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Scaffolds for Content Literacy

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As pumpkins ripen lazily outdoors during the last warm days of September, several small groups of third graders are actively planting bean seeds indoors. One group gathers around the tray of supplies and begins to examine the hard cover of the tan-colored seeds that will serve as the stimulus for this inquiry-base life science unit.

S1: [Rakes fingers through several seeds]; can you believe these will grow into tall trees?

S2: Yeah, suppose they grow into trees that touch the sky?

S3: Beans grow on vines…people. I know 'cause we planted beans in our yard this summer and they didn't touch the sky. [Holds up one seed for closer inspection] Crunchy beans are in this seed…see how smooth it is?

S4: [Nods head in affirmative manner] Yeah…those tall trees on the poster came from seeds like this one, [gestures at plant poster on bulletin board as he turns seed over in his hand].

[Short pause before continuing), I wonder if we plant some in store-bought soil…do you think they'll grow big and ummm…if we plant some in soil from the yard…they'll grow small?

Sherrie: [Second author and classroom teacher] Wow! Good question. So, are you saying that perhaps the quality of soil plays a role in the growth of a plant?

S4: [Bobs head up and down in quick succession while surveying the tray of supplies] Hey, you forgot to put soil out.Sherrie: We're not using soil…we're planting our bean seeds in water.

S4: [Head jerks back and mouth falls open] In water?

Inquiry into authentic questions generated from student experiences is central to science teaching and learning (NSTA, www.nsta.org/about/positions/beyond2000.aspx). The above vignette shows that, without any teacher prompts, the students are trying to make sense of their experiences based on the materials in front of them. The thought expressed by S1, stimulated S3 to activate what she already knew about planting bean seeds. Also, in his conversation, S4 implied that perhaps different soil types may promote the growth of plants and appears confused at the thought of growing plants in water.

Inquiry-based experience is good teaching practice, as many teachers believe that naturally occurring student questions, such as the one expressed by S4 can serve as discussion points during current instructional lessons regardless of the subject being taught. Inquiry-based experience occurs when teachers provide specific contexts or relevant manipulative materials for students to examine, explore, and investigate and corresponds to a specific topic under study. Advocates believe that implementing these stimulating tasks before reading can motivate students to become active participants in learning events (Guthrie, McRae, & Klauda, 2007; Harvey, & Daniels, 2009).

Further, literacy integration in content areas such as science has numerous benefits, for example, many students do not learn in meaningful ways with hands-on-only experience or text-only experience; therefore, one ideal entryway to meet different needs is to use a combined approach (Wigfield, Guthrie, Perencevich, Taboada, Klauda, McRae, & Barbosa, 2008). This collective method combines hands-on experience with text experience. Hands-on experience prompts students to evoke all of their senses for richer learning, while text experience provides a meaningful context for literacy opportunities. Palincsar and Magnusson (2001) have indicated that research on ways teachers implement this combined approach is limited, and some (Guthrie, Wigfield, Humenick, Perencevich, Taboada, & Barbosa, 2006) have clearly stated that more attention must focus on the use of stimulating tasks that can arouse student's curiosity prior to or during instruction.

This article focuses on how Sherrie utilized a modified version of the Scaffolded Reading Experience (Graves, Juel, Graves, & Dewitz, 2011) as an instructional approach to provide scaffolds and support for students using supplemental science texts. We discuss a family of evidence-based comprehension strategies implemented to help third graders increase their reading abilities while building scientific knowledge as they explored the life cycle of plants. Sherrie's primary goal was to develop students' reading comprehension and meet

science standards regarding needs and functions of plants.

Comprehension

Comprehension is the engine that drives the reading process. Reading comprehension is defined as "…the process of simultaneously extracting and constructing meaning through interaction and involvement with the written language" (RAND Reading Study Group, 2002). Good reading comprehension often requires knowledge about the world (Duke & Pearson, 2002). Real-life experiences with inquiry-based projects can promote students' ability to better comprehend what they read (Hapgood & Palincsar, 2007). Comprehension strategies can be explicitly and successfully taught during the primary grades (Duke and Bennett-Armistead, 2003) and through cross-curricular integration (Hapgood & Palincsar, 2007).

Researchers (Duke & Pearson, 2002; Harvey & Daniels, 2009; Mckee & Ogle, 2005) have discussed several effective comprehension strategies that enable successful reading of informational texts. These cognitive processes include: activating prior knowledge by making connections; predicting and inferring; generating and answering questions; developing content area vocabulary; and summarizing. Additionally, text structure awareness is crucial, as it increases understanding of how text information is organized (Vacca, Vacca, & Mraz, 2011). Many of the techniques utilized in reading instruction can also be used during the teaching of science since these subjects share similar cognitive and metacognitive processes, as well as cross-curricular connections (Hapgood & Palincsar, 2007). Therefore, one powerful way to increase students' reading comprehension and develop science knowledge is through cross-curricular integration.

Good Practice

Educational researchers and practitioners have advocated that integrating literacy strategies during content area instruction makes sense since it can significantly increase students' comprehension of texts (Barclay, Benelli, & Schoon, 1999; Hapgood & Palincsar, 2007; Kragler, Walker, & Martin, 2005; Moss, 2005; Neufeld, 2005; Morrow, Pressley, Smith, & Smith, 1997; Reutzel, Smith, & Fawson, 2005; Williams, Stafford, Lauer, Hall, & Pollini, 2009). Content area literacy goes beyond learning from textbooks; it refers to all "forms that today's texts can take, whether textbook or trade book, e-mail, electronic messaging, or Internet sites," (Moss, 2005, p. 48). Content literacy is "the ability to use reading, writing, talking, listening, and viewing to learn subject matter in a given discipline…involves the use of research-based cognitive learning strategies designed to support reading, writing, thinking, and learning with text," (Vacca et al., 2011, p. 13).

Instruction in content literacy beginning in the early grades is especially important as the recently released Common Core State Standards in English Language Arts (Common Core State Standards Initiative, June 2010) recommend literacy integration in content area courses, such as history, social studies, science, mathematics, and other technical subjects. The Common Core State Standards were established to ensure that K-12 students are highly proficient in literacy for college and career success by the end of high school. Additionally, the emphasis on state and national standardized assessments and technological tools have increased the need for students to become more proficient in understanding, analyzing, synthesizing, and evaluating various types of nonfiction such as informational texts.

Informational text is text that provides information about the natural or social world and contains specific text features and specialized vocabulary to achieve that purpose (Duke, 2004). The rich descriptions, examples, and illustrations of this type of text offers students many different opportunities to make sense of information, compared to textbooks (Labbo, 1998). All teachers integrate nonfiction in their instructional practice, and this often includes supplemental informational texts. Saul and Dieckman (2005) proposed including supplemental trade books for read alouds, independent reading, and as a springboard for activities that enable the development of content literacy. Science trade books offer numerous benefits to engage students in content area literacy instruction; they present material in a more interesting manner compared to textbooks, and often share information that is absent from textbooks. According to Schussler, Link-Perez, Weber, and Dollo (2010), elementary students know less about plants than they do animals because classroom textbooks commonly provide greater coverage on animals; therefore, trade books on plants were specifically selected for this inquiry.

Because of accountability pressure to improve standardized-test performance, it is critical for elementary students to learn to read and discuss nonfiction, including informational text in order to develop an understanding of this genre very early

in their education (Duke & Bennett-Armistead, 2003). Using supplemental informational texts during inquiry-based science instruction supports students' literacy development and scientific knowledge. Thus, one way to improve students' performance and test results is "by incorporating reading comprehension skills and strategies into science instruction," (Kinniburgh & Shaw, 2009, p. 20).

Many (Baker, 2004; Barclay et al., 1999; Connor et al., 2010; Duschl, Schweingruber, & Shouse, 2007; Girod & Twyman, 2009; Hapgood & Palinscar, 2007) have argued that for a variety of reasons, it makes sense to integrate literacy and science. Girod and Twyman (2009) concurred. Their study compared two high-quality science-based curricula: one science-based and the other a blend of science and literacy. They discovered that second graders taught the blended program outperformed their peers who used the science-only curriculum. Factors responsible for these results were directly related to the literacy components implemented which included summary of ideas presented across texts and questioning and critiquing the texts. This study reaffirms the idea that literacy is an integral part of inquiry-based learning.

Inquiry-based engagement: Gaining students' attention by engaging them in hands-on activities is an important step in establishing an atmosphere that supports active learning. Proponents of inquiry-based engagement (Hidi and Harackiewicz, 2000) have stated that certain conditions or stimuli present in the learning environment can encourage average and less reluctant learners to participate more meaningfully in content area tasks, thereby fostering academic gains. Science activities consistently evoke students' interest; therefore, teachers can capitalize on this to propel students' learning. Young children are naturally curious about the natural world, and this innate fascination with *how and why things work* provides a rich context for hands-on exploration to ease understanding of complex phenomena. In the third-grade classroom, the motivational context was the life cycle of plants using the hydroponics method. Hydroponics is the process of growing plants in water. This technique allows plants to grow more quickly in small areas by adding a nutrient solution to the water. This hands-on engagement activity seemed to heighten the third graders senses and prepared them for reading and writing activities.

Inquiry-based science lessons can build content area knowledge and literacy skills (Duschl et al., 2007). It is problem-based, question-driven, and

encourages active, collaborative learning (Harvey & Daniels, 2009). Inquiry-based science instruction should provide students with a wealth of reading and manipulative material that seek to stimulate their curiosity, generate interest to learn more, and encourage investigation through engagement and teacher scaffolds (National Research Council, 1996). Connor, Rice, Canto, Southerland, Underwood, Kaya, Fishman & Morrison (in press).found that second-grade students with multiple opportunities to engage in teacher scaffold science instruction showed stronger gains in learning content vocabulary compared to students whose teachers provided fewer scaffolds and opportunities. Additionally, teacher scaffold of science instruction enormously benefited third graders with weak content knowledge (Connor et al., in press).

Scaffolds: Teacher scaffolded instruction is a powerful technique that can foster students' comprehension. Wood, Bruner, and Ross (1976, p. 90), described scaffolding as a "process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts." Pearson noted that scaffolding allows teachers to "to intervene in an environment and provide the cueing, questioning, coaching, corroboration, and plain old information needed to allow students to complete a task before they are able to complete it independently" (1996, p. 273). Scaffolding relates to the gradual release of responsibility model, a 3-phase instructional support system. In this model, the teacher first assumes most of the responsibility by modeling and explaining a specific skill or strategy. Then the teacher and the students assume joint responsibility as the skill or strategy is applied and practiced, and finally the students assume all or nearly all of the responsibility to independently apply the skill or strategy (Clark & Graves, 2005; Duke & Pearson, 2002). Over time, as students gain proficiency, the scaffolds or supports are gradually removed. Thus, for purposes of this project, scaffolding includes Sherrie's questioning, coaching, modeling, and other teacher talk that enabled the students to grasp text understanding they otherwise may not accomplish alone.

Scaffolding is rooted in social constructivist views of learning which posits the theory that learning is a social activity and through interacting with others, students learn to make meaning of their environment and construct new understandings (Vygotsky, 1978). According to Vygotsky (1978) students' thinking and learning develops first on a social plane, that is, through interaction with others before becoming internalized. Initially, a more capable individual, such as a teacher, must model, support, and assist students with a new or difficult task, thereby guiding them to more successful attempts in accomplishing the task. Then gradually and with practice, students acquire and internalize the skills and knowledge, and eventually perform these operations with little or no support. These assisted interactions align with the Scaffolded Reading Experience (SRE), where teachers and/or peers act as models and facilitators.

Modified Scaffolded Reading Experience

Literacy researchers have created several frameworks to stimulate students' active involvement and understanding of texts. Of these, the SRE was selected because of its flexibility in meeting a wide variety of students' comprehension needs. The SRE advocates the teaching of several activities during three different phases of reading, *before-during-after*, and when implemented as needed, can have a dynamic effect on students' reading comprehension. Robb (2003) believes that a good approach for literacy instruction during science must include strategies students can implement before, during, and after the reading. In this project, Sherrie used a modified SRE since it was the beginning of the school year for these third graders and they were all at different reading levels. The modified SRE allowed flexibility for reminding students about strategies they know and use, teacher explanations and modeling of the strategies, and transference of the strategies for students' independent practice.

The following section explains how Sherrie used the modified SRE approach to teach a family of related reading strategies to support students' understanding of plants. This experience required extended planning time and occurred across 8 weeks. Additionally, the books used were supplied to students as class sets; therefore, each student had an individual copy. Using specific examples across time, we share the strategies with supporting evidence; provide snippets of teacher explanation and modeling, collaborative use of the strategy; and independent student use of the strategy.

Set a Purpose

Teaching students to set a purpose before reading will better help them to focus on particular aspects of the text, and perhaps this can make the reading process less difficult for many of them. It can also

create anticipation and enthusiasm for information to be read (Graves et al., 2011).

Before: At the onset of the plant unit,

Sherrie: Boys and girls, as we learn about the life cycle of living things, I am going to remind you of a few strategies that good readers use when they read. One thing good readers do before they read something is set a purpose, which means that they think of a reason for why they should read the book. Setting a purpose can help you become better readers. It is a way to help you focus on what you need to learn. When you pick up a book or a magazine or a newspaper, you should always set a purpose for reading. You can ask yourself questions, such as: Why am I reading this book? What do I want to learn? What do I need to look for as I read? How can this information help me?

Today, I want to show you one way good readers set a purpose for reading. They use what we call an Anticipation Guide. [Sherrie passes out copies] The purpose for an Anticipation Guide is for you to think about what you're going to read and at the same time try to remember what you already know. We're going to read a book called, *The Vegetables We Eat* (Gibbons, 2007) and find out more about vegetables, like the beans we planted. But before we do that, I want you to think about what you know about vegetables. Do you eat vegetables? What vegetables do you like best? Do you help your parents select vegetables at the supermarket? Do you help your parents to plant vegetables in the summer? Do these vegetables grow above the soil or below the soil? I want you to turn and talk to your neighbor on what you know about vegetables.

During: Sherrie allowed students to talk for three minutes before calling their attention back to her; directing students' attention to the Anticipation Guide.

Sherrie: We're going to read each of these statements, and on the first line you're going to write the word Agree or Disagree based on what you already know or think you know about vegetables. Listen as I read the first statement to you, *Vegetables are plant parts*. On the left line write Agree or Disagree based on what you know about vegetables. Later, if you change your mind, you can write your revision on the second line.

Upon completion of the other five statements and with the book under the Elmo Projector, Sherrie asked the students to follow along as she read aloud from *The Vegetables We Eat*. She reminded students to listen carefully and change their responses if necessary. In a child-friendly format of colorful realistic illustrations and informative text, this book distinguishes the eight categories of vegetables: leaf, bulb, flower bud, root, tuber, stem, fruit, and seed.

After: With a partner, each student practiced setting a purpose with one of the book sets, *Plants!* As we monitored the groups, we noticed them asking and answering questions and sharing with one another what they already know about plants.

Intermediate grade students can learn to set their own purposes for reading when teachers model techniques, such as the Anticipation Guide. According to Vacca et al. (2011), the Anticipation Guide helps to create eagerness for learning and is composed of several declarative statements that students must answer individually before reading the text as this sets the stage for active reading and discussion of the topic being studied.

Activate Prior Knowledge

The schema or prior knowledge students bring to a reading situation has the potential to greatly influence the dynamics of their learning. Researchers agree that prior knowledge facilitates one's understanding of texts (Adams & Collins, 1977). When reading, students bring an array of prior knowledge, information, and experiences that serve to influence the way they make meaning of a situation or a text (Adams & Collins, 1977). However, all students do not activate their prior knowledge and integrate with new information to link connections; therefore, it is important for teachers to show students how to use this technique.

There are three types of connections students can make related to prior knowledge: text-to-self connections, text-to-text connections, and text-to-world connections. Students can make text-to-self connections when they link the target text or event and relate it to some personal experience, prior knowledge, or understanding. For example, in the opening vignette, S3 informed her peers that beans do not grow on trees, but on vines because her family had grown some in their backyard earlier in the year. Text-to-text connections examine the relationship between the current text and relate it to texts read in the past. For example, after participating in the hydroponics experiment, watching a video clip of the time lapse of a bean plant, and reading the book *Flowers* (Bodach, 2007), students learned that plants need flowers because flowers are the plant part that makes seeds and fruit. Finally, text-to-world connections require relating certain aspects of the text to what is happening or what has happened in the larger community or world.

Before: To enable students to access their prior knowledge and make connections with new information, Sherri asked the students to consider what they already know about plants and what else they wanted to find out.

Sherrie: Remember, boys and girls, we've been talking about what good readers do to help them better understand what they read. When studying a topic, good readers think about what they already know about the topic. So today, I want you to think a little more about what you know about plants. I'm passing out small sticky notes, and I want you to write two things, one on each note based on what you already know about plants and what you want to find out.

After a few minutes, Sherrie asked the students to place the sticky notes on the white board, then stand back and read what everyone had written. As students read the notes, Sherrie encouraged them to identify and talk about the similarities among their responses. Sherrie read aloud the list of student-generated words and ideas, which allowed everyone to hear what was shared. She then asked the students to try to group the notes based on something that was specific to them. For example, she removed the following notes: apples, peaches, blueberry, bananas, watermelon, and cherry and placed this small cluster in one corner of the whiteboard.

Sherrie: What are the same about all of these things?

S1: They're fruits.

Sherrie: [Sherri writes the word *Fruits* above this category.] Good. Now, you group the other words.

Individually and in pairs, students arranged and rearranged the notes in small groups. After notes were grouped in individual clusters, Sherrie asked the students to think of a label that would best identify each group. And with her help, the students created labels for each of the six clusters.

During: After returning to their seats, Sherrie handed out more sticky notes and asked the students to listen for new information about plants as she read the book *Be a Friend to Trees.*

Sherrie: As you hear something new…something that you don't already know, write it down on your sticky notes, and we will put it on our map.

After: As she read a section of the book, students wrote on their sticky notes. At several points during the reading, Sherrie paused to allow students time to write.

Sherrie: As you read the book with your partner, keep looking for other information we don't already have, and we'll add it to our map. You can also talk about other important things about plants you know that's not in the book or on our map, and I will come around and check to see how you're doing. Remember to write your ideas on sticky notes.

Called List-Group-Label, this activity was developed by Hilda Taba (cited in Vacca, Vacca, & Mraz, 2011) and serves as an extension to brainstorming. It entices students to generate a list of words, group the words into a logical order, and create labels for each of the clusters. This activity not only required active listening of the teacher read aloud, but encouraged collaboration between the students as many contributed numerous ideas.

Text Specific Knowledge

Duke and Pearson (2002) noted that text features and text structures enable the understanding of important ideas and can increase recall of specific material. Text features are organizational aids that help to facilitate reading and consist of text elements such as, bold and italized words, headings, illustrations, graphs, a table of contents, glossary, and other similar features. Text structure shows the organization among ideas, and knowing how a text is organized can provide clues to make interrelated connections. When students can see relationships among concepts and ideas, they can better capture meaning and essential ideas of the text (Vacca et al., 2011). These text specific knowledge features help readers to locate information by maneuvering around the text in a recursive manner. The following scenario provides a snapshot of how Sherrie introduced students to text features and text structures.

Before: Sherrie holds a hard copy of the Yellow Pages,

Sherrie: What is this?

S1: The book my baby sister sits on at the dining table.

Sherrie: Yes, it's so big, it can be used to give her added height, …but what is the purpose of this book?

No responses.

Sherrie: Have you seen this book before?

Lots of nods.

Sherrie: It's a telephone directory. Have you seen Mom or Dad use this book?

More nods.

S2: My Mom used it to find the pizza place.

Sherrie: Yes, we can use it to locate information we need, such as finding the address or telephone number of the pizza place [holds book up with both hands and dramatizes], but look at the size of it… look at all these pages. How can I possibly find what I need?

No responses.

Sherrie: Well, boys and girls, this book is organized in ABC or alphabetical order. So if I want to find places that sell pizza, I would not start by reading page one; that would make no sense. Instead, I would look at the index under the letter "p" for pizza and this will give me the information I need.

[Sherrie scanned the index section, located places selling pizza, and showed it to students].

Sherrie: The telephone directory is an informational book, and most informational books contain certain features, like words written in bold letters that mean "Hey, pay attention to me!'

Brief pause as she continues to scan book.

Sherrie: Or you might see a table of contents or a glossary. Have you seen some of what I'm talking about in the books we're reading?

Lots of nods.

Sherrie: Well, this is another way authors help us to understand what we read, and good readers always pay attention to these features. Here, let me show you.

Sherrie opens book *Life Cycle of a Bean* and shows Content page.

Sherrie: Remember we said there's a reason for everything? Well, if we want to find something specific, the table of contents can help us. So for example, if we want to know what a bean pod is or what it looks like, we can go to page 22 and find out. If we read that page and we still don't know what a pod is, then we can go to the Glossary, look up the word *pod*, and find the meaning. [Sherrie demonstrates.]

Sherrie: So with your partner, I want you to practice taking turns looking at these features in your book, [writes the word *pollination* and *pollen* on the white board].

Sherrie: Using the table of contents, I want you find the page about *pollination*, then go to the glossary

and read the meaning of the word *pollen*. Put a sticky note on both of these pages, and I'll come around and check. I do not want you looking through the entire book, just focus on what I'm asking you to do, [checks students' work and gives praise].

Sherrie: Okay boys and girls, I have something else I want to show you on how authors organize books. If a book is organized a certain way, it can help us understand and remember the information, [holds up a copy of *Life Cycle of a Bean*].

Sherrie: This book is organized in a sequence. A sequence is when one thing comes before another, which comes before another, and so on. In this book, the sequence tells the order in which the bean seed becomes a plant. Before I read the book, I want you to look at the sentence strips in front of you. They are mixed up right now, but with your partner, I want you to try and organize them in the order you think they should be in. Organize the strips in a sequence to show what stage of the bean plant comes first, then second, and so on.

[Pause].

Sherrie: The first sentence strip should be: *The bean seed is planted in the soil with other bean seeds.* Raise your hand if you need help, and we'll come over and help you.

During: Students work in small groups to place the sentence strips in sequential order.

Sherrie: Now as I read the book, I want you to carefully listen to see if your strips are in the correct order; if not, I want you to reorder them. If you don't get it quite right, that's fine; we will continue practicing this with some other books."

After: Each student was given a paper with sentences out of sequence. They were asked to cut apart and order in sequence without the help of their partners.

Teaching text structures to elementary students can be a difficult task; however, focusing on one specific type of structure that is relevant to the type of books being used seems like an ideal way to teach this element. Read, Reutzel, and Fawson (2008) provides a thorough discussion with concrete examples and titles of books most suited for teaching a particular type of text structure.

Predict and Infer

Generating expectations of what might happen next and predicting what can happen in alternative scenarios are powerful influences on how students create meaning when reading or listening to others (Anderson, Wilkinson, & Mason, 1991). When students predict, they apply prior knowledge and develop hypotheses and later test these to confirm or reject their predictions. Further, generating expectations and predictions allow students to anticipate upcoming information, integrate text knowledge with prior knowledge, and monitor for understanding (Palincsar & Brown, 1984).

Before: The following example demonstrates Sherrie's verbal scaffolding of the predicting strategy using the cover illustration of *Hungry Plants,* a book that provides information about several types of insect-eating plants.

Sherrie: Boys and girls, when good readers read a book or a magazine or a newspaper, they always make predictions. To predict means to make a best guess about what something might be about or what will happen next, and this is a way to help us focus on the information we are reading. Today, I will show you how to become a better reader by making predictions. [Direct students to carefully examine the cover of the book *Hungry Plant*.]

Sherrie: The title of this book is *Hungry Plants*, but before I read it, I'm going to ask myself what this book might be about before I even open it. Looking at the title, I'm thinking that perhaps it's about food for plants. I'm also using the illustration on the cover to help me think. As I look more closely, I can see a picture of a plant. Some of the leaves are open and some are closed. Based on my experience with plants, the leaves are always open, so I wonder why some of the leaves on this plant are closed. I also notice that the inside of the leaves are mostly reddish-orange. So, help me remember what we learned about colorful flowers and leaves. Why do some plants have such brightly colored flowers and leaves?

S5: Bugs like the color.

Sherrie: Yes, insects are attracted to the bright colors of flowers and leaves. There are three insects in this picture, a fly and two bees. I notice that one bee is partially trapped in this closed leaf. So based on what I've told you about my observation of this illustration, what do you think this book might be about?

S6: Plants that trap bugs … the bee flies to the red leaf.

S7: Yeah, the bee flies in to look at the leaf, but the leaf traps the bee and pokes it with the prickles.

S5: I wonder if the bee will get away?

Sherrie: That's a good question. What do you predict will happen?

S5: The fly will touch the leaf; it will open, and the bee will fly away.

Sherrie: That's a good guess, but at this point, we're unsure. So follow along in your copy as I read the first chapter to find out if your prediction is right or not.

[Upon completion of chapter one.]

Sherrie: So even though plants don't have claws and teeth, they can still trap insects for food. What's your best guess about other ways plants trap insects for food?

S8: Maybe that sticky stuff, like glue can trap them.

Sherrie: So tree sap might be one way; that's a very good guess.

During:
Sherrie: I'm curious to find out what other tricks and traps plants use to catch insects, so I'm predicting that in the next chapter, we're going to learn other ways plants trap insects for food.

Sherrie: Right now, I want you to partner read chapters 2 and 3. As you read, I want you to make predictions of what might happen next, so stop after every 2 pages and take turns making predictions. [Students partner read, pausing to make predictions].

After:
Sherrie: Today, we worked on making predictions. I shared an example with you, we worked through one together, and as I walked around, I heard you and your partner making predictions. So now, it's time for you to practice making predictions on your own. You're going to read chapters 3 and 4 silently, and as you read, I want you to stop after every 2 pages and make a prediction of what might happen next. Write your prediction on a sticky note, place it on that page and continue reading to see if your prediction is right or not.

Teaching students to predict and infer enables them to set a purpose for reading. Asking students to think, wonder, and predict encourages active engagement with the text and helps them to generate expectations about upcoming information (Duke & Pearson, 2002; Graves et al., 2011).

Question

Teaching students to monitor their understanding by generating and answering questions is an important strategy in making meaning of texts. Asking and answering questions that involve deeper levels of thinking has been shown to be a form of knowledge construction (Chan, Burtis, Scardamalia, & Bereiter, 1992; Graves et al., 2011). Questioning as a technique to enhance learning has received wide acclaim in the educational community. The research claims that students can increase and monitor their understanding when they integrate text information with prior knowledge through text-based and knowledge-based questioning and wondering and also by questioning the text.

Before: The example below shows one way that Sherrie taught students to question the text.

Sherrie: Today, I want to share with you another strategy good readers use, and it's something we all do every day. We ask questions. We ask questions when we want something. We ask questions when we are confused about something. We ask questions to find out what someone else thinks about something. And when reading, we also ask questions about what the author is telling us. We may want to ask questions about a word or an idea. Some questions we ask might be right there in the book we're reading; other questions may require us to think about what we already know and see how it connects to what the author is telling us (Au & Raphael, 2005). Asking ourselves questions about what we're reading is very important to helping us learn.

During:
Sherrie: Let's take a look back at Chapter One of *Hungry Plants*, because I have a question. [Sherrie reads from book]

> Everything is quiet in the bog. Or *almost* everything. A tiny black fly buzzes around, looking for food. All of a sudden, it smells nectar, a sugary juice that plants make. The sweet smell is coming from a strange plant growing flat against the ground. The fly lands near the plant and crawls toward a leaf. Closer, closer, closer. SNAP! The leaf slams shut, squishing the fly between two green walls. The fly tries to get out but can't. The fly will never escape. This plant will eat it alive! (Batten, 1997, p. 5-7).

Sherrie: My question is, why did the fly crawl towards the leaf and not to the stem?

S1: It smells the juice.

Sherrie: Maybe the nectar is there, but what else?

S2: Maybe it knows that's where the food is.

Sherrie: Okay, good; so why do you think the leaf of this plant gives off the sweet smell?

S2: That's where the nectar is and when the fly goes to take a drink, the leaf snaps shut.

Sherrie: Good. We know this is an insect-eating plant, and it seems that the leaves give off a sweet smell to attract the fly in order to trap it for food. And remember, the author tells us that this plant grows flat against the ground; so why is it important for the author to give us this piece of information?

S3: To let us know where it grows.

Sherrie: Okay, so if it grows flat against the ground, would it get as much sunlight as the taller plants growing around it?

S3: No.

Sherrie: So think back about our discussion from last week about the purpose of leaves. What's their job?

S1: They make food for the plant.

Sherrie: So the leaves of this low-growing plant probably get little sunlight to make food, so it traps the fly to make food for the plant. And as we learn later in this chapter, plants that eat insects grow in poor soil.

After: On chart paper, Sherrie wrote and asked students to perform the following:

1. Silently reread chapters 1, 2, and 3.
2. After reading every 2 pages, stop and ask yourself a question about the information you've read. Write your questions on the sticky notes.
3. Ask questions such as:
   A) What types of plants eat insects?
   B) How do the plants trick and trap the insects?
   C) What do you think might happen if these plants cannot find insects to eat?
4. Small group discussions: You will meet in small groups to share your questions and responses with other group members.

Questioning as a way to build higher levels of learning is strongly supported by research. Teaching students to generate and answer different types of questions is a valuable technique since it can probe for deeper levels to thinking and increase overall comprehension of text (Au & Raphael, 2005; Graves et al., 2011; Vacca et al., 2011).

Clarify

Researchers (Graves et al., 2011; Vacca et al., 2011) believe that understanding is enhanced when readers monitor their thinking as their progress through a piece of text. Therefore, clarification of text is good practice as it forces readers to be aware of their comprehension as they are reading.

Before: In the following scenario, Sherrie tells students how to clarify text ideas and words to obtain meaning.

Sherrie: Boys and girls, today I want to introduce you to a strategy called clarifying. We all clarify information when we're talking to others; you do this every day. Have you ever asked someone a question and then find yourself confused by the answer they gave?

Nods.

Sherrie: So what do you do?

S5: We ask what they mean?

S6: We ask, what did you say?

Sherrie: Yes. We ask them to repeat what they said so we can better understand them. So to clarify means to go back and try to make sense of what they've said. This works the same when I'm reading a book. If I don't get what the author is saying, I sometimes stop and reread the part that's confusing, or I try to figure out the words I don't know by looking for clues around those words. As you read the book *How a Plant Grows*, I want you to stop and clarify ideas the author is sharing or words you don't know. So follow along in your books as I read the first few pages.

During: Sherrie reads page 6 of *How a Plant Grows* (Kalman, 1997).

> Parts of a plant. Green plants have three parts: a stem, roots, and leaves. Each part of the plant has important jobs to do. The stem holds up the leaves and flowers. It carries water and minerals from the roots to the leaves. Food made in the leaves travels down the stem to the roots. (p. 6)

Sherrie: Boys and girls, this is a lot of information the author is sharing, and I need to understand it. So, I'm going to pause and reread this paragraph that tells me the job of the stem. [Rereads paragraph aloud], I know the stem is a plant part and it holds up the leaves and flowers, but it also takes water

and minerals—that must mean other healthy things—from the roots to the leaves. So it must be getting these other healthy things from the soil. The stem also takes food made in the leaves to the roots. After clarifying this, I understand why the stem is important to the plant.

After: [Sherrie tapes a large sheet of chart paper on the wall and calls students' attention to it.]

Sherrie: Now I want you to browse through the book and look for words you don't know, I want you to write the words on this chart paper. [Students look through the book and write several words on the chart paper].

Sherrie: Let's look at one of the words you wrote, *germinate* [underlines the word]. Suppose I don't know how to say this word or what the word means; I can chunk it into parts I know, so *ger-mi-nate*. If I say it fast, then it sounds like *germinate* [emphasis]. But now I have to figure out the meaning, so I'm going to reread the part about germinate and look for a context clue to help me get the meaning [rereads the sentence]. So the author is saying that inside the seed, a tiny plant is waiting to grow or germinate. Now I realize that germinate must mean to grow. And as I read the next sentence, I learn that seeds will not sprout if they do not have the right amount of heat and water. Again the author gives me a clue, and I use this clue to figure out that the word germinate must mean to grow or to sprout.

Sherrie: Find your buddy, and partner read the rest of the book. Remember to pause and clarify what those words mean. You can figure out the meaning of these words by looking for clues or by asking if the words remind you of another word you know or you can ask your buddy.

The clarifying techniques Sherrie shared are developmentally appropriate for third graders. Monitoring understanding and knowing what to do when it breaks down is a key technique to enhancing knowledge. Rereading, slowing down, using context clues, looking for the prefix or suffix of the word, breaking the word into smaller or more familiar parts are all ways to clarify for meaning.

Summarize

Teaching students to summarize can promote their overall comprehension abilities. Summarization is a complex cognitive process that includes recalling main points with supporting details, ordering by importance, deleting irrelevant or redundant information, and using specific vocabulary to replace a list of items (Duke & Pearson, 2002). Teachers can improve elementary students' ability to summarize by demonstrating and requiring them to pause after every few pages and explain in two sentences what the author is saying.

Before: The following example shows one way Sherrie guided students in determining important information they learned after reading the book *Leaves* (Bodach, 2007).

Sherrie: I want us to look at another strategy good readers use when they read: they pause after reading a few pages and tell themselves about the main points they've read. We call this a summary. A summary is sharing a few important points about the story or book. You don't tell everything you've read, just a few main points. With your partner, I want you to read the book *Leaves*, and we will practice telling and writing a summary.

During:

Sherrie: I'm going to read pages 4-6 to you and pause to tell myself what the author wants me to know about leaves.

> Plants Need Leaves. Leaves grow from the stems of plants. Most leaves are green. Leaves make food for the whole plant. They use water, air, and sunlight to make the food. (Bodach, 2007)

Sherrie: I know we're studying the job of different plant parts, so I'm reading with this in mind. I think the author wants me to know that the job of leaves is to make food for the plant. So after reading these two pages, my summary is leaves make food for the plant. And as I read on, I will ask myself, what else does the author want me to know about leaves?

After:

Sherrie: Working with your partner, you're going to practice writing short summaries. I've provided you with a page to write the main points the author is sharing. After reading every 2 pages, you'll stop and tell your partner in one sentence, the main point the author is saying and write these down.

Elementary students can begin to learn how to summarize by partner reading a small chunk of text and sharing the main point. Providing students with a summary prompt as they begin to learn about summarization is helpful since it breaks the process into small, manageable parts. On this prompt (see Figure 1), students were required to list three things they learned about leaves, in addition to using their own words to explain how leaves help the plant.

Closing Thoughts

Science and literacy share strong interconnected knowledge links. Teacher scaffolded instruction during science lessons can support students' literacy development while building scientific knowledge. Requiring students to read multiple trade books can help them learn new science concepts; providing numerous opportunities to collaboratively practice new and known reading comprehension strategies can increase their meaning-making abilities. Thus, when planted early and nurtured regularly, content area literacy can bloom profusely.

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Ryan Cornelius was a student teacher in Wiedyk's classroom during this project.

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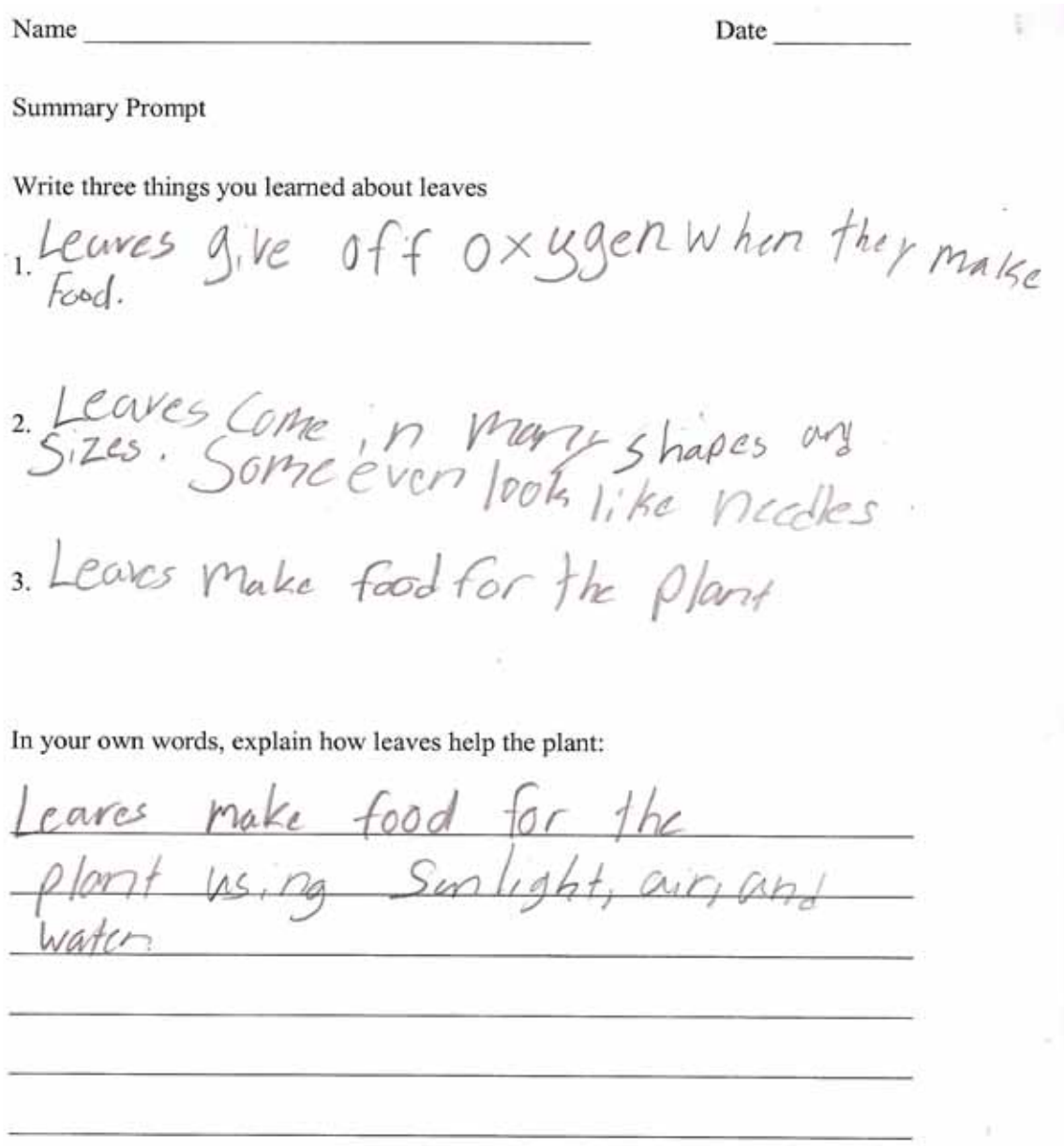
FIGURE 1



Name _____ Date _____

Summary Prompt

Write three things you learned about leaves

1. Leaves give off oxygen when they make food.

2. Leaves come in many shapes and sizes. Some even look like needles.

3. Leaves make food for the plant

In your own words, explain how leaves help the plant:

Leaves make food for the plant using sunlight, air, and water.

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