

# Original

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

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**Abstract**

The purpose of this action research project is to investigate a possible improvement in mathematic understanding for Navajo students by adding a literature component to an established curriculum. A quantitative research approach will be implemented. Students for this study are the students I taught last year and the students I have this year. Determination for placement in a class is not under teacher control. The study will use the assessments provided by the text. The curriculum will be Saxon Math 1, Second Edition, by Nancy Larson, 2004 Saxon Publishers. The literature and activities will be chosen from the list provided by the publisher. It is predicted by including a literature component student understanding will improve.

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### **Problem Statement**

Bread Springs Day School uses Saxon Math as its primary mathematic curriculum. Saxon Math requires an average score of 80% for a student to be considered passing. Further, the class average score also needs to be maintained at 80% for the teacher to be considered competent. My average class score during the 2004-2005 school year was 75%. In an effort to improve this score and to help my students scores improve on our local progress testing (MGS, minimum grade standards), beginning of year and end of year Levels Test (NWCLTM, National Consortium Levels Testing for Mathematics), and the annual CTBS (California Test of Basic Skills), I began to search for possible changes I could make in my teaching to increase student understanding and retention.

First, I became completely familiar with the curriculum, especially the scripted and manipulative materials. I did this mid-school year 2004-2005. Although I was teaching the material exactly as prescribed in the lessons, my students were not understanding or retaining the concepts being taught.

At this point I began examining the possibility of some basic learning and knowing differences based on Navajo cultural values and ideas. I discovered that Navajo children are taught to watch and observe rather than ask questions. Navajo children are taught to be quiet and not to guess. They are taught never to try until they are completely certain they will succeed. This requires the classroom teacher to hold much different expectations for student behavior during class.

Another major learning style embedded within the culture is that of a circle. Non-linear learning is moving from the whole to the part. An example of this is an orange. These kids learn best when given the whole orange to examine. Then to move to removing the rind, examine the rind and replace it on the orange until the student is completely satisfied he understands the relationship between the rind and the whole orange. This analogy can be taken further to removing the rind and then a single section of orange, the skin on the section, the juice filled cells, seeds, navel, etc. As long as the student can continue to relate back to the whole and the

previously learned parts, he will understand, learn and retain. (See Appendix A for further discussion of this concept.)

Within the Navajo culture, a teacher is thought of as a parental and a grandparental position and equal in responsibility for the child's physical, emotional and educational well-being. A major part of a Navajo child's teaching, prior to school, is through the use of story telling. It was this discovery which gave the birth of this research project. Since stories and story telling are the culturally embedded teaching style, perhaps they will also improve the learning in the Navajo classroom.

### Research Questions

1. Will adding a literature component and appropriate activities, to the Saxon Math Curriculum, improve student learning and retention in an all Navajo student first grade classroom, located at Bread Springs Day School, on the Bread Springs Reservation?
2. Are traditional methods of teaching math in Navajo classrooms effective?
3. What are the global learning styles of Navajo children?
4. What instructional sequences are effective for teaching Native American Students?
5. What is the role of stories in Native American educational practices?

Although I have five research questions, I will only be collecting data for question number one. Questions two, three, and five are addressed in my Literature Review. Question number four is only mentioned in my Literature Review, but would be a great place to begin a more in depth study at a later time. There is no definitive research on this question at this time.

### Definition of Terms

**Ethnomathematics:** For the purposes of this study, the definition of ethnomathematics listed in Brenner's paper will be used. Ethnomathematics "acknowledges the value of the knowledge base that children themselves bring to school: and engages children in activities based on everyday

mathematics in ways that help them "develop meaningful problem solving and greater mathematical power" (Brenner, 1998, p. 239).

**Non-linear Instruction:** The working definition for Non-Linear Instruction will be: Always start by viewing "the whole and then work toward understanding each part (Zilberberg, 1994)."

**Navajo Classroom:** The Navajo classroom is defined as an assigned group of Navajo children (First Graders), with no other races or tribes represented within the school student population.

**Traditional Methods:** For this research project, traditional methods will mean standard methods for teaching in the elementary classroom as taught in typical education/teacher preparation classes, in the United States of America. It does not refer to the traditional ways, concepts or practices of the Navajo or Native American people.

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## Review of Literature

"There is little extant research regarding mathematics education for Native American students (Davidson, 1998). The supporting research only states that these children learn differently than Western children (Ascher, 1991; Nelson-Barber and Estrin, 1995)

The professional literature in education indicates that:

- (a) No "Western mathematics" textbook is, by itself, appropriate for teaching Native American students;
- (b) Assessment of Native American students via standardized achievement tests is inadequate; therefore
- (c) Additional instructional methodologies and evaluation procedures are needed such as curriculum-based evaluation and authentic assessment (Gilliland, 1999; Davidson, Miller 1998; DeAvila, 1998)

Information regarding the use of literature as a tool for enhancing mathematics instruction for Navajo children was not available. However, four basic subjects were reviewed in an effort to examine the possibility of using children's literature in the all Navajo classroom. These subjects include (1) ethnic specific learning styles, (2) ethnomathematics as it relates to

Native American cultures, (3) using stories and literature as teaching tools regardless of ethnicity or subject, and (4) using stories and literature as teaching tools in the mathematics classroom.

Native American student learning in mathematics is influenced by several contextual factors: a) federal, state and local policy decisions and mandates, b) Native American culture, community, language, and ways of knowing, c) the culture of poverty, d) isolation, and e) classroom practice (Nelson, Simonsen and Swanson, 2003). To improve student learning, it is critical to situate mathematics education within the context of the culture where it is being taught (Davidson, 2002).

The Navajo teacher must view themselves as the parent of the children they teach. This means the teacher is expected to build a unique and special relationship with each child. The teacher assumes a greater responsibility for the health, education and growth of the children in their classroom. "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" says Rex Jim. (Benson, 1997)

The parenting practices of Native American students tend to contradict traditional schooling practices. Traditional tribal learning emphasizes "watch-then-do" or "listen-then-do" rather than "trial and error," which is often emphasized in schools (Swisher and Deyhlen, (1989). Native American languages do not align well with traditional mathematics vocabulary and terms, thereby causing learning problems for Native American students (Moore 1994).

Native American students' learning styles tend to be (a) global, or holistic, (b) visual, (c) reflective and (d) collaborative. (Hilberg & Tharp, 2002). Global learners benefit from (a) an overview of concepts prior to explanations of each segment or detail, (b) discussions focusing on overarching themes and use of metaphors, and (c) the use of visual presentations. Because Native children seem to learn better using visual representations, they score much higher on tests linked with visual/spatial processing. Visual learners almost double their learning if presented with information including both illustrations and text, when compared to using text only materials.

Reflective learners learn best when allowed to watch until they are satisfied they understand the process required (Neha, 2003). When given a Myers-Briggs Type indicator, Native American students scored significantly higher on "perceiving" associated with a reflective decision-making style. In traditional Native communities and homes, children work with others to finish tasks and solve problems. Most students, including native students, preferred pair or group work, 'global-visual' students were especially partial to group work. (Hilberg & Tharp, 2002)

In a study concerning Romany students (mostly holistic learners) in a Greek school (generally using a linear method) found "theory for them is useless....they don't develop cognition by posing questions but by experiencing answers". (Vaseleiadou, 1998)

The cultural learning style for the Navajo child is observation. In fact, 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 ). Then and only then are they comfortable in attempting even the easiest of actions. Navajo children are also taught it is wrong to ask questions. Asking questions is viewed as taking a short cut to knowledge. In vivid terms to ask is to steal knowledge it has taken the person being asked a life time to build (Neha, 2003). A third and important part of the Navajo processing or thinking style is its non-linear nature. Generally, Navajo people need to view the whole and then work toward understanding each part (Zilberberg, 1994). These unique ways of learning are cultural in nature and form the basic education platform from which a classroom teacher can begin to build mathematic and problem solving skills.

Indigenous peoples have traditionally used performance assessments to determine how each individual could best contribute to the survival of the tribe, clan or village. These "assessments" were designed to support the teaching and learning of students' understanding of the skills, cultural traditions and values as determined by parents and the community, and to inform local communities about the work its students can do. Success was seen as both a personal achievement and a community asset. Recognizing individual achievement based on a



norm-referenced test works in opposition to the importance of place and tribal bonds the Native American communities encourage (Deyhle and Swisher, 1997; National Council of Teachers of Mathematics, 2000).

"Ethnomathematics is a research program of the way in which cultural groups understand, articulate and use the concepts and practices which we describe as mathematical, whether or not the cultural group has a concept of mathematics" (Barton, 1996). At the center of the culture of mathematics is the nature of mathematics itself. Mathematicians do not agree about cultural nature of mathematics. The primary issue is whether mathematics is "external" or "internal" to the person. This debate traces its roots to the days of Plato (externalist) and Aristotle (internalist) (Dossey, 1992). The internalists see connections between mathematics and culture while externalists view mathematics as culture free. Alan Bishop, (1976, 1983, 1986, 1988), believes mathematics is "a cultural product which has developed as a result of various activities." This "cultural product" includes counting, locating, measuring, designing, playing and explaining. Stigler and Baranes (1998) view mathematics as "an assemblage of culturally constructed representations and procedures for manipulating these procedures" (Boaler, p. 258). The externalists say that in the context of learning, conflict is the starting point of teaching and this conflict can be provided by the student's culture (Chevallard, 1990).

Ethnomathematics has been further defined as the study of traditional and everyday mathematics and the integration of findings from this study into the development and use of curricular methods and materials that are aligned with content standards (Brenner, 1998; Davidson, 1989). Ethnomathematics "acknowledges the value of the knowledge base that children themselves bring to school: and engages children in activities based on everyday mathematics in ways that help them "develop meaningful problem solving and greater mathematical power" (Brenner, 1998, p. 239).

Current research suggests that certain instructional sequences are more successful than others for teaching Native American students. A recommend instructional sequence builds on Native American students' intuitive and ethnomathematical knowledge. Ethnomathematical

knowledge, including forms of mathematics embedded in culturally linked activities in everyday life, can provide critical foundations for students. From this knowledge base, students can begin to understand symbolic representations and procedures, leading to an understanding of the underlying principles and theory. This sequence does not occur in a linear fashion, as students often move back and forth between the various stages of understanding (Trumbell, Nelson-Barber, and Mitchell, 2002). Curriculum designed to be used in Native American classrooms needs a constructivist approach to learning combined with a sociocultural perspective. The constructivist approach "recognizes students as active meaning makers" by building upon their prior knowledge, while the sociocultural perspective "recognizes the importance of social and cultural systems and their associated values and expectations on students' learning" (Trumbell et al, 2002).

Mathematics within Native American cultures is very different than in the main stream culture of the United States of America. The Yupik tribe in Alaska has a unique number system built upon a base 20 with a sub-base 5 counting system and uses non-standard measurement to build most of the structures needed for daily living (Lipka and Adams, 2004). In the mainstream culture of the USA, stories and fairytales are usually based on the number 3 (Three Blind Mice, The Three Little Pigs and a general outline for stories as problem, two unsuccessful attempts and a third successful solution), while in the Navajo culture stories are based on the number 4 and are built on the belief of a four level world development, four sacred mountains, the four directions north, south, east, west. (Ross, 2005) Linguistically, many Navajo phrases and idioms as well as verbs begin with the same word used for the number 4. (Marshall, 2005) The teacher working with Native American students needs to be sensitive to the mathematics of the culture, and accommodate the learning styles which are predominate in the culture's use and understanding of mathematics, mathematic tools as well as the vocabulary of mathematic language.

Content standards should specify Indigenous knowledge and Eurocentric knowledge as complementary instead of competing learning goals.

It is absolutely necessary that students learn Eurocentric concepts as well as

their own ways of recognizing patterns, symbols, estimation/intuitive measurements, and ways of keen observation of place. Native students have to realize that our ways of measuring and knowing are identity-building processes, and that in-depth knowledge of these ways need not interfere with one's being and connection to the earth. Native students can then pursue careers in mathematics and the sciences buttressed by a Nature-way worldview giving them a kind and polite disposition to the world. (Kawagley, 1999, p.49)

The cumulative effect of increasing the connections between what students learn and experience in school with what they experience outside of the learning environment appears to have a significant impact on academic performance (AKRSI, Year Three Report, n.d.b, p. 3) "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)

To successfully implement the principles and practices of Ethnomathematics will take time and resources for (1) identifying culturally specific and everyday knowledge, (2) development and field-testing responsive curricular materials and learning activities, (3) formative evaluations to make adaptations and revisions (McREL, 2002)

Boaler found the ways in which the teacher acted as mediator between the text/curriculum and the students had a greater impact on student learning than interaction between the student and the curriculum. For example, teachers who introduced real-world mathematics activities by participating in conversations with the students regarding the tasks were more likely to cover the essential learning of the content area. "Students should never be left to interpret text-based problems alone"(Boaler, 2002, p. 245).

Culturally specific contexts in teaching and learning mathematics include a) using relevant examples from the student's own culture; and b) exposing students to a variety of cultural contexts. Examples in the first category include making mathematics curricula more accessible to Native, African and Hispanic Americans. Examples of the second include using

multicultural children's literature to teach mathematics and integrating Ethnomathematics principles in middle and elementary school classrooms (Bush, 2003).

"Native American people traditionally have used stories as a form of instruction. Stories serve to unite the family and the community. Stories are not told indiscriminately, however. The telling of stories is tailored to the individual child's stage of growth at a particular moment. Two children may be the same age, yet their teacher or elders may tell them different stories so as to accomplish different goals", says Rex Jim. (Benson, 1997)

Use of children's literature to enhance mathematic instruction has been shown to increase student comprehension and retention of the new concept. This is because the material is presented with more meaningful and authentic applications. Literature can nurture genuine curiosity about real-world experiences and foster a desire to investigate, discover, problem-solve, inquire and apply knowledge to new situations. It is particularly helpful in stimulating the use of prior knowledge or learning to gain new understanding and new skills (Oakes, Carpas, Hughes, Lenzo, 2004)

"As we (my students and I) enjoy picture books (containing mathematic content) together, individual children make spontaneous comments about mathematical ideas, strategies, or problem solutions that emerge from the situation." (Jenner and Anderson, 2000). Literature provides meaningful contexts in which to use and expand mathematical knowledge. (Anderson and Anderson 1995; Whitin and Wilde, 1992).

Using storytelling in the classroom is a powerful tool for engaging children in solving mathematical problems. (Ameis, 2002). "One possibility is for the teacher to read appropriate books that have mathematical problems embedded in them. Another is to have children write stories that contain problems. This 'second' idea has the substantial extension of having children write simple word problems. This strategy has been shown to be effective in helping students understand arithmetic operations and become better problem solvers. (Ford 1990)

"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." (Ducolon, 2002)

Many researchers have found value in using trade books to engage students in mathematic reasoning and communication. (Hellwig, Monroe, Jacobs, 2000). Gailey (1993) established four distinct categories of trade books used in mathematics instruction: (1) counting books; (p. 258), (2) number books (p. 258); (3) miscellaneous storybooks which happen to "touch on a mathematical concept" (p.258); and (4) concept books, which "explore specific mathematical concepts" (p. 259).

Hellwig, Monroe and Jacobs (2000) have established a scale of 5 criteria for evaluating literature books for use in mathematics education. These criteria include accuracy, visual and verbal appeal, connections, audience and the "wow" factor. (Heilwig, Monroe, Jacobs, 2000) Although most books will not score high in all five areas, many will be noteworthy in one or more aspects. Most mathematics trade books are good potential resources if the teacher develops ways to use them to help students learn concepts in a meaningful way. (Hellwig, Monroe, Jacobs, 2000)

### **Summary**

Through my experience last year and confirmed up by my literature review, the traditional methods of teaching math are not effective in Navajo classrooms. The literature clearly states that the sequence of instruction used by standard, mainstream text materials is not appropriate or effective. However, the proper sequence has yet to be determined.

The literature shows Native American (including Navajo) people are generally non-linear thinkers who learn by experiencing the answers. They are also global thinkers who view the importance of the survival of the tribe over the survival of the individual. A great deal of importance is placed upon the relationships between people as well. A teacher is thought of as a grandparent/parental figure in a child's life. Learning will only take place within the context of a strong relationship. For this reason, Navajo children strongly prefer working in small groups or pairs to working on their own. The weaker student physically and emotionally depends on his

peers to help him understand. Since relationships change, so will the teaching style for each child change over time. The classroom teacher must understand this concept and diligently build effective and loving relationships with each child assigned to his/her classroom as well as the each child's siblings, parents and extended family.

Though almost all children learn best by moving from the concrete/tactile stage to the more abstract, Navajo children need more time to move between the stages. The use of manipulatives is different because they must first examine and understand the manipulative before they can go on to use it as a tool. Saxon Math Publishers tells teachers to train the children these are tools not toys, but the Navajo child can not use the tool until he is satisfied he understands everything about what its capabilities. The Native child needs time to play with or examine the tools long before they can be manipulated for learning and problem solving.

Although little research is found directly concerning the use of literature to teach mathematics in a Navajo classroom, synthesizing the research available certainly points in this direction. Navajo children learn by *watching* and *experiencing* the processes and answers to their questions. Sensitivity to the rich mathematic knowledge embedded within the Navajo language and culture creates an *atmosphere where students can build upon their intuitive knowledge of mathematics and opens their minds to new and different ideas*. Stories and storytelling is a natural and familiar method of learning for the Navajo child. Therefore, literature may provide a non-threatening and fun tool in which to begin *building new understanding, thinking, using prior learning and understanding to solve new problems and thinking in new and different ways*.

### **Hypothesis**

It is predicted by including a literature component and appropriate activities to the established Saxon Math curriculum, Navajo first grade students mathematic understanding (as demonstrated by their test scores) will improve.

### **Rationale for Hypothesis**

My hypothesis is derived from my reading and my simple experiments (See Appendix A for further explanation). Navajo children learn by *watching* and *experiencing* the processes and answers to their questions. Stories and storytelling is a natural and familiar method of learning for the Navajo child. Good stories that captivate both students and teachers can be used to develop process skills and essential knowledge. A good book allows all of everyone, to think, reason, solve problems, compare and contrast, critique and communicate in both old and new ways. For these reasons, I believe reading literature containing mathematical concepts and including appropriate activities, will improve both authentic performance and paper/pencil test scores for Navajo first grade students, by providing opportunities for more observation, group interaction and discussion, and a culturally appropriate means of education.

### **Methodology**

#### *Subjects*

This unit of instruction targets first grade Navajo students, approximately ages 5-9 years old attending school at Bread Springs Day School in Bread Springs Chapter, Navajo Nation Reservation, at Gallup, New Mexico. Students at this age are already unique individuals with their own learning styles and interests. The students are somewhat generally homogeneous in regards to skills, background knowledge, and life experiences. They share the common experiences of kindergarten in the all Navajo classroom, extreme poverty including a lack of sewer and running water facilities, reservation life, a high exposure to drug and alcohol use, a

substantial exposure to spousal and child abuse, native customs and traditional medicine, including the 'we all rise together' concept of working for the survival of the tribe. According to Bureau of Indian Affairs (BIA) statistics, only 1 in 6 first grade students come to school without having been the victim of sexual abuse. Fewer than 1 in 6 have escaped viewing spousal and child abuse in their own home.

Most of these students are essentially visual and tactile learners. Most students at this age are non-readers or very low beginning readers. By February, about half of these students will begin to read independently at a low first grade level. By year end, about 80% will read at a mid-ending first grade level.

The average first grader in our school has already experienced both physical and sexual abuse and neglect. The average student in my class begins the year with an approximate vocabulary of 200 words (both English and Navajo combined).

Navajo students at this age are often like little sponges, and usually able to absorb new information when presented in a fun, culturally sensitive manner and within the context of an individual relationship with the teacher. They prefer to watch and observe before trying an activity on their own. Culturally, they are taught to work as a tribal member so they do not enjoy independent work, but will risk punishment to work in pairs or groups. Low students depend on the group to help them succeed. Failure is viewed as a humiliation for themselves and their families. These children like to be told they are special and assured they can succeed in the classroom. They are competitive, but only in games and never in doing better than another student on class work. Individual students are taught to help each other (behavior main stream USA calls cheating) as part of the tribal teaching of 'we all succeed or fail together' and 'no one is more important or rises above their peers. Although many parents want their children to have a better life, they do not view education as a path to that life. Children may be encouraged to go to



college, but the threat of them moving from the reservation is too frightening for most parents. They do not want their children to become enculturated into the Western Ways.

Students will be more successful learners if they are shown the big picture and see individual skills as small parts relating to the whole. They will also feel safer and the learning environment will be more appropriate if the stronger and weaker students are allowed to work together.

### *Setting*

Bread Springs Day School is a BIA (Bureau of Indian Affairs) School. It is a federally funded and relies very little on local or tribal funds to operate. Bread Springs Day School has two first grade classrooms. One is taught by a Navajo teacher with a Navajo aide and has 17 students. The other is taught by a Caucasian teacher and no aide. For the past two years, the ratio of boys to girls in first grade, has been about 1/1. The students are all Navajo by race and live on the Navajo Reservation. The second classroom is the only class of students 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 7.5 miles from the closest main road (hwy 602) and 20 miles from the nearest town (Gallup). The primary industry is tourism. Most of the parents are employed in some type of service work in restaurants, hotels, and stores, earning minimum wage. Some are jewelry makers and weavers, but are not paid well for their wares. Some have become trained to work in the medical industry. We have two local hospitals... PHS is operated by the Public Health Department and is only accessible to the Native American population. Rehoboth Hospital is operated by Christian Charity and McKinley County. It is accessible for all

who live in the area or need medical assistance. About half of the law enforcement and fire protection departments have Native American employees. The ambulance is operated by a private company. They employ well trained personnel who are both Native and non-Native.

On the reservation, law enforcement is not reliable. Ambulance service is 20 miles away and very expensive. Most homes are heated by wood burning stoves or coal furnaces. Less than 75% have running water or indoor plumbing. The average family lives as a multi-family unit in the same home and in the same camp. The roads are not paved. Alcohol and drug abuse are so common, very little attempt is made to regulate it. The child abuse rates are very high; it is common for a child to come to school with bruises from physical abuse or infections caused by sexual abuse. Although these are reported and documented by the school staff, most of these reports go uninvestigated by persons in authority. Many children are living with aunts, uncles, grandparents or older siblings for their own protection. Often, the person they are living with is only slightly less abusive than the person they are hiding from. It is not uncommon for a child to have one or both parents or guardians in jail for periods of time. It is a challenge for the school to maintain records of guardianship for each child. Since I am not related to the people on the reservation, I understand very little about the clan system of government or who is to be trusted with information.

### *Instruments*

Saxon Math Program Testing: Saxon Mathematics I is taught in 5 lesson units with a paper/pencil test every 5th lesson. The performance evaluations are done during each 10 lesson cycle. The paper/pencil tests evaluate knowledge learned in the previous lessons. For example: Lesson 50 has a test. The items on the test are designed to evaluate all skills taught through lesson 45. Concepts taught in lessons 46 through 50 will be tested during lesson 55. The performance evaluations evaluate the material learned during the previous lessons. For example: Lesson 50 has a performance evaluation. This evaluation will test performance of concepts

taught in lessons 1-40. Lessons 1-50 will be evaluated during the Lesson 60's evaluation period. This sequence of testing gives students opportunities to practice new learning before being expected to perform with any skill.

*Research Design:*

The research design for this study is a quantitative method. The sampling is random in that the teacher has no control over which child is placed into their classroom. The classroom make-up is homogeneous except for the sex of the participants. The ratio of girls to boys is approximately 1/1. All students in the study are Navajo children living in the Bread Springs or Red Rock Chapters of the Navajo Nation, near Gallup, New Mexico. The control group, the group not receiving the treatment, is the class taught by the same teacher last school year.

To summarize:

Twenty-eight first grade Navajo students (ages five to nine years old, level 1.1) will be participating in this study.

Control Group -- received the Saxon Math I curriculum as prescribed and scripted. This group has 7 boys and 7 girls. This was class the 2004-2005 school year.

Experimental Group--will receive the Saxon Math I curriculum as prescribed and scripted, as well as a literature and appropriate activities for the concepts being taught.

This group contains 8 girls and 6 boys. This is the class 2005-2006 school year.

*Research Procedure*

Students in the study will be taught counting, shapes and patterns, number facts, time, measurement, money, graphing, number sense, and word problem solving and writing through the use of Saxon Math I as prescribed. An appropriate literature component and activities suggested by the Saxon Publishing Company, and suggested literature and activities from

Learning through Literature, fun Language Arts Activities with a Math Twist, by Carson-Dellosa Publishing will be added to enhance the established curriculum. The sequence of instruction will be prescribed by the Saxon Math curriculum scripts. The experimental group's performance will be compared to the group taught the previous year, by the same teacher and using the same curriculum, but without the literature and activity connections.

### *Strategies to Confront Validity Issues*

The primary means of ensuring validity is the use of random cluster sampling and the same teacher for both the control and the treatment group. The classroom teacher has no control over who is placed in their class. This may be a concern since I have made some basic changes to my teaching style based on my literature review and experience with teaching the class last year (control group). I may not be able to determine if the literature and activities are the only factors in improved scores since teaching style changes can also affect student performance. However, I felt it unethical to ignore information that might help my students succeed. I also tested, in some very simple experiments, the validity of the information before making any major changes in my teaching style. These tests and their results are explained in Appendix A. Further, I will compare this year's class performance before and after adding the literature component by comparing MGS and NWCLM test scores from August/September and April/May.

The another possible threat to validity, is the large number of families moving in and out of the area. Many students may be enrolling mid-year, do so because they have attendance or behavior problems and McKinley County has expelled them. County law does not allow students expelled from one public school to enroll in any public school in the county. Therefore, one of the only choices they have is a BIA school. This means these students will usually be very low because they haven't been in school. Students who are behaviorally maladjusted to being in school, will spend a while learning to function within our system. Students moving into the area to avoid family abuse, are already in trauma and will take time before being able to

concentrate on school activities. These students may or may not have been taught using Saxon Mathematics Curriculum or mathematics with a literature component. These threats are not within the control of the classroom teacher and will have to be noted in an Appendix B. They can not be controlled by the teacher.

The third threat to validity is the instability of the families of children in the classroom. Several children are not living with their biological family, but with extended family. Some of these children do not know where they will sleep on any given day. They don't know if there will be food to eat or clean clothing for them. Help with homework is inconsistent at best. A major family mix-up can move a child from home to home without the teacher being aware of the changes, except by the changes in behavior of the child. If any of these things are known to have happen, they will be documented in Appendix B.

# Original

## Data Analysis

The null hypothesis is: Adding a literature component with appropriate activities, will not significantly improve test scores on both performance and paper/pencil tests for Navajo first grade students attending Bread Springs Day School, over those students not receiving the literature component and activities who attended the same school, when assigned to the same teacher and using the same curriculum the previous year.

The data to be collected is primarily numerical in nature, (test scores).

The results from last years class on all tests given and the percentages needed to attain passing levels for this year are as follows:

Test	Passing Score	2004-2005 mean score	% increase needed to meet acceptable levels
Saxon Tests	80%	74%	10%

It is my belief, an improvement of 15% in the mean scores for each student in the experimental group is significant enough to validate my hypothesis as true, when compared to

last years' performance. The data for this year's students scores on the Saxon Math Tests will not be available until January 2006.

### Schedule

<u>Time</u>	<u>Activity</u>	<u>Analysis</u>	<u>Purpose</u>
As soon as project is approved for study.	Acquire necessary literature for the next 10 - 15 lessons.		This will give me enough time to find books before I need them since I am choosing from prescribed lists.
Two weeks after project approvals have been received.	Obtain copies of the first 15 books and plan lessons in combination with the prescribed Saxon Lessons.	Two weeks is plenty of preparation time to be ahead of where I need to be to continue the study without a hitch.	If I am always working on lessons for 2 weeks from today, I will be ready when the lessons are needed.
End of the school year	Data Collection will be complete.	I will need to organize the final data collected and integrate it into the previous groups of data.	Prepare a formal analysis of the data collected in all areas. My goal is a 30 % improvement over all. However, I think this study would show the hypothesis as true if a 15% improvement in mathematic scores was seen in all students participating in the study.
June 15, 2005	Complete all data analysis and draft report	Send a preliminary draft to mentor for comments and critique.	I think someone other than me should look the final report over before I send it in as completed.
June 30, 2005	Submit completed project to WGU.		

### Budget

There will be expenses to purchase books not available through the public library. During my preliminary research for this project, I found very few books available locally and will need to purchase most of these books from a variety of new and used books stores. The total cost for books for project is about \$800.00. Additionally, there are activities suggested to help bring out the math in each story. Most of these activities will include some materials not available through

the school. The estimated cost for these materials is about \$300.00. I have obtained funding through personal resources.

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Original

### **Appendix A**

My research question is "Will adding a literature component, with appropriate related activities, to an established Saxon Math curriculum improve test scores for first graders in my all Navajo classroom?"

I could not find information directly related to my topic. I did find a **cultural need** for multiple applications of the same process and skill as well as opportunities to observe the appropriate operations to solve problems. I also documented a **cultural teaching style** in storytelling. I found information which documented **the need to be sensitive to the mathematics already embedded within the language and culture** of the Native American (Navajo) student. And I discovered a set of learning styles which generally predominate the Native American cultures. These learning styles tend to be **non-linear**, requiring the "step one, step two, first this, then that" approach to be changes to a circular pattern that helps the student move from the whole to the part and back to the whole through as many repetitions as is necessary for the student to become satisfied he understands.

To test if these different findings to see if they applied to my Navajo students I performed four simple experiments. The findings are as follows:

To test the non-linear learning/teaching idea, I purchased two bookmark project kits from Oriental Trading Company. These had the same number of pieces and basic instructions.

The first kit I taught like I always have, by going according to the directions. I gave the children the unopened kit and tried to get them to listen to me as I demonstrated by doing. There was no completed model to show. The kids made a mess with the glue and only a few successfully completed the activity with something they were happy with. None of the bookmarks resembled mine.

Two days later, I tried the same activity but with a less linear teaching style. First, I made one of the bookmarks so the children had a completed project to examine. Next, I placed the completed project on the right hand side of my board and drew a picture of the project without the final piece. Then I asked the class, "What did I take away?" (The glasses.) Then I drew a picture omitting the last two items. "What did I take away this time?" (the hat) I continued this process, until the entire bookmark had been "taken apart" in pictures. Granted, we had made a line of pictures but they all referred back to the completed project.

At this point, I asked the children what they thought they should do first when they get their kits. They all liked the idea of lining up the pieces in order from left to right so they could "get it right". I handed out the kits and the glue and without further instruction, the children were able to complete the project on their own with a great deal more success than the previous experience.

A second experiment I did was to have the children practice their addition facts for adding the number 2, to numbers 0 - 9 (the two's facts). I gave them a grid and had them copy the facts from the board onto the paper. We repeated them over and over, yet when tested, they could not remember these simple math facts.

The following week, I tried something different. I remembered reading that these children learn from 'experiencing the answers'. I had the children sit in a circle with me. I had a stick of 6 snap cubes. I simply called the stick '6'. I closed my eyes and broke the stick into two sticks. I used the same grid I had used previously, and wrote the number of cubes in my right hand on the top (4) and the number of cubes in my left hand (2) and an addition (+) sign, equals (6) because we knew we started with six. I repeated this several times and then handed the stick to one of the children. They repeated the process. We found (discovered) 20 ways to make six as a class.

Then I gave the children a stick of 7 and let them work in pairs to find 20 ways to make 7. This they did easily. The next day I tested the children on both the six and seven facts. The lowest score was 70% correct. The mean was 87%.

Ecstatic, I gave each of the children a 5 stick and told them they had to do the operation alone. I moved them far away from each other and required silence for the activity "find 20 ways to make 5). This was very frustrating. These children are dependent upon each other for

comfort and success. Although they did succeed, it took much longer and lots more teacher encouragement for them to get it done. When tested the following day, the lowest score was 20% and the mean score only 50%.

This experience showed me that my students must be allowed to work together in pairs or small groups, to succeed. It also showed me they do learn by experiencing the answers and creating the questions.

Embedded within the American mainstream culture is the number 3. Third time is a charm and three strikes and you're out. (Although football has four downs to move ten yards.) Most of the children's stories involve the number 3; The Three Little Pigs, Three Blind Mice, The Three Bears. In contrast, most Native American stories and idioms contain the number 4.

To test this basic cultural difference I read two stories. The first was "The Four Little Foxes" and the second, "The Three Little Wolves". The children responded to "The Four Little Foxes" much more than "The Three Little Wolves". I even tried "The Three Pigs", but they still preferred the 'foxes' story. I purchased some Native American stories from several different tribes and found they all had the number 4 as part of the writing style. My students much prefer these stories to stories I have read in other classrooms. They understand the jokes and seem to understand the stories much better when written in this culturally appropriate style

To test the cultural teaching style of story telling, I started explaining the phonics and basic writing structures of English in story form. Noun became a character in a story about names and what they mean. Verb is a little critter that vibrates. He is always active and can't sit still. Every sentence train must have a noun and a verb. The train must have a big head (capital letter) and some type of tail (punctuation mark). Since this is about all we do in first grade, this series of stories only contains these characters. I had been fighting these conventions in speaking and writing for a very long time, but after reading and re-reading these stories, even allowing the children to write stories about Noun and Verb, my students began to improve in understanding,



speaking and writing. Storytelling does work. (Probably for everyone, but especially for my class.)

# Original