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ABSTRACT

There are many reasons to consider the integration of science and language arts. The most compelling of these reasons is that there is evidence showing cognitive parallels between the two subjects. However, whether there is equal developmental progress in both areas is still unclear. The process skills that science and language arts have in common are making and verifying predictions, making inferences, and drawing conclusions. It seems that the use of hands-on activities, which are inherent to a good science program, could provide a stimulating arena for the concurrent teaching of the basic skills in communication. Drawing upon the parallels between the two raises the following research questions: (1) How does the use of science topics during language arts instruction influence the development of reading and writing skills? (2) Science can provide a purpose for reading and writing. How does the integration of them effect the students' reading choices and basic writing skills? and (3) How can I as a student teacher use science to improve reading and writing. The study included students (n=27) in a 5th grade classroom. Among the findings, it was noted that the integration of reading with science and the integration of writing with science would need to be dealt with as two separate issues. Science appeared to be successfully integrated with reading, but far less so with writing. (Contains 14 references.) (MVL)

BUILDING BRIDGES: USING SCIENCE AS A TOOL TO TEACH READING AND WRITING

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There are many reasons to consider the integration of science and language arts. The most compelling of these reasons is that there is evidence showing cognitive parallels between the two subjects (Baker & Saul, 1994; Glynn & Muth, 1994; Rivard, 1994; Romance & Vitale, 1992). However, whether there is equal developmental progress in both areas is still unclear. The focus of recent research has been upon using reading and writing to teach science. The results of this research has persuasively shown that there is a clear benefit to science comprehension when the integration of the two subjects is done with careful planning (Gaskins & Guthrie, 1994; Glynn & Muth, 1994; Keys, 1994; Romance & Vitale, 1992; Schmidt, 1999). What has not been investigated in-depth is whether reading and writing also show significant development through this integration. The shortage of adequate class time is a persuasive reason to combine subject areas, but at the foundation of quality learning in most subjects is the ability to read and write. It is important to focus upon the impact of the integration of these subject areas on the reading and writing objectives as well as the science objectives. Science-related issues arise throughout life and a student is better prepared to deal appropriately with these and other erudite issues when reading and writing for understanding are explicitly taught (Gaskins & Guthrie., 1994).

Purpose

Glynn and Muth (1994) state that "learning to read prepares a student for reading to learn" (p. 1060) and that "learning to write prepares students for writing to learn" (p. 1064). The

question remains as to whether the procedure of learning to read and write can be done simultaneously with comprehension of informational content. Meaningful activities that teach writing and reading, such as searching through science text and writing a report, can be an excellent method for promoting language art skills but does not necessarily engage students in actually understanding the science concepts (Dickinson, Burns, Hagen & Locker, 1997). The use of interactive, inquiry-based science activities to create a reason for reading and writing could theoretically establish a methodical approach to learning that would benefit the development of these skills.

Background

Casteel and Isom (1994) emphasize the inter-related connection between the language arts and science in their statement that "one way to ensure improved science learning is to begin with what students know about the reading and writing processes" (p.538). Smith and Johnson (1994) believe that "literature can become the lens through which content is viewed" (p.198) and that the integration of curriculum sets the stage for students to read, think, communicate and make decisions about all kinds of information that they encounter.

While science and language arts may have objectives that are disparate (Dickinson & Young, 1998) there are also sub-structural elements in both which are analogous (Gaskin et. al., 1994; Romance & Vitale, 1992; Schmidt, 1999). Reading, writing and science all require a combination of the utilization of cognitive processes and the activation of conceptual knowledge. The cognitive strategies that are applicable to reading and writing are comparable with the strategies used to construct science understanding. A study done by Keys (1994) demonstrated a direct correlation between students' writing for structured investigation reports and the development of scientific reasoning skill. Casteel and Isom (1994) formulated an illustration of

the supportive nature of literacy processes to science understanding that included predicting, organizing, questioning, and evaluating. The process of reading begins with identifying the topic of the text and then using relevant background knowledge about that topic; the initial step of experimenting in science involves identifying the problem and making connections and observations about it. Padilla, Muth, and Lund (1991) believe that "it would be naïve to assume that a one-to-one relationship exists among all the science and reading processes," but they also state that "several critical similarities exist" and that we can "use these similarities to apply the skills taught in science to comprehension of written assignments" (p. 17).

Research Questions

The process skills that science and language arts have in common are making and verifying predictions, making inferences, and drawing conclusions. It seems that the use of hands-on activities, which are inherent to a good science program, could provide a stimulating arena for the concurrent teaching of the basic skills in communication. Drawing upon the parallels between the two: How does the use of science topics during language arts instruction influence the development of reading and writing skills? Science can provide a purpose for reading and writing. How does the integration of them effect the students' reading choices and basic writing skills? How can I as a student teacher use science to improve reading and writing?

Procedures

Intervention

The setting of this study was a typical 5th grade classroom in Southeastern Washington. There were 27 students, 16 girls and 11 boys, between the ages of 10 and 12. The research was conducted during the solo-teaching phase of my internship. The intervention for this research was modeled after the PAR Lesson Framework that is outlined in Richardson and Morgan

(2000). This framework for content-reading instruction included the following steps: *Preparation*, which considers textual features and student background knowledge, *Assistance*, where the instructional context for the lesson is provided, and *Reflection*, which provides critical thinking opportunities and openings for extension activities and enhancement (p. 6-7). Each of these steps included a writing segment, which focused upon the science topic that was being investigated.

During the Preparation portion the students performed hands-on science activities and experimentation. The reading material used for this investigation was the *Ecosystems* Student Activity Books (NSRC, 1996). They completed What-I-Know-Activity (WIKA) and Anticipation Guide sheets (Appendix A) to help preview and ask questions about the upcoming reading. The writing portion at this stage consisted of guided note taking in science journals (Appendix B) during experimentation activities as well as the completion of the pre-reading guides.

The Assistance step involved guided reading procedures that included pre- and post-reading activities with the whole class. Through the use of Venn diagrams for comparison and contrast, vocabulary lists, key concept clarification, and listing what the students learned from the reading I looked for inconsistencies and misinformation. Organizational charts that assisted the students to discover comparisons and contrasts were provided for them to complete during silent reading. "The teacher usually sets up the matrix and encourages students to fill it in as they read. In this way students understand the relationships and build meaning as they read" (Richardson & Morgan, 2000, p.170). These completed charts were used as study aides and included the social aspects of learning when groups or pairs of students filled them in. The important vocabulary words were discussed and placed on a chart in the classroom.

The Reflection phase took place when students were given the opportunity to ask themselves what they learned and demonstrate their learning by writing a formal paper on the topic studied. Using the notes from their science journal, the organizational charts and the Student Activity Books as informational sources the students concluded the unit with a one page expository paper. Preparation for this final paper included writing several drafts of a business letter, writing a descriptive paragraph, and a compare and contrast paragraph. The first topic, "What We are Doing in Science," was used to model for the whole class how to write a letter to the principal to explain what they had been studying. This model included two paragraphs that each had a topic sentence, supporting details and a concluding sentence. After demonstration of the format of a business letter, each individual student wrote a letter. A modified rubric that is based on the six writing traits was used to score the papers (Appendix C). The original rubric that this rubric was modified from was obtained from the website, which is published by the Jericho School District in New York. It is aligned with the Washington State EALR numbers: 1.1, 1.2, 1.3, 2.2, 2.3, and 4.1. Also, in accordance with component numbers 3.1, 3.2 and 3.3 of the writing EALR's the intervention process included turning in rough drafts and revisions as many times as necessary (Appendix D).

Data Collection

The data collection techniques that I chose for this research included the following: (a) collection of student papers prior to intervention, during the instruction phase and their final drafts, (b) my daily journal in which I recorded observations of the implementation of activities, (c) 16 hours of video-taped sessions that specifically recorded student investigations prior to writing their papers and science and language arts instruction, (d) collection of the student science journals, and (e) a weekly checklist that recorded book choices which were made by the

students during free reading time (Appendix E). The journals were not graded for conventions, sentence fluency or word choice. These journals were intended to be a forum for the students to integrate the interactive, inquiry-based science activities with the information from reading into an informal written format. The process skills that language arts and science have in common, questioning, predicting, organizing, and evaluating, were all included in the Note Taking Guidelines (Appendix A) which were used as writing prompts in the use of their science journals. The timeline for data collection is shown in Figure 1.

Data Analysis and Relationship to Purpose

I performed a general screening of the five data sources collected to determine whether the use of science as a topic had encouraged students to focus on using reading and writing to process meaningful information. The formal expository essay was evaluated according to the guidelines defined in the rubric and was a tool for the final assessment of the impact of the integration of the science activities and writing instruction. I sought patterns of change in writing samples and scores from the rubric.

The science journals were considered for their formative value in determining student understanding. The note-taking guidelines were supposed to provide a format to estimate whether the student is on track in their science learning or if they need to be guided to texts that would enhance their understanding.

Videotapes of the instructional and investigative stages of this research project were used to verify that the process was being implemented successfully and provided a method of self-evaluation of the methods that were used to instruct. The videotapes were viewed with the objective of noting the student use of reading materials to satisfy an inquiry. I looked for patterns in the videos that would indicate the impact on reading once a purpose had been

provided by the science investigations. The use of the Anticipation Guide and What I Know Activity sheets were specifically videotaped to determine their effectiveness in assessing the students reading for comprehension.

Comparative tabulation of the book choice checklists was an assessment of whether there was an increase in students who selected non-fiction books for obtaining information during free reading time. This would be an indication that the reading was being done to seek explanation and meaning. Reading for a purpose has been shown to increase comprehension (Gaskins & Guthrie, 1994; Keys, 1994; Schmidt, 1999).

An analysis of the student papers and their rubric writing scores, triangulated with an investigation of the video tapes and my teaching journal, the book choice checklists and the student science journals was used to validate whether the science topic had impacted the students' reading and writing skills. I also sought counter-examples in the students' work to look for patterns that would further validate my study.

Outcomes

Conclusions and Implications

Within the first two weeks it became obvious from review of the videotapes and my teaching journal that the integration of reading with science and the integration of writing with science would need to be dealt with as two separate issues. From the onset there was significant success in the integration of reading with science and very little development in merging writing and science. There were several indicators that the integration of reading and science was advantageous.

The successful achievement of science objectives using reading as a tool (Romance, 1992) supports the implication that there should also be a corresponding benefit to language arts.

The processes that are intrinsic to efficient science comprehension are compatible with the processes that increase reading skills. Baker (1991) asserts that "one of the most important self-regulatory skills for reading is monitoring comprehension, which involves deciding whether we have understood (evaluation) and taking appropriate steps to correct whatever comprehension problems are noted (regulation)" (p.3). Evaluation and regulation are essential components of both science and reading. The goal was to encourage students to utilize reading strategies in their attempt to make sense of the science topics, and as a result refine those reading skills as well.

A videotaped session verified that this does occur, but that the students needed to be prompted by the teacher before they would use the text to investigate a question. During the process of creating a Venn diagram of the similarities and differences of aquarium and terrarium animals a question was raised as to whether snails had eyes. There was an illustration in the text that the students had already read, but a very vocal debate ensued among the students. At my prompting a student retrieved the text and looked up the answer and read it aloud for the class. Another incident occurred in which several students were arguing that the jelly-like masses in their ecocolumn were snail eggs, and again, when they turned to me for verification I directed them to the text. This incident was particularly encouraging because they read beyond the information that they were seeking and added new knowledge about the reproduction of the fish as well as the snails.

Further evidence that science and reading instruction are compatible is extracted from the analysis of the Anticipation Guide and What I Know Activity (WIKA) sheets. The Anticipation Guide prediction that a statement related to the science reading was a fact resulted in an average of 68% correct *before* the reading. The percentage that was correct *after* the text had been read

increased to 92.3%. These percentages remained generally consistent for three separate Anticipation Guide science-reading assignments. The WIKA reading worksheets asked what the student knew before the reading, what they knew after looking at the text with its pictures and diagrams, and what they knew after they read the text. The final section of WIKA asked the students if there was anything that they still were wondering. Comparative analysis of these sections gave evidence that the reading was used to process science information during the act of reading. The first time in which they completed the WIKA activity sheet, ten students were able to correct misinformation that they written in the first section (that isopods are insects) after they had completed the reading (they are related to lobsters). There were five students who did not correct their erroneous information after reading. The second time that the students completed the WIKA assignment there were thirty-eight incidents in which students corrected misinformation statements and six that remained uncorrected. The relevancy of the questions that the students posed in the last section was inconsistent, with twenty-seven questions being posed that were relevant and fifteen questions that were either extraneous or were answerable from reading the text. The shared metacognitive skills, in both reading and science, of posing and verifying predictions, making inferences and drawing conclusions (Padilla et. al., 1991), resulted in the data demonstrating a direct and beneficial correlation between them. Teaching students the reading strategies of how to preview a text and seek specific information was very compatible with science. Figure 2 shows a listing of results related to the advantages and disadvantages of integrating reading and science.

The evidence from the videotapes and journal entries that students needed to be prompted to expand scientific information from a text was verified by a review of the book choice checklists. The data collection was somewhat inhibited by the fact that there was no classroom

library and the students were only allowed to visit the school library on Friday. This data was further skewed by the inconsistent number of Fridays during this research due to two snow days and two district workdays. The number of non-fiction books checked out by the students over the course of the implementation showed a slight, but negligible, change.

A further review of the book titles revealed that there were only 4 out of the total 67 non-fiction books checked out that could be viewed as books that were related to our specific science topic. Triangulation of the book checkout data with my teaching journal, which recorded a discussion with the school librarian requesting a display of relevant books, revealed that the high of 12 non-fiction books checked out at the end of February was prompted by that visual display. Previous to attending that library session they also received verbal encouragement from me to consider those books. See Figure 3 for a graphic representation of books checked out.

The integration of the writing instruction with science became problematic during the Preparation stage of this research. In accordance with the PAR (Preparation-Assistance-Reflection) plan the students were given a science journal to record their hands-on activities during this initial stage. The note taking guidelines were introduced as an guide to help them get started taking notes but were not a requirement; they should feel free to write whatever they considered significant. After they had been writing in their notebooks for a week and a half I stipulated that they were now *required* to use the guidelines and it had the negative effect of reducing the amount and the insightful aspects of their writing.

This is an example of a science journal entry (complete with grammatical and spelling errors made by the student) **without** the guidelines:

> Hand lense Investigations
> In the terrarum I see lots of of roots sprouting in the mustard spot, and the Alfalfa. In the Alfalfa I think I buried it to deep. I wounder why the grass is not sprouting, maybe I didn't plant them well. It's weird because not all of the mustard seeds are growing, and most of the Alfalfa seeds are (Watered it 11 times) In the aquarium they'res buble

everywere for some reason. From the Algae the water looks more dirty. Looking through the lense the water looks like it has little pieces of hair in it. I think the Algae is making the water smell like its from the river. I have been woundering why they call duckweed duckweed but it's because ducks eat it and other animals

After I began **requiring** the students to use the note taking guidelines the same student made this entry in her journal:

1. Today we aereated our aquarium. When we put air in it the fish swam close to wear we were aereated also the duckweed started geting closer. 2. I think we may have babie snails their 3. I have observed poop on some leaves. Relly small so I'm not sure. 4. I'm not sure if anytthing is going to happen 5. Nothing really happened. 6. Same 7. I think we are going to add duckweed again in a few weeks. 8. there is a drawing at the top ^ 9. I'm still wondering if we have babie snails.

This example of the reduction in the quality of the processing of their science thinking was replicated in student after student. Instead of using the guidelines as prompts to write more, they simplified their answers to basically yes or no type responses, with less detail. The impact on science as well as the volume and quality of the writing was negative.

During the Assistance phase I modeled how to write a two- paragraph business letter to the principal using a topic sentence, supporting details and a concluding sentence for each paragraph. I also directed the students to use the vocabulary lists and science charts that we had created as a class to get information for their individual letters to the principal. The first draft that was turned in astounded me in the lack of ability in writing. Of the 22 letters that I received there were only two that followed the guidelines which required that both paragraphs had a topic sentence, supporting details and a concluding sentence. All of the letters contained misspelled words that were part of the environmental print. The subsequent corrections and requirement to re-write was met with great dismay on the part of the students. There were 10 students who had to write more than two drafts.

The next assignment, to write a descriptive paragraph with the writing prompt "Imagine that you are an animal in your ecocolumn and describe a day in your life," was meant to simplify the task of writing to one basic paragraph. The first draft of this assignment was even more alarming in the lack of structure. It became apparent to me that these students would need basic instruction on how to formulate a paragraph. The following is an example turned in from a high achieving student of the rough draft of her descriptive paragraph:

> Hi! My name is Manpie but there are these two girls that are big, huge hue-hue-humans. They call me small and my partner big. We hate it. When we're all sound asleep they always tap our container and wake us up. By the way did I tell you we are in this small container that bugs us. It really hurts when they knock it over. Well I go the yans and It's getting dark. So see you later. Bye.

Again, the number of times that many of the students had to rewrite their paragraphs was discouraging to them. They quickly lost interest and enthusiasm for the topic of science. There was clearly a gap in the objectives that needed to be achieved in writing and the objectives that had previously been progressing well in science. I made the decision at this point that it had become necessary to separate the two subjects to maintain growth in both areas.

I began to implement a highly structured sequence of instructions for writing called Power Writing. This teaching structure introduced by J.E. Sparks in his book *Write for Power* assigns a number value to words, phrases and sentences. It helps keep the writer on topic and teaches a way to organize thinking into cohesive, logical paragraphs. There are five stages that a student must go through before they are ready to write a paper. Because of the necessity for repetition to obtain mastery I decided to allow the students to pick a topic that interested them while they were progressing through the first four of the five stages. In spite of high interest and involvement in the class science activities, not one student chose to write about science. After three weeks of intensive instruction in writing I returned to the topic of science and assigned a

paragraph that would compare and contrast the aquarium and terrarium environments of their ecocolumns. It was encouraging to see the average grade for the final draft increased to 92.1%. However, the impact of imposing this very defined written structure upon on the science topic resulted in paragraphs that were nearly identical and limited the science information processing.

The final four-paragraph essay assignment was meant to be an instrument to help determine whether the merging of the science topic with writing requirements was successful at the final stage of instruction. The following is two of the four paragraphs of an essay titled "What We Did In Science:"

> In science we made an ecocolumn. We built a terrarium and an aquarium. We did this so we could see how our world works. We also polluted our classroom ecosystems.
>
> The reason we did this science experiment was so we could see how our world works. For example, we have a lamp for the sun, which evaporates the water from the aquarium into the terrarium. It then forms clouds and since it's in a bottle and it's covered, just like our world, it then rains. This means that we don't need to water it.

The results of this essay were much more satisfactory in their adherence to basic grammatical structure and the actual learning that had occurred in science became more evident.

The evidence from the writing portion of my research suggests that teaching students the basic skills of how to write well is not necessarily compatible with instruction in science. The science concepts seemed to lose impact and importance to the students, when they were required to re-write, re-word and edit their papers. Writing was an effective medium for them to demonstrate and summarize their science learning, but the instruction phase of writing needed a variety of topics to keep the students engaged and motivated. There was distinct disadvantage to science learning that resulted from the total integration of science and writing.

The implications for the results of this research in my own teaching are that it has a decided influence upon whether, and to what degree, I will integrate reading and writing and

science in my classroom now that I have moved beyond my student teaching. It seems logical to integrate reading and science since it appears to be a very effective way to teach students the strategies for reading to obtain information. However, reading to obtain information is only one of the objectives of reading and there are many reading skills and strategies, such as interpreting a poem, that would be difficult to integrate with science. Evidence from my research indicates that the integration of writing instruction and science should be done in the final stages of the writing instruction. The complex goals and objectives of writing can have the effect of suppressing the cognitive processing of science concepts. The successful implementation of reading and science that is demonstrated in this research could influence other teachers by clarifying the degree in which the integration of the two subject areas should be cultivated. Although the existing research base demonstrates that there is a clear benefit to science when writing and reading are integrated with it, this current study indicates that the development of reading and writing should cover a wide range of subjects in addition to science in order to be effective. The cognitive parallels that exist between science and reading and writing do *not* outweigh the conflicting objectives that sometimes arise. This research indicated that interdisciplinary instruction should be approached with a clear idea of the objectives in all of the areas, and a willingness to separate the subjects when it is beneficial to their development. These results can be generalized to many elementary classrooms and it is evident that instruction in reading and writing are bridges to virtually all of the subject areas and should not be confined to science alone.

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Appendix A

Sample What I Know Activity Sheet and Anticipation Guide

WHAT I KNOW ACTIVITY SHEET: ___TOPIC_____

What I know about_____ _____	What I know about_____ _____ after preview	What I need to know as I read	What I know after reading	What I still need to know

Anticipation Guide: ____(topic)_____

Instructions: Before reading pages ____ through_____ in *(name of text)*__ place a check mark in the space to the left of each of the statements with which you agree. Then during the reading, place a check on the right of the ones you find to be true. BE SURE YOU ARE ABLE TO REFER BACK TO THE TEXT TO PROVIDE EVIDENCE FOR OR AGAINST EACH STATEMENT.

true	false	True or false statement from text.	true	false

Appendix B
Guidelines for Taking Notes

Note-taking guidelines

1. What did you do? What things did you notice when you did it?

2. What changes were made?

3. What are some things that you have observed?

4. Describe what you thought would happen.

5. What actually did happen?

6. Why do I think that it happened like that?

7. What do you predict will happen next? What do you want to make sure that you record accurately so that you can notice changes.

8. Is there a drawing or diagram that will help demonstrate what happened?

9. Are there some things that you are still wondering about? Where can you find more information about this?

Appendix C

Writing Rubric

http://www.bestschools.org/seaman/classrooms/reading/writing.rubric,

Jericho School District, New York

	WOW!!!	YES!	OK	OOPS!
	4	3	2	1
FOLLOWING DIRECTIONS Did I follow directions?	•follows all directions	•follows most directions	•follows some directions	•follows few directions
MEANING Did I show understanding?	• shows insightful understanding of important ideas	• shows understanding of most of the important ideas	• shows partial understanding of important ideas	• show no understanding of important ideas (misses the point)
Did I make clear connections?	•makes strong connections and reflections	•makes a few connections and reflections	•makes weak connections and reflections	•makes no connections or reflections

SUPPORTING DETAILS Did I develop my writing?	• uses specific details and accurate examples	• uses adequate examples and details	• uses minimal details and examples	• uses few or no details and examples
ORGANIZATION Did I organize my writing?	• shows strong organization with beginning, middle, and end	•shows good attempt at organization	• shows some organization	• shows no organization; confusing
EDITING Did I edit my work?	•no errors	•few errors that affect meaning	•some errors that make meaning unclear	•many errors that make meaning unclear
Spelling	• misspellings only on challenging words	• misspellings on some basic grade-level words	• misspellings on many basic grade-level words	• misspellings make meaning unclear
	WOW!!!	**YES!**	**OK**	**OOPS!**
	4	3	2	1

Appendix D
Washington State Essential Academic Learning Requirements

Writing

1. The student writes clearly and effectively.
W1.1 develop concept and design
W1.2 use style appropriate to the audience and purpose
W1.3 apply writing conventions

2. The student writes in a variety of forms for different audiences and purposes.
W2.1 write for different audiences
W2.2 write for different purposes
W2.3 write in a variety of forms
W2.4 write for career applications.

3. The student understands and uses the steps of the writing process.
W3.1 prewrite
W3.2 draft

W3.3 revise
W3.4 edit
W3.5 publish

4. The student analyzes and evaluates the effectiveness of written work.
W4.1 assess own strengths and needs for improvement
W4.2 seek and offer feedback

Appendix E
Book Choice Checklist

Student Name	Book Title	Non-Fiction? Yes	No

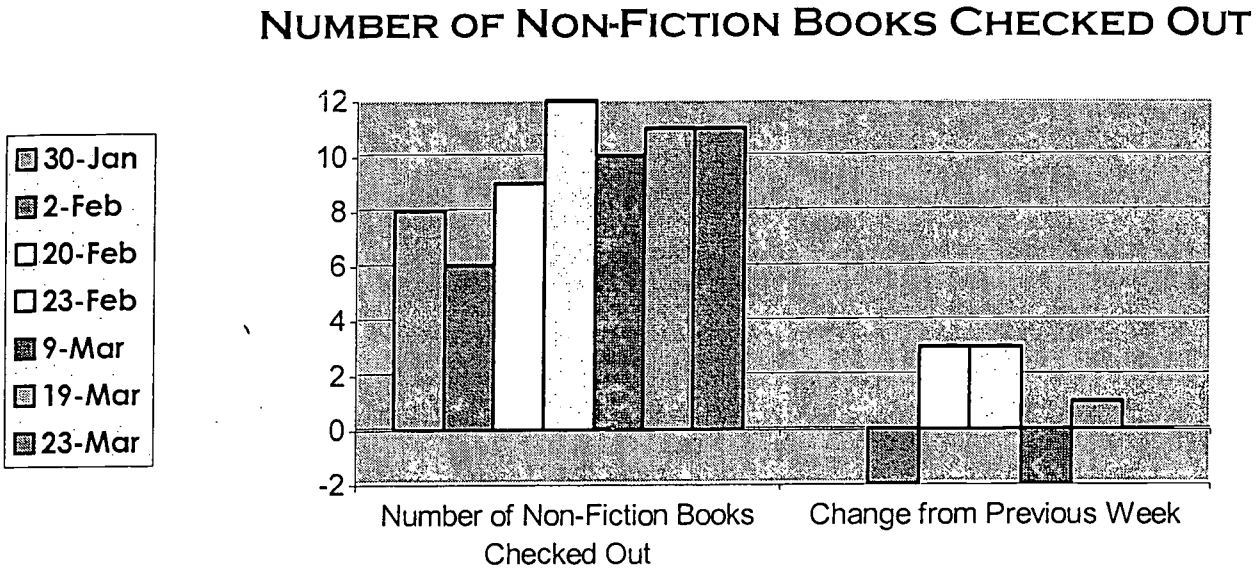
Figure 1. Timeline for Data Collection

WEEK ONE & WEEK TWO	• Recorded observations in journal • Video taped during language arts and science instruction time • Collected two book choice checklists
WEEK THREE	• Recorded observations in journal • Video taped group instruction of letter to principal • Implemented and collected student science journals
WEEK FOUR	• Recorded observations in journal • Video taped student investigations & research • Collect student science journals • Collected two book choice list • Collected rough and final drafts of individual letters to principal
WEEK FIVE	• Recorded observations in journal • Video taped student investigations & research • Collect student science journals • Collect one book choice checklist • Collected rough and final drafts of descriptive paragraph
WEEK SIX, SEVEN & EIGHT Separated Writing and Science Instruction	• Recorded observations in journal • Collect student science journals • Collect one book choice checklist • Power Writing Instruction
WEEK NINE & TEN Reintegrated Science and Writing Instructions	• Record observation in journal • Collect and conduct student self-evaluation of science journals with rubric • Collect one book choice checklist • Collected rough and final drafts of Power Writing Compare and Contrast Paragraph and 4-paragraph Expository Science Essay

Figure 2. Advantages and disadvantages of integrating reading and science.

Integration of Reading and Science	
Advantages	Possible Disadvantages
• Students learned to preview texts before reading.	• Students needed to be prompted to use a text to answer questions.
• Students gained skills on how to read to obtain information.	• Self-selection of non-fiction books showed no significant change.
• Reading and Science objectives of students *verifying predictions* were met. • The majority of the students self-corrected misinformation.	• A multitude of aspects related to reading was not addressed due to the limitations set by science objectives. (creative, reader response, poetry, etc.)

Figure 3. Number of non-fiction books checked out over the course of the study.



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