

INCREASING STUDENT INTEREST AND ACHIEVEMENT IN SCIENCE BY  
INTEGRATING SCIENCE AND READING IN THE ELEMENTARY GRADES

by

Mary Larson

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In presenting this professional paper in partial fulfillment of the requirements for a master's degree at Montana State University, I agree that the MSSE Program shall make it available to borrowers under rules of the program.

Mary Larson

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## ABSTRACT

The purpose of this study was to incorporate the instruction of science in the context of language arts. Students experienced science instructions as they read, listened to and interpreted language. The students received greater instruction in science, enhanced their language arts skills, and indicated they enjoyed science more than pre-treatment. Data revealed that elementary students can become knowledgeable contributors to society when taught how to read and interpret expository text.

## INTRODUCTION AND BACKGROUND

For the past 26 years I have been teaching in the Polson School District on the Flathead Indian Reservation which is in western Montana in the Mission Valley. Currently, I teach third grade at Linderman Elementary School, with an enrollment including second, third, and fourth grade students. According to Linderman's administrative assistant, we have 389 students, of which 62% are on free and reduced lunch, and our American Indian population is 42% (J. Taylor, administrative assistant). Currently, I have 22 students in my classroom: 11 girls and 11 boys; 46% are American Indians and 54% are Caucasian.

The Flathead Indian Reservation is the contemporary home of the Salish, Kootenai and Pend d'Oreille Tribes. We have the Salish Kootenai Tribal College nearby, which draws students and their young families to our rural area from throughout the United States. These families are often a transient population who move between our small rural towns to find housing and work so that they can go to college, thus contributing to a high student turnover throughout Mission Valley schools. Many of these families face financial difficulties as well as the problems that come with moving to a new area, like unfamiliarity with the community that can result in an isolation and lack of support from an extended family.

For the past several years, discussions within our school district about the lack of curriculum consistency throughout grades and grade levels, low test scores, struggles with Adequate Yearly Progress, cultural diversity, and time constraints for mandated curriculum in the elementary classroom have motivated me to investigate and address some of these concerns. What I wondered is what we could do to initiate higher

achievement scores, reduce time constraints, become more consistent throughout our district with our curriculum, and honor our native families.

Along with these local issues, our country is also seeing a national shortage of scientists, engineers and mathematicians. This begs the question: what can be done as an elementary teacher in the Polson School District to help local students increase their desire to learn more about the world around them? The hope was to accomplish this by instilling a passion within students for science. The goal of this action research project was to encourage young eight and nine year olds to investigate their world through science by introducing them to science vocabulary, teaching them to compare and contrast scientific information, providing opportunities for scientific expository reading, and helping them to begin to read and write like scientists. My goal is to also encourage inquisitive thinking and to teach a mindset to identify and solve problems.

Concerns about low test scores and time constraints in the elementary classroom with all the mandated curricular areas required to be taught led me to my primary focus question: Does the use of integrated reading and science curriculum impact gender growth on achievement scores in science and reading? Gender was easy to include in this study for it is always a question that is asked of teachers on who showed the most growth, boys or girls and it is a question that I always ask myself. I also wanted to know if integrating science and reading would affect teacher preparation for more effective and efficient use of time being used for student instruction. Lastly, would this study impact students' attitudes in science and reading when taught using an integrated approach?



## CONCEPTUAL FRAMEWORK

Most elementary teachers' daily instruction focuses more than three quarters of the time on language arts, reading and math which receives the most attention due to the "No Child Left Behind Act" (NCLB), mandated in 2001. In some districts, this means that other curricular areas like science have been put on the back burner due to time constraints. As stated by the Education Writers Association (June 2006), many districts "in their rush to raise their Annual Yearly Progress scores (AYP) scaled back on science and concentrated solely on reading and math achievement" (p. 1).

In 2007, President Bush announced the American Competitiveness Initiative (ACI) proposal "to provide millions of dollars for improvement in science and math education by bringing professionals into classrooms, increasing the number of Advanced Placement courses in high schools as well as providing tools, services and professional development for educators" (Education Writers Association, p. 3) thus conveying that science no longer could be placed on the backburner, but had to be tested along with reading and math. "Researchers are concerned that testing science content will be focused on the assessment of memorized information instead of students' comprehension and evaluation of scientific understandings" (Hess, 2007, p. 3). Money for NCLB and ACI initiatives has been limited, making it necessary for teachers to figure out how to teach science, reading and math in an effective way, with the funding as well as time constraints they face. Frederick Hess, director of Education Policy Studies at the American Enterprise Institute has concerns that "the United States will not be able to compete successfully in the global economy since the recognition of communications, transportation, and financial markets have created an increasingly global economy in

which high-level science, math, and language skills are crucial to national well-being” (2007, p.1).

Elementary teachers have to make the most efficient and effective use of their curricular time, so if successful teachers approach the teaching of science in an integrated fashion, it might solve some of the time limitations they face. Through meaningful integration of the teaching of science and reading, both areas of study have the potential to greatly enhance one another. Coskie’s (2006) research suggests that sharing reading and writing instruction time with that of science is time well spent. A wide range of instructional strategies may be used to support reading and science growth for all students. Douglas, Klentschy and Worth (2006) point out that there are several strategies or methods that support both areas of study because they are already very similar. For example, in reading, as well as in science, students make predictions by using evidence from the story and also by using evidence in science experiments to come to conclusions. These predictions are often based on prior knowledge or background experiences. Students who are drawing inferences and making connections in reading tend to gain a greater understanding of the topics, which leads to increased comprehension skills and vocabulary development in reading and science. Douglas, Klentschy and Worth (2006) have found that “children come to school with much more knowledge of the world around them and are able to comprehend and reason much more effectively than was typically presumed” (p.5). Quality science instruction with appropriate reading tools and hands on exploration will scaffold student’s background knowledge and afford greater science comprehension in the classroom. Therefore, “teaching these skills in reading and

science will compound the effort made to prepare these students for real life situations” (Douglas et al., 2006 p. 7).

Reading and science have common standards that could be inter-related by using a well-researched program. The National Science Education Standards and the Standards for the English Language Arts are very comparable. They both affirm that the purpose for reading is to acquire, learn and understand new information. Both standards also indicate that by educating students with these principles that they will be able to make; personal decisions as well as connect in intellectual discourse and will increase financial yield for themselves and society (NCTE/IRA, 1996). Royce and Wiley (2005) also recognize the similarities between the goals of Science and English disciplines, “It easier for teachers to see the possibilities of meeting the standards in both disciplines when integrating the subjects” (p. 4).

Capraro and Slough (2008) acknowledge that “there is a need for fully articulated science instructional programs, enabling today’s science teachers to be well-prepared in instruction in order to teach science to a student population having great diversity in cultures, backgrounds, interests, and language and reading abilities” (p. 2). Teachers have to teach the same curriculum to all involved. Bringing the real world into the classroom by using science trade books and science text books, can serve to differentiate students’ learning but “choosing appropriate informational trade books and pieces of science textbooks can be complicated when your purpose is improving reading ability and also gaining science concepts” (Carver & Bailey, 2010, p. 4).

As teachers learn to combine science and literacy effectively, classroom conditions and methods might include literacy and science centers, guided reading and

science activities. Literacy and science centers allow students to be self-directed while the teacher is involved with a guided reading group using expository science texts and trade books that are differentiated for ability groups. Fredericks (2003) suggests that “guided reading provides teachers with a systematic approach to small-group reading instruction by encouraging students to become actively and meaningfully engaged with science literature” (p. 5). Supplementing with student newspapers, magazines, games and technology can also foster independent scaffolding practices. Royce and Wiley (2005) claim that “addressing learning goals in science and reading will not compromise any subject but will maximize efficiency within the school day and it is possible to teach these subjects effectively through integration” (p.6).

Science trade books and science texts in the elementary classroom can promote excitement for science and reading. Labbo (1990) advocates that, trade books present familiar language patterns for children to build knowledge and scaffold their learning in science content. Terminology in trade books is used so elementary students can understand the content with supporting illustrations and patterns. In their work, Cervetti, Pearson, Bravo, and Barber (2006) have found that “trade books can model the nature and processes of science, sharing with readers the questioning strategies, uses of evidence, and making of conclusions in which real scientific thinkers engage” (p. 5).

National Geographic and publishers of science and reading programs are currently linking science and literacy together because they feel that “student achievement gains are greater in well-integrated programs than in traditional approaches” (National Geographic, 2010, p. 6). “Science text and trade books can and should be a natural and normal part of children’s experiences with science and reading” (Fredericks, 2003, p. 2).

Science experiences and activities provide students the time to explore and discover conceptual understandings on their own. Combining science and reading can help improve students' meta-cognitive skills enhancing their ability to draw inferences and make connections as they engage in scientific investigation and reading of literature. Baker (2004) tell us that, "To the extent that science and literacy draw on many of the same cognitive and meta-cognitive processes, cross-curricular connections may well have a synergistic effect in promoting development" (p. 254).

Science activities are one way of developing students' questioning skills, which in turn helps students' comprehension skills in literacy, as they learn to question the vocabulary and the stories while reading. Students arrive in the classroom with varying levels of vocabulary skills and lowering expectations within the science curriculum will not help either the struggling readers or the high achievers. Adding cooperative learning groups in the science classroom will promote more active learning with students reading and talking together in flexible heterogeneous groupings, as well as games and technology to make learning come alive for all students. Self-motivated science experiences help students build prior knowledge and encounter concrete examples of vocabulary concepts.

Memorizing vocabulary words usually does not work for students to be able to make the connections necessary for understanding concepts. Students need to seize word meanings by semantic associations connected to earlier learned facts, ideas and concepts. "Teachers who put discussion high on their list will expand and deepen students' understandings of those vocabulary words" (Amaral, Garrison, & Klentschy, 2002, p.1). Science circles or discussion groups can "equip students to communicate their thinking

and understanding, while also serving as an authentic indicator of student achievements in science and literacy” (Greitz & Calfee, 2004, p. 10). Teaching vocabulary in a meaningful way is essential for effective science and reading instruction so students can participate actively in decision making for themselves and their society.

Miller and Calfee (2004) make a strong case for the symbiotic relationship that can occur when science and reading are assimilated, thus contributing to greater critical thinking, thoughtful consideration of ideas and better concept learning. “Reading makes thinking visible, allowing students to self-assess complex content knowledge through science activities. This allows a teacher to assess the student in two dimensions: overall reading ability and specific science content achievement” (p.12).

Teachers are often looking for ways to inspire and encourage their students as well as to promote high expectations and good attitudes and habits. Often science carries a reputation of being boring, difficult and hard to comprehend. Overcoming this status lies in the hands of the teacher to promote informative, engaging science content to all types of learners. Trade books can help introduce and expand upon scientific principles or ideas and provide numerous opportunities for students to investigate science in meaningful ways. The process of integrating reading and science helps students’ begin to build a bridge between their background knowledge and textual knowledge and serves as an informal assessment for the teacher. “Integrating reading with science makes political and research-based sense, especially during these times when reading and math are dominating so much of today’s elementary school curriculum” (Holliday, 2003, p. 3).

Fredericks (2003) affirms that “Literature provides students with multiple opportunities to probe, poke, and peek into the mysteries of the universe- whether that

universe is their own backyard or a galaxy far away”. “The marriage of science and reading can be a powerful vehicle in stimulating students to explore their immediate and far flung environments” (p. 9).

## METHODOLOGY

The treatment for this action research was the implementation of reading and analyzing multiple informational expository texts, related to science study, woven into the language arts curriculum. The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained. This project was conducted over an eight month period, from September 2011 through April 2012.

During the first month of school, the third grade students had regular instruction in large groups that involved separated science and reading curriculum. A daily routine included reading instruction for 60 minutes and also incorporated science instruction for 30 minutes every other day. Multiple measures were used for data collection such as 1) student reading and science achievement scores, recorded by gender 2) student and parent attitude questionnaires and 3) teacher surveys.

Students took a Science Interest Questionnaire in October before I started the integration of reading and science and then repeated it again in April (Appendix A). These questionnaires were tallied and student responses were calculated to determine if there was growth in attitudinal change over time and throughout units of study after integration. A parent Science Questionnaire was also administered two times this past year to assess whether parents recognized science as an important aspect in their child's

educational growth (Appendix B). These questionnaires focused on students' interests towards science study and the impact the treatment made towards their science attitudes, as well as their parents' position on science education.

The Student Science Topic and Genre Interviews (Appendix C) was designed to interview third grade students to find out which scientific topics were lacking and needed future attention. The survey results suggested that my attention for scientific instruction should begin by using earth science. Earth science was one area that the students seemed to be deficient in as far as experience and background knowledge, thus determining the treatment units I would teach.

Over the next several months, four units of science study were used in the treatment plan: Soil, Forces on the Land, Minerals, Rocks and Fossils. A science pre-assessment test was given before each unit, and then a science summative assessment test was given at the end of the units to assess science growth by gender over time (Appendices D, E, F and G). During the four units of study, a variety of instructional materials was used: science textbooks; non-fiction elementary science related trade books; National Geographic Kids Magazines; non-fiction library books; realistic fiction stories; experiments; technology and charts. The objective was to expose the children to an assortment of expository text with an expectation that the children would seek out more knowledge with all these resources surrounding them, thus improving reading and science achievement within each gender. Photographs were taken during all types of reading instruction to show student interest levels. Students were encouraged to take pictures during science experiments, field trips, and family activities that related to our units of study. By taking pictures the students could get parents and siblings more



involved with our study as well as adding the photos in their science journals to help them remember what they had seen and learned.

Star Reading assessments through the Renaissance Learning Site are data based tests that we use at our school for instructional planning, progress monitoring and placement. This test was used to provide evidence that addressed the question: How will integrating science and reading improve student reading achievement by gender? Three tests were taken throughout the year, once in September, November, and again at the end of March. The Star Reading Test Scores were compared to show growth by gender over time in reading instruction. The students were also taught to use Excel to graph their own reading and science growth so that they could take an active role in improving their own scores.

Throughout the treatment time, a few teachers joined me in a book study related to my action research. The study involved the book called “Reading and Writing in Science” by Maria Grant and Douglas Fisher. This enabled me to use researched-based practices with specific reading strategies, which helped support my action research.

During this action research project, eight colleagues at Linderman Elementary volunteered to be interviewed concerning the challenges of curriculum and time constraints placed on elementary teachers. Interviews were conducted to self-assess efficiency and effective use of class time in reading and science instruction, lesson planning and classroom management (Appendix H).

The data sources described above are summarized in the Triangulation Matrix (Table 1). The information provides the triangulated data for my action research

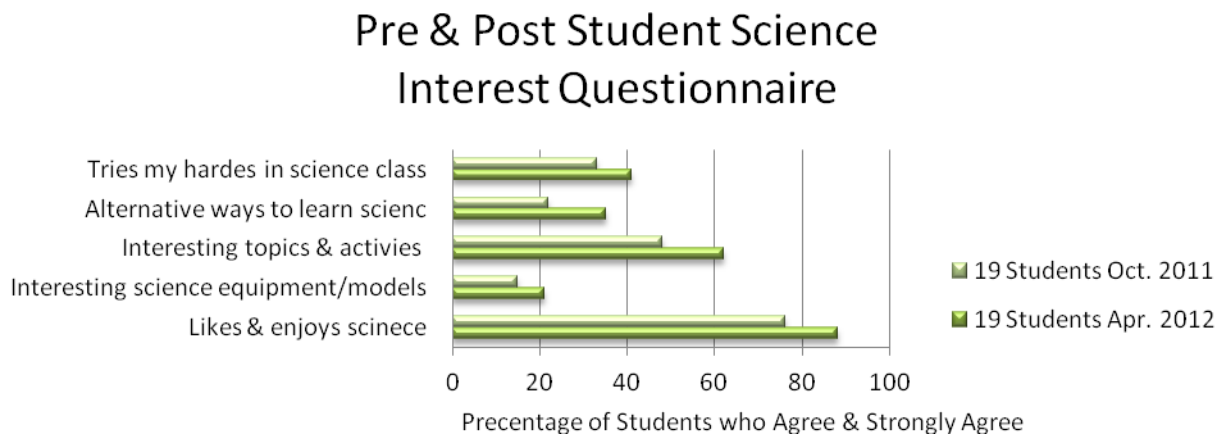
questions regarding third grade students reading and science integration, attitudes and academic growth over time.

Table 1  
*Triangulation Matrix for Data Collection*

Research Questions	Data Source 1 Quantitative sources	Data Source 2 Qualitative sources	Data Source 3
<p><i>Primary Question:</i> 1. How will integrating science and reading improve gender achievement scores in reading and science? (growth comparisons between genders)</p>	<p>Science pre and post test assessments for each unit of study by gender.</p> <p>Star Reading pre and post assessment scores by gender, also comparing with the 5 other 3<sup>rd</sup> grade classrooms</p>		<p>Faculty Book Study: “Reading and Writing in Science”</p>
<p>2. Will combining the reading and science curriculum impact students’ interest in science study?</p>	<p>Likert Scales: Student Interest Questionnaire and Parent Survey Questionnaire</p>	<p>Student Science Topic and Genre Survey</p>	<p>Teacher Observations/Pictures</p>
<p>3. Is combining science and reading an efficient and effective use of time?</p>	<p>Teacher Curriculum Survey and Interviews</p>	<p>Comparison table: amount of material covered in science and reading from year to year</p>	<p>Teacher Resource List for each unit of study</p>

### Student Attitudes about Science

Upon comparing the results of the student Science Interest Questionnaire (pre-and post instrument), it was revealed that the third graders' attitudes about science showed considerable improvement (Figure 1). Before the reading and science treatment plan started, 76% of the students ( $N=20$ ) claimed to like and enjoy science whereas after the treatment plan 88% of the students ( $N=20$ ) demonstrated that they benefitted from the enjoyment of science instruction. The most substantial growth on this Student Interest Questionnaire was in the "Activities and Topics Studied in the Classroom" theme. This particular theme went up 14% after the treatment plan. One other theme that went up considerably was "Alternative Ways to Learn about Science", with an increase of 13%.



*Figure 1.* Selected student science interest questionnaire responses pre- and post-treatment for third grade students Oct. and April, ( $N=20$ ).

### Student Survey about Science Topics and Genre

I asked my students what types of genre they preferred when reading about science. Out of the 8 girls surveyed 80% indicated that realistic fiction was their favorite and magazines was the least favorite. Out of 8 boys surveyed 100% chose magazines and

non-fiction genre as their favorite with realistic fiction coming in as their least favorite. The interview revealed 60% of the girls prefer reading and answering questions by themselves. One girl stated that, “When other kids read out loud I don’t have the right kind of voice inside my head to hear the information clearly. I understand better when I read it inside my own head.” Ninety percent of the boys chose to read and answer questions together as one boy put it, “I don’t have to think by myself, others can help me when I’m stuck.”

### Parent Questionnaires

Results from the Parent Questionnaire in response to how they felt their children evaluated science are shown in Figure 2 ( $N=22$ ). Eighty-seven percent of the parents thought that their child enjoyed the study of science. After the treatment plan 93% of the parents ( $N=17$ ) indicated their child enjoyed the study of science which was an increase of 6% from the beginning of the year. Seventy-four percent of the parents felt that their child found the study of science helpful in everyday life and will use science in his or her career in the future. After the treatment 85% of the parents responded that they thought science would be useful in their child’s life and future careers, which was an increase of 11% from the beginning of the treatment. Before the implementation of the treatment, 30% of the parents agreed that science was boring, or made their child nervous and that it was too much of a challenge for their child. After the treatment only 23% of the parents had doubts that their children were bored with science and nervous with the challenges of science, a decrease of 7% in this negative response to science.

### Pre & Post Parent Questionnaire

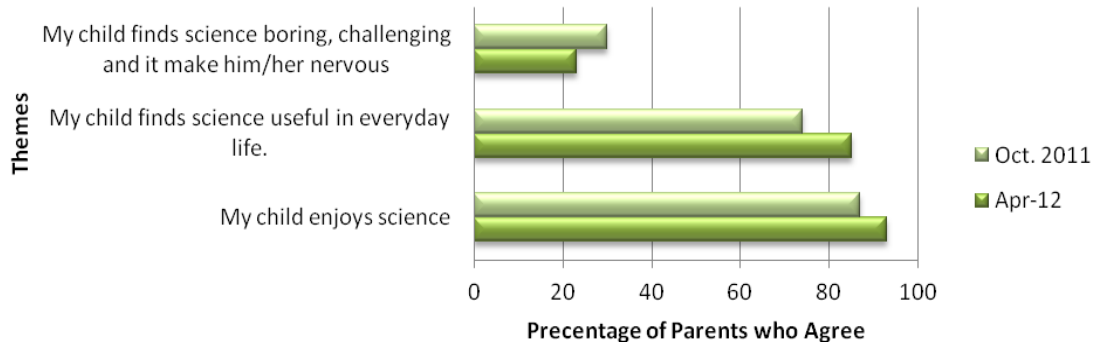


Figure 2. Parent science interest questionnaire responses pre- and post-treatment for third grade students Oct., (N=22) and April, (N=17).

### Student Growth In Science Content Knowledge

Data in the form of pre- and post science assessment test scores were compared to assess students’ content knowledge and change over time. Analyses of this data (Figure 3) revealed that the average growth of females’ content knowledge (N=9) in third grade on the soil assessment test went up 30.7% and the average growth of the males (N=10) on the same assessment test went up 25% from pre to post test.

### Soil Unit Assessment

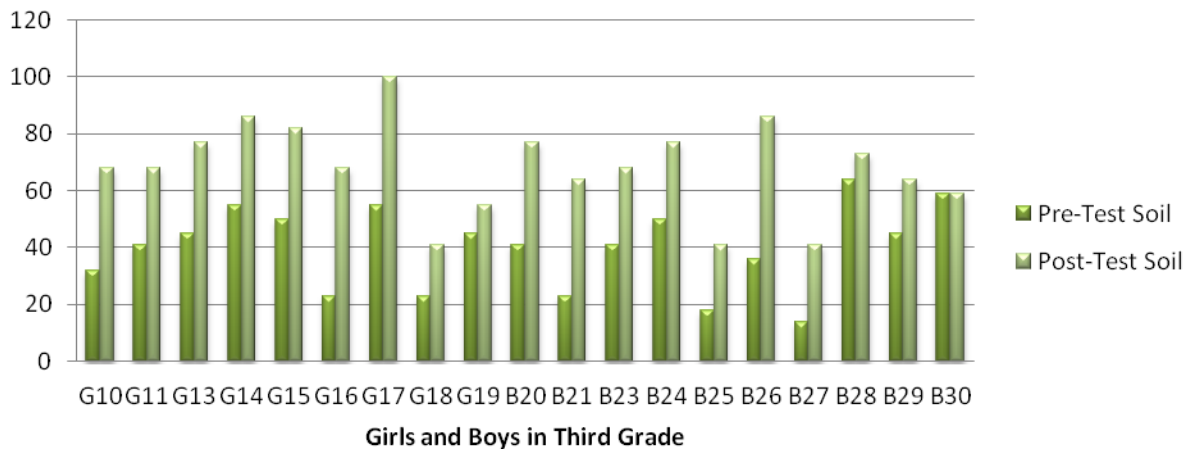
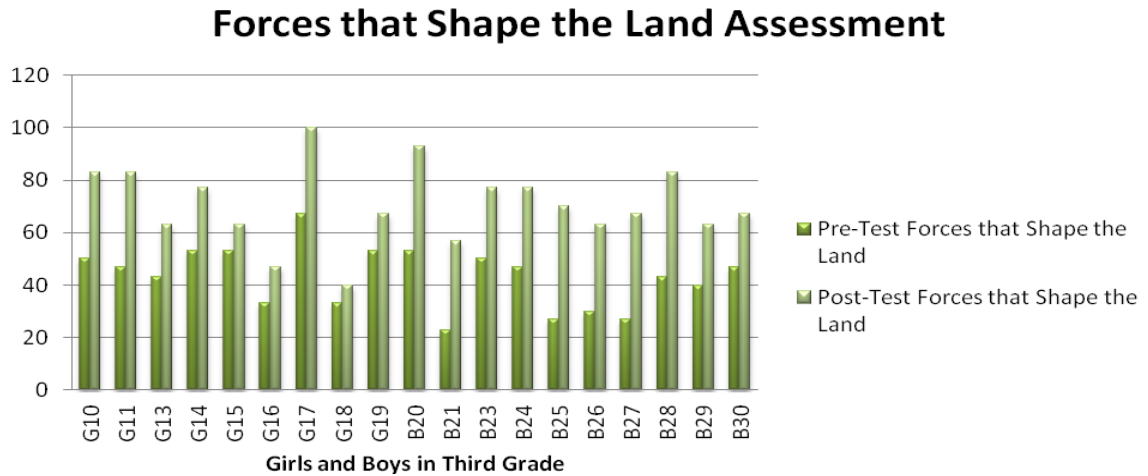


Figure 3. Soil unit pre- and post assessment tests for third grade students Oct. and Nov., (N=20).

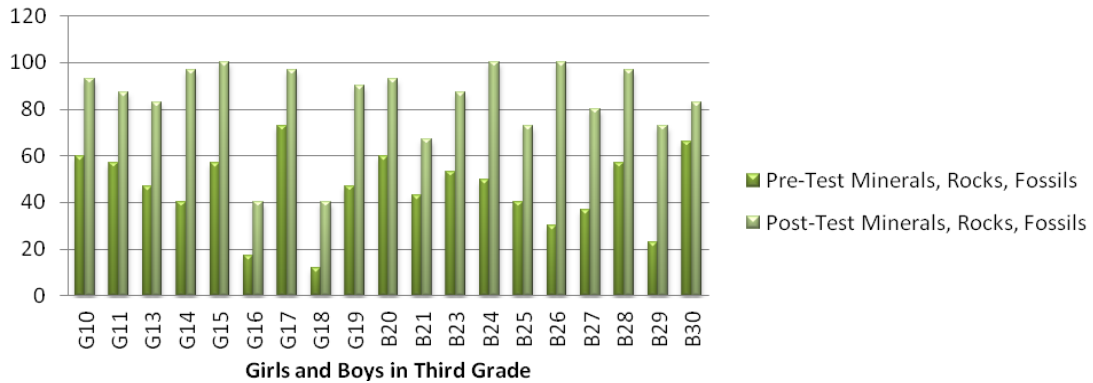
The data taken from the Forces that Shape the Land Assessment test (Figure 4) also showed growth in science content knowledge with the females' ( $N=9$ ) average growth at 21.2%. The 3rd grade males ( $N=10$ ) increased their science content knowledge average growth from pre to post by 34%.



*Figure 4.* Forces that shape the land pre- and post assessment tests for third grade students Jan. and Feb., ( $N=20$ ).

The data from the Minerals, Rocks and Fossils Unit (Figure 5) indicates that the females ( $N=20$ ) increased their science content knowledge in this particular area by 35.2% and the males in third grade increased their science content knowledge by 39.4%.

## Minerals, Rocks, and Fossils Assessment



*Figure 5.* Minerals, rocks, and fossils pre- and post assessment tests for third grade students Mar. and April, ( $N=20$ ).

Over all the girls science growth in 3 science tests from pre to post increased by an average of 29.04%, where as the boys science growth in 3 science tests from pre to post increased by 32.8%. There was a 3.76% difference between boys and girls science growth (Figure 6).

## Average Gender Growth in Science Assessment



	Girls	Boys
Soil Assessment	30.7%	25%
Forces on Land Assessment	21.2%	34%
Minerals, Rocks, Fossils	35.2%	39.4%
<b>Average Gender Growth</b>	<b>29.04%</b>	<b>32.8%</b>

*Figure 6.* Gender growth in science concepts over three units of earth science study, girls ( $N=9$ ), boys ( $N=10$ ).

### Reading Achievement

In September prior to the treatment plan, Star Reading assessments were administered and the data collected for the females (Figure 7) indicated that 4 out of the 9 females tested were below third grade level for reading, 2 tested above third grade level and 3 were at third grade level. After the treatment 7 out of the 9 females were at grade level or above.



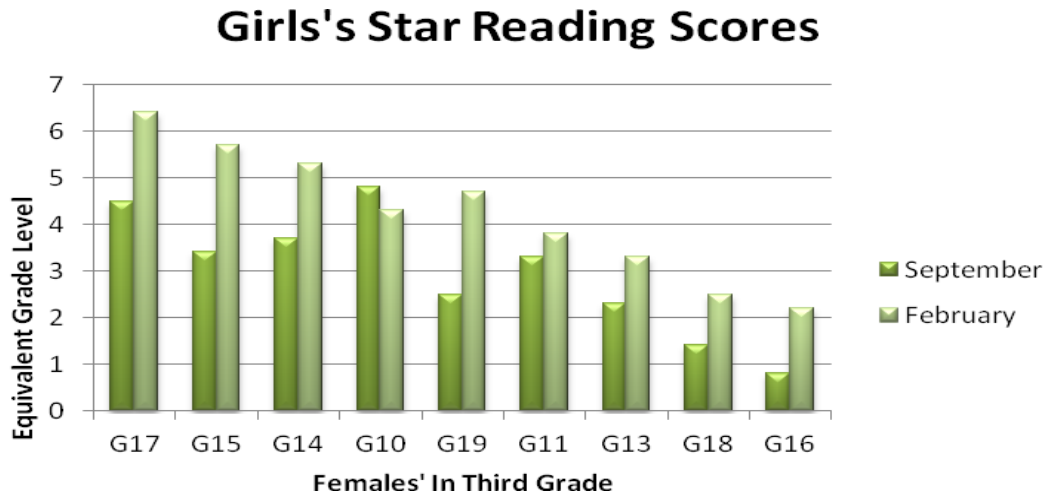


Figure 7. Star reading scores for Larson's third grade females, ( $N=9$ ).

In September the boys' reading scores (Figure 8) before the treatment plan indicated that 7 out of 10 boys were below third grade reading level, 2 boys were at grade level and 1 boy was above third grade reading level. After the treatment plan 7 out of the 10 boys were at grade level or above.

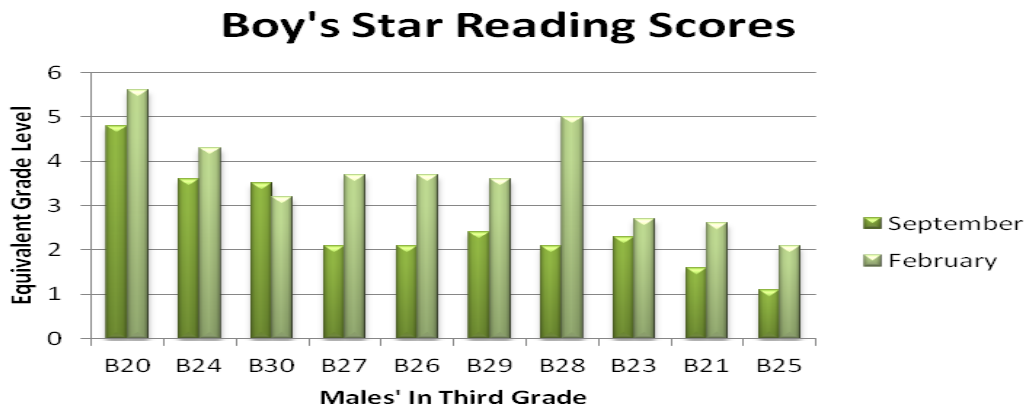


Figure 8. Star reading scores for Larson's third grade males, ( $N=10$ ).

After correlating the average Star Reading Assessment scores (Figure 9) throughout the year for the other 5 3rd Grade Linderman Classrooms, the data indicated only a .37 percentile rank reading increase within these 5 classrooms. Whereas within

my classroom the students reading scores made a substantive achievement growth of 7.28 percentile rank over the school year.

### Linderman Third Grade Classes Star Reading Growth 2011-2012

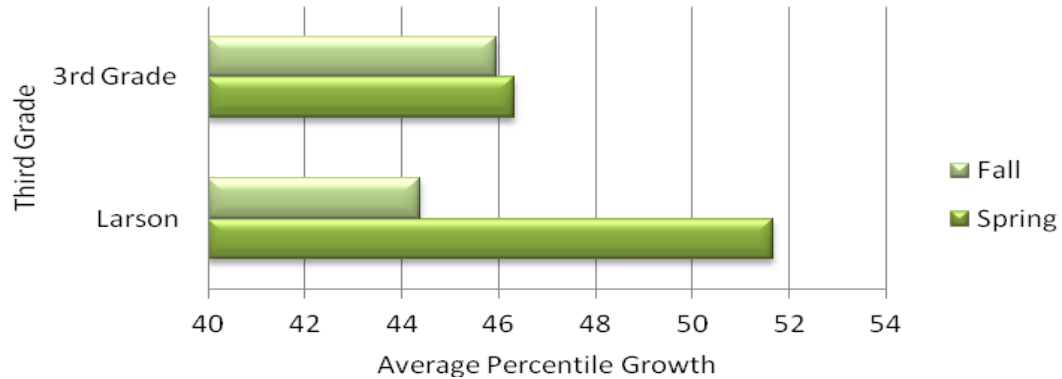


Figure 9. Star reading average scores of nine months growth, for Linderman Elementary third grade students, ( $N=83$ ); Larson's class, ( $N=21$ ).

#### Teacher Interviews

Teachers were interviewed to self-assess efficiency and effective use of classroom time, reading and science instruction, lesson planning and classroom management. The interview protocol can be found in Appendix H. Out of the eight teachers interviewed, 100% *strongly agreed* that time constraints are an issue in the classroom, and that the amount of curriculum we have to get through within the year is tough to accomplish ( $N=8$ ). Seventy-five percent of the teachers interviewed thought science and reading could be integrated to alleviate time constraints and we could be more effective in how we teach our students. Six out of the 8 teachers each had 10 or more years of teaching experience.

Two teachers said that they are in the process of creating integrated science and social studies units to alleviate time constraints in their classrooms and that they are making it happen to some extent. One second grade teacher interviewed stated that she “focuses on a science topic and then develops all of her lessons around that science topic.” For instance, she uses polar bears as a focus and then teaches math facts, reading, writing, art and music around this topic. This teacher also admits she, “Only focuses on life science because all other science areas are more difficult for her to develop cross curricular lessons.”

One teacher’s concern was, “How all the reading skills would be covered when integrating science into reading?” This teacher was afraid we would not introduce our students to different types of genre or teach them strategies to read fiction if we focused so much on science or non-fiction text. This teacher was leery of this type of integrated approach even though she felt the time constraints and the curriculum push in the classroom needed to be changed or improved. The new inexperienced teachers admitted, “Integrating science and reading would take a lot of time and effort.”

A young fourth grade teacher with not much experience wanted professional development to help put all the pieces together to make science and reading integration work for her and her students. She was fearful that the students might have, “Huge gaps in learning and that she would be responsible for the gaps.” She also thought the students might have higher success rates if they didn’t have to learn so many skills from so many different curricular areas.” She said that she, “Might agree to incorporating science, reading and writing if all the teachers followed a reliable, nationally tested program.”

She indicated that she “is aware that some seasoned teachers don’t like to follow programs and a science and reading program might not work so well for these teachers.”

The last teacher I interviewed was working towards her doctorate in curriculum development. She thought integrating science into reading would make a lot of sense. She believes, “we cannot get all subjects taught within a school day by separating them.” She is, “afraid many students are missing science because they have to be pulled out of the classroom for intervention in reading and math during our science time.” She assumed, “a tested and researched program would have to be purchased to allow for the needs of our students and to also meet our Montana Standards.” She was adamant that, “teachers didn’t have time to put a program together to meet these requirements.” She would like to see “a program that would include differentiated reading and scientific processes.”

#### More Effective and Efficient use of Time

After combining my reading and science lessons, my science time increased approximately 2½ hours every week. The Comparison Scale indicates the number and range of curricular topics covered in science, and reading (Table 2). These comparison scales compared two years of course work: Year one, 2009-2010, during which science and reading were taught separately and then the treatment year, 2011-2012, during which I merged both reading and science together. This comparison table helped me to keep track of and to illustrate more efficient and effective use of instructional science time. A list of resources for each unit of study was also gathered and put into folders for next year’s use and for sharing with colleagues.

Table 2

*Comparison Scale: Science Curricular Topics Covered Within Two Years*

2009-2010	2011-2012
*(Sept. & Oct.)Plants & Animals <ul style="list-style-type: none"> <li>• Types of Plants</li> <li>• Types of Animals</li> </ul>	*(Sept. & Oct.) Plants & Animals <ul style="list-style-type: none"> <li>• Types of Plants</li> <li>• Types of Animals</li> </ul>
	*(Nov.)Plants & Animals Interact <ul style="list-style-type: none"> <li>• Where living Things Are Found</li> <li>• Living Things Depend on One Another</li> </ul>
*(Nov., Dec.& Jan.)Earth's Land <ul style="list-style-type: none"> <li>• Minerals Rocks &amp; Fossils</li> <li>• Forces that Shape the Land</li> <li>• Soils</li> </ul>	*(Dec. , Jan. & Feb.) Earth's Land <ul style="list-style-type: none"> <li>• Minerals Rocks &amp; Fossils</li> <li>• Forces that Shape the Land</li> <li>• Soils</li> <li>• Earth Resources</li> </ul>
*(Feb., Mar. & Apr.) Cycles on Earth and in Space <ul style="list-style-type: none"> <li>• Water Cycle</li> </ul>	*(Mar. & Apr.) Cycles on Earth and in Space <ul style="list-style-type: none"> <li>• Water Cycle</li> <li>• Observing Weather</li> <li>• Earth and Its Place in the Solar System</li> </ul>
	*(May.) Investigating Matter <ul style="list-style-type: none"> <li>• Properties of Matter</li> <li>• Changes in Matter</li> </ul>
	* (May & June) Exploring Energy, Forces <ul style="list-style-type: none"> <li>• Energy</li> </ul>

### INTERPRETATION AND CONCLUSION

My research indicated that the integration of science and reading promoted positive change in attitude and interest in science. Immersing third grade students throughout the past six months in science content using all different types of texts, charts and technology to foster positive attitudes toward science and reading greatly enhanced the attitudes of the participants in this action research study. My findings mirror previous studies (e.g. Dykstra, 2010; Coskie, 2006). Dykstra (2010) states, “as these shared

strategies suggest, integrating reading and science holds promise for improving student achievement” (p.3) and Coskie (2006) also affirms “that attitudes in science will improve” (p.1). The analysis from the student questionnaires provides evidence that the treatment greatly improved students’ attitudes towards science and reading instruction in the classroom. The post- Parent Questionnaires also suggested “high satisfaction” in their child’s science instruction this past year.

Considerable achievement growth in science content knowledge occurred from pre to post assessment tests. At each evaluation, scores from students pre-and post-tests indicated that the third graders were 1) getting more accustomed to taking science tests; 2) possibly getting more involved in the science content; 3) gaining more strategies on how to read expository text; or 4) possibly all the above.

The first science test during the treatment plan was a soil test. The students took a pre-test before we studied soil and a post-test when we finished the soil unit. The girls started out from their pre- to post-soil test with a 30.7% increase. Only 3 out of the 9 girls had an 80% or higher on their first post test. Then on the second test, which was “Forces that Shape the Land,” they only increased their scores by 21.2%, which may indicate that they didn’t have as much interest in this topic or that they just didn’t learn as much. On the Minerals, Rocks and Fossils test the girls finished with a nice increase of 35.2% which was their highest increase. By the time they took this post test 7 out of the 9 girls scored in the high 80% and 90% range. By the end of the treatment plan the overall female average growth in science content was 29.04%.

The boys started out on their soil test with a 25% increase from pre- to post-test. Only 1 out of the 10 boys had an 86% and all the other boys were below a 78%, most of

them far below. The second pre- to post-test indicated the boys increased by 34% which was nearly as high as the girls biggest increase.

On the “Minerals, Rocks and Fossils” test an increase of 39% by the boys on the post-test was by far the largest increase out of all the pre- to post-tests taken. By this time 7 out of the 10 boys were scoring in the high 80 and 90 percent range. By the end of the treatment plan, the boy’s average science growth was 32.8%, which was 3.76% higher than the girls’ averages. Both boys and girls scores indicated impressive science growth throughout the treatment plan.

Possible reasons for female students scoring higher in the beginning of the treatment plan may be that the girls had previously been exposed to more science content than the boys; or it might be attributed to the boys being less mature at the beginning of the year; the boys reading scores being lower than that of the girls; or that the boys’ written answers were not as well-developed as the girls’ answers.

Obtaining gender scores was valuable when it came to supporting females or males as well as individuals in science knowledge. Once again, my data confirms many other studies in that the students that have good vocabulary skills and background knowledge have the higher scores and the biggest advantages in their academic achievement.

At the beginning of the treatment plan the girls’ average reading scores were at a 2.97 grade equivalent and the boys’ average reading scores were pretty comparable with a 2.56 grade equivalent. By the end of the treatment plan the girls’ average reading scores increased to a 4.25 grade equivalent and the boys’ average reading scores

increased to a 3.65 grade equivalent. The girls made the biggest gain in reading with an increase of 1.28 grade equivalent and the boys made a gain of 1.09 grade equivalent.

In September, 5 out of 9 girls entering my class were at grade level or above and only 3 boys out of 10 were at grade level or above. The majority of the boys began third grade behind in reading. In May, at the end of the treatment plan 7 out of 9 girls were at grade level or above and 7 out of 10 boys were at grade level and above. Seventeen out of nineteen students demonstrated considerable reading growth throughout the treatment plan, which I attribute to expository reading in the science area.

The females attained higher reading scores than the males throughout the treatment plan, but I also attribute the girls' growth to more time at home spent on reading, according to the daily homework folders monitored in my classroom. The boys, on the other hand, didn't accumulate as much reading homework time as the girls, thus this is one possible reason that their reading scores did not increase as much. Also, 5 out of the 10 boys in the treatment group have very impulsive or immature personalities and have a tendency to guess at answers instead of taking time to analyze and think about what is being asked on the test. Therefore, the reading tests might not indicate what some of the boys are actually capable of achieving.

Evidence that my treatment plan was well worth all the hard work, came when comparing the year's average reading growth of all Linderman's third-grade classrooms with the growth of my students' average reading growth. In the fall, the average percentile range for the 5 third grade classrooms was 45.97 percentile rank and my class was at a 44.38 percentile rank, a difference of 1.59 percentiles. By the end of third grade, the 5 third grade classes only increased their average percentile range to 45.97 percentile



and my class increased to a 51.66 percentile. The 5 third grade classes increased only .37 percentiles and my class increased by 7.28 percentiles. My class definitely showed more academic growth in reading than the other classes which I would like to attribute to my treatment plan.

The action research plan afforded me the opportunity to keep my own students all day long, as opposed to grouping them into levels shared and taught by additional staff members and myself. Instead, I instructed them in all the curricular areas which of course included integrating science and reading time throughout the day. The other 5 third-grade classrooms divided their students into leveled reading groups and math groups and sent small groups to other teachers for instruction while I was able to differentiate reading instruction within my own classroom. My action project allowed me to assimilate science into every subject area, not just reading. My expectations for my students were high and I was able to demand growth in science and reading because I knew their academic levels at all times. The students also knew their scores and tried hard to improve on them not only for me but for themselves.

In addition, the teachers' interviews indicated that curriculum and environment in the elementary classrooms should be altered in some fashion in order for all the curricular demands to be taught in an efficient, timely manner. With the New Common Core Standards and Next Generation Science Standards, newly adopted in Montana, my capstone research questions are particularly appropriate at this time in the educational development world. With issues of time constraints in the classroom and reading and math at the top of the curricular ladder, we need to teach our students how to dissect and analyze all kinds of informational texts, with less emphasis on fiction. These needs will

have to be addressed in our nation's public school districts, as well as in private and charter schools. Teachers are recognizing the need to make changes in their own classrooms. One way to accomplish this is by obtaining quality children's literature that promotes science concepts, and invites curiosity from the readers, which then can ignite science-related projects and cross-curricular activities.

### VALUE

The challenges of planning and accomplishing this classroom based project have led to three noteworthy changes in my teaching practices. One of those changes was to bring as much science into the classroom as possible and to show the students how much gratification can come from learning and studying science. Teachers' attitudes about science can stimulate excitement and growth within their students, or do just the opposite and turn students' attitudes about science towards being negative. Throughout this research project, I have gained a true appreciation for the love of science that our elementary students have, and their abilities to question what is going on in the world around them. Also, the articles I read for this capstone paper have given me a strong desire to set in motion a plan to impress upon our district, community, and state the importance of science education for the future of our children. The better my students are prepared in science and reading the more successful they will be as adults. The need to be the best science and reading teacher I can be for my students' academic growth has also become a goal of mine. We need young minds that can be analytical, to help solve problems that will drive useful technology for the improvement of mankind. Productive individuals who have a handle on the scientific world will not only improve our world but will ideally protect it and look out for the survival of all the species.

I learned several valuable lessons from this study. Kids love science and love to ask questions, and learn about the world around them. I learned that it doesn't matter what type of genre you are reading from as long as it is related to them and science, kids will enjoy it. It was obvious that the children in my classroom grew in reading expository text and taking science tests related to expository information; they improved the more they were exposed to the literature and to the tests. The parents of my students supported my action research and helped bring more science into the classroom as well as offering science related field trip experiences.

The second noteworthy change is that I've learned that science education is a hot issue right now in the U.S. and many publishing companies are starting to combine reading and science together to promote expository reading not only in the middle and high schools but also in the elementary schools. I also learned that time constraints will always be an issue and will always have to be addressed no matter what you are trying to accomplish, a concern that teachers across the country raise regardless of their level in the classroom.

Finally, I learned that I became even more passionate about teaching science than I ever was previously. I see this action research as an avenue to help advance elementary science education in our state and nation. Overall this project has given me opportunities to grow in the science teaching of young children and to encourage young teachers to become involved in science education for the elementary students. I plan to share this project and my resources with my colleagues to promote science and reading education for all.

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APPENDICES

APPENDIX A

SCIENCE INTEREST QUESTIONNAIRE

## SCIENCE INTEREST QUESTIONNAIRE

## Science Interest Questionnaire

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**There are no correct answers for the following questions. You are being asked your opinion. Be as honest as you can. Only circle one answer for each question.**

	Strongly Agree	Agree	Undecided Uncertain	Disagree	Strongly Disagree
1. I like science.	1	2	3	4	5
2. My friends like science.	1	2	3	4	5
3. Our science classroom contains a lot of interesting equipment.	1	2	3	4	5
4. We cover interesting topics in science class.	1	2	3	4	5
5. I enjoy all kinds of science	1	2	3	4	5
6. We do a lot of fun activities in science class.	1	2	3	4	5
7. My teacher makes good plans for us in science class.	1	2	3	4	5
8. I try hard to do well in science.	1	2	3	4	5
9. I watch science programs on TV.	1	2	3	4	5
10. My mom and dad like science.	1	2	3	4	5
11. My brothers and sisters like science.	1	2	3	4	5
12. I always try hard in science, no matter how difficult the work.	1	2	3	4	5
13. Science magazines and stories are interesting.	1	2	3	4	5
14. I like studying about _____.	1	2	3	4	5

Portions of this instrument are components/modifications of the Teacher Enrichment Initiatives  
2009 The University of Texas Health Science Center at San Antonio



APPENDIX B

PARENT QUESTIONNAIRE

## PARENT QUESTIONNAIRE

(Your child's interest in science)

Parent's Name: \_\_\_\_\_ Date: \_\_\_\_\_ Child's Name: \_\_\_\_\_

We would like to know your opinion about your child's interest in science! The survey is voluntary and your individual responses will be kept completely confidential. Completing the survey has NO effect on your child's grades. Thank you for your assistance.

**Circle the answer that best describes your child. Please answer each question. Do not think too much about each question; your initial thought is usually the most accurate.**

	Strongly Agree	Sort of Agree	Not Sure	Sort of Disagree	Strongly disagree
1. My child enjoys science.					
2. My child likes finding answers to science problems.					
3. My child typically finds scientific topics boring.					
4. My student looks forward to science lessons in school.					
5. My child would like to study science in more detail than he/she does now.					
6. My child is good at science.					
7. I think my child could do more difficult science work.					
8. Answering science questions in class make my child nervous.					
9. My child sees science as being useful in everyday life.					
10. My child enjoys discussing science topics.					
11. My child will need science for his/her career and future jobs.					
12. My child likes to understand the scientific					

explanations for things.					
13. My child believes he/she will use science in many ways as an adult.					
14. My child is challenged by science problems he/she doesn't understand immediately.					
15. The challenge of science problems appeals to my child.					

**List 3 jobs you have heard your child say he/she would like to have when he/she is an adult.**

\_\_\_\_\_

\_\_\_\_\_

Portions of this instrument are components/modifications of the Fennema & Sherman (1976) Attitudes about Math survey.

APPENDIX C

STUDENT SCIENCE TOPICS AND GENRE INTERVIEWS

### Student Science Topics and Genre Interviews

Pretend your teacher is a scientist! She is going to ask you some science questions. Be as honest as you can.

1. What type of science do you like to learn about? Rate these areas of science from 1 to 3 with 1 being your favorite and explain why.

\_\_\_\_\_ Life Science (study of animals, plants, life cycles, human body, and habitats)

\_\_\_\_\_ Earth Science (landforms, rocks, fossils, soil, solar system, and weather)

\_\_\_\_\_ Physical Science (matter, energy, sound, light, motion & forces, magnetic simple machines)
2. What types of books would you like to read out of when learning about these science topics? Rate the books from 1 to 5 with 1 being your favorite and explain why.

\_\_\_\_\_ fiction science books

\_\_\_\_\_ non-fiction science books

\_\_\_\_\_ realistic fiction books

\_\_\_\_\_ magazines
3. Would you rather read by yourself, or with a small group? Put an X by the one you prefer. Explain why.

\_\_\_\_\_ by yourself

\_\_\_\_\_ with a small group
4. Would you rather answer questions about the book with the teacher and a group of friends or answer the questions by yourself? Explain why.

\_\_\_\_\_ with teacher and friends

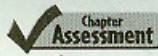
\_\_\_\_\_ by myself
5. Do you like writing, drawing, and diagramming in science journals? Explain why. \_\_\_\_\_ Yes \_\_\_\_\_ No



APPENDIX D

SOIL ASSESSMENT

Name \_\_\_\_\_  
Date \_\_\_\_\_



## Soils

### Part I Vocabulary 2 points each

Match each term in Column B with its meaning in Column A.

Column A	Column B
<u>C</u> 1. Saving resources by using them carefully	A bedrock
<u>B</u> 2. Soil that has small grains and holds water easily	B clay
<u>F</u> 3. Material found in nature that living things use	C conservation
<u>D</u> 4. Material made up of decayed parts of once-living things	D humus
<u>G</u> 5. Richest layer of soil	E loam
<u>E</u> 6. Rich soil with a lot of humus	F resource
<u>A</u> 7. Layer of solid rock under soil	G topsoil

Write the letter of the term in the Word Bank that best completes each sentence.

Farmers need 8. J to grow crops. Sometimes farmers use 9. I to save the soil by planting thick grass or clover between rows of other crops. To keep the water from washing the soil away from the sides of hills, farmers use 10. H.

H contour plowing  
I strip cropping  
J soil

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Name \_\_\_\_\_

### Part III Critical Thinking 8 points each

Write complete sentences to answer Questions 16–20.



Pictures A and B show bedrock in two different places.

Which bedrock do you think will turn to soil faster?

Explain your answer.

Possible answer: The bedrock in Picture B will turn to soil faster because rain and wind can reach it.

17. What is one way that farmers use compost?

Possible answers: Farmers put compost in soil to add minerals and other things that plants need. Farmers use compost as fertilizer.

18. How is water good for topsoil? How can water harm topsoil?

Possible answer: Water can soak into topsoil to be used by plants, but water can also wash away topsoil.

19. Describe how minerals from the soil end up inside your body.

Possible answer: Minerals are found in the soil, and plants grown in soil take in minerals. Then people eat the plants or eat the meat of animals that ate the plants.

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### Part II Science Concepts and Understanding 4 points each

Write the letter of the best choice.

- A 11. Which would turn into soil the fastest?  
A compost                      C bedrock  
B gravel                         D plastic
- H 12. Some farmers plant rows of alfalfa between rows of corn. Doing this is known as—  
F tilling  
G contour plowing  
H strip cropping  
J clear-cutting
- D 13. Clay is a good material for making pots. Why?  
A Clay has lots of humus.  
B Clay has both large grains and small grains.  
C Clay has large grains that hold little water.  
D Clay is sticky and holds water easily.
- F 14. Which type of soil would be best for growing plants?  
F loam  
G clay  
H compost  
J sand
- A 15. Which soil is best for growing corn?  
A loam                            C humus  
B sand                            D clay

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Name \_\_\_\_\_

20. Name a way farmers can save soil from erosion. Describe how this method conserves the soil.

Possible answer: contour plowing; farmers plant rows of crops around the sides of hills instead of up and down. This keeps water from running off in straight lines, so the soil is not washed away.

### Part IV Process Skills Application 10 points each

Use the pictures to answer Questions 21–22.



21. What can you infer from the picture about how the canyon got so deep?

Possible answer: The river eroded layers of rock.



22. What do you predict will happen to the soil on the mountains when there is rain? Why?

Possible answer: Some of the soil will erode, because the rain will wash it down the slopes.

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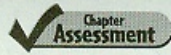
Unit C • Chapter 3

APPENDIX E

FORCES THAT SHAPE THE LAND ASSESSMENT



Name \_\_\_\_\_  
Date \_\_\_\_\_



## Forces That Shape the Land

### Part I Vocabulary 2 points each

Use the letters of the terms in the Word Bank to complete the sentences.

Earth's surface can change very rapidly. Movement of the crust and mantle can cause an 1. A. Changes can also happen when a 2. E erupts and lava flows onto the land. A 3. C happens when large amounts of water cover land that is normally dry.

A process called 4. F breaks rocks into smaller pieces, and 5. D moves the pieces around. Erosion can also be caused by huge sheets of ice, or 6. B.

Earth's surface has many features, which are called 7. I. A place that is much higher than the land around it is a 8. J. A 9. G is a thin band of land near a coast. A flat area is a 10. K, and a 11. L is a flat area higher than the land around it. A lowland area between higher lands is a 12. M, and a 13. H is a valley with very steep sides.

- A earthquake
- B erosion
- C flood
- D glaciers
- E volcano
- F weathering
- G barrier island
- H canyon
- I landforms
- J mountain
- K plain
- L plateau
- M valley

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Name \_\_\_\_\_

22. Circle the letter of the landform that is shown in the picture below.



- A valley
- B glacier
- C canyon
- D barrier island

23. Tell how you chose your answer to Question 22. How did you know that the answer was not one of the other landforms listed?

Possible answer: A canyon has steeper sides than a valley. The landform is not surrounded by water, so it is not an island. It is made of rock, so it is not a glacier.

### Part III Critical Thinking 7 points each

24. Does weathering occur in areas that have freezing temperatures? How do you know? Possible answer: Yes; water flows into cracks in rocks and then freezes. As it freezes, it takes up more space and breaks the rocks into pieces.

25. Describe a place in which floods may happen. Possible answer: Floods may happen in places with many rivers and lakes that receive a lot of rain.

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Name \_\_\_\_\_

### Part II Science Concepts and Understanding 3 points each

Write *E* if the picture shows erosion. Write *N* if it does not.



14. E      15. N      16. E      17. E

For Questions 18–21, write the letter of the best choice.

- D 18. Which is the slow movement of soil down steep hills?  
A weathering      C delta  
B mudslide      D creep
- F 19. Which part of Earth folds to make mountains?  
F crust      H core  
G mantle      J magma
- B 20. What can the holes made by glaciers become?  
A hills      C plateaus  
B lakes      D caves
- J 21. Which of the following does NOT cause weathering?  
F wind      H water  
G plants      J soil

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Unit C • Chapter 2

Name \_\_\_\_\_

### Part IV Process Skills Application 6 points each

26. What damage can be caused by a volcano?  
Possible answers: blows off mountaintops; covers land with ash and lava; sends out hot clouds of ash, rock, and gases; burns buildings and forests

27. Explain how floods change the land.  
Floods damage buildings and leave soil, mud, and sand behind. They also cover fields with rich soil that is good for growing crops.

Use the table to answer Questions 28–29.

AREAS OF FOUR GLACIERS

Glacier	Size
Greenland	700,000 sq mi
Malaspina	840 sq mi
Antarctica	5,400,000 sq mi
Jostedal	300 sq mi

28. Which of the glaciers covers the smallest area? Jostedal
29. Which of the glaciers is the second largest? Greenland
30. To make a model of a plateau, would it be better to use a step stool or a racking chair? Why?  
A step stool; it has a flat top and it does not move.

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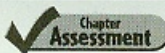
Unit C • Chapter 2

APPENDIX F

MINERALS, ROCKS AND FOSSILS ASSESSMENT



Name \_\_\_\_\_  
Date \_\_\_\_\_



## Minerals, Rocks, and Fossils

**Part I Vocabulary** 2 points each

Match each term in Column B with its meaning in Column A.

- |   |  |
|---|--|
| <p><b>Column A</b></p> <p><u>D</u> 1. Rock that was once melted but has cooled and hardened</p> <p><u>E</u> 2. Earth's middle layer</p> <p><u>H</u> 3. Solid material made of one or more minerals</p> <p><u>J</u> 4. Materials that settle into layers and harden</p> <p><u>B</u> 5. Earth's solid outer layer</p> <p><u>G</u> 6. Solid natural object that has never been alive</p> <p><u>F</u> 7. Rock that has been changed by heat and pressure</p> <p><u>C</u> 8. Marks or remains of a once-living thing</p> <p><u>A</u> 9. Center of Earth</p> <p><u>I</u> 10. A process of changing rock types</p> | <p><b>Column B</b></p> <p>A core</p> <p>B crust</p> <p>C fossil</p> <p>D igneous rock</p> <p>E mantle</p> <p>F metamorphic rock</p> <p>G mineral</p> <p>H rock</p> <p>I rock cycle</p> <p>J sedimentary rock</p> |
|---|--|

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Name \_\_\_\_\_

12. Name the three types of rocks.  
igneous sedimentary metamorphic
- 4 18. How can sedimentary rocks become metamorphic rocks?  
Sedimentary rocks become metamorphic rocks by great heat and pressure.
- 4 19. In what type of rock would scientists be most likely to find fossils?  
sedimentary rock
- 4 20. How do scientists know the kind of food that dinosaurs ate?  
from examining their fossils and inferring if the dinosaurs were plant eaters or animal eaters based on the shape of their teeth

**Part III Critical Thinking** 7 points each

21. How might school be different if Earth's supply of graphite ran out?  
Possible answer: Graphite is a main ingredient in pencil lead. Without graphite, pencils would be made from some other material.

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Name \_\_\_\_\_

**Part II Science Concepts and Understanding** 4 points each

Write the letter of the best choice for Questions 11–13.

- B 11. Hardness, color, and shape are examples of a mineral's—  
 A price C health  
 B properties D weight
- H 12. What is formed when mud or minerals fill a mold?  
 F fossil H cast  
 G diamond J rock
- C 13. Iron is used in all of the following EXCEPT—  
 A ships C pencils  
 B buildings D cars

Write the correct terms for Questions 14–16.

mantle crust core

14. crust

15. core

16. mantle

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Name \_\_\_\_\_

22. If you kept an igneous rock in your classroom for six months, would it change into a metamorphic rock? Why or why not?  
No; it would not change, because great heat and pressure are needed to change an igneous rock into a metamorphic rock.  
Also it takes a long time for one kind of rock to change into another kind.

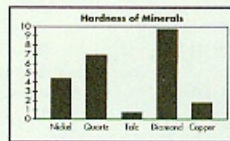
**Part IV Process Skills Assessment** 9 points each

Hardness is one of the properties of minerals. It is measured on a scale of 1 to 10 (1 for the softest and 10 for the hardest).

Use the bar graph to answer Questions 23 and 24.

23. List the minerals in order from hardest to softest.

- diamond
- quartz
- nickel
- copper
- talc



24. Which kind of coin do you think lasts longer, a coin made of copper or one made of nickel? Why?  
Nickel; because nickel is a harder mineral than copper.

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APPENDIX G

TEACHER CURRICULUM INTERVIEWS

## Appendix G

### Teacher Curriculum Interviews

This is a totally voluntary survey and your individual responses will be kept completely confidential. Thank you for your assistance.

Years of teaching experience _____	Strongly Agree				Strongly Disagree
1. Time constraints are an issue in my classroom.	1	2	3	4	5
2. The amount of required curriculum is an issue in my classroom.	1	2	3	4	5
3. I am interested in an integrated curriculum to reduce the negative impacts of time constraints and mandated curriculums.	1	2	3	4	5
4. Reading, writing and science can be taught through an integrated approach.	1	2	3	4	5
5. What is your opinion about combining science, reading and writing curriculum together?					
6. In what ways, if any, would integrating science, reading and writing be a benefit to your instruction and to your students?					
7. What are the potential pitfalls in this approach, please explain why.					