was unambiguous ($p < .001$). The analysis of the influence of adult Level I literacy and demographics on language arts scores was less dramatic, but still relevant. Of the four variables, about 24% of the influence on language arts scores was due to adult Level I literacy ($p = .262$), less than 12% due to unemployment ($p = .267$), barely 3% due to high school "dropout" rate ($p = .794$), and 42% due to race ($p = .014$). The proportion of influence was similar with that for math scores, but the levels of significance were much more unreliable. Of the four factors, the only one with a significant relationship was race at $p = .014$.

Summary

This study was conducted to determine if there is a correlation between the adult literacy rates of one generation and the math and language arts literacy scores of the children in the next generation. To this end, data were collected and tabulated from publicly-available databases to determine the relevant ACTAAP math and language arts literacy scores of Arkansas eighth grade students in 2003, the adult literacy rates in 1990 as estimated by NIFL, and selected census indicator data of unemployment, education, and race. Strong and significant correlations were found between the proficiency levels of eighth grade students in 2003 and adult literacy levels in 1990 at the time those children were born, especially with the lowest level of adult literacy. Math scores correlated slightly stronger than language arts scores alone, probably because the math portion of the ACTAAP contains a substantial reading component, so math literacy is in effect measuring both numeracy and reading literacy. Moderate correlations were found

between eighth grade math and language arts literacy scores in 2003 and adult rates of unemployment and high school dropout rate in 1990. The strongest correlation was between eighth grade math and language arts literacy scores and the race of the adults in 1990.

Conclusions

Mean adult literacy proficiency in 1990 and the combined Level I and Level II adult literacy as estimated by NIFL were almost identical in their description of adult literacy in Arkansas. The upper limits of Level I literacy barely qualify as a functional level of literacy, equivalent to a third- or fourth-grade education. Many counties in Arkansas are at that level as a county mean. Even upper Level II tasks would not qualify for most high school math or language arts class work. This has more than just a statistically significant impact on the next generation. It affects every aspect of their lives from birth onwards. A wealth of educational theory, anecdotal and scientific evidence, and plain old common sense reiterates the indelible effect of early childhood experiences on development and learning. A parent is a child's first teacher and the parent's own literacy experiences are the curriculum from which that teaching must be drawn.

The strong correlation found in this study linking adult literacy and later achievement by children provides one more example for the thesis of the parents' influence on children's learning. It must be emphasized, however, that this study does not examine parent-child pairs directly and the results of the study cannot be said to pertain to individual families per se. This study showed that conditions of adult literacy and demographics in a sample of *counties* are correlated with scores in math and language arts literacy of children in the *county,* thirteen years later. This cannot be said to describe the conditions in individual homes and families, or why one particular child is not proficient in math or language arts. However, by describing the

conditions prevalent in the county as a whole, we can make some broad predictions about the level of proficiency on achievement tests likely to be encountered in subsequent years by the children in that county. The general environment is not the only influence, but it is a measurable, predictable influence.

This study found that counties with high percentages of adults in the lowest category of literacy proficiency had a strong tendency to also have the lowest test scores by eighth grade students in the same county thirteen years later. Counties with high unemployment and high percentages of adults who did not complete high school also were associated with low test scores by the next generation of children. Correlations of adult demographic data show that these are the same counties. The lowest levels of adult literacy are linked to unemployment and high school dropout rates. Whether it can be said that one causes the other is difficult; all three are cross-linked into a web of mutual cause and effect that cannot be untangled within the limits of this kind of study. Counties with the greatest percentage of non-white adults had a very strong tendency to also be the counties with low children's test scores thirteen years later and this most persistent of social problems had (and continues to have) the strongest effect. Some of this may be due to the relationship between race and high school dropout rates noted earlier in the results, but much of it is probably a reaction to the psychological and social pressures of racism, historic underemployment, and a wide variety of cultural issues.

Correlating low levels of adult literacy to unemployment, lack of education, and race should not be surprising, not just as a matter of common sense and established research, but because those were some of the same indicators used to estimate those levels of literacy in the first place. What takes this study in a new direction is applying this dual test to the children of those adults. Research into the importance of parents as a child's first teacher would lead one to

expect that their children's literacy, measured by standardized tests, would correlate with the literacy levels of the adults around them in their early years. What is more insidious from a social reformer's viewpoint -- and educators are at heart social reformers -- is that children continue to repeat the same dreary pattern of their adult predecessors. The children's test scores reflect not only the literacy of the adults around them, but also the unemployment, high school dropout rates, and racial characteristics of the county in which they live thirteen years later.

Many environmental factors go into the development of a literacy-rich childhood, not just adult literacy. Many of the literacy experiences that provide this enrichment have, on the surface little direct connection with the "three R's." A safe and secure home environment with the freedom to engage in exploratory play, take learning risks, and observe an openness to new experiences helps build a scaffold on which the more "academic" skills can hang. The cycle of illiteracy, unemployment, and poverty does not provide a foundation of security and willingness to take "safe" risks that promote learning. Discouragement breeds more discouragement and giving up becomes contagious, one of the first lessons of early childhood in poverty and illiteracy.

Parents who do not themselves have the reading skills to model reading, or even to effectively use *TV Guide* or read a recipe, have little likelihood of positively influencing their children to read. Parents who are too tired from the frustrations of poverty are not as psychologically supportive of emergent literacy experiences as parents with more advantages of employment, education, and income. Every part of succeeding at school hinges on the ability to read, even in most non-academic subjects. Lack of pre-school preparedness is just the first step in a pattern of failure that begins in early childhood and follows many children of limited literacy background in limited literacy in their own life. By the time they get to school the die is cast for

many of these children and it becomes very difficult to fill in the gaps and encourage the kind of mindset that promotes successful development into a full range of literacy.

Recommendations

Blaming schools for failure to achieve the lofty goals of the No Child Left Behind Act and similar politically appealing banner cries will achieve little. The school has a duty and responsibility to address each child's educational needs starting at wherever that child is at the moment, regardless of background. The school also has a duty and responsibility to ensure that each child has every opportunity to grow and mature into a full literacy that goes beyond the "three R's" to a full functioning capability as a responsible and active citizen.

Goals of full literacy will probably remain little more than a political slogan unless the underlying factors limiting literacy can be addressed. Expanding the movement toward pre-school intervention begun in the 1960's with Head Start and the War on Poverty may offer ways to begin breaking the cycle of poverty, racism, and illiteracy. Programs like Even Start could be another step toward promoting literacy. Education needs to be a family affair, not just a cry for "parental involvement" in the school. Rather parents need to be *part* of the school, as teachers and learners both, not just for volunteer programs and meetings. This represents a sea change in attitude to the role of the school in the community. Many parents need to be in school for their own education, and the family literacy movement offers just such an opportunity, with parents and children learning together. Schools need to open up to the community and become a working part of that community instead of an isolated body with the narrow agenda of coaching children toward an achievement test or diploma.

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Appendix 1

Eighth Grade Enrollment and ACTAAP Test Scores by County in 2003

COUNTY	Enrollment	Mean Math Score	Mean Literacy Score
Arkansas	285	156.5	186.6
Ashley	269	156.5	188.3
Baxter	355	179.0	194.5
Benton	1560	171.7	198.3
Boone	330	187.2	201.0
Bradley	142	147.6	179.8
Calhoun	51	163.3	197.9
Carroll	226	157.1	188.3
Chicot	273	149.6	184.1
Clark	188	167.3	191.3
Clay	170	169.9	197.2
Cleburne	220	182.5	201.7
Cleveland	100	167.2	191.0
Columbia	275	178.7	179.8
Conway	217	163.9	188.0
Craighead	867	178.7	198.1
Crawford	676	177.6	199.4
Crittendon	708	151.0	184.9
Cross	275	165.9	190.6
Dallas	128	150.5	181.7
Desha	191	156.8	195.6
Drew	201	165.0	188.6
Faulkner	929	175.3	196.5
Franklin	239	179.1	194.3
Fulton	114	179.5	194.9
Garland	816	172.0	195.9
Grant	337	180.7	200.4
Greene	400	180.5	187.4
Hempstead	240	154.9	183.1
Hot Spring	358	181.9	191.4
Howard	72	162.3	190.6
Independence	290	182.3	209.7
Izard	123	181.3	198.4
Jackson	172	164.3	196.0
Jefferson	1001	148.1	174.8
Johnson	215	175.4	186.7
Lafayette	81	159.0	184.3
Lawrence	198	172.9	201.2
Lee	105	135.1	169.1

Appendix 1 (continued)

Eighth Grade Enrollment and ACTAAP Test Scores by County in 2003

COUNTY	Enrollment	Mean Math Score	Mean Literacy Score
Lincoln	40	141.1	166.0
Little River	154	165.8	201.9
Logan	210	176.9	193.6
Lonoke	702	177.8	196.7
Madison	162	181.4	202.8
Marion	150	168.1	197.0
Miller	418	164.9	184.8
Mississippi	455	145.4	178.9
Monroe	93	145.5	175.0
Montgomery	90	168.2	195.0
Nevada	112	162.3	193.8
Newton	91	169.1	186.1
Ouachita	349	154.2	180.6
Perry	95	168.0	191.4
Phillips	347	137.7	170.2
Pike	151	164.9	181.5
Poinsett	279	164.0	180.5
Polk	256	180.1	202.7
Pope	624	176.3	202.1
Prairie	84	175.5	204.3
Pulaski	3143	153.7	182.0
Randolph	219	179.2	202.2
St. Francis	339	143.0	174.0
Saline	813	177.6	193.0
Scott	93	157.2	188.3
Searcy	67	178.2	196.7
Sebastian	1014	173.9	195.9
Sevier	181	173.3	192.6
Sharp	192	166.6	187.7
Stone	111	189.4	206.8
Union	528	162.0	186.6
Van Buren	148	174.3	195.9
Washington	1521	180.9	201.4
White	759	173.0	197.3
Woodruff	82	151.1	175.9
Yell	232	169.5	193.8

Appendix 2

Adult Literacy and Demographic Census Data by County in 1990

COUNTY	1990 Population Age 16+	Adult Mean Literacy	Adult Literacy Level I (%)	Adult Literacy Level II (%)	Unemployed (%)	Not in Work Force (%)	< 9th Grade Education (%)	9th-12th Grade Education (%)	Ethnic Minority (%)
Arkansas	16,299	251	25	37	4	40	19	19	22
Ashley	18,314	248	27	38	5	42	14	22	28
Baxter	25,823	260	22	35	3	56	13	19	1
Benton	75,844	274	15	30	2	39	9	16	3
Boone	22,120	266	17	35	3	40	14	18	1
Bradley	9,094	237	32	40	5	47	18	24	32
Calhoun	4,402	NA	NA	NA	5	44	15	21	25
Carroll	14,644	266	16	35	4	40	14	17	1
Chicot	11,257	221	43	42	7	48	23	25	57
Clark	17,248	260	24	34	3	44	13	17	24
Clay	14,463	240	25	44	4	46	30	21	0
Cleburne	15,684	255	21	38	4	48	18	20	1
Cleveland	5,980	251	25	38	4	44	15	23	14
Columbia	19,589	251	30	34	5	43	12	22	36
Conway	14,475	254	24	36	4	42	14	20	16
Craighead	53,631	270	16	34	3	35	14	15	7
Crawford	31,494	264	17	36	4	39	14	21	3
Crittendon	35,579	240	32	39	6	38	18	24	44
Cross	14,139	241	28	42	5	42	20	22	25
Dallas	7,352	237	33	39	4	45	17	22	40
Desha	12,087	236	35	39	6	46	19	23	43
Drew	13,070	255	25	35	5	38	14	20	28
Faulkner	46,478	276	15	30	4	36	9	16	9
Franklin	11,470	258	19	37	4	42	17	22	1
Fulton	7,956	246	25	42	4	51	22	21	1
Garland	59,576	265	23	31	3	48	11	18	9
Grant	10,672	267	16	35	3	38	12	19	1
Greene	24,751	259	18	39	5	40	20	21	1
Hempstead	16,287	245	29	38	4	41	13	24	32
Hot Spring	20,124	256	22	36	5	44	14	21	13
Howard	10,214	252	24	37	4	39	15	22	22
Independence	24,021	263	18	36	4	39	14	21	3
Izard	9,222	252	24	38	3	53	18	20	1
Jackson	67,757	239	28	43	5	46	23	23	15
Jefferson	64,239	247	31	36	6	42	13	20	44
Johnson	14,281	259	20	37	5	45	17	18	3
Lafayette	7,331	232	37	41	5	49	19	27	39
Lawrence	13,646	247	22	43	4	47	24	21	2
Lee	9,266	215	45	43	7	51	26	28	58

Appendix 2 (continued)

Adult Literacy and Demographic Census Data by County in 1990

COUNTY	1990 Population Age 16+	Adult Mean Literacy	Adult Literacy Level I (%)	Adult Literacy Level II (%)	Unemployed (%)	Not in Work Force (%)	< 9th Grade Education (%)	9th-12th Grade Education (%)	Ethnic Minority (%)
Lincoln	10,920	234	36	46	3	60	17	25	37
Little River	10,528	256	23	36	4	39	12	22	23
Logan	15,797	256	20	39	4	44	17	23	3
Lonoke	29,074	268	18	33	4	35	12	21	10
Madison	8,851	250	19	39	2	40	22	17	1
Marion	9,694	257	22	37	4	51	14	21	1
Miller	28,763	253	26	35	4	42	13	22	24
Mississippi	41,321	246	28	38	6	40	19	20	29
Monroe	8,436	231	37	42	5	49	23	23	39
Montgomery	6,228	255	22	37	2	48	18	22	1
Nevada	7,728	246	30	37	3	46	14	25	34
Newton	5,781	251	23	41	5	50	21	20	1
Ouachita	23,109	246	31	35	5	42	14	21	36
Perry	6,219	255	21	39	4	43	16	23	3
Phillips	20,074	222	42	41	6	49	24	23	55
Pike	7,843	258	22	36	3	45	15	24	4
Poinsett	18,766	239	24	46	6	42	28	21	8
Polk	13,341	257	22	36	3	46	17	21	2
Pope	35,311	268	17	34	4	38	13	18	4
Prairie	7,376	246	25	40	3	43	21	22	14
Pulaski	267,761	273	21	26	4	33	7	15	28
Randolph	12,848	246	23	42	4	47	25	18	1
St. Francis	20,178	231	38	40	7	45	21	23	48
Saline	48,684	274	14	32	3	35	9	17	3
Scott	7,906	250	22	40	4	43	21	23	2
Searcy	6,139	245	25	42	5	50	27	19	1
Sebastian	76,395	270	18	30	4	35	10	19	11
Sevier	10,587	252	23	37	3	40	19	22	12
Sharp	11,432	254	24	38	5	57	16	19	1
Stone	7,707	252	23	39	5	46	22	18	1
Union	35,314	254	29	33	4	44	11	23	31
Van Buren	11,253	253	24	38	4	54	17	20	1
Washington	88,376	279	13	30	3	34	10	15	4
White	42,584	262	19	37	5	42	15	19	4
Woodruff	7,037	232	34	42	5	47	23	26	30
Yell	13,876	253	22	39	3	42	18	24	4