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Children's Literature and Mathematics:
Use in the Navajo First Grade Classroom

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Abstract

The purpose of this research project is to investigate if adding literature and activities to the established curriculum will help Navajo students understand mathematics better. To do this, I will implement a quantitative research approach, where the control group is my students from last year and the experimental group is my students for this year. As the teacher, I do not determine which children are placed in the class; however, the students will be in the first-grade and range between five and nine years old. The study will use the assessments provided by the curriculum, which is Saxon Math 1, Second Edition, by Nancy Larson, 2004 Saxon Publishers. I will supplement the text with literature and activities provided by various publishers. Most of the data for this project will be qualitative; however, Saxon Mathematics provides several tests that I will issue throughout the year providing me with quantitative data. I will compare the results of my class from this year with the results of my class from 2004–2005.

Problem Statement

Bread Springs Day School uses Saxon Math as its primary mathematic curriculum. Saxon Math requires students to receive an average score of 80 percent to pass. Unfortunately, during the 2004–2005 school year, my students' average score was only 75 percent. This average includes their results on our local progress testing, beginning- and end-of-year Levels Tests from the National Consortium Levels Testing for Mathematics, and the annual California Test of Basic Skills. In order to help my students improve their scores on each of these tests, I began searching for ways I could change my teaching that would increase my students' understanding and retention.

During the 2004-2005 school year, I thoroughly studied the recommended curriculum, particularly the scripted and manipulative materials. Although I taught the material as the lessons prescribed, my students did not seem to understand or retain the concepts. At this point I began wondering if the students' cultural background might cause them to learn differently than students from a Caucasian background. I discovered that the Navajo culture differed considerably from typical Caucasian culture. For example, Navajo students are encouraged to watch and observe rather than ask questions, to keep silent rather than guess at questions they do not know, and to abstain rather than try something at which they might fail.

Additionally, the Navajo culture encourages learning styles that are non-linear. This learning style means that they learn best when they see how individual parts relate to the whole concept. For example, if I were to teach my students about an orange rind, I would start by giving them the entire orange to examine. Then I would remove the rind, allow them to examine the rind, and replace the rind on the orange until the students were completely satisfied that they understood the relationship between the rind and the orange. If I wanted to teach more about the orange, I would simply continue this process by removing a single section of the orange, the skin on the section, the juice-filled cells, etc. As long as the students understand the big-picture concept, they

are able to understand, learn, and retain the material. (See Appendix A for further discussion of this.)

In Navajo culture, a teacher is seen as a type of parent or grandparent figure; therefore, the teacher's responsibilities for a child's physical, emotional, and educational well-being are similar to those of his or her parents. Navajo parents teach their children through storytelling long before the children ever attend school. Navajo students are, therefore, comfortable and familiar with this method of learning. This realization led me to conclude that if I use stories with my students, my students will likely understand concepts better and retain them longer.

Research Question

The research project will investigate the following question: If teachers add a literature component and appropriate activities to the current Saxon Math curriculum, will the students' learning and retention increase?

Definition of Terms

Frequent terms used in this paper are defined below.

Ethnomathematics: Ethnomathematics researches the ways in which different cultures understand and use mathematical concepts (Barton, 1996).

Non-linear Instruction: This refers to learning that begins with the whole concept and then works toward understanding individual parts (Zilberberg, 1994).

Navajo Classroom: The Navajo classroom is defined as an assigned group of Navajo first-grade children. No other races or tribes are represented within the school or student population.

Traditional Methods: This refers to the standard methods for elementary-level teaching as taught in typical teacher-preparation classes in the United States. It does not refer to the traditional ways, concepts, or practices of the Navajo or Native American people.

Review of Literature

There was no information available regarding the use of literature for improving Navajo children's mathematics instruction. Nevertheless, I reviewed three basic topics in order to examine the possibility of using children's literature in the all-Navajo classroom. These topics include (1) ethnic specific learning styles, (2) stories and literature as teaching tools, and (3) ethnomathematics in Native American cultures.

Ethnic Specific Learning Style

Native American students' learning styles tend to be global, visual, reflective, and collaborative (Hilberg & Tharp, 2002). This conclusion was made based on research showing that Native American children score much higher on tests linked with visual/spatial processing, on the Myers-Briggs Type Indicator (MBTI) Native American students score highest on parts associated with reflective decision-making, and in most Native American communities and homes, children work with others to finish tasks and solve problems (Hilberg & Tharp, 2002).

Because of these learning styles, teachers of Native American students should overview the entire concepts before explaining the smaller segments, have discussions that focus on overarching themes, use visual presentations and illustrations, and allow students to watch a process until the students are satisfied that they understand before they are required to do it themselves (Neha, 2003).

Boaler found that when a teacher acted as mediator between the curriculum and the students, it had a greater impact on student learning than when the student was left to interpret the curriculum on his or her own. In other words, students are most likely to learn the essential concepts if their teachers discuss the tasks with them (2002, p. 245).

Additionally, teachers of Navajo students must view themselves as a parent to those whom they teach. This means that the teacher should build a unique and special relationship with each child. The teacher assumes a great responsibility for the health, education, and growth of the children in their classroom. Rex Jim states that "teaching is based on the Navajo idea of *k'e'*, which means respect for relationships. Since relationships are always changing, the art of teaching is one that requires continual evaluation and revision" (Benson, 1997). Teachers must constantly refine their teaching styles if they want to build these important relationships with their students.

The teacher must realize that parenting practices of Native American students tend to differ from traditional school practices. Traditional school practices tend to emphasize "trial and error," whereas Native American tribes typically advise "watch-then-do" or "listen-then-do" (Swisher and Deyhlen, (1989). Navajo children are taught to watch until they are certain they can perform a task (Deyhle and Swisher, 1997; Trumbell, Nelson-Barber, and Mitchell, 2002). Only after watching the process do these children feel comfortable enough to attempt even relatively simple tasks.

In addition, the Navajo culture teaches children not to ask questions. Asking questions is perceived both as taking a shortcut to knowledge and as stealing knowledge from someone who

has rightfully earned it (Neha, 2003). Additionally, Navajo people's processing or thinking style tends to be non-linear. Generally, Navajo people need to first see the whole and then work toward understanding each part (Zilberberg, 1994). When a classroom teacher recognizes these unique ways of learning, this will form the basic education platform from which he or she can then help students build mathematic and problem-solving skills.

Native American culture also emphasizes individual success less than traditional schools emphasize it. Instead, Native American communities emphasize the importance of tribal membership. Success is seen more as a community asset than as simply a personal achievement. Historically, Native Americans used performance assessments merely to determine how each individual could best contribute to the group, never to compare individuals with each other. Thus, recognizing individual achievement on a norm-referenced test goes contrary to Native American culture and values (Deyhle and Swisher, 1997; National Council of Teachers of Mathematics, 2000).

While individual success is not important to Native Americans, individualized teaching is highly important. Native American people traditionally use stories in order to instruct, and they adapt these stories to an individual child's needs and maturity levels. (Benson, 1997). Rex Jim states, "two children may be the same age, yet their teacher or elders may tell them different stories to accomplish different goals" (Benson, 1997).

To make a culturally specific context in which to teach and learn mathematics, a teacher should (1) use relevant examples from the students' culture and (2) expose students to a variety of cultural contexts. In other words, teachers should relate math problems to specific things students

do within their culture. They can also use multicultural children's literature to teach mathematics (Bush, 2003).

Stories & Literature as Teaching Tools

When a teacher uses children's literature to supplement mathematical instruction, students better comprehend and retain new concepts. This improvement occurs because the material is presented with more meaningful and authentic applications. Literature helps students become curious about real-world experiences and it can make them want to investigate, discover, problem-solve, inquire, and apply knowledge to new situations. (Oakes, Carpas, Hughes, Lenzo, 2004). Ducolon states that "high-quality children's literature that is captivating for both students and teachers can be used to develop process skills and essential knowledge in children . . . a good book allows all of us, young and old, to think, reason, solve problems, compare and contrast, critique and communicate in both old and new ways" (2002).

Additionally, telling stories in the classroom is a powerful way to help children engage in problem solving (Ameis, 2002). Ford states that teachers could read books that have mathematical problems embedded within them. Teachers could also have their students write stories that contain problems and then have their students write simple word problems based on their stories. Studies have shown that this method helps students understand mathematical operations and solve problems (Ford 1990).

Stories also encourage students to participate, and, usually, the more students participate, the more they will understand. Jenner and Anderson stated that when they use picture books containing mathematic content with their students, children volunteer comments about

mathematical ideas, strategies, or solutions based on the different situations (Jenner and Anderson 1995; Whitin and Wilde, 1992).

Of course, stories should not be used indiscriminately. One researcher, Gailey, identified four distinct categories of books that are useful for mathematics instruction: counting books, number books, miscellaneous storybooks which happen to "touch on a mathematical concept," and concept books that "explore specific mathematical concepts" (Gailey, 1993, p. 258-259).

Hellwig, Monroe, and Jacobs have established a scale of five criteria for evaluating literature books for use in mathematics education. These criteria include accuracy, visual and verbal appeal, connections, audience, and the "wow" factor. Although most books will not score high in all five areas, many will be noteworthy in one or more aspects. Many of the books that only score high in one or two ways can also be good potential resources (2000).

Ethnomathematics in Native American Cultures

To improve student learning, teachers must place mathematical education within the context of the culture where it is being taught (Davidson, 2002). In order for students to have the greatest success in school, connections need to be made between school and home. Demmert says, "Congruency between the school environment and the language and culture of the community is critical to the success of formal learning" (Demmert, 2001, p.9). Stories helps create these connections. Additionally, teachers can use findings from ethnomathematics to help students increase these connections. To do this, a teacher must recognize the ways children understand and use mathematical concepts in their regular lives, and then plan activities based on their findings (Brenner, 1998, p. 239).

One way teachers could apply ethnomathematics for Native American students would be to incorporate stories or themes that are built around the number four. Whereas in mainstream U.S. culture, stories and fairytales are often based on the number three (e.g. The Three Little Pigs), Navajo culture stories are based on the number four and are built on the belief of a four-level world development (e.g., four sacred mountains) (Ross, 2005). Linguistically, many Navajo phrases, idioms, and verbs begin with the Navajo word “four” (Marshall, 2005).

In order to successfully implement the principles and practices of ethnomathematics, teachers need to (1) identify culturally specific and everyday knowledge, (2) develop and test responsive curricular materials and learning activities, and (3) format evaluations to make adaptations and revisions (McREL, 2002). Additionally, when teaching mathematics to Navajo students, teachers should take into account the factors that influence their learning. These factors include a) federal, state, and local policy regulations, b) Native American culture, community, and language, c) poverty, d) isolation, and e) classroom practices (Nelson, Simonsen and Swanson, 2003).

Summary of Literature

Through my experience last year and through studying various literature, I have found that traditional methods of teaching math are not effective in Navajo classrooms. The literature clearly shows that the sequence of instruction used by standard U.S. textbooks is not appropriate or effective for teaching Navajo students. Nevertheless, the proper sequence for teaching Navajo students has not yet been determined.

Literature shows that Native American people are generally non-linear thinkers who learn by experiencing. They are also global thinkers who place the importance of tribe survival over the

survival of individuals. Navajo students are taught to work as a tribal member rather than focusing on their individual successes. For this reason, Navajo children strongly prefer working in small groups or pairs rather than individually. Students who struggle to understand the material depend on their peers to help them understand.

Additionally, Native Americans place high importance on relationships. Because a teacher is thought of as a grandparent/parental figure for the child learning will only take place within the context of a strong relationship. Since relationships change, the teaching style for each child also should change over time. Classroom teachers must understand this concept and diligently build effective and loving relationships with each child assigned to their classrooms as well as with those children's siblings, parents, and extended family.

Although most children learn best by moving from concrete to abstract concepts, Navajo children need more time to move between these two concepts. When using manipulatives with Navajo students, therefore, a teacher should allow the students adequate time to examine and play with the manipulatives before using them as tools. Although Saxon Math Publishers tells teachers to train the children that these are tools not toys, Navajo children cannot use them as tools until they feel that that they understand everything about its capabilities.

Although I found very little research that directly addressed using literature to teach mathematics to Navajo children, available research leads me to conclude that it would be effective. Navajo children learn by watching and experiencing the processes and answers to their questions. When teachers are sensitive to the rich mathematic knowledge embedded within the Navajo language and culture, this creates an atmosphere where students can build upon their intuitive knowledge of mathematics and open their minds to new and different ideas. Because storytelling is a familiar method of learning for Navajo children, literature may provide a non-threatening and

fun tool that will allow them to build new understanding, use prior learning to solve new problems, and help them think in new and different ways.

Hypothesis

I predict that if I include a literature component and appropriate activities to the established Saxon Math curriculum, my Navajo first-grade students' mathematic understanding will improve, and this improvement will be reflected by an increase in their test scores.

Rationale for Hypothesis

I derive my hypothesis from my reading and from my simple experiments (See Appendix A for further explanation). My reading shows that books are effective tools for helping students in mainstream U.S. Classrooms develop mathematical skills. Since storytelling is a familiar method of learning for Navajo children, I believe that using stories in a Navajo classroom would also be effective. Additionally, I believe that using activities that correspond to the literature will help students learn, because studies show that Navajo children learn best by watching and experiencing the processes and answers to their questions.

Methodology

This section will give information regarding the subjects, stakeholders, setting, cultural demographics, materials, research design, research procedure, validity issues, data collection, and data analysis for this project.

Subjects

The subjects for this experiment will be the first-grade Navajo students who attend school at Bread Springs Day School in the Bread Springs Chapter of the Navajo Nation Reservation at Gallup, New Mexico. These students range in age from five to nine years old and are

homogenous in terms of background, prior knowledge, and basic skills. All of the students have the following things in common:

They all attended kindergarten in an all-Navajo classroom.

They all live in extreme poverty including a lack of sewer and running water facilities.

They all live on a reservation.

They are all highly exposed to drugs and alcohol, use traditional medicine, and share native customs, including the 'we all rise together' concept of working for the survival of the tribe.

Besides these things, 83 percent of the students have witnessed some type of abuse and 83 percent have been sexually abused (BIA statistic). The average student in my class begins the year with a combined English and Navajo vocabulary of approximate 200 words, and most of them cannot read above a very low beginning level. Nevertheless, these students tend to learn quickly when teachers present new information in a fun, culturally sensitive manner. Based on past classes, by February 50 percent of these students should begin to read independently at a low first-grade level, and by May 80 percent should read at a mid-ending first-grade level.

Most of these students are visual and tactile learners, and, for that reason, they prefer to watch and observe before trying an activity on their own. Additionally, because they view failure as a humiliation for themselves and their families, these children like to be told they are special and assured they can succeed.

The Navajo culture teaches that “we all succeed or fail together” and “no one is more important or rises above their peers”; resultantly, these students have learned to work as a group member and do not enjoy assignments they must complete by themselves. Instead of doing individual

work, they will risk punishment by working with a partner or in a group. Low-level students in particular depend on the group to succeed. While these students are competitive in games, they never compete with each other in schoolwork.

Although many Navajo parents want their children to have a better life, they do not view education as a path to that life. Some parents encourage their children to attend college, but most parents are afraid that their children will become acculturated in western ways if they move away from the reservation.

Stakeholders

Stakeholders in this project include current students, future students, families of the students, myself, and the school's other teacher or future teachers.

Setting

Bread Springs Day School is a federally funded BIA School. It relies very little on local or tribal funds to operate. Bread Springs Day School has two first-grade classes. One class is taught by a Navajo teacher with a Navajo aide. The other class is taught by me, a Caucasian teacher with no aide. My class is the only one participating in the study.

Cultural Demographics

The school campus is located on the Bread Springs Chapter of the Navajo Indian Nation, near Gallup, New Mexico. The school is 20 miles from Gallup and seven and a half miles from the closest main road.

Gallup has two local hospitals: PHS Indian Hospital and Rehoboth [McKinley Christian Hospital](#). PHS is operated by the Public Health Department and is for Native Americans only. Rehoboth is operated by a Christian Charity and is available to anyone who needs it.

On the reservation, multiple families tend to share the same home or camp. Most of these homes are heated by wood burning stoves or coal furnaces, and over seventy-five percent lack running water or indoor plumbing. Additionally, roads are not paved, law-enforcement is unreliable, and alcohol and drug abuse is common.

Most of the students' parents earn minimum-wage working in restaurants, hotels, and stores. Other parents make and sell jewelry or weavings, work in the medical field, help on an ambulance, or work with law-enforcement or fire-protection departments.

Child-abuse is prevalent, and because of this, many children have moved away from their parents to be with extended family or older siblings. However, often their new guardians are also abusive. Many children have one or both parents or guardians in jail. Because of this, students change residence often, and it is difficult for the school to maintain accurate records of guardianship.

Materials

I will use the Saxon Math I, Second Edition, by Nancy Larson, 2004 Saxon Publishers. Additionally, I will select literature and activities from a list provided by Saxon Publishers and from Carson-Dellosa Publishing's book, [Learning through Literature, fun Language Arts Activities with a Math Twist](#).

Research Design:

Twenty-eight first-grade Navajo students will participate in this study. All of these students live in the Bread Springs or Red Rock Chapters of the Navajo Nation, near Gallup, New Mexico. The control group is composed of the seven boys and seven girls whom I taught last school year using the regular Saxon Math I curriculum. The experimental group is composed of the six boys and eight girls whom I will teach this coming school year using the regular Saxon Math I curriculum and also corresponding literature and activities. Because I have no control over which students are placed in my classroom, the sampling is random. Except for gender, the class make-up is homogenous. I will use both qualitative and quantitative research methods to evaluate the results.

Research Procedure

Students in the study will learn counting, shapes and patterns, number facts, time, measurement, money, graphing, number sense, word-problem solving, and word-problem writing through the use of Saxon Math I as prescribed. Additionally, they will use literature and activities as suggested by the Saxon Publishing Company and by Carson-Dellosa Publishing. They will learn concepts in the order prescribed by the Saxon Math curriculum scripts. I will compare the experimental group's performance to the performance of the control group who did not use the literature and activities.

Validity Issues

Although I will attempt to ensure validity by using random-cluster sampling and by using the same Saxon Math textbook for both the control and treatment groups, there are three main threats to validity in this experiment: my altered teaching style, new students, and family instability.

Altered Teaching Style. I have changed my teaching style slightly based on my literature review and increased teaching experience; therefore, I may not be able to determine if the literature and activities are the only things affecting the students' performances.

New Students. Families are constantly moving into and out of the area. Based on past experience, many students will enroll mid-year after McKinley County has expelled them for attendance or behavior problems. Students who are behaviorally maladjusted will need time before they can function well within our system. Additionally, students who move into the area to avoid family abuse are already in trauma and will need time before they can concentrate on school activities. These incoming students may or may not have been taught using Saxon Mathematics Curriculum or mathematics with a literature component. These variables are not within my control, and so I will note them in an Appendix B.

Family Instability: Sometimes major family problems occur that cause students to move from home to home. Some of these children do not know where they will sleep, what they will eat, or what they will wear on any given day. If these changes occur, I will probably not be informed of them, although I may discover them. If I become aware of any of these things, I will document them in Appendix B.

Data Collection

I will collect my data through the testing method prescribed by Saxon Mathematics I textbook. This text prescribes using paper/pencil tests every fifth lesson and performance evaluations every tenth lesson. The paper/pencil tests cover five-lessons' worth of material and the performance tests cover much more. These tests differ from mainstream U.S. testing in that the tests do not cover the most recently learned material. For example, the paper/pencil test for lesson 50 evaluates the skills taught in lessons 40 through 45, and the performance evaluation for lesson 50 tests performance of concepts taught in lessons 1-40. Additionally, I will use results from the students' beginning- and end-of-year Levels Tests from the National Consortium Levels Testing for Mathematics, and the annual California Test of Basic Skills.

Data Analysis

The null hypothesis is that adding a literature component with appropriate activities will not cause Navajo first-grade students who attend Bread Springs Day School to receive significantly better test scores than those students who used the same curriculum but did not use literature or activities.

I will collect primarily test scores, which are qualitative in nature. After collecting this data, I will compare the performance of the experimental group to that of the control group.

Additionally, using the national tests, I will compare the experimental group's performance at the beginning of the year with its performance at the end of the year. The first of these tests will take place before I have used literature or activities to teach them; the second of these tests will, of course, be after I have been using literature and activities to teach them.

Last year, the control group's mean score for all the Saxon tests was 74 percent. In order for my hypothesis to be true, the experimental group's scores need to be at least 89 percent—an increase of 15%. I will not have the experimental groups' scores until the end of the school year.

Schedule

The following schedule shows the activities I will complete, the purpose for each activity, and the dates by which I will complete them.

<u>Activity</u>	<u>Purpose</u>	<u>Time</u>
Gather literature for the next 10–15 lessons.	To review literature to determine which stories might be effective.	July 27, 2005
Combine literature and activities with Saxon textbook.	To be ready when the lessons are needed.	August 10, 2005
Collect, organize, and compare the data.	To prepare a formal analysis of the data collected.	May 2, 2006

Draft a report and send draft to mentor.	To gain an unbiased opinion.	June 15, 2006
Submit completed report to Western Governors University	To obtain a review of the report.	June 30, 2006

Budget

I will need a total of \$1100 to complete this project. I will use the first \$800 to purchase several books that are not available in the public library. I will purchase these books from a variety of new and used books stores. With the remaining \$300, I will purchase materials that are not available through the school for the suggested activities. I have obtained funding through personal resources.

Conclusion

This project will attempt to prove that adding literature and activities to the curriculum of Navajo first-grade students will improve test scores and comprehension. Please approve this project by July 1, 2005.