

The Integration of Literacy and Geography: The Arizona GeoLiteracy Program's Effect on Reading Comprehension

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Abstract

To provide the first interstate quasi-experimental assessment on the power of content integration in building reading skills, the authors studied the effects on reading comprehension of GeoLiteracy—a K-8 package of 85 lessons that teaches geography in the context of practicing reading and writing skills. Ninety-six third through eighth grade teachers in Arizona and Michigan divided up into intervention and comparison groups. Intervention teachers taught GeoLiteracy lessons during their language arts or social studies times, and their comparison teacher counterparts taught the curriculum as usual—without GeoLiteracy. Statistical analyses of reading comprehension assessments of the 2,539 students involved reveal statistically significant im-

provement in reading comprehension scores for students in Grades 5 through 8 who were taught using the GeoLiteracy curriculum. Qualitative data regarding intervention teacher practice are also described.

Introduction

Since the passage of No Child Left Behind (NCLB—No Child Left Behind Act of 2001) with its testing mandates, elementary schools have focused their energy, money, and time on improving reading and math scores. This trend continues despite research indicating that increased time spent on mathematics, science, civics, and language arts does not necessarily mean that student achievement will rise in those areas (Baker, Fabrega, Galindo, & Mishook, 2004). Even so, as Rabb (2004) explains,

Because so much money is at stake, school district after school district is reducing the time given to other subjects in K-8 so as to intensify the teaching of reading and math, which alone are tested under the provisions of NCLB. History, civics, geography, the social studies in general, and the arts are being virtually wiped out (p. 1).

Although members of the U.S. Department of Education decry the curtailment of social studies and the arts¹, elementary teachers continue to feel pressure to teach only those subjects that are tested, especially reading (von Zastrow and Janc, 2004).

Despite the importance of social studies in the elementary curriculum (Levstik, 2002), teachers, especially elementary teachers (Pedulla et al., 2003), feel mounting pressure to raise test scores. This national trend of cutting back on the teaching of anything not tested echoes true in reports of elementary teachers from Washington (Bach, 2004) to Maryland (Perlstein, 2004). In addition to anecdotal records, recent studies reveal the narrowing of the curriculum in response to NCLB's mandates. The Center on Education Policy (2006) published a report describing NCLB's impact on schools. Among the negative aspects reported was the reduced instructional time in subjects not tested under the provisions of NCLB. Social studies is a content area that was specifically noted as being cut in many schools across the country.

Some social studies educators have responded by integrating reading or mathematics skills into the teaching of social studies at the elementary level—a course of action recommended by the National Council for the Social Studies (National Council for the Social Studies, 1994). Our work presents the first interstate study on assessing the impact of teaching social studies, particularly geography, on reading skills. Our research asks the specific question “What effect, if any, does the

GeoLiteracy program have on reading achievement of third- through eighth-graders?" We start with a brief review of literature on the integration of content areas. The second section summarizes the GeoLiteracy K-8 curriculum package that teaches reading skills with one strand of social studies, geography. We then present methods employed in our interstate study, followed by our results. We end by detailing some broader implications of this study for education.

Hope for Elementary Social Studies in Integration

The Content Area-Reading Connection

While the emphasis on teaching reading at the expense of social studies and other content areas in the elementary grades remains an unintended consequence of NCLB, literature suggests that curtailing content areas (such as social studies) from the elementary curriculum may have detrimental effects on reading achievement in the upper elementary grades—the very grades where students have the most serious reading achievement challenges (Biancarosa & Snow, 2004; Kamil, 2003). Literacy researchers have asserted that reading comprehension is enhanced through instruction in the content areas. For instance, Duffy et al (2003) argue that reducing social studies, science, and the arts may have a negative impact on reading achievement:

If the goal is to improve students' reading achievement, not teaching these subjects will limit students' background knowledge of many topics about which they may read. Because having adequate background knowledge is necessary if one is to comprehend or understand what one is reading, lack of instruction in these subjects may ultimately affect students' reading achievement negatively (p. 685).

McKenna and Robinson (2005) support this assertion by pointing out that content area teachers develop students' abilities to read and write about content simply by teaching it. Enhancing knowledge of content improves "any subsequent reading and writing germane to that knowledge" (McKenna & Robinson 2005, p. 168).

The claim that instruction in the content areas boosts reading achievement has been posited for decades. In fact, as early as 1917, E. L. Thorndike (Moore, Readence, & Rickelman, 1983; Thorndike, 2005/1917) argued that "perhaps it is in their outside reading of stories and in their study of geography, history, and the like that many school children really learn to read" (Thorndike 2005, p. 97). In addition, when teachers link new information to students' prior knowledge, the topic has more interest to the student, which in turn stimulates their interest in reading (Brophy & Alleman, 2002; Doty, Cameron, & Barton, 2003;

Good & Brophy, 2000; Irvin, Lunstrum, Lynch-Brown, & Shepard, 1995). Existing insight, therefore, holds that reading in the content areas stimulates interest in reading and increases reading achievement.

Ideas for Keeping Social Studies in the Classroom

One solution to the problem of curtailment of social studies instruction in the elementary curriculum is to include social studies on mandated assessments. Although including social studies on standardized tests might have the effect of encouraging reluctant teachers to teach the subject, it does not guarantee that the instruction will be meaningful or relevant. In fact, Hursh (2001) notes “the faith that high-stakes tests will improve teaching and learning is contradicted by research” (p. 351). In addition, as Evans (2004) points out “the standards movement, through its imposition of a technology of testing, may freeze out the possibility of alternative approaches to social studies” (p. 173). The fear is that teachers will teach only those skills and concepts that are tested, sacrificing in-depth lessons requiring critical thinking, real life applications, and other higher order thinking skills that are vital in the learning of both reading and social studies (Taylor, Pearson, Peterson, & Rodriguez, 2003; Yeager, 2000).

Integrating the curriculum remains another solution to address the reduction of social studies in the elementary grades. The National Council for the Social Studies recommends integrating social studies across the curriculum (Brophy, 1990; National Council for the Social Studies, 1994; Sandmann & Ahern, 2002). Elementary teachers often integrate social studies skills and concepts with other areas, sometimes revolving all content areas around a theme (Lindquist, 2002), sometimes infusing one content area into another (Parker, 2005), and often using quality children’s trade books instead of or as a supplement to textbooks to teach social studies content (Krey, 1998; T. McGowan & McGowan, 1989; T. M. McGowan, Erickson, & Neufeld, 1996).

A variety of arguments support integrated curriculum as well as a subject-centered approach to teaching. In reviewing debates over subject-centered approaches to teaching versus an integrated curriculum, Hinde (2005) found that both sides of the integration argument have a connection to teacher expertise in common:

The bottom line on the research concerning the efficacy of an interdisciplinary approach to curriculum is that when skilled, knowledgeable teachers employ integrated methods, student achievement is equal to or better than students who are taught in the traditional separate-subject approach (p. 107).

Researchers in literacy and social studies who examine best practices in teaching find the same basic characteristics and practices among the

most exemplary teachers, including integration across the curriculum (Allington & Johnston, 2002; Yeager, 2000). These exemplary teachers use reading and writing strategies as tools to achieve the goals of various content areas. Students of elementary teachers who integrated literacy across the curriculum and did not curtail the curriculum, not only reported satisfaction with their teachers, but also made better than average reading achievement on nationally normed standardized achievement tests during the course of the school year under study (Allington & Johnston, 2002).

Many examples exist of methods and programs that integrate across the curriculum, but this article focuses on the Arizona GeoLiteracy Program as a case suitable for interstate study.

The Arizona GeoLiteracy Program

In 2002 teachers, professors, assessment specialists, and specialized experts such as cartographers and programmers associated with the Arizona Geographic Alliance (AzGA) produced a series of kindergarten through eighth grade lesson materials that meet Arizona's content standards in reading, writing, and geography. This program, called GeoLiteracy (Hinde & Ekiss, 2002), was well received by teachers because the lessons were written and field tested by practicing teachers, and the lessons seemed to successfully integrate geography with reading (particularly comprehension) and writing by means of engaging and creative activities. Teachers who were familiar with GeoLiteracy enthusiastically supported the program, and 1,293 of them completed surveys conducted by AzGA expressing their opinions that GeoLiteracy lessons increase students' reading comprehension. Despite teacher testimony, there was no empirical evidence that supported teacher opinions. Therefore, the purpose of this study was to examine the effects of social studies instruction on reading achievement, in this case 2,589 third through eighth graders.

Background on the GeoLiteracy Program

A seventh grade geography teacher from Mesa, Arizona, concerned by her students' lack of content knowledge, spurred the idea of developing a curriculum integrating² elementary language arts with geography through the state standards. This Teacher Consultant with AzGA voiced her concerns to AzGA's coordinators, who in 2001 secured a grant from the National Geographic Education Foundation (with support from the Arizona Department of Education and Arizona State University) to develop a curriculum that integrates reading, writing, and geography as described in the Arizona state academic standards for kindergarten through eighth grades.

Teacher Consultants and National Board Certified K-8 teachers from Arizona created the lessons. Working in grade level teams, teachers developed lessons based on the Arizona reading, writing, and geography content standards. The lessons also address national geography standards. In addition to writing the lessons, the teachers received training from a local school district's assessment specialist to create assessments that not only address each lesson's objectives, but that mirror standardized reading and writing test formats. The teachers also collaborated on the development of supplemental materials such as worksheets, ground and satellite images, animations, and maps created by the cartography program in Arizona State University's School of Geographical Sciences. Experts in geography, history, and religious studies also edited for content clarification and correction.

After the lessons were complete, they were piloted in schools from districts across Arizona with demographics that reflect the state as a whole (See Figure 1 in Appendix B). When piloting was complete, the writing teams made final revisions on the lessons based on feedback from piloting teachers. Over a year after the process began, the first workshops distributed a GeoLiteracy compact disc (CD) with 85 complete lesson plans³ integrating geography with reading and writing. AzGA has since conducted 56 workshops as of Fall 2006 to train educators in 10 states who teach over 136,683 students in the use of GeoLiteracy.

Method

Background of Study Design

The National Reading Panel describes a dearth of research regarding teaching methodologies that demonstrate improved student performance (National Institute of Child Health and Human Development, 2000). Student achievement as measured by scores on reading comprehension tests is a valuable means of determining effective interventions that lead to increased student achievement (Beretvas, 2004). In order to obtain evidence-based data on the efficacy of GeoLiteracy, the National Geographic Education Foundation (NGEF) funded our study to answer the call for research that measures student achievement in reading using a curriculum that, in this case, incorporates geography.

Study Design Overview

The ideal study design would have been to randomly select and then randomly assign teachers to control and intervention groups within a single school setting and with foreknowledge of their prior teaching experience. Similar to other education research, random assignment and selection of teachers was found to be unfeasible (Kingsbury, 2006) due to recruitment issues related to the national focus on

the testing of reading and math, as well as teachers' expressed reticence to participate in mandated research that would require them to adjust their curriculum or practice. To demonstrate problems associated with a study such as this one, the Texas Geographic Alliance⁴, an original participant in this research, was unable to provide teachers for the study because of the unwillingness of administrators to release their teachers from their mandated curriculum and recommended instructional practices. Thus, for logistical reasons, we adopted a quasi-experimental design involving 96 teachers in two states who volunteered to participate in the study.

The Arizona Geographic Alliance, the Michigan Geographic Alliance, and Arizona State University's College of Teacher Education and Leadership collaborated in this study to determine GeoLiteracy's efficacy. Teachers from Arizona and Michigan volunteered to participate in this study. The teachers who volunteered then asked other teachers from their same school and grade level to participate as comparison teachers. The teachers were subdivided into (a) an intervention group of elementary teachers in Arizona and Michigan who taught GeoLiteracy lessons to enhance their reading or social studies curriculum, and (b) a comparison group that taught their regular district-mandated social studies and reading curriculum.

Participating teachers completed a questionnaire where they reported their years of teaching experience, gender, and other background information. From these questionnaires, we ascertained that the teachers who participated, both intervention and comparison, were predominately female (89%), and that they had been teaching a number of years that ranged from one to 33 years (median years experience for both groups was 17).

Teacher participation was voluntary, regardless of role (intervention or comparison). The teachers were mainly recruited through mailings and notices sent to Teacher Consultants (TC's) with the Arizona and Michigan Geographic Alliances asking for volunteers to participate in a national study. In addition, notices were sent to third through eighth grade teachers who were on the Alliance mailing lists. The teachers who responded were given detailed information and instructions about the study and the GeoLiteracy program. Of the teachers who volunteered, all but a few volunteered to be intervention teachers. (One teacher volunteered to be a comparison teacher; two teachers volunteered to recruit teams from their school to participate in the study but did not participate themselves.) The intervention teachers then asked a fellow teacher at their school and grade level to volunteer to be a comparison teacher. The comparison teachers were then sent instructions as well.

The intervention teachers administered a reading pretest (the testing instrument is described below), taught three to five predetermined GeoLiteracy lessons⁵, and then administered a reading posttest. A com-

parison teacher from the same school and grade level administered the reading pretest and later the posttest but did not teach any GeoLiteracy lessons. In some schools a third teacher from the same grade also volunteered and participated as another intervention teacher.

There was a three to four month span from the time the teachers administered the pretests to the time they administered the posttest. Most of the Arizona teachers administered the pretest in late August or September of the school year and administered the posttest in late November or early December. The Michigan teachers administered the pretest in October of the school year and the posttest in January or February. The intervention teachers reported that most of the lessons required one or two class meetings (some of the lessons for Grades 6, 7, and 8 required up to three class periods). The generalist elementary teachers usually tried to select lessons that emphasized reading skills that aligned with their reading/language arts curriculum. Specialist teachers in middle schools or junior high schools selected lessons that emphasized reading skills or content information that aligned with their content area (either social studies or English).

In all, there were 55 intervention teachers (36 from Arizona and 19 from Michigan) and 41 comparison teachers (24 from Arizona and 17 from Michigan). In every grade, there were more intervention teachers than comparison teachers because about one third of the study teams contained two intervention teachers (a Teacher Consultant and a non-Teacher Consultant) and one comparison teacher. This translates into 2589 students involved in this study from 33 participating schools (See Figure 2 in Appendix B). We compared pretest and posttest reading performance of students in intervention teachers' classes compared to those in comparison teachers' classes.

The design of this study allowed us to compare similar demographic groups, since the students in the GeoLiteracy intervention and comparison groups were from the same schools and grade levels. Therefore, the results for them are highly comparable. Since there was not enough data collected in year 1 of the study in fourth and eighth grades from which we could draw conclusions, we were granted permission to extend the study into year 2. Data obtained from the year 2 study of fourth and eighth grades were integrated into year 1 for fourth and eighth grades and are described in the findings.

The Test Instrument

Dr. Elizabeth Hinde of Arizona State University and Dr. Carl Smith of Indiana University wrote the reading tests. The tests were piloted in the spring of 2004, revised as necessary, and administered in the fall semester of 2004. Estimates of internal consistency reliability were computed for all grades. Coefficient alpha values ranged from .56 to .72 for posttest results. The moderately low reliability estimates are likely

due to the relatively low number of test items (ten) on each assessment. Logistical considerations, again, limited this study. We limited the tests to 10 items at the suggestions of teachers prior to conducting the study. Potential study teachers were unwilling to administer a curriculum that included another lengthy test. To attain a relatively large sample of teachers, we felt the need to reduce the test to ten items.

The tests required students to read three to 11 paragraphs (depending on grade level) and answer 10 selected-response questions. The test design is not unlike subsections of the reading portion of standardized assessments, where students read a brief passage and then answer selected-response questions about the passage. The reading skills that were targeted for this study include cause/effect, sequencing, main idea, summarizing, drawing conclusions/inferences, following directions, and reading/interpreting graphic displays. These skills were purposefully emphasized in the development of the GeoLiteracy lessons, since they align with state standards in reading and are thus included in state assessments. It is important to note that the tests do not assess student knowledge of geography/social studies content. They were designed to assess student knowledge of selected reading skills that the GeoLiteracy lessons reinforce. The passages that the students read on the tests were unrelated to the content of the GeoLiteracy lessons targeted for the study, but the reading skills that the lesson reinforced were tested.

Data Analysis

Descriptive statistics of pretest achievement, posttest achievement, and pre-post differences were examined for each group of students in Grades 3 through 8 (i.e., students exposed to GeoLiteracy lessons or students receiving regular curriculum instruction). Analysis of covariance (ANCOVA) was conducted for each grade. The independent variable was GeoLiteracy group, and the dependent variable was posttest reading score. Pretest score was employed as a covariate to account for the relationship between pretest and posttest reading achievement. A series of preliminary analyses and graphical examinations was also conducted to ensure the valid application of ANCOVA and to evaluate underlying statistical assumptions.

Results

Our study involving two states, 33 schools, 96 teachers, and 2589 students reveals that integrating geography with reading is associated with higher scores on tests of reading comprehension. Results indicate that for Grades 5 through 8, students receiving GeoLiteracy-enhanced instruction differed significantly in reading comprehension achievement from students who did not receive instruction using GeoLiteracy. The

results of the GeoLiteracy intervention can be viewed in Figure 3 (See Appendix B). In grades 3, 5, 6, 7, and 8, the mean pretest score, mean posttest score, and pretest/posttest difference were higher for the students whose teachers used GeoLiteracy lessons that addressed reading comprehension skills along with geography. In fourth grade the difference was slightly higher for students in the comparison group than for the students in the intervention group. However, the differences were not significant between groups for Grades 3 and 4. Both groups showed increases in reading scores from pretest to posttest for all grades, except for the comparison group in Grade 8, which actually showed a slight decrease on the posttest.

Preliminary Analyses

The valid application of analysis of variance requires that any observed differences on the covariate (pretest score for this study) between groups be due to chance, and not due to an inherent difference between the groups (Miller & Chapman, 2001). While we were unable to employ random assignment, we do believe that the study's design supported the assignment of groups such that, for each grade, students in both groups are representative of the same population. Independent-samples t-tests were conducted to assess the presence of systematic group-related differences in pretest achievement. Only Grade 7 showed a significant difference between groups on pretest performance. There were no significant pretest differences for grades 3, 4, 5, 6, and 8.

Correlations between pretest and posttest scores for each grade were moderately high for each grade ($r = .60, .58, .63, .57, .61, \text{ and } .56$, respectively, for Grades 3 through 8). Corresponding eta values, with values close to the correlations, show a high degree of linearity ($\eta = .61, .60, .64, .57, .62, \text{ and } .57$, respectively for Grades 3 through 8). We employed pretest score as a covariate in the analysis of covariance due to the observed linear relationship with posttest score in all grades.

Initial analyses performed to evaluate the homogeneity of regression slopes assumption for ANCOVA indicated that the relationship between the pretest and posttest does not vary significantly in grades 3, 4, 5, 6, and 8 as a function of intervention and non-intervention group. However, the slopes are heterogeneous for Grade 7, with $F(1,578) = 4.577, p = .033, \eta^2 = .008$. An additional analysis to clarify the interpretation of ANCOVA results for Grade 7 was also conducted and is described later.

ANCOVA Results

For each grade, a one-way analysis of covariance (alpha set at .05) was conducted to evaluate the effect of GeoLiteracy lessons on the posttest measure of reading achievement, employing the pretest measure of reading as the covariate. These analyses indicate that the GeoLiteracy

intervention exerted a small but statistically significant effect on reading comprehension scores for grades 5, 6, 7, and 8 but not for grades 3 and 4. The net effect is small as revealed by the η^2 values (See Table 2 in Appendix A) and as reflected by the adjusted means for each grade (See Table 3 in Appendix A), but the effect is statistically significant.

Although the ANCOVA for Grade 7 showed a significant difference, the homogeneity of slopes assumption was violated, and the presence of an interaction must be taken into consideration. Regression lines for the two groups intersect at the pretest value of 1.17, reflecting a lack of significant difference in the lower range of pretest values. The Johnson-Neyman procedure was applied to identify the region of non-significance (Huitema 1980). The calculated region of non-significance extends from -57.54 to 4.09 points (i.e., practical scores of 0—4), indicating that the effect of GeoLiteracy is significant for Grade 7 students scoring above four on the pretest.

Teacher Descriptions of Instruction

In order to provide the reader an overview of the teacher interaction with the lessons, this section offers a glimpse into teacher views. Teachers who conducted the GeoLiteracy lessons for this study also completed surveys regarding their impressions of each lesson's value in teaching reading, writing, and geography. The surveys included eight questions asking the teachers to respond to statements using a five point Likert scale regarding their impressions of each of the lessons. The main purpose of the survey was to target problems the teachers identified so that, if necessary, AzGA could revise the lessons according to teacher suggestions. The survey was included for AzGA's use and not necessarily as part of this study. However, on the survey the teachers were also asked to write comments concerning each lesson. Since the large number of teachers involved in the study precluded researchers from actually observing the teachers administer the lessons, the comments they provided afforded a glimpse of their teaching of each lesson that the researchers had not initially expected.

In their descriptions of GeoLiteracy instruction on surveys, some teachers gave very limited responses and even made some negative comments. However, most of the responses were positive about the perceived effects of GeoLiteracy on their students' geography, reading, and writing achievement. For instance, a sixth grade teacher (from a self-contained classroom) referring to a specific lesson noted, "[This is] an incredible lesson to reinforce research skills, sharing, and independent learning. I will definitely use it as part of my Africa unit in the future." A sixth grade reading teacher commented, "This lesson was timed at a period in our social studies curriculum where the teacher was reviewing the five themes of geography. After doing this lesson in reading, the students had comments like 'I get it now.' They asked me

why I didn't teach social studies!" This same teacher also made the following comment after teaching another GeoLiteracy lesson: "[This is] not one I'd probably use in reading again. It required too much teacher instruction on the historical background, and not of current interest to students." Similar comments were made by other teachers who noted that particular lessons required more geography or history background than they possessed, or, on the other hand, required much more reading instruction than they were inclined to do.

Teachers also noted that some lessons seemed to motivate their students to read or learn more about a particular topic. For instance, a Michigan fourth grade teacher noted, "My students write bi-weekly letters to me about what they are reading independently. After the lesson, I believe more students were interested in reading that particular story [referring to a book used in a particular GeoLiteracy lesson], which was already among my books for students to choose." After teaching a lesson to her sixth graders regarding Jerusalem, another teacher commented, "Great lesson! My students' skills are low and their knowledge of the world is limited; this lesson is good with other lessons on the Middle East."

Of particular interest to the researchers were the comments that described how the teachers actually delivered the lessons to their students. In some cases, teachers adjusted the lessons to align with their school or district's curricular requirements. The following fifth-grade teacher from Michigan pointed out that she adjusted the lesson to correlate with Michigan's mandated social studies test:

In Michigan our state social studies test has a written portion on it where students take a stand on a given subject. They have to use a Core Democratic Value (CDV) as well as data to score on all three points. I read *The Lorax* [as part of the GeoLiteracy lesson] to my fifth grade class stopping at the point where the Onceler builds his plant. I then wrote the question, "Should the Onceler build his factory?" They had to take a stand and use a CDV to support their stand—practice for the state test. I finished the book the next day and they had to write a summary sentence. Even my special ed kids did well on the summary sentence.

This teacher further pointed out that the students (including her special education students who come into her room during social studies time) achieved not only the social studies goals, but goals for reading and writing as well.

While the preceding teacher made a relatively large adjustment to the lesson, other teachers made minor adjustments. For instance, many teachers noted that they decided to put the students in groups (e.g., one fourth grade Michigan teacher said, "I had them work in groups

in the reading section; this proved beneficial to my students with lower reading skills”), or felt the need to read orally to the students rather than have them read independently (e.g., a sixth grade Arizona teacher said, “The article on Tucson was written at a level that is higher than my students’ ability, but I read it with them”).

In general, the intervention teachers adjusted the lessons to meet their own teaching styles or to address the mandated curricular requirements of their school, district, or state. Their responses reflected positive impressions about teaching the lessons and on the perceived impact of the lessons on their students’ achievement.

Discussion

Subtle Signal Supports Prior Insight

This study indicates that when teachers employed GeoLiteracy lessons, their students’ reading comprehension achievement improved. The significance of gain varied by grade level, but it is clear that when GeoLiteracy was used, there was a positive trend in student achievement in reading comprehension. This study demonstrates that specifically analyzing the effects of an integrated program like GeoLiteracy yields valuable insights on the efficacy of integrated curriculum on student achievement.

It is important to note that while the results from third and fourth grades show that GeoLiteracy had little or no effect on reading comprehension, the students still gained in reading achievement from pretest to posttest. This indicates that teaching social studies, particularly geography, at the very least does not negatively affect the reading achievement of students. The fact that the students still gained in reading ability whether or not GeoLiteracy was employed in those grades indicates that there is no credible reason to cut social studies from the curriculum in efforts to increase reading scores in grades 3 and 4. Additionally, as this study shows, students in fifth through eighth grades showed significant increases in reading comprehension when GeoLiteracy was taught. This finding supports the assertion by literacy researchers (described earlier) that when social studies content is taught, students’ reading achievement is enhanced.

Furthermore, the results of this study confirm teachers’ expressed opinions that GeoLiteracy had a positive impact on their students’ reading comprehension. Prior to the study, teachers articulated their beliefs that GeoLiteracy was a useful and effective program, but there was no scientific evidence to support their claims. Despite the limitations of this study (described below), the GeoLiteracy experience reveals that achievement increases when teachers employ a sound integrative program. A not inconsequential result of this integrated program involves the retention of social studies—particularly geography—as a part of

the instructional day, which counters the current trend in elementary classrooms of curtailing social studies instruction.

This study leads to the question of the effects on reading comprehension that may occur as a result of the lack of social studies instruction in the elementary grades. It may be too broad a generalization to make as a result of this study that students who are not taught social studies in the elementary grades may eventually have reading comprehension difficulties in later grades. However, it is a topic whose time has come. Does the lack of social studies instruction in the elementary grades cause students' reading comprehension to suffer in later years? Our study suggests that the answer to that question might be yes. However, the effects of the lack of overall social studies instruction in the early grades on reading achievement in the upper grades would require a different study than the one we conducted.

Marzano (2000) predicted that instruction in the 21st century will become more scientific, making the argument that instruction has been studied in enough breadth and depth to provide a sound scientific basis for instruction. This study on the efficacy of GeoLiteracy on reading comprehension is one of many studies that could be included in Marzano's scientifically based research call. In addition, this study responds to the call of the National Reading Panel (National Institute of Child Health and Human Development, 2000) to provide evidence of sound educational practices that improve student performance in reading.

The teachers who participated in this study volunteered for their roles in the research and were not randomly selected or assigned. The National Reading Panel (National Institute of Child Health and Human Development, 2000) found similar problems in their analyses of reading research. One criterion for determining the effectiveness of various reading comprehension programs in their report was that the participants be randomly assigned to the treatment and control groups. However, as the report states, "This criterion was relaxed in a number of studies where random assignment of classrooms was not carried out" (National Institute of Child Health and Human Development 2000, p. 4-41). The panel suggests that when random assignment is not possible, researchers should try to meet quasi-experimental criteria and to collect data on the comparability of participants in the treatment and control groups (National Institute of Child Health and Human Development, 2000). Kingsbury (2006) also suggests employing a quasi-experimental design in determining curriculum efficacy. The GeoLiteracy study attempted to meet the quasi-experimental set of criteria, since random assignment and selection was not possible. Furthermore, the abandonment of random assignment permitted us to compare intervention and comparison students with the same socioeconomic background and maintain teachers with a similar length of experience.

Limitations

A number of limitations exist in a study involving a large amount of teachers and students. A concern we had during the course of this study was the fact that there were only ten items on each of the grade level reading tests. Low instrument reliability can reduce the statistical power of the significance tests performed, for example in the ANCOVA analysis, where the covariate is assumed to be measured with little or no measurement error. While we realized that ten was a small number of test items to determine achievement, resulting in relatively low alpha coefficients, early discussions with teachers concerning this study revealed a likely tradeoff. Teachers expressed reluctance to participate if the study required students to take a lengthy test. Therefore, we decided to limit the number of items to 10 in order to increase the total number of participating teachers.

We realize that likely the biggest limitation of this study rests in the inability to control teacher pedagogy, specifically how the treatment teachers actually conducted the GeoLiteracy lessons. Other teacher-related issues existed but were relatively minor in their net impact. For instance, the teachers were asked to administer the pretests and posttests during appointed weeks, but some teachers administered the tests earlier while others did so later. As described earlier, many teachers adjusted the lesson plans to align with their specific contexts as well. We further acknowledge that having teachers volunteer to participate and then have them convince a colleague to be a participant might be seen as a limitation. Yet, we felt that it was critical to maintain similarity in demographics in comparison and intervention groups, and this requirement was best met by asking intervention teachers to recruit other teachers.

Conclusions

Given the current trend to hold schools accountable through assessments of reading and mathematics, many teachers are feeling pressure to teach only those subjects that are tested, curtailing or eliminating those areas that are not tested—such as social studies. Reading researchers have asserted that lack of content area instruction in the elementary grades may have a detrimental effect on reading achievement in middle school and beyond. To wit, according to Biancarosa and Snow (2004) and Kamil (2003), the crisis in reading is not in kindergarten through third grade, where decoding strategies are primarily learned. The reading crisis is in the fourth through twelfth grades, where mandated assessments emphasize reading comprehension. It is in these middle and upper grades where reading achievement declines. Our study shows that the reading comprehension of students in Grades 5 - 8 improved when they were taught an integrated program that includes

emphasis on social studies content—the GeoLiteracy program in this case. Therefore, use of GeoLiteracy enhanced reading achievement in the grades that reading researchers contend need the greatest help.

In an attempt to integrate reading with geography, the Arizona Geographic Alliance produced GeoLiteracy for the express purpose of keeping geography in the elementary school curriculum. While sound arguments exist for and against an integrated curriculum, it is clear that when skilled teachers integrate across content areas, students gain. The GeoLiteracy study described in this article reveals that (a) almost all students who were taught GeoLiteracy lessons showed gains in reading achievement, (b) students in Grades 5, 6, 7, and 8 showed statistically significant gains in reading comprehension compared to students who did not use the program, and (c) students in Grade 7 who already had moderate reading skills showed statistically significant gains in reading comprehension relative to comparison students.

GeoLiteracy alone is certainly not the solution to the pressures that elementary teachers feel to teach only those curricular areas that are tested. However, this program shows how teachers can use a particular strategy for creatively and thoughtfully integrating the curriculum, whereby standards in reading and social studies can be addressed while students gain in both areas.

Appendix A

Table 1. Means and Standard Deviations by GeoLiteracy Group

Grade	Group	N	Mean Pre-test (SD)*	Mean Post-test (SD)*	Mean Difference (SD) (Post-test – Pre-test)
3	Geo used	229	5.86(2.34)	6.39(2.42)	.524(2.04)
	No Geo	156	5.67(2.01)	5.99(2.25)	.321(2.08)
4	Geo used	172	5.46(2.03)	6.32(1.88)	.860(1.83)
	No Geo	184	5.55(2.11)	6.57(1.99)	1.02(1.87)
5	Geo used	326	6.65(2.11)	7.32(2.20)	.675(1.96)
	No Geo	216	6.43(2.27)	6.85(2.21)	.417(1.77)
6	Geo used	317	6.06(2.10)	6.91(2.06)	.858(2.03)
	No Geo	170	5.75(2.35)	6.16(2.30)	.418(2.01)
7	Geo used	336	6.81(2.06)	7.32(2.07)	.509(1.75)
	No Geo	246	5.92(2.31)	6.07(2.22)	.155(2.21)
8	Geo used	164	5.70(1.88)	6.21(2.06)	.506(1.86)
	No Geo	83	5.34(1.95)	5.20(2.02)	-.133(1.87)

*Raw pretest and posttest scores, out of a maximum possible score of 10.

Table 2. Analysis of Covariance for GeoLiteracy

Grade	df	F	MSE	p	η^2
3	1, 382	1.931	3.561	.165	.005
4	1, 353	1.409	2.513	.236	.004
5	1, 539	4.998	2.942	.026	.009
6	1, 484	11.711	3.148	.001	.024
7	1, 579	24.422	2.991	<.001	.040
8	1, 244	11.584	2.907	.001	.045

Table 3. *Adjusted Means and Standard Errors from GeoLiteracy ANCOV*

Grade	Group	Adjusted Mean	Standard Error
3	Geo Used	6.34	.125
	No Geo	6.07	.151
4	Geo Used	6.35	.121
	No Geo	6.55	.117
5	Geo Used	7.27	.095
	No Geo	6.93	.117
6	Geo Used	6.85	.100
	No Geo	6.28	.136
7	Geo Used	7.10	.095
	No Geo	6.37	.112
8	Geo Used	6.13	.133
	No Geo	5.35	.188

Appendix B

Figure 1. *The 5300 piloting students in classrooms of over 100 teachers in more than 20 participating districts come from diverse settings in Arizona.*

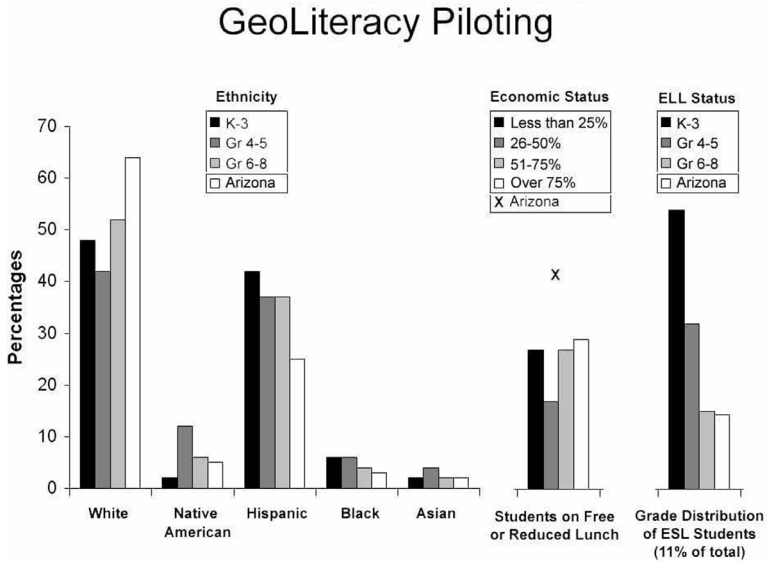


Figure 2. *The 2589 students in 33 participating schools come from diverse settings in Arizona and Michigan, mixing urban/rural/suburban and Title I and other schools.*

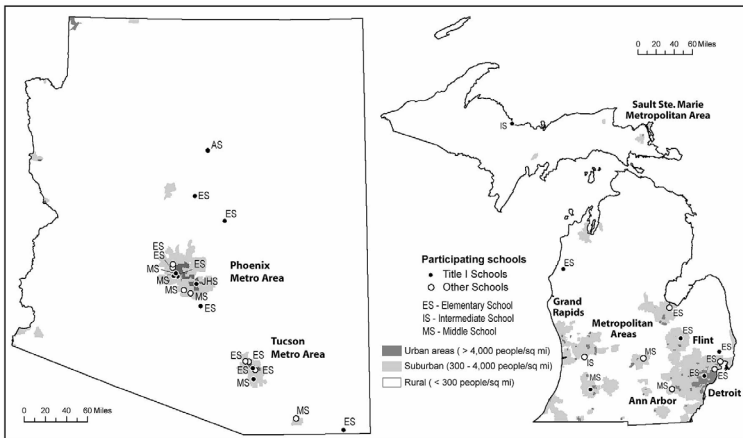
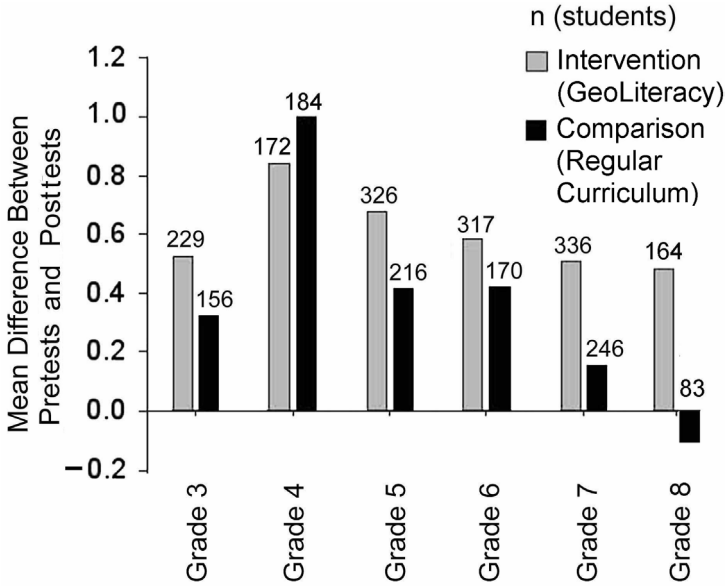


Figure 3. *Summary difference between students taught the GeoLiteracy lessons and those students taught their schools' regular social studies and reading curricula. Each student took a reading pretest and a reading posttest. The pretest was first subtracted from the posttest. Then, students were grouped into those taught the GeoLiteracy lesson and those taught the regular social studies and reading curricula. This graph portrays the means of those groups and number of students.*



Notes

1. Susan Sclafani, Counselor to the Secretary and Assistant Secretary for Vocational and Adult Education of the U.S. Department of Education, pointed out at the Preparing America's Future Regional High School Summit in Phoenix, AZ on April 16, 2004, that schools must not narrow the curriculum because students' interests are varied. She stressed that not only should high school administrators and teachers be aware of this, but that elementary and middle school principals must get the message that subjects not tested, like social studies and the arts, are just as vital as those that are tested.
2. For the purposes of this study, we align ourselves with Parker's (2005, pp. 452 - 453) description of an interdisciplinary or integrated curriculum:

A curriculum approach that purposefully draws together knowledge, perspectives, and methods of inquiry from more than one discipline to develop a more powerful understanding of a central idea, issue, person, or event. The purpose is not to eliminate the individual disciplines but to use them in combination.

3. For more information about the GeoLiteracy program and to view sample GeoLiteracy lessons, visit the Arizona Geographic Alliance website at <http://alliance.la.asu.edu/azga/>.
4. The Texas Geographic Alliance was an original partner in this study. Although many Texas teachers expressed an interest in the importance of the research, they were worried about teaching anything that was not expressly included on the Texas assessment. In no uncertain terms, an important justification for this study—to see if integrated curriculum can teach reading and hence help preserve social studies in the elementary classroom—ironically prevented a third state from partnering in the research.
5. The treatment teachers were limited to certain lessons in order for the researchers to maintain some control of the lessons that were taught. The lessons from which they could choose emphasized various reading skills that are tested on state-mandated assessments.

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