

To Pen or Not to Pen: That is the Question

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Abstract

Assistive technology has provided tools for students with learning disabilities to improve their performance in the area of reading. Much of this technology has required the student to use a computer equipped with text-to-speech software. One of the latest tools is a small reading pen that enables the user to scan a word or sentence that the pen then "reads" aloud. This study investigated how the Quicktionary Readingpen II (QRP II) affected the reading comprehension levels in science and social studies of a group of twenty eight middle school students who have been diagnosed with a specific learning disability in reading. The students used the Quicktionary Readingpen II for silent reading assignments and in testing sessions in which comparison were made between normal, unassisted reading and reading assisted by the Quicktionary Readingpen II.

The results of this study indicate that across grade levels, in both science ($P < 0.001$), and social studies ($P = 0.014$), the Readingpen significantly improved comprehension levels as shown by an increase in number of correct answers on given tests. On average, the Readingpen increased science scores by 18 percentage points and social studies by 10 percentage points.

Introduction

Reading difficulties are one of the most significant problems experienced by children identified with learning disabilities (Swanson, 1999). Communication in today's world is becoming increasingly more intensive and varied. We use email and the Internet to send messages and get information. In addition, we still use letters, books and articles on a daily basis. The ability to read and comprehend is still essential. Comprehension is particularly problematic for students with special needs. Decoding words takes so much time that the concentration required for understanding the content decreases (Tompkins, 2003). Reading teachers continue to use extensive, systematic phonics programs to help their students become more proficient readers, but remediation is not instantaneous. Fortunately, there are also technological developments that can benefit these learning disabled students.

The author of this paper received a grant from the Ecolab Corporation to purchase six Quicktionary Readingpens (Wizcom Technologies, Inc.) for students in her reading program. The QRP II is a fully portable assistive reading device that enables users to quickly and easily scan a word and hear it spoken aloud. The purpose of this study was to determine the effects of using the QRP II on the comprehension skills of middle school learning disabled students in the areas of science and social studies. The author was optimistic that the QRP II could provide support, promote independence and increase reading comprehension levels for those students who have not become

successful with traditional decoding strategies.

Review of Related Literature

The ability to read is essential for living in today's world; personal independence requires at least functional literacy. Failure to read restricts academic progress because proficiency in math, English, science, or social studies depends on the ability to read. Reading is also a key to personal/social adjustment and to successful involvement in community activities (Lerner, 2000).

Reading is one of the most difficult tasks that students encounter in their education. Some students may never learn to read with confidence. At least 80 percent of children diagnosed with a learning disability have their most severe difficulties in learning to read ("Strategies + Technology = Solutions for Reading Challenges", 2003). Many learning disabled students that have been diagnosed with a reading disability are placed in separate educational programs, such as a resource room, in hopes that they will receive more appropriate instruction, in spite of these special programs, students continue to find learning from their social studies and science textbooks overwhelmingly difficult. Often, poor readers do not possess an adequate sight vocabulary and must concentrate to decode many of the words in the passages of the textbooks. With all of their energy focused on trying to recognize individual words, they may not comprehend much of the content. Since comprehension is the goal of reading, these students continue to have difficulties. In addition, teachers continue to place a high value

on the textbook as an indispensable instructional tool. Studies estimate that students spend as much as 75 percent of their classroom time and 90 percent of their homework time involved with textbook material and that dependence upon textbooks increases with grade level (Ciborowski, 1995).

As students move through the grades reading tasks change dramatically. They are expected to read for information in their science and social studies classes. They might be required to read a chapter independently, complete written answers to questions on the chapter and to take a test on the content covered in that chapter. It is not surprising that many learning disabled students cannot complete these assignments. Content textbooks are generally written at or above the grade level in which they are used (Ciborowski, 1995). If a seventh grade student is reading, for example at a fourth-grade level and the social studies textbook is written at an eighth grade level, there will be a four-year discrepancy between the student's reading level and the reading level of the textbook. Therefore, teachers must use strategies to help special needs students have a positive experience when using the textbook for assignments.

Assistive technology has provided tools for students with learning disabilities to improve their performance in the area of reading. As defined by the Individuals with Disabilities Education Act (PL 101-476) the term **assistive technology device** means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities (Learning Disabilities

Association of America, 1995). To date, much of the technology for reading assistance has required the student to use a computer equipped with text-to-speech software.

The goal of assistive technology is to aid instruction and to provide important accommodations for students with disabilities. Technology has a great motivational factor that will frequently interest students who would be reluctant to learn in other ways (Blachowicz & Ogle, 2001). "For students with disabilities, technology is the great equalizer," says John Williams, who has written about assistive technology for more than 20 years ("Technology - The Great Equalizer", 2003).

One of the latest tools is a small and handy piece of equipment that is used like a pen. The Quicktionary Readingpen II (QRP II) is a portable, handheld tool that is able to scan a printed word (6 to 22 point font), and then say the word via a computer-synthesized human sounding voice through a built-in speaker or earphone. There are additional features of the QRP that can help poor readers. They include: displays syllables, spells words out loud, keeps a history of scanned words, contains over 200,000 definitions found in the American Heritage College Dictionary, defines words with definitions (cross reference), scans inverted, hyphenated text, and scans left to right depending on the comfort of the user. The QRP II can scan full sentences and read each word out loud while it highlights it. Features are accessed through a small keypad on the QRP II and the LCD window shows scanned text and definition simultaneously. The QRP has been in existence for eight years and a new model was introduced in January, 2001 (WizCom

Technologies, 2001). The new model was used for this study.

There have been few studies completed on the effects of using the Readingpen in a controlled environment. Wizcom Technology spokesperson, Steven Heller, told this researcher that two such studies have been submitted for publication and should be available to the public early in 2004. Preliminary results from the study that is ongoing in Iowa indicate that students who use the QRP II increase oral word reading accuracy and are able to retain words that were scanned one day later (Miller, 2002).

Dr. Paul J. Gerber, Professor of Education at Virginia Commonwealth University in Richmond, Virginia, used the QRP with a group of adult students with reading disabilities and their tutors to discover its utility in increasing reading decoding and comprehension. Results were mixed. The Reading Pen was found to be very useful for some adult students while others did not find it to be helpful at all (Gerber & McShane, n.d.)

Corrine Sebrechts published an article entitled "The Reading Pen: A Powerful Tool for Dyslexic Persons" in which she summarizes the opinions of remedial teachers who have seen and tried the Reading Pen in the Netherlands (Sebrechts, n.d.). Some of the disadvantages noted were: too expensive, takes too long for some students to master scanning, the word is not read promptly enough for some students, and the voice on the pen gets on your nerves. Other teachers 'found the pen gave their students a sense of independence and decreased some student's resistance to reading. In conclusion, Sebrechts feels that those teachers using the Readingpen should

maintain realistic expectations from the pen. She feels that the Readingpen opens a range of possibilities for some students who could discover that reading is fun (Sebregt, n.d.).

Ria Janssen, a dyslexia specialist also in the Netherlands, sent questionnaires to buyers of a Readingpen. The average age of this focus group was 13 and the average experience with the Readingpen was six weeks. 22 respondents reported that they used the Reading Pen for homework and to a lesser extent in the school setting. 67% of those responding feel they are more independent readers and more than 80% indicated that they understand a text better and faster (Janssen, n.d.).

The Wizcom Technology website (www.readingpen.net) has numerous testimonials from parents and educational specialists that discuss the advantages and disadvantages of using the Readingpen. These testimonials echo the studies that have been mentioned in this section.

Research on the effectiveness of using the Reading Pen with students with disabilities is an ongoing process. The results of this research will be shared with Wizcom Technologies.

Statement of the Hypothesis

Over the last several years, assistive technology devices have been available to help students with reading disabilities compensate for their poor reading skills. The QRP II is one of the latest tools that claim to help slow readers improve their comprehension skills. Some research has been carried out on the effect of the QRP II on reading comprehension. This researcher feels that further study is warranted. Therefore, it was hypothesized that middle school learning

disabled students will exhibit significantly higher comprehension levels in science and social studies when using the QRP II as part of their instructional technique for silent reading activities.

Research Methodology

Participants and Setting

The setting for this study was a middle school located in Bunker Hill, West Virginia. The sample included 28 sixth and seventh grade middle school students who have been identified with a learning disability in reading. These students are divided into four classes of LD Resource Reading that is taught by the researcher. Two classes are sixth grade level and two classes are seventh grade level. The students were informed of this study and were excited to be part of a research process.

Research Design and Procedure

A quasi-experimental research design was chosen for this study due to the inability of the researcher to randomly select students with a reading disability from the county school system. The researcher is permanently assigned to this learning environment with these individuals on a daily basis.

The initial stage of the research was the collection of baseline data. This researcher used the *Qualitative Reading Inventory-3* (Leslie & Caldwell, 2001) because it provides numerous passages designed to assess silent reading and comprehension of students. The QRI-3 contains narrative and expository passages that are highly representative of the structure and subject matter of materials found in basal readers and content-area textbooks (Leslie & Caldwell, 2001). Narrative materials are

stories with characters, a plot, and a sequence of events that occur during the story (Lerner, 2000). Narratives are used frequently in elementary reading instruction and students are familiar with the format. Expository materials include informational materials, for example, textbooks used in content areas such as science and social studies (Lerner, 2000). The QRI-3 measures comprehension through the answers to explicit and implicit questions. Answers to explicit questions can be found in the text, while answers to implicit questions require the reader to make an inference based on a textual clue (Leslie & Caldwell, 2001). A qualitative reading inventory was administered to all students. The selection chosen for this silent reading activity was a narrative reading with an instructional level of six for the sixth graders and seven for the seventh graders. Each selection contained explicit and implicit questions. The number of correct answers established a baseline reading comprehension score.

The next ten days were spent instructing students on Readingpen use. A PowerPoint presentation prepared by Wizcom Technologies was shown to the students. This presentation was chosen for the excellent visual instructional techniques that all students could benefit from. Students were allowed to use the Readingpen for any silent reading activity during the two weeks. Headphones were provided for each individual student to use with the Readingpen.

At the beginning of the third week, all students were assigned a number from one to twenty-eight. The way in which the numbers were assigned corresponded to the alphabetical listing of the last name of each student in each

class. The students used these numbers on all data collection papers for this research. Fourteen numbers were chosen randomly and these students became the experimental group for the next week. These students were encouraged to use the Readingpen exclusively for any silent reading activity during this time. The remaining students had no access to the Readingpen or any other type of assistive technology during this time. All students had the same type and number of silent reading activities. At the end of two weeks a science test was administered. This expository passage contained both explicit and implicit questions. Sixth grade students were tested using a passage with a readability level of grade six while seventh grade students were tested using a passage with a readability level of grade seven. The experimental group was encouraged to use the Readingpen during the test. During the next week, the remaining students had access to the Readingpen and a similar, but different science test was administered. Both science tests used had the same readability level and the same kinds and numbers of questions at each grade level. This scenario was repeated for the next two weeks. Two different social studies tests were administered at the end of weeks five and six. Again each of these expository readings had the same readability level and the same kinds and numbers of questions. Comprehension was measured as the number of correct and incorrect answers on the tests.

Statistical Analysis

The first analysis evaluated whether cumulative scores from each set of tests (science with Readingpen, science without Readingpen, social studies with Readingpen, social studies without

Readingpen) differed from baseline scores. A repeated measures analysis of variance in the multivariate mode (PROC GLM; SAS Institute 1988 p. 604) was used. Grade level was included as a fixed-effects factor to evaluate any interactions between type of test and grade of student. If the model was significant, a contrast comparison was used to see which tests differed significantly from baseline. These comparisons were made across all grade levels.

In the next set of analyses, the effect of the Readingpen on test scores (baseline scores were omitted from these analyses) within study topics was examined. Again, repeated measures analysis of variance in the multivariate mode was used to test if (1) the interaction between grade levels was significant between science with a Readingpen versus without and social studies with a Readingpen versus without, and (2) if not, the effect of using a Readingpen across all students within each study topic was then tested.

A final analysis was used to determine, within a topic of study, if the Readingpen significantly improved one type of reasoning over another (implicit versus explicit). Paired t-tests (PROC MEANS; SAS Institute, 1988), were used to evaluate the change in correct scores due to use of Readingpen for implicit and explicit questions: one test for science, a second test for social studies, a third test for implicit questions between study topics, and a final test for explicit questions between study topics. Significance for all tests was determined at $\alpha = 0.05$.

Results

Twenty-eight middle school LD students participated in this study. Fifteen were in the sixth grade and thirteen were in the seventh grade. All of these students are in a resource class for reading each school day. During this study students were tested in science and social studies both with and without using the Readingpen. Each test was scored and per cent values recorded. The mean and standard error was calculated for each type of test (Table 1).

Significant differences were seen in test scores across study topics and testing methods, including the baseline test ($P < 0.001$). Compared to baseline, this difference was limited only to the science exam without Readingpens where students scored significantly lower than baseline ($P < 0.001$). The significant interaction of grade level and type of test ($P = 0.002$) arises from sixth graders outperforming seventh graders on the baseline test and the social studies tests but seventh graders outperforming sixth graders in science (Fig. 1). There was no significant interaction of grade level with reading technique for science ($P = 0.77$) or social studies ($P = 0.06$). Across grade levels, in both science ($P < 0.001$) and social studies ($P = 0.014$), the reading pen significantly improved cumulative correct scores (Fig. 1).

An improvement was seen in correct answers for both implicit and explicit questions with the use of the Readingpen for each study topic (Fig. 2). Within science there was a trend for greater improvement in answering explicit questions than there was for answering implicit questions with the aid of a Readingpen (Fig. 2), but this relationship was not significant ($t = 0.96$; $P = 0.34$). Within social studies, there

was no evidence of different levels of improvement with the Readingpen for either type of question ($t = -0.06$; $P = 0.96$; Fig. 2). The improvement in answering explicit ($t = 1.79$; $P = 0.085$) or implicit ($t = 0.59$; $P = 0.56$) questions with the Readingpen did not differ between science and social studies.

Discussion

The results of this study support the original hypothesis: middle school learning disabled students using the QRP II as part of their instructional technique increased their reading comprehension levels in science and social studies by an average of 18 and 10 percentage points respectively (table 1). Only science scores without a Reading Pen were significantly different from their baseline scores (fig.1). An improvement in correct answers for both implicit and explicit questions was shown, but this relationship was not significant (fig.2).

There are a number of limitations to be noted. Variations in comprehension as a function of prior knowledge could have affected the number of correct answers on the tests. Additionally, students have different backgrounds, interest levels and motor skills that could have an effect of the results of this study.

The researcher was also able to make several informal observations during the course of this study. At the beginning all of the students were excited about this new technology. Most students were able to use the Readingpen and all of its functions within the two-week training period. Some, however, continued to have difficulty scanning the words or sentences. These same students became frustrated easily if the Readingpen did not scan correctly the first time. Some students continued to

have trouble understanding some of the definitions that were generated and did not like the computer-generated voice of the QRP II. There were also complaints that the Reading Pen could not read colored print or decipher handwritten work. The pace of the response was also a criticism.

Despite these criticisms, many students continue to have success with the Readingpen. During silent reading these students have become more independent and do not have to ask the instructor for word pronunciations or definitions. They applaud the QRP dictionary and enjoy having the definitions "right there." The students have commented that it has been helpful that even the definition can be read aloud. Some students will read for longer periods of time and are able to read more pages than those students who are not using the QRP II. These students appear to have a better understanding of what they are reading. At random the researcher chose a page from the library books that the students were reading and asked a few questions. Students using the Readingpen often have more correct answers than those students who do not wish to use the pen. On a test those students using a QRP II do not give up as easily as those not using a pen. They will persevere until they understand a sentence or a question. These students tend to answer more questions and their answers are more complete.

Additional informal observations appear to indicate that boys and sixth grade students tend to use the Readingpen more frequently than girls and seventh grade students.

Without question, assistive technology can be an important aid in helping individuals learn to read and comprehend. Yet in the case of the QRP

II, the researcher found that it is not the perfect answer for every student. For some, it promotes independence and increases confidence levels. For others, it is a source of frustration. The process of using it technically and practically was too overwhelming and did not appear to be helpful for all students.

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Table 1. Mean and Standard Error for Types of Tests Used in This Study

Type of Test	Mean (%)	Standard Error (%)
Baseline	57	4.8
Science with Readingpen	60	4.3
Science without Readingpen	42	5.7
Social Studies with Readingpen	64	4.8
Social Studies without Readingpen	54	4.1

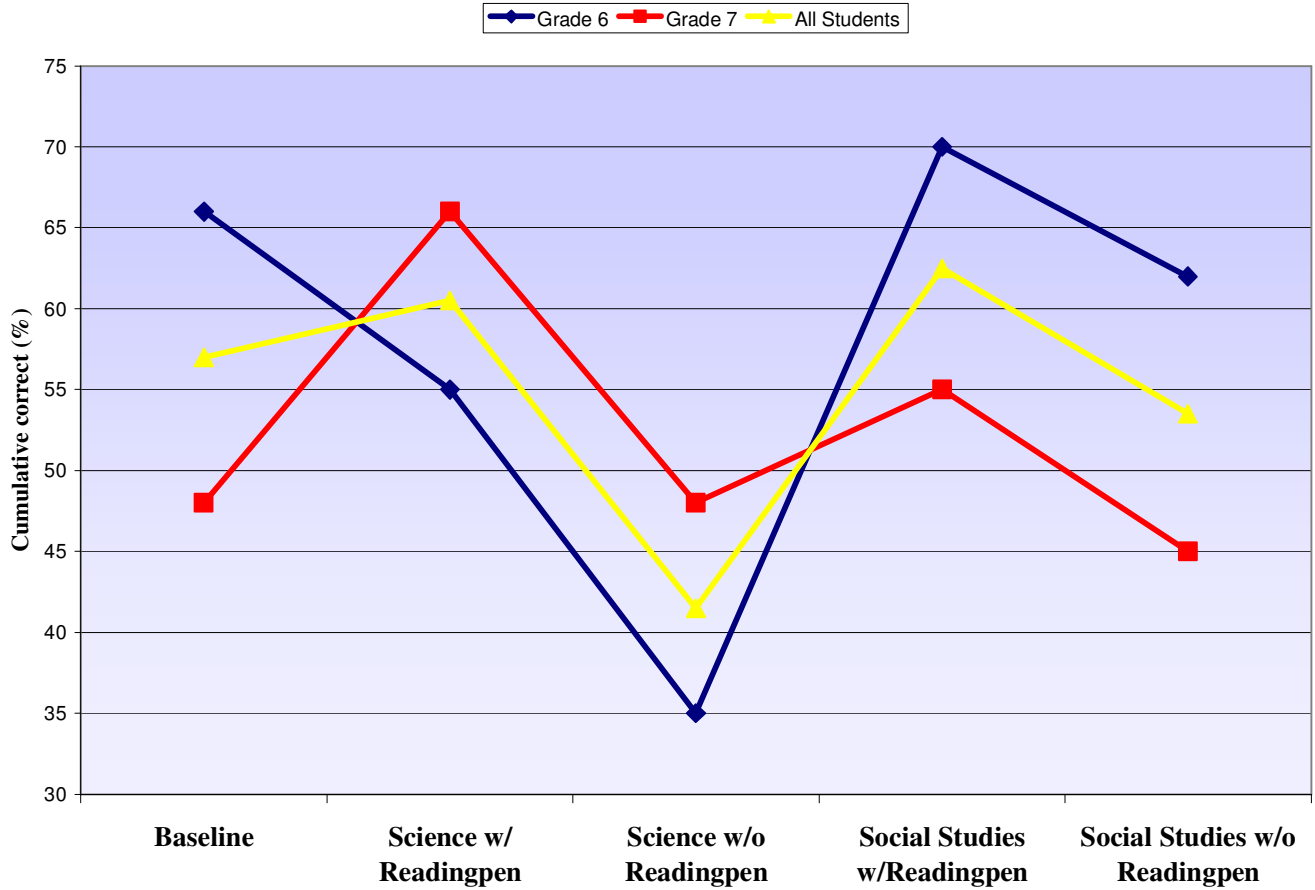


Figure 1

Test scores for sixth and seventh grade students across two study topics (science and social studies), across two reading techniques (with or without Readingpen), and one baseline comprehension test. Only science scores without a Readingpen were significantly different from baseline scores (as indicated by star). These data indicate that use of the Readingpen increased test scores within science and social studies

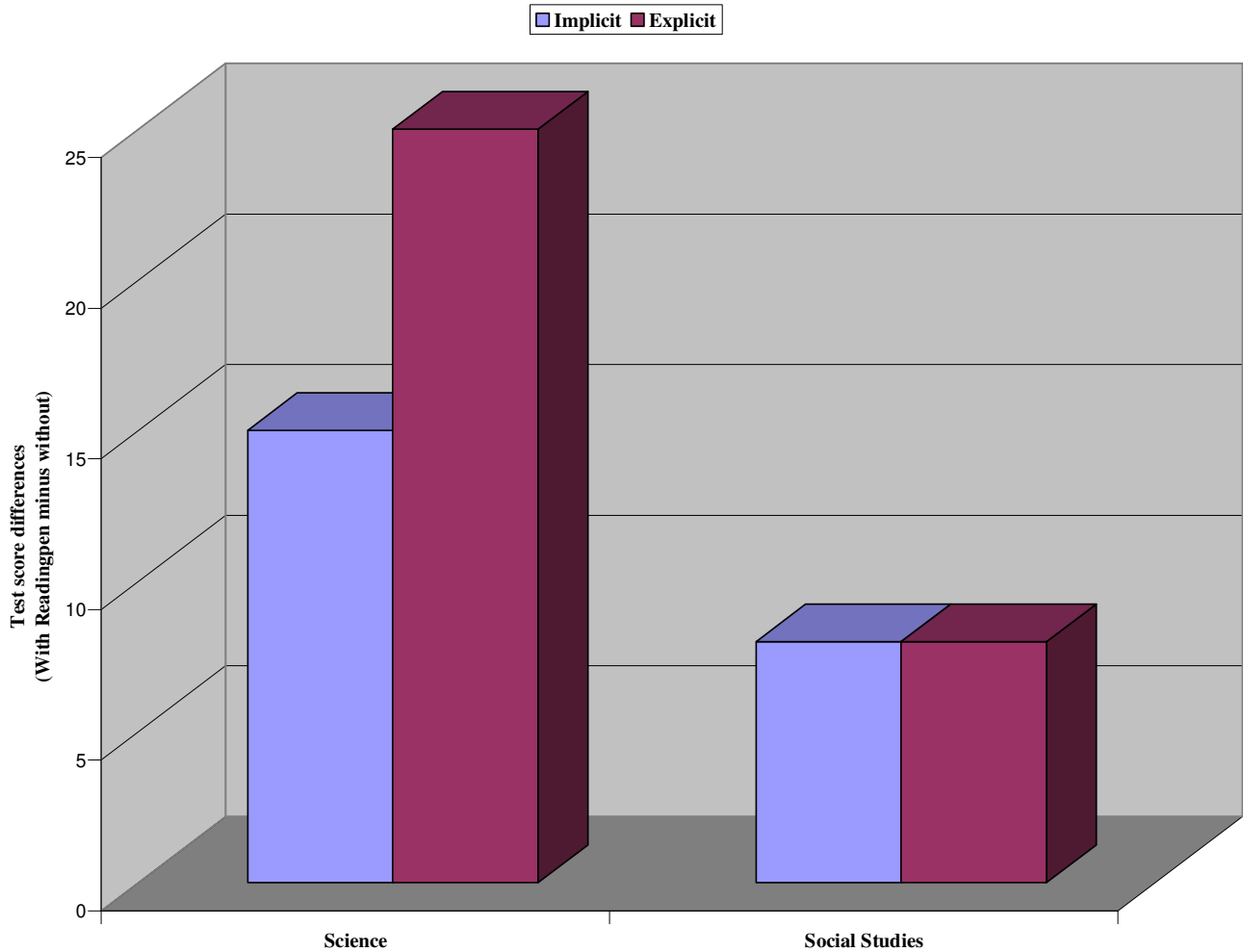


Figure 2

For 28 students, the change in test scores on percentage points across two reading techniques (with or without reading pen) and two study topics (science and social studies) for explicit and implicit questions. There were no significant differences for type of questions within a study topic.