



Using the Think-Aloud Strategy to Bolster Reading Comprehension of Science Concepts

Evan Ortlieb

Megan Norris

Texas A&M University – Corpus Christi

Comprehension of text is developmental in that it begins with a child's ability to listen and make sense of language. Though listening comprehension is often the predecessor towards reading comprehension; some children maintain difficulties in listening comprehension throughout schooling and into adulthood. This quasi-experimental study investigated the effectiveness of using a think-aloud strategy to improve students' reading comprehension in science within a kindergarten classroom. Results indicate that using think-alouds as a during-reading activity significantly increases a student's comprehension of science concepts. Findings provide relevant information about employing think-alouds as an instructional tool for teachers in the primary grade levels.

Keywords: comprehension, think-aloud, prevention, science, literacy, kindergarten

Comprehension is one of the five core components of reading, which has been a hot topic for the last few years (Cassidy & Ortlieb, 2011; Cassidy, Valadez, & Garrett, 2010; Dymock, 2007). Teachers are always in search for enhanced methods of comprehension strategy instruction. Comprehension is a complex process that requires students to use multiple cognitive skills, such as auditory processing (Huey, 1908/1968; Anderson, Hiebert, Scott, & Wilkinson, 1984). Students also need to have direct instruction of strategies, which can help develop reading comprehension (Loveless, 2012). Comprehension consists of a variety of strategies that children must know and manipulate in order to understand readings; struggling readers often have difficulty comprehending texts that they are reading because they lack these skills. Although it is also difficult for teachers to teach strategies, according to Dymock (2007), there could possibly be more improvements in students' understanding when reading text, because of the increase of teachers making a point to teach strategies. Many children do not have the foundational skills such as word

recognition, vocabulary development, and prior experiences that are considered necessary to connect text with meaning (Pardo, 2004). One way teachers can augment students' comprehension strategy use is through think-alouds.

The think-aloud method has been widely used as a strategy of instruction by teachers to model for students the thinking process (Dunston & Headley, 2002); this in turn can help promote comprehension (Block & Israel, 2004). The think-aloud helps to enhance students' abilities of the thinking process and understand what they comprehend, and it allows for the reader to connect meaning and understanding with the text. Block and Israel further that students feel that think-alouds are beneficial to their thinking process when the correct method is taught to them and it allows for teachers to become better educators. Teachers show their thinking process and how their thoughts are occurring during the reading for students who are struggling with comprehension. Through using a think-aloud teachers are able to vocalize how they think as they read (Davey,

1983).

Although its utility is widespread, existing quantitative research evidence for its effectiveness is limited and as a result, additional investigation is needed to investigate its importance in the early grades. Ericsson and Simon's (1980) approach to collecting think-aloud data has been used in many studies since the early 1980s. However, it has been criticized as doubts have been raised about its validity. The purpose of a think-aloud is to extend Ericsson and Simon's work by modeling what good readers do before, during, and after reading. It is used to elicit prior knowledge of a subject, determine word meanings, and allow for readers to connect with the text, providing an example of how to be expert readers and has been proven that students can read with greater understanding (Block & Israel, 2004).

The purpose of this study is to examine the impact of a teacher think-aloud strategy using nonfiction science texts on oral reading comprehension of kindergarten students. Students need teachers to explain their thinking and reading processes (Block & Israel, 2004), while teachers need an expanded evidence base of this strategy's usefulness in the classroom environment for promoting the comprehension skills that many students are lacking.

Theoretical Framework

This research investigation is grounded in theories of using schema to build comprehension. Schema is a concept that describes how knowledge experiences are stored and play a role in the comprehension process (Anderson, Reynolds, Schallert, & Goetz, 1976; Bartlett, 1932). Schema theory states that all knowledge is organized into units; furthermore, students' varied background knowledge and experiences lead to different levels of understanding of a text or different interpretations (Anderson, Reynolds, Schallert, & Goetz, 1976). Readers have to make sense of the new knowledge gains by connecting it with prior knowledge by using logical inferences.

Vygotsky proposed that with adult supervision children could accomplish tasks that they would not normally be able to without assistance (Dickson, Chard, & Simmons, 1993). Scaffolding is the process through which needed support is given until eventually one gains the ability to use skills independently (Rosenshine & Meister, 1992). Although most students need the support of an adult when learning a new skill or concept, eventually the teacher shifts the responsibility for learning to the child; the teacher provides less support as the student gains proficiency (Pearson & Gallagher, 1983).

Scaffolding is a temporary structure for the teacher to support students and minimize their struggles. It is a bridge that is used between students' supported and independent levels. Dixon (1994) provides a scaffolding example for scaffolding with a gradual release of assistance. He warns that premature removal of support

for the student can result in "serious intellectual injury" which is difficult to rehabilitate. The ultimate goal of teaching the think-aloud strategy to students is to allow them to use it when completing reading tasks on their own for their own comprehension.

Review of Literature

Scaffolding and Think-Alouds

Stone (1998) cites several studies in which scaffolding has been proven to be effective through his observations. Cazden (1979) also states that parents play games with their children at home and use a scaffolding model; taking turns. A similar scaffolding process is seen in middle and high schools, in which teachers use a question-answer session with their students as a scaffold to see if mastery is accomplished. Even as adults, it is commonplace to use a variety of scaffolding methods in everyday learning situations.

Larkin (2001) completed several observations on teachers who used a scaffolding model, finding it led towards the development of independent learners; she noted several elements that teachers incorporated into learning that proved to be very successful. Some of these guidelines include establishing what the learner already knows, beginning with what students can do, and knowing when it is time to stop (Larkin, 2001). As a teacher, you want your students to feel successful and have a sense of accomplishment. Scaffolding works best when the teacher knows the students learning abilities and is there to provide support for students to encourage successful learning.

The think-aloud is a strategy that allows a teacher to verbalize thoughts while reading orally, modeling for students how the process of comprehension works (Harris & Hodges as cited in Block & Israel, 2004). The think-aloud strategy can be used as a scaffolding model to develop higher thinking and learning, and allows for the clarifications of difficult concepts or tasks. According to Tierney and Readence (2000), teachers can use the think-aloud strategy as a way to scaffold students reading comprehension. In a think-aloud, teachers model their own thinking and reading strategies for the students as they need. The goal of the think-aloud strategy is that eventually students will develop a similar thinking process when they are reading independently, thereby improving their comprehension.

Listening Comprehension

Studies involving the relationship between listening and reading comprehension have been extensively researched (Curtis, 1980; Hoover & Gough, 1990; Singer & Crouse, 1981; Stanovich, Cunningham, & Feeman, 1984; Sticht et al., 1974). Insights from the field of cognitive psychology emerged, especially pertaining to schema theory, leading reading researchers to concentrate on how background knowledge of a topic and the semantic features of the language affected comprehension (Pearson & Johnson, 1978). The syntactic features of the

language can be transferred via read alouds and oral language. Hart and Risley (1994) demonstrated large disparities in reading ability are already evident by 1st grade based on the qualitative and quantitative differences in oral language that children from different SES backgrounds are previously exposed. To develop comprehension skills that transfer to independent reading, listening comprehension should be explicitly taught in primary grades. Since the 1970s, little research has been conducted to further Sticht's highly influential work.

Explicit Comprehension Strategy

For more than three decades, research has been conducted on explicit comprehension strategies (Dymock, 2007). Comprehension strategies need to be taught explicitly and modeled long term for students at all grade levels (Block & Pressley, 2002). Opportunity to practice these strategies with assistance should be allotted until they understand the strategy and how to use it correctly. Comprehension can even be modeled in the first few years of human development, allowing students to see how good readers think and interact with texts (Gregory & Cahill, 2010).

The comprehension revolution (1970-1990) provided us with the notion that comprehension was more than decoding and word recognition (Duke, 2001; Gregory & Cahill, 2010), leading towards increasing numbers of studies being conducted on comprehension. Still, there are minute amounts of research available on explicitly teaching comprehension strategies to younger students (Gregory & Cahill, 2010) because of the ongoing emphasis of word decoding and reading skills.

In one study, Gregory and Cahill (2010) followed a kindergarten teacher to see if comprehension was developed through explicitly teaching strategies. The teacher activated schema for students by making connections, visualizing, and asking questions. By using schema theory as the basis for her comprehension strategy instruction, the teacher delivered instruction to her kindergarten class that would ordinarily be used with older students. Her successes suggested that explicit comprehension strategies can be taught successfully to young students.

Knowledge of strategies is important for students to select a thinking process that aids in their comprehension (Block & Israel, 2004). Knowing several strategies allows for students to select the appropriate comprehension process to use for the task at hand. When comprehension strategies are taught explicitly for students, they learn how to select the appropriate strategy. Comprehension should be taught separately and collectively. Effective think-alouds show how good readers do things before, during, and after readings which assist students in their own learning. Comprehension is

the process in which readers construct their meaning through text. The more background knowledge that a reader has to help connect to while reading the text, the easier it is for the reader when it comes to understand what is being read (Pardo, 2004).

Comprehension in Content Areas

Along with hands on learning, learning from text is an important aspect of any content area (Neufeld, 2005). If students are taught comprehension strategies explicitly, this can help them to read more effectively in other content areas. According to Neufeld, comprehension strategy instruction will be the most effective if it is being taught in context with what students are learning. If they are expected to read something, then they need to be taught the comprehension strategies that will help them understand this new concept.

To be successful at mastering content in areas such as science or social studies, students need to comprehend the text that they are reading as it relates to knowing something or applying that knowledge. Students are incredibly involved in reading and writing throughout subject area classes (Knipper & Duggan, 2006); comprehension is demonstrated not only through reading but also through writing. Teachers need to be knowledgeable in comprehension strategy instruction, regardless of the content area.

Content area reading should begin in early grades so that students are prepared for reading and comprehending advanced texts of increasingly difficult readability and concepts (Moss, 2005). Content area comprehension no longer just refers to reading and writing, but to all aspects of literacy that are involved in these subjects. This includes technology such as e-mail, internet sites, or electronic messaging (Moss, 2005). A literacy event is made by students engaging in some form of text (Pardo, 2004). According to Duke (2000) the average first grade student spent only 3.6 minutes per day with informational texts. Students are not being taught using a variety of genres. Classroom libraries contain more narrative texts than any other genres.

In schools, reading instruction needs to be integrated into content areas to help students learn at the same time they are reading. Research on the think-aloud strategy is now a hot topic. Duthie (1996) suggests that it is possible to associate instruction in reading with comprehension instruction in expository texts, teaching young readers how to relate to the text and choose which comprehension strategy is most appropriate for the subject they are learning.

Methods

Participants

A Title I public school in South Texas was the site of this study. Students from Pre-Kindergarten to

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| 1. Give an example of light energy (one source) |
| 2. Give an example of sound energy (one source) |
| 3. Give an example of heat energy (one source) |
| 4. What is something that interacts with a magnet? |
| 5. Something that does not interact with a magnet? |
| 6. Describe the location of an object (Using the term above, below, behind, beside, and in front of.) |

Figure 1. Pre-test/Post-test.

fifth grade are educated in this school. They have the following ethnic composition: 73% Hispanic, 16% Native American, 9% White, and 3% African American. A majority of the families are from an economically disadvantaged background and 91% qualify for free and reduced lunch.

There were 37 kindergarten participants in this study. Two separate classes were selected; in group A there were 17 students and in group B there were 19 students. Students in group A were randomly assigned to the experimental treatment group and received science instruction through think-alouds in nonfiction text as well as regular instruction from the schools' adopted curricular program of the Texas Education Service Center Curriculum Collaborative, called CSCOPE. This curriculum support system is fully aligned to the state standards to provide a common language, process, and structure for curriculum development. Its adoption is widespread throughout the state of Texas. Meanwhile, Group B served as the control group and received science instruction through the schools adopted curriculum of CSCOPE.

Materials

Both groups were given a pre-test before the study began using the final evaluations taken from the CSCOPE curriculum (see Figure 1). These questions were asked orally and were scored as either correct or incorrect answer. If they could give a suitable example they received one point, whereas if they could not give an example, they received zero points. The pretest consisted of six questions over the topics that would be taught during the five week duration of the study derived from the CSCOPE curriculum. Nonfiction science books were chosen based on their relation to the topic that was being taught during the week's lessons. The books were chosen by the researchers based on their knowledge of grade level appropriate nonfiction texts suitable for think-alouds.

Procedures

The unpaired t-test results from pretest scores of both the control and experimental group found no statistically significant differences between the two classes $t(34) = 0.01, p = 0.98$. Scores for the control group ($M = 1.05; SD = 1.08$) were comparable to those of the experimental group ($M = 1.06; SD = 1.05$). Random assignment of treatment was provided as one group would

serve as the control group, while the other as the experimental group. The independent variable was the method in which nonfiction books were presented in the classroom setting.

Intervention. The experimental group received instruction from the regular curriculum and supplemental instruction from the use of think-alouds in nonfiction science books. Students received instruction from the think-aloud method for 15 minutes a day, three days a week in addition to the regular 20 minutes of CSCOPE science time. To perform a think-aloud a teacher must model for the students how their thinking strategies occur:

- 1) Choose a trade book that is grade-level appropriate for the topic of study;
- 2) Preview reading material to find any unfamiliar vocabulary or parts in the story that can confuse students;
- 3) Give background knowledge on the topic at hand. Then take a book walk (flipping through the pages) to look at illustrations and nonfiction features;
- 4) While reading, pause and make comments about what you are thinking in order to clarify for students how comprehension is taking place;
- 5) Verbalize predictions, confusing parts, or connections with prior knowledge to help show comprehension of the text (in an effort to lead children to make predictions);
- 6) Close the lesson with a strong connection to the book, or short review of the purpose of the story. (Vacca & Vacca, 2010)

One specific vignette from the proceedings of a teacher performing a think aloud using the text, *The Very Hungry Caterpillar*, is as follows:

T: Today, we are going to read the book – *The Very Hungry Caterpillar*. It was written by Eric Carle, one of my favorite children's book authors. You may have seen caterpillars before on the playground or at home. We are going to find out all of the things the caterpillar eats! But first, let's look at some of the vocabulary words that you will come across in the book. To "nibble" means to bite or chew something. You nibble when you eat a piece of a granola bar for

instance. How many of you have nibbled on something today? The next word is “push.” Pressing against something or shoving is other words for push. I want you to extend your arms against your desk and push. See if you can move the desk a few inches. Very good, now you understand the action of pushing. And finally, our third word today is “come.” Each of you arrived at school this morning. You come here each day. Someone might ask you to come over to play after school.

T: Let’s take a look at the book. As I flip through the first few pages, what do you notice that’s different about this book. Look at the holes in the pages and the different sizes of the pages. Here on page 6, what do you think the caterpillar is doing? Remember to look at the pictures for clues. Caterpillars can touch, taste, smell, and see just like we can. They have tiny antennae which sense smell. They eat at night and during the day and have three pair of legs. They can even change colors!

T: Now I will begin reading the story to you, stopping along the way to tell you what I am thinking about while I read aloud the book. So let’s begin.

T: On Monday, he ate through 1 apple but he was still hungry! (I can relate; eating just one apple would leave me still hungry too!). On Tuesday, he ate through 2 pears but he was still hungry! (Hmm, this caterpillar sure does like fruit. I wonder if he didn’t eat dinner on Sunday night and that’s why he is so hungry on Monday and Tuesday. Show me how you lay down for a rest). On Wednesday, he ate through 3 plums but he was still hungry! (OK, 3 plums seem actually less than 2 pears in size so that’s not too odd to see. But I think he should eat other foods to balance out his diet. I wonder if caterpillars eat chicken and veggies like we do. I am also noticing a pattern that the caterpillar eats one more fruit per day than the previous day. I bet he will eat four peaches next. I wonder when he will get full too! Can you nibble like the caterpillar?) . . .

T: Now that we have finished the wonderful book – The Very Hungry Caterpillar, what action words describe what that caterpillar is doing? Can you think of another way to say that?)

T: Now let’s talk about the science words on page 8, what season of the year is it in the picture? How can you tell? What season is next? Finally, let’s compare the foods that the caterpillar ate to see which ones are healthy: apple, pear, plum, strawberry, orange, chocolate cake, ice-cream

cone, pickle, Swiss cheese, salami, lollipop, cherry pie, sausage, cupcake, watermelon, and green leaf. I know all of these may have sounded tasty to you but as we go through them, let’s put a “check” next to the healthy ones and an “x” next to those that are not healthy foods.

The control group received regular instruction according to the district curriculum adoption; these science lessons are designed to be 20 minutes long, five days a week. The topics taught were energy, magnets, motion, and location.

Data Collection and Analysis

The pre-test and post-test consisted of six questions that were taken from CSCOPE. The questions were modified to be answered orally. The questions for the pre and post test have construct validity from their derived origin within the CSCOPE curriculum. Teacher observations were recorded for duration of study to provide an extension of quantitative data results.

At the end of the five weeks, the post-test questions were given to each student orally to measure the growth, if any, from the pretest. Data from group A and group B were then compared using an unpaired t-test to see if there was a statistical significance, and a Cohen’s d effect size was calculated to measure the effect of the comprehension intervention.

Results

The aim of the study was to determine the effect of using an explicit think-aloud approach to aid in comprehension development of kindergartens in the science classroom. Results indicate that among the kindergartens at an elementary, Title I school in South Texas participating in the study (n = 36), there was a statistically significant difference between the gains in the two classes, class A (M = 4.06, SD = 1.56) and class B (M = 2.63, SD = 1.57), $t(34) = 2.74, p \leq .05, CI.95 .37, 2.49$. Therefore, the null hypothesis is rejected that there is no difference in comprehension scores between kindergarten students. Further, Cohen’s effect size value (d = .41) suggested a moderate to high practical significance.

Discussion

This study examined the effectiveness of using a think aloud to develop oral reading comprehension in a kindergarten classroom. The primary purpose was to examine if students receiving the intervention would experience greater comprehension of the subjects being taught than students who did not receive this treatment. The data showed that there was a statistical difference between the control group and the experimental group. The students in the control group gained 2.5 questions correct on average compared to the experimental group which had an average gain of 4 questions from the pre to post test (see Table 1).

Table 1
Mean of improvement by groups.

| Instructional Group | Mean of Pre-test | Mean of Post-test | Mean Gain of Improvement | SD |
|---------------------|------------------|-------------------|--------------------------|------|
| Group A | 1.06 | 5.48 | 4.06 | 1.56 |
| Group B | 1.05 | 3.68 | 2.63 | 1.57 |

Students obtained higher gains on comprehension in the experimental group than students who did not receive the treatment. The results show that there was an educationally meaningful difference between the two classes involved in the study. The findings suggest that students have a higher comprehension of subjects taught when they are involved in extra instruction such as think-alouds than students who just received the daily CSCOPE curriculum. From teacher observations, students appeared engaged more than usual during the think-aloud sessions rather than when taught strictly by CSCOPE. They were also more aware of the nonfiction texts and were eager to listen to the books. Students often asked to look at the nonfiction texts during their free time.

The present study suggests that young children’s performance, when involved in think-alouds is important for their comprehension of text, stated by Davidson, Vogel, and Coffman (1997). The results of this study shed light on the usage of the think-aloud strategy during read aloud sessions.

Limitations

Results of the present study should be interpreted with consideration of the following limitations. Factors such as the small sample size and the group studied were a sample of convenience. There was not a random sample of populations, which can limit the ability to generalize the intervention effects found in the current study. The 15 minutes of additional instruction time three days per week allocated to read alouds may have factored into increased success of experimental group’s increases in reading comprehension of scientific concepts. More studies in a diverse population needs to be performed in order to generalize the findings.

Implications

The findings of this study suggest that elementary teachers can better support their students’ reading comprehension in science with the direct instruction using think alouds. Due to the lack of research in the area of supplemental uses with think-alouds, there are many other areas that should be explored. The current study focuses on one area of comprehension – science. This study could be replicated for different content areas to help increase comprehension in other subjects.

This current study was done during whole group

study for 15 minutes a day, three times a week for five weeks. It is unclear how much additional time is needed to optimize the best outcome for students. This study was completed as a supplemental approach, and not as a small group intervention. It is unknown how this would provide additional support for students if implemented in small groups or even one on one.

Further Study

For further research, this study should be replicated in an older grade within the same content area (science). This would provide research as to what age groups the comprehension strategy of a think-aloud would support. More studies could be conducted if the content is only taught through think-alouds, if teachers were not limited in their guided curriculum. Researchers could determine if the implementation of think-alouds could provide enough context support that teachers could use to fully support their teaching strategies. A replication of this study using a larger sample size and a longer duration time of study would provide the context for greater generalizability.

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Author Notes

Evan Ortlieb, Ph.D.
Texas A&M University – Corpus Christi
College of Education
Early Childhood Development Center 219H
6300 Ocean Drive Unit 5834
Corpus Christi, Texas 78412-5834
(361) 825-3661 Fax (361) 825-2562
evan.ortlieb@tamucc.edu

Dr. Evan Ortlieb is the undergraduate reading program coordinator and an assistant professor at Texas A&M University – Corpus Christi, where he teaches undergraduate and graduate courses in elementary reading and literacy research. His scholarship focuses on struggling readers and remediating reading difficulties in elementary learners. He is also very interested in literacy clinics and preservice teacher education. Most recently, he has begun publication of an international book series entitled Literacy Research, Practice, and Evaluation.

Megan Norris
Texas A&M University – Corpus Christi
College of Education
Early Childhood Development Center
6300 Ocean Drive Unit 5834
Corpus Christi, Texas 78412-5834
(361) 825-3661 Fax (361) 825-2562
mnorris@islander.tamucc.edu

Megan Norris is a kindergarten teacher in the Corpus Christi, Texas area, where she focuses her research efforts of reading improvement and comprehension development in the content areas.



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Mary Lou Fulton Teachers College • Arizona State University
PO Box 37100, Phoenix, AZ 85069, USA

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