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Thesis

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MS in Mathematics, Science, and Technology Education

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### Literature Review

The literature review will explore the importance of developing literacy skills to improve reading comprehension. The literature suggests that without the appropriate tools, students are at a disadvantage for decoding, organizing, and synthesizing the information they read. The paper examines the use of expository texts with an emphasis on why these texts are difficult to comprehend. The literature suggests that reading strategies can help students develop their understanding of the text, which will lead to improved academic performance.

The literature review discusses the types of reading strategies: before-, during-, and after-reading strategies. The review provides an overview of the strategies, including an explanation of the purpose of using the strategy. The literature explains the appropriate methods for implementing the strategies, along with the goals for learning and reading comprehension. The literature review provides an in-depth analysis of three reading strategies that occur before, during, and after reading. The before-reading strategy discussed is the anticipation guide. The anticipation guide accesses the students' prior knowledge on the topic. The during-reading strategy is called a think-aloud, which requires students to verbalize their thoughts as they read. The after-reading strategy is a concept map, whereby students organize and connect information from the reading. For each strategy, the literature describes the strategy with specific examples, applications, and the overall effectiveness of the strategy.

#### *What is Literacy?*

A deficiency in developed reading and literacy skills compromises academic success (Kozen, Murray, & Windell, 2006). Literacy has typically meant the qualities of

being able to read and write. Recently, the meaning of literacy has evolved to emphasize the importance of students constructing meaning by taking on an active role in reading and writing (Bloome, 1986). Bloome explained that in the classroom environment, literacy takes on a more social context. A literate student can express their ideas to the community of learners in order to develop ideas and expand their understanding of the reading.

It is essential to teach students how to comprehend texts so they are able to communicate their thoughts effectively. Johnston (1985) stated that “the goal of comprehension instruction should be to improve readers’ *ability* to comprehend” (p. 635). The main purpose of instruction should be to improve the skills that students use to comprehend text. Students can then apply these skills to all the reading material that they encounter. Johnston acknowledged that when the students were provided with literacy strategies, they became more adept at learning through reading and responsible for their own learning.

Johnston (1985) described a strategy “as any systematic, goal-oriented behavior that can be generalized beyond the immediate task” (p. 636). In terms of literacy, a strategy provided a particular system for decoding the text with the ultimate goal of understanding the text. The literacy strategy should be general enough that it is applicable to many different types of texts. Johnston explained the importance for students to see the benefit of using a strategy by exploring the affect it has on their reading comprehension. Johnston concluded that if the students did not see how the strategy was benefiting them, the probability of them using the strategy in the future diminished.

*Expository Texts and Reading Comprehension*

Harris and Storr (2005) noted that as students advance through academia, expository texts gained a greater emphasis in the classroom. Expository texts are characterized by facts, details, and examples to provide information on various topics. Expository texts differ from narrative texts, which provide a more delineated path for interpreting the text. Harris and Storr explained that expository texts require students to negotiate numerous starting and stopping points, interpret graphs and charts, and scan the text for meaning.

Expository texts come in many forms such as generalization, compare and contrast, and enumeration (Montelongo, Berber-Jimenez, Hernandez, & Hosking, 2006). The general expository text form follows the format of presenting a main idea and offers supporting details to produce a convincing argument. An expository text that follows a compare and contrast format will impart parallels and disparities between two opposing topics. An enumeration text pattern provides information in the form of listing facts or ideas (Montelongo et al.).

Expository texts can be more difficult to comprehend due to the complexity of the concepts presented (Duffelmeyer, 1994). Harris and Storr (2005) expressed that teaching students how to read different text forms would improve their ability to understand the concepts they encounter while reading. Montelongo et al. (2006) stated that “the recognition of an organizational pattern enables the student to form a mental representation of the information and to see the logical relationships advanced by the author” (p. 29). Recognition of organizational text features improved the students’ ability

to comprehend and recall information. Students can implement strategies before, during, or after reading takes place.

### *Before-Reading Strategies*

Strategies implemented before a student begins to read focused mainly on accessing the students' prior knowledge on the subject. Before-reading strategies prepare the students for the material they will be reading. Johnson and Martin-Hansen (2005) maintained that if the topic was introduced before the students began to read, they were able to activate the schema on that content. Before-reading strategies can identify alternative conceptions students had about the topic in order to develop the correct framework for incorporating new information.

Accurate prior knowledge served as the basis for introducing new material (Belk, Seed, & Abdi, 2005). The new information filled in gaps where the prior knowledge was lacking, but it should still fit into the schema of prior knowledge on the subject. If the prior knowledge on the subject was inaccurate, there can be an adverse effect on the ability of the student to recall information from new reading material (Pressley, Johnson, Symons, McGoldrick, & Kurita, 1989). If prior knowledge was accurate, however, it can stimulate recollection and reframing of the text. Students that had prior knowledge of the text are more likely to connect with the new material (Pressley et al., 1989).

In their research, Johnson and Martin-Hansen (2005) found that prediction and vocabulary instruction were important to consider before beginning a reading assignment. By anticipating what the text would contain, the students were able to gain an idea about what they would be learning. By providing students with vocabulary instruction, the students were more likely to understand the concepts to which the vocabulary terms

pertained (Johnson & Martin-Hansen). Harris and Storr (2005) explained that the word scavenger hunt familiarized students with the content vocabulary by requiring students to scan the text to find certain words and terms that relate to them. This strategy is useful because it helps students identify key vocabulary terms before they were required to understand its application in the text.

Other pre-reading strategies included using visual cues to begin the brainstorming process and stimulate prior knowledge. Utilizing a picture to explore the text provided the students with a mental image in which to connect the information they read (Pressley et al., 1989). Students can also use a pre-reading plan to brainstorm about the reading assignment. In a pre-reading plan, students brainstormed about the topic, contemplated their responses, and refined their knowledge (Belk et al., 2005). In the first stage of a pre-reading plan, the teacher identified the topic in order for students to share their prior knowledge. The students brainstormed together to produce as many facts about the concept as possible. The teacher connected the facts in a web-like formation. When a student proposed a suggestion, they had to explain how it related to the main concept (Belk et al.) Belk et al. found that a pre-reading plan “helps students to rehearse, elaborate, and organize information” (p. 44). Brainstorming, like many other pre-reading strategies, helped students relate to and convey their prior knowledge on the topic.

#### *During-Reading Strategies*

Strategies that focused on reading while it is taking place are useful in examining comprehension. Belk et al. (2005) explicate:

Comprehension monitoring is the act of understanding what is being read, or being aware that what is being read is not being understood, and making

adjustments as needed. This process involves controlling and adapting reading strategies to attain meaning from the text. (p. 44)

Belk et al. emphasized that during-reading strategies can be beneficial to students that required assistance in decoding and understanding text meaning. By working with the text while students are reading, it was possible to identify comprehension problems immediately. Clarification enabled greater command over the content of the text and increased reading proficiency (Johnson & Martin-Hansen, 2005). It was important for student to recognize when incongruence occurred between prior knowledge and the information contained in the text. Once the student recognized the conflict, it was possible for the student to replace the inaccurate information, which encouraged growth in the understanding of the topic (Pressley et al., 1989).

Johnson and Martin-Hansen (2005) expressed the importance of reflection while reading when they stated that “Having students reflect on reading while reading also sends the essential message that reading is thinking and that a reader is actively thinking throughout the reading” (p. 12). Reading is not a passive process; it requires students to form connections between the concepts in the reading and to their prior knowledge on the subject. By stopping during points in the reading, the students were able to reflect and process the information to which they were exposed.

Finch (2003) determined that presenting students with questions to answer while they were reading could help them navigate through the text and supplied a purpose for reading. Another strategy that students could implement during reading was a reading road map. The reading road map indicated to students when to read carefully and when it was appropriate to skim the text. Finch expressed that the reading road map provided an

outline of the key concepts the students should search for as they read. Finch explained that students enjoyed this type of activity because they only had to read portions of the text and because there was a clear outline for the directions. The map included how to read the selections and required the students to complete tasks, such as answering questions, for each selection in order to promote critical thinking (Belk et al., 2005).

Johnson and Martin-Hansen explored response logs as another strategy that students can utilize when they were reading. A response log can be structured or open-ended and required students to respond to information in the text (Johnson & Martin-Hansen). An open-ended response log allowed students to determine the information they would respond to for themselves (Johnson & Martin-Hansen). In a structured response log, the students developed a chart with two, three, or four columns. In the response log, the student located important information, and then provided the page number, a summary of the information, and their reaction to the statement. A teacher could use a response log to identify areas of confusion, comprehension, and interest in the topic (Johnson & Martin-Hansen). During-reading strategies, such as reading road maps and response logs, can help students monitor their comprehension and process information while they read. They can help students identify the important information in the reading, which could enable them to focus on the most important concepts.

#### *After-Reading Strategies*

Johnson and Martin-Hansen (2005) established that after-reading strategies were useful in examining how students comprehend the reading in the short-term and long-term. The thinking and understanding processes did not stop after completion of the text; the learning process continued to develop over time (Johnson & Martin-Hansen, 2005).



After-reading strategies were also useful in determining how the students had incorporated the new knowledge into their existing framework of knowledge (Belk et al., 2005). By creating more opportunities for students to process information after they had read, it was more likely that the students retained the information and incorporated it into their knowledge base.

After-reading strategies can help students organize the information they have read. Harris and Storr (2005) illustrated that a 5-4-3-2-1 organizer helped students identify key concepts and find details to support the main ideas. In this strategy, the students should find five key ideas and supply four facts that correlate to them. The students should then identify three new vocabulary terms and the meaning of those terms, two facts they already knew from the text, and one question that was not answered by the text (Harris & Storr). This strategy provided a quick summary of the text, which developed understanding and provided a reference for students to review in the future.

Another strategy teachers could use to assess student comprehension is the KWL, which stands for know, want to learn, and learned. This activity can be completed as a class or in small groups. To initiate a KWL, the teacher or the students created a chart with the headings know, want to learn, and what was learned (Belk et al., 2005). The teacher identified what the topic was and the students wrote down all the information they knew about the topic in the know column of their chart. The students then examined what they knew about the topic to determine what they would like to find out through the reading. The students indicated what they would like to learn by writing down questions or comments in the want to learn column of the chart. Belk et al. identified that when students identified what they wanted to learn, the students were designing their own

purpose for reading. By generating their own questions, the students were more engaged in the text.

While reading, the students should search the text for the answers to their questions. After reading is completed, the students should write down all the information they learned from the reading in the learned column of the chart. The students should determine if the text answered their questions and if the new information corresponds with their previous knowledge that they recorded. Belk et al. (2005) maintained that a KWL helped students monitor their own comprehension of the text and placed them in control of their learning. By writing down all the information, the teacher can later examine the chart for the overall understanding of the students (Belk et al.).

#### *Anticipation Guides: A Before-Reading Strategy*

The purpose of before-reading strategies was to expose students to the content of the reading before they delved into the topic. Many before-reading strategies, such as anticipation guides, visual cues, textbook scavenger hunts, pre-reading plans, etc., afford an opportunity for students to stimulate prior knowledge on the subject. The strategies explored the content of the reading and examined the textual features of the reading to aid in organizing the information. Before-reading strategies prepared the students for learning in order to increase reading retention rates (Kozen et al., 2006).

Anticipation guides offer an interactive approach to initiate student thinking on reading topics. An anticipation guide combined literacy instruction and learning content in order to develop decoding skills, vocabulary recognition, and understanding of text meaning (Kozen et al., 2006). An anticipation guide posed a series of statements to which the students should respond. The guide should include statements that are clearly true or

false, but it should also contain statements that challenge the students' perception on the content. Kozen et al. emphasized that all of the statements in the anticipation guide should focus on information in the reading that provided evidence to the validity of the statements. When designing an anticipation guide, the main concepts in the reading should be identified and statements that agree or disagree with the reading should be created. Once the students have reacted to the statements, they can share their ideas in small groups (Kozen et al.).

In an anticipation guide, students are required to compare their present beliefs and understandings with the knowledge they gained from the text. Though many anticipation guides mainly use agree or disagree statements, it may be beneficial for students to respond that they are unsure about the statement (Merkley, 1997). Merkley determined that adding an unsure option in the anticipation guide reduced the amount of random guessing and helped the students evaluate their own understanding of the concepts addressed. Lipson (1984) found that students were more likely to respond correctly during post-tests if they marked unsure in the anticipation guide instead of providing an inaccurate statement about agreement or disagreement. Lipson explained that when students had marked unsure in the anticipation guide, they were more likely to refer back to the text to find answers to post-test questions.

As the students read, they saw whether the text confirmed their previous beliefs. If the information they encountered differed from their previous considerations, they may have had to change their understanding. Students only integrated new material if they confronted the information that was not compatible with their original schema of knowledge (Duffelmeyer, 1994). The students should be able to support their beliefs

through textual evidence from the reading. Anticipation guides encouraged comparisons between previous beliefs and the new information from the reading (Merkley, 1997).

#### *Applications of Anticipation Guides*

Anticipation guides are a useful literacy tool because they engage students in the reading assignment. Kozen et al. (2006) explained that “through prediction, reaction, and controversy, the guide acknowledges students’ interests, knowledge about a topic, and personal experience” (p. 199). Kozen et al. emphasized that anticipation guides are effective in any content area. Duffelmeyer (1994) stressed that the strategy appealed to students because they were able to express their opinions and interact with their peers. The questions in the anticipatory set facilitated engaging discussions in which the students could participate (Duffelmeyer). Participation in discussions can supply immediate feedback, which can eliminate the potential for alternative conceptions that comprise the students’ intelligence on the topic. Kozen et al. stated that anticipation guides employed the use of inquiry to engage students in problem-solving. Kozen et al. asserted that anticipation guide are a student-led activity that encouraged students to explore their own understanding.

Kozen et al. (2006) described anticipation guides as valuable study guides. The students can review their own growth or change in understanding to encourage greater solidification of the information. Teachers can use anticipation guides as an evaluation tool to assess student understanding on the topic (Kozen et al.). By reviewing the students’ understanding before and after the assignment, it is possible for the teacher to gain an accurate portrayal of the students’ awareness of their learning on the subject.

Kozen et al. emphasized that student understanding can be gauged by the explanations they provide and by how they use the text to support their assertions.

### *Effectiveness of Anticipation Guides*

Some adaptations may be necessary to ensure that the anticipation guide is valuable to students and promotes long-term retention of the material covered in the reading. Kozen et al. (2006) stressed that visual or auditory cues may be necessary to supplement the text when reading alone does not lead to mastery of the material. In some cases, the length of the passage may be too long for students to retain all the information. In such circumstances, it would be appropriate to group the text into smaller sections. To accommodate all students in the classroom, it may be useful to create anticipation guides that vary in difficulty (Kozen et al.). Students that have a strong grasp of the information would benefit from an anticipation guide with more challenging, detailed statements. Anticipation guides with less detailed statements are more suitable for students with a developing understanding of the concepts.

The effectiveness of an anticipation guide is contingent upon the quality of the statements that comprise it (Duffelmeyer, 1994). The students must have some prior knowledge about the statement posed in the anticipation guide in order for it to have relevance. Duffelmeyer explained that the purpose of the activity is to stimulate the students' prior knowledge, so it is not effective if the student has little previous exposure to the concept. Duffelmeyer determined that anticipation guides should avoid common knowledge statements because they do not challenge the students' perception and lead to minimal discussion on the topic.

Effective anticipation guides should focus on the central concepts. General ideas are more productive than specific ideas because they elicit more discussion. The students can use the specific concepts to support the general idea, which creates a problem-solving approach to the question (Duffelmeyer, 1994).

*Thinking Aloud: A During-Reading Strategy*

Text features have an impact on the ability for a student to comprehend the meaning of the text. Loxterman, Beck, and McKeown (1994) emphasized that “the extent to which a reader comprehends a text depends on the interaction of the nature of the text and the reader’s knowledge and processing capabilities” (p. 353). In order to increase comprehension rates of text, researchers have designed strategies that will help students investigate the text through revision and connecting with the text (Loxterman et al.). Many students have difficulty determining when it is appropriate to stop reading and reflect on the material they have read. By modeling the process of reading and thinking about the text, it is possible for students to develop reading strategies that will help them decode text meaning.

Kucan and Beck (1997) asserted that the think-aloud strategy encouraged students to verbally express their thoughts and ideas about the text while they were reading. Kucan and Beck considered thinking aloud as an inquiry process into the meaning of text. During the think-aloud, students verbally expressed their thoughts and ideas about the text. The think-aloud process included questioning and remarking on the text, utilizing prior knowledge, and making inferences and predictions about the text (Oster, 2001). Oster established that a think-aloud required students to use metacognition to analyze when they had questions or comments about the text. Instead of passively reading, the

students examined when it was appropriate to stop reading to check for understanding. Oster concluded that by creating awareness of their thinking and understanding of the reading, students were more likely to ask questions and devise strategies to access greater comprehension of the content.

When a think-aloud is implemented, the teacher should model the strategy first. By modeling their own thinking while reading, the students were able to see how the teachers were processing the information they read. The comments included hypotheses, examples that validate or disprove a hypothesis, visualizations, confusing concepts, vocabulary definitions, when to re-read, and text critiques (Kucan & Beck, 1997).

Martin-Hansen and Johnson (2006) explained that “As students watch their teachers model the think-aloud process, they gradually get more comfortable identifying their own thinking processes and over time begin to think more critically themselves” (p. 56). Once the students understood the strategy, they could implement it by occasionally pausing and expressing their thoughts and questions about the reading. By verbally expressing their thinking, the students were able to communicate and solidify their thoughts and ideas.

#### *Application of the Think-Aloud Strategy*

Oster (2001) found that when students verbalized their thoughts about the text, their thinking process was uncovered. The thoughts that they revealed provided insights into the connections they were making while reading and the overall comprehension of the content (Oster). By communicating their thoughts, students were forming their understanding of the text and gaining insights into the process of understanding (Kucan & Beck, 1997). Kucan and Beck declared that the act of discussing the reading exposed

the students to the thinking process and the ideas of their peers, which lead to deeper understanding of the material.

A think-aloud can be completed individually, with partners, or with the entire class. Through their research, Harris and Storr (2005) found that partner think-alouds provided students with the opportunity for social interaction in order to verbalize their thoughts on the topic and investigate how others interpret the same text. Harris and Storr stated that during the activity, the students should take turns sharing about the reading. The students should summarize the text and discuss areas of confusion, important concepts, and connections they made to the text.

#### *Effectiveness of Thinking Aloud*

Many studies have indicated that thinking aloud during reading improved student scores on comprehension tests (Loxterman et al., 1994; Silven & Vaurus, 1992; Oster, 2001). The value of a think-aloud is dependent upon the type of text being read. If the text is too difficult for the students to comprehend, there may be too much confusion for a think-aloud to be useful (Loxterman et al.). In cases where the reading is too difficult, it may be necessary to modify the text so that the main concepts are evident. Loxterman et al. argued that “for thinking aloud to have its greatest advantage, students need to work with a text that connects information and provides adequate explanations” (p. 364). If the text did not provide connections or explanations, it became difficult for students to reflect because there was too much information to process.

The value of a think-aloud can be increased by incorporating a structured and guided approach to the strategy (Loxterman et al., 1994). Some think-aloud activities simply ask the students to share their thoughts and ideas. Loxterman et al. described that



a structured think-aloud would require the students to summarize the text and answer questions that connect central concepts in the reading.

### *Graphic Organizers: An After-Reading Strategy*

Text structures become more complicated as students progress through academia. Immersion of important information within the text makes it more difficult to determine key components of the text such as the main idea (Coburn, 2003). Since many of the texts students read in the classroom are expository, it is important to develop skills to decode the information in these types of reading. Graphic organizers are effective tools to aid students in structuring and synthesizing the information they encounter during reading.

Graphic organizers serve as an outline to the text by depicting relationships between main ideas, facts, and important concepts. They do not follow the format of traditional outlines because the information does not flow in a linear fashion. A graphic organizer utilizes a visual framework to convey information and relationships between concepts (Coburn, 2003). According to Coburn, graphic organizers helped build connections from students' prior knowledge to new information. The visual representation of the new information activated the students' schema of prior knowledge on the subject.

### *Concept Maps as a Type of Graphic Organizer*

A concept map is a visual diagram of information that creates connections to different facts and ideas. Plotnick (2001) explained that, "A concept map is a graphical representation where nodes (points or vertices) represent concepts, and links (arcs or lines) represent the relationships between concepts" (p. 2). A keyword or phrase labels the connections between facts and ideas to explain how they are related. The links or

propositions between the concepts can go one or both ways (Vanides, Yue, Tomita, & Ruiz-Primo, 2005).

The concepts in the map are summaries, so the amount of information from the text is simplified. Vanides et al. (2005) explained that the maps can be designed to be open-ended or with restraints, but the open-ended maps provided more information about what the student understood and provided more opportunity for creativity and expression of ideas. Concept maps require interpretation from the viewer, but they also help synthesize information in a concise, organized manner. Vanides et al. stated, “concept maps allow students to think deeply about science by helping them to better understand and organize what they learn, and to store and retrieve information more efficiently” (p. 28). According to Plotnick (2001), there are many benefits to concept mapping such as generating ideas, communicating complex ideas, integrating new and old knowledge, and assessing understanding or alternative conceptions.

#### *Applications of Concept Mapping*

Plotnick (2001) explained that students could use concept maps for brainstorming ideas about a text or organizing information from a text. Plotnick described this process:

As one puts ideas down on paper without criticism, the ideas become clearer and the mind becomes free to receive new ideas. These new ideas may be linked to ideas already on the paper, and they may also trigger new associations leading to new ideas. (p. 3)

Plotnick maintained that concept mapping was an effective learning tool because it required the learner to form connections and relationships between ideas. This is in support of the constructivist learning theory that emphasizes incorporating new

information into already existing structures of knowledge. Novak, Gowin, and Johansen (1983) found that incorporating knowledge into an existing schema enabled students to remember the information and made it more meaningful.

The concept mapping process can be useful in a small group setting. Plotnick (2001) found that allowing students to communicate their ideas to their peers facilitated deeper understanding of the material. The communication process enabled problem solving, which benefited students by the development of solutions and alternative ideas (Plotnick, 2001). This helped students expand their framework of knowledge and generated a more sophisticated understanding of the concepts.

Concept maps are a resource for teachers to establish how well students comprehend the information they are reading. Vanides et al. (2005) asserted that as students became more familiar with the technique of concept mapping and gained a better understanding of the content, their maps will become more complex and sophisticated. A more intricate map indicated a more profound understanding of the concepts and their relationships. Students that had a strong grasp of the material created maps that were highly connected and explained the connections well. Students that needed to develop their understanding of the content created maps that were simple with few connections (Vanides et al.).

Concept maps can also help identify alternative conceptions students have about the content. Plotnick (2001) explained that when students designed a concept map, they were expressing their thoughts and ideas about a particular concept (Plotnick, 2001). By examining their work, the teacher was able to identify how the students organize, connected, and synthesized information (Vanides et al., 2005). When a student drew a

connection between two unrelated concepts, their alternative conception about the subject became apparent. In addition, if a student did not draw a connection where one should be, it was evident that the student has not developed a strong understanding of how the concepts were related (Vanides et al.). The teacher could establish where and to what degree alternative conceptions were influencing the students' comprehension of the topic. Vanides et al. determined that when a teacher is able to gain a better understanding of the students' thinking, it facilitated addressing the alternative conception more successfully.

#### *Effectiveness of Graphic Organizers*

Many researchers have investigated the effectiveness of using graphic organizers in the classroom and have consistently found that they improve reading comprehension (Aivernann & Boothby, 1986; Plotnick, 2001; Ruddle & Boyle, 1989). Graphic organizers, such as concept maps, enabled students to identify information quickly through visual cues. The minimal use of text made it easier to locate main ideas. Plotnick explained that the "visual representation allows for development of a holistic understanding that words alone cannot convey" (p. 3). Graphic organizers are especially useful for readers that had a difficult time understanding how to organize key concepts from the text (Coburn, 2003). According to Novak et al. (1983), students that participated in concept mapping performed better on long-term retention tests than students that did not utilize concept maps.

Santhanam, Leach, and Dawson (1998) conducted a study to examine the long-term benefits of using concept maps. Through their study, the researchers found that the method used to introduce students to concept mapping determined whether they continued using the strategy in the future. Through instruction, the students needed to

develop recognition for the advantages of using concept maps. According to the study by Santhanam et al., the concept maps should be challenging, but should not require an excessive amount of time and effort to complete.

### *Summary*

It is important to consider literacy in the context of social interaction. By communicating about reading selections, students develop a method to enhance their understanding and incorporate knowledge into their existing framework of understanding. The purpose of literacy strategies is to help students identify how to comprehend text and communicate their understanding to others.

Before-, during-, and after-reading strategies are important tools for students to develop the skills to understand texts. Before-reading strategies can help activate the students' prior knowledge on the topic they will be reading. During-reading strategies can enable a student to monitor their comprehension of the text. After-reading strategies are useful in organizing and synthesizing information from the text. All of the strategies allow the teacher to identify the strengths and weakness in student understanding in order to adjust their instructional strategies. By implementing strategies to enhance literacy, students have the skills to comprehend textual information and improve academic achievement.

## Methodology

Through the course of the 2006-2007 school year, eighth grade science students were exposed to different reading strategies. The purpose for implementing the strategies was to see how developing reading skills would affect reading comprehension. The strategies implemented focused on three different stages of reading: before, during, and after. The students were provided with articles and textbook passages to analyze during the Anatomy unit of the course.

### *Participants*

The participants in this study were eighth grade science students in the Cherry Creek School District. Two science classes participated in the study. The classes were chosen based upon similarities in the class demographics. Each class was introduced to the reading strategies using the appropriate curriculum.

The students in the study ranged from ages 13 to 14. For the purpose of this study, the first science class will be referred to as Class A and the second science class will be referred to as Class B. Class A was comprised of 28 students. Fifteen of the students were male and 13 students were female. Fifty percent of the class was Caucasian, 11% were African American, 11% were Asian, and 28% were Hispanic. Four students in the class received free or reduced lunch and one student had an individual evaluation plan for special educational needs. Class B was comprised of 27 students. Sixteen students were male and 11 students were female. Sixty-seven percent of the students were Caucasian, 7% were African American, 7% were Asian, and 18% were Hispanic. Three students in the class received free or reduced lunch and two students had an individual evaluation

plan. Attendance was regularly consistent; therefore, the numbers were representative of the students that participated in the study.

### *Tools for Gathering Data*

The articles for the study were examined for their appropriate readability for eighth grade students. To determine if the article or passage was appropriate, they were examined using the Flesch Reading Ease and the Flesch-Kincaid Grade Level score. The Flesch Reading Ease score rated the text on a 100 point scale. The higher the score, the easier it was to understand the document. The Flesch Reading Ease score took into account the average sentence length (ASL) and the average number of syllables per word (ASW). The formula for the Flesch Reading Ease score is  $206.835 - (1.015 \times \text{ASL}) - (84.6 \times \text{ASW})$ . The Flesch-Kincaid Grade Level score rated the text on a U.S. grade-school level. For example, a score of 8.0 meant that an eight grader would be able to understand the document. The Flesch-Kincaid Grade Level score also took into account the average sentence length and the average number of syllables per word. The equation for the Flesch-Kincaid Grade level score is  $(.39 \times \text{ASL}) + (11.8 \times \text{ASW}) - 15.59$ . The readability statistics determined the difficulty of the reading and appropriate grade level of the reading.

The data collected consisted of quiz results from the reading assessments. Each quiz was ten questions in length and focused on the main ideas and important concepts in the reading. The performance of the control group was compared with the results from the experimental group. Data was also collected through personal observations, classroom discussions, and student evaluations of the effectiveness of the strategy. After completing each strategy, the students rated the effectiveness of the strategy on a scale

from one to ten. Ten identified the strategy as very effective and one identified the strategy as not effective. The students also provided comments on the strategy and explained whether they would use the strategy again in the future.

### *Overview of Procedure*

The students were exposed to three different reading strategies. The before-reading strategy was an anticipation guide. The during-reading strategy was a think-aloud. The after-reading strategy was a concept map. For each strategy, one class served as the experimental group, which performed the reading strategy, while the other class served as the control group. There were two phases for each of the strategies. The procedure for both of the phases was the same, but the class receiving the strategy changed. During phase one of the strategy, Class A was the control group and Class B was the experimental group. During phase two of the strategy, Class B was the control group and Class A was the experimental group. All of the students were exposed to the strategy during one of the phases.

### *Procedure for Before-Reading Strategy*

The before-reading strategy was an anticipation guide that focused on an article that examined the Nervous System, specifically parts of the brain. The anticipation guide posed a series of statements to which the students responded (Appendix A). The main concepts in the reading were identified to create statements that disagreed or agreed with the text. The guide contained statements that challenged the students' perception on the content. Once the students reacted to the statements, they shared their ideas in groups of four. The anticipation guide required students to compare their present beliefs and understandings with the knowledge they gained from the text.



As the students read, they had to determine if the text confirmed their previous beliefs. After completing the reading, the students referred back to their anticipation guide in order to write a paragraph confirming or disproving their original perceptions. They used textual evidence from the reading to support their statements. The students then compared their previous beliefs with their newly held perceptions as they discussed the reading in small groups. After the discussion, the students completed a quiz on the important concepts in the reading (Appendix B).

Class A served as the control group and did not participate in an anticipation guide for the reading on energy. They were asked to read the article and then they received the quiz on the reading. The results for Class B, the experimental group, and Class A, the control group, were compared. After completing the first phase of the before-reading research, the groups switched and Class A performed an anticipation guide while Class B served as the control group (Appendix C). The procedure stayed the same but both classes read an article on the eye and its function. The quiz focused on sensory information and parts of the eye (Appendix D). After both sets of classes received the strategy, the overall results of the effectiveness of the strategy were compiled.

#### *Procedure for During-Reading Strategy*

The during-reading strategy was a think-aloud on a passage in the students' textbook that examined the Circulatory System. Class B was introduced to the strategy first. The think-aloud strategy was modeled by the teacher for the first half of the passage. During the think-aloud, the teacher verbally expressed thoughts and ideas about the text while reading. The think-aloud process included questioning and remarking on

the text, utilizing prior knowledge, and making inferences and predictions about the text. After modeling how to think aloud while reading, the students were asked to utilize the strategy as they read the rest of the passage with a partner.

The students had to examine when it was appropriate to stop reading to check for understanding. The students implemented the strategy by occasionally pausing and expressing their thoughts and questions about the reading. The students verbally expressed their thinking on the reading and created a discourse with their partner on the topic. Once the discussion was completed, the students were given a quiz to evaluate their comprehension of the text (Appendix E).

Class A served as the control group for phase one of the during-reading strategy and did not complete the think-aloud, but did complete the quiz on the Circulatory System (Appendix F). During the second phase of the strategy, Class A completed a think-aloud on a passage from the textbook on the Circulatory System and blood. The procedure was the same as in phase one of the during-reading strategy. The results from the quizzes from phase one and two were compared to identify how the think-aloud strategy affected reading comprehension.

#### *Procedure for After-Reading Strategy*

The after-reading strategy was a concept map. For phase one, the concept map focused on an article that described the Respiratory System. After reading the article, the students formed groups of four. In each group, the students wrote the main ideas of the reading and then connected the concepts using words or phrases that described the relationships between the concepts. After completing the map, the students presented and

explained their maps to the class. Following the discussion on the concept maps, the students took a quiz pertaining to the reading (Appendix G).

In phase one, Class A did not participate in concept mapping but just read the article and took the quiz (Appendix H). During phase two, the roles were reversed and Class A prepared a concept map for the second reading on the Circulatory System. Class B did not create a concept map for the second reading. The test results for both groups were compiled to determine the overall effectiveness of concept mapping on reading comprehension.

## Results

The results of the study were determined by analyzing a triangulation of data. Through the course of the 2006-2007 school year, eighth grade science students were exposed to different reading strategies to determine the effectiveness of the strategies in improving reading comprehension. The strategies focused on three different stages of reading: before, during, and after. The study used six articles from the Anatomy unit; each had a Flesch-Kincaid Grade Level score of between 8.0 and 8.5. The quantitative data collected consisted of quiz results from the reading assessments. Each quiz was ten questions in length, which consisted of completion questions, short answer, or a combination of the two. The students could receive partial credit on their answers. The study compared the performance of the control group with the results from the experimental group. The qualitative data consisted of personal observations, classroom discussions, and student evaluations of the effectiveness of the strategy.

Table 1 provides a summary of the mean percentage score on the quizzes for each experiment by control and experimental group. N/A in the data table represents that a class did not participate as either the control group or the experimental group in a particular experiment.

Table 1

*Mean Percentage Score on Quizzes for Control and Experimental Groups*

Literacy Strategy	Control Group		Experimental Group	
	Class A	Class B	Class A	Class B
Experiment 1: Anticipation Guides	60	N/A	N/A	74
Experiment 2: Anticipation Guides	N/A	63	77	N/A
Experiment 3: Think-Aloud	55	N/A	N/A	89
Experiment 4: Think-Aloud	N/A	50	83	N/A
Experiment 5: Concept Mapping	51	N/A	N/A	55
Experiment 6: Concept Mapping	N/A	53	58	N/A

*Experiment 1: Phase One, Anticipation Guides*

In the first experiment, Class A was the control group and Class B was the experimental group. Class A did not receive the anticipation guide strategy and received a mean score of 60% on the Nervous System quiz (Appendix B). The sample size was 28 students. The standard deviation of the sample was 1.81 and the variance was 3.28.

Class B received the anticipation guide strategy and received a mean score of 74% on the Nervous System quiz (Appendices A and B). The sample size was 28 students. The standard deviation of the sample was 1.65 and the variance was 2.72.

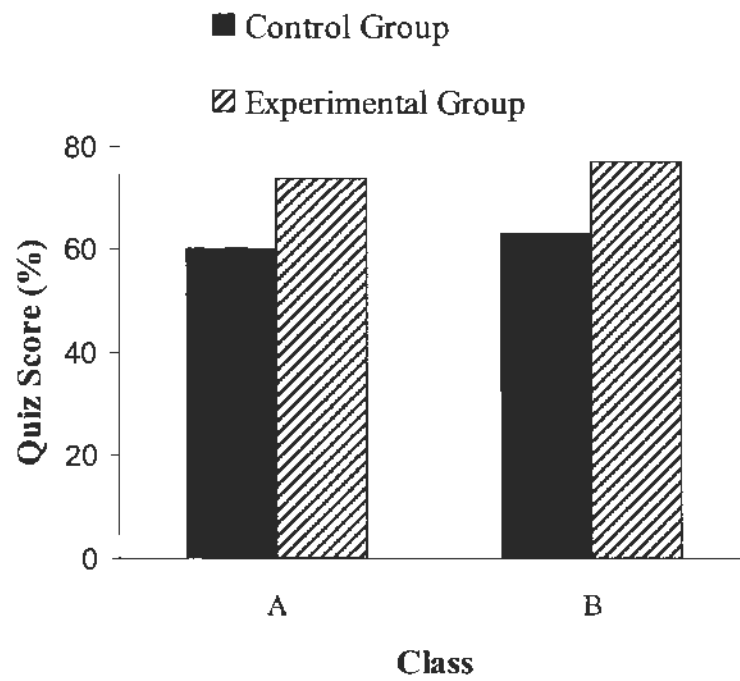
*Experiment 2: Phase Two, Anticipation Guides*

In the second experiment, Class B was the control group and Class A was the experimental group. Class B did not participate in an anticipation guide for the reading and received a mean score of 63% on the quiz (Appendix D). The sample size was 28 students. The standard deviation of the sample was 1.94 and the variance was 3.76.

Class A participated in an anticipation guide for the reading and received a mean score of 77% on the reading assessment (Appendices C and D). The sample size was 28 students. The standard deviation of the sample was 1.77 and the variance was 3.13.

Figure 1 provides a summary of the results for experiments one and two.

Figure 1. Quiz Score for Anticipation Guide for Classes A and B as a function of experimental and control groups.



*Experiment 3: Phase One, Think-Alouds*

In the third experiment, Class A was the control group and Class B was the experimental group. Class A did not use the think-aloud strategy for the reading and received a mean score of 55% on the quiz (Appendix E). The sample size was 28 students. The standard deviation of the sample was 1.85 and the variance was 3.42.

Class B participated in a think-aloud for the reading and received a mean score of 89% on the reading assessment (Appendix E). The sample size was 28 students. The standard deviation of the sample was 1.67 and the variance was 2.79.

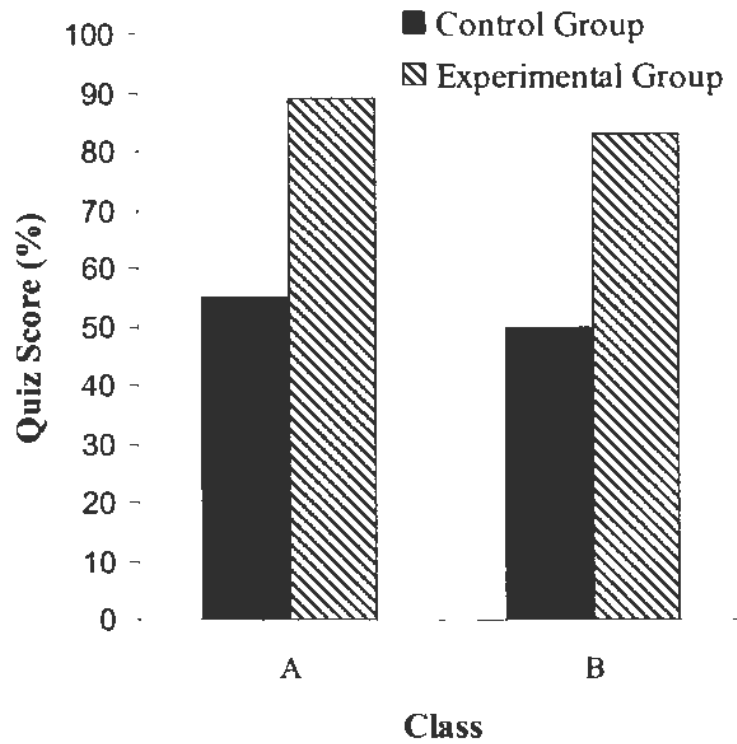
*Experiment 4: Phase Two, Think-Alouds*

In the fourth experiment, Class B was the control group and Class A was the experimental group. Class B did not participate in a think-aloud for the reading and received a mean score of 50% on the quiz (Appendix F). The sample size was 28 students. The standard deviation of the sample was 1.89 and the variance was 3.57.

Class A participated in a think-aloud for the reading and received a mean score of 83% on the reading assessment (Appendix F). The sample size was 28 students. The standard deviation of the sample was 1.73 and the variance was 2.99. Figure 2 provides a summary of the results for experiments three and four.



Figure 2. Quiz Scores for Think-Alouds for Classes A and B as a function of experimental and control groups.



*Experiment 5: Phase One, Concept Maps*

In the fifth experiment, Class A was the control group and Class B was the experimental group. Class A did not create a concept map on the reading and received a mean score of 51% on the quiz (Appendix G). The sample size was 28 students. The standard deviation of the sample was 1.98 and the variance was 3.93.

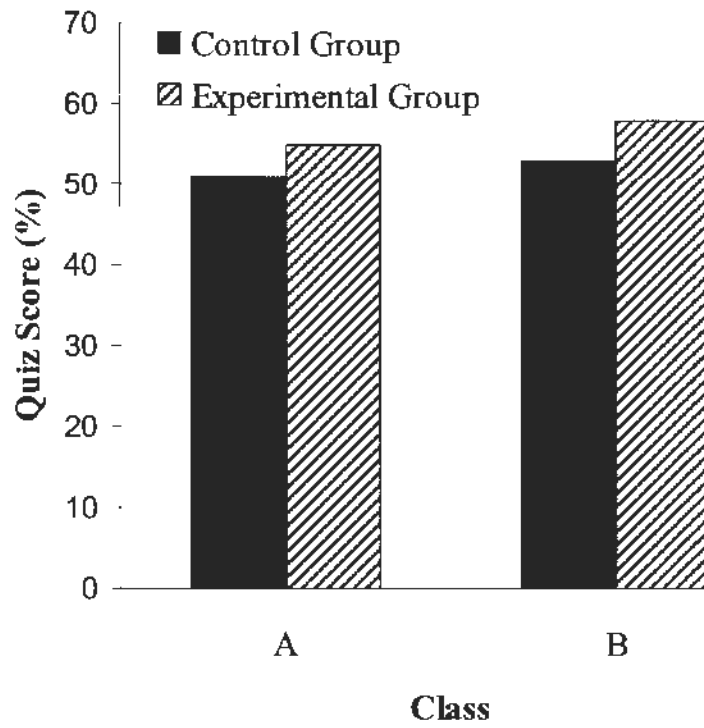
Class A participated in an anticipation guide for the reading and received a mean score of 55% on the reading assessment (Appendix G). The sample size was 28 students. The standard deviation of the sample was 1.71 and the variance was 2.92.

*Experiment 6: Phase Two, Concept Maps*

In the sixth experiment, Class B was the control group and Class A was the experimental group. Class B did not complete a concept map on the reading and received a mean score of 53% on the quiz (Appendix H). The sample size was 28 students. The standard deviation of the sample was 1.86 and the variance was 3.46.

Class A participated in an anticipation guide for the reading and received a mean score of 58% on the reading assessment (Appendix H). The sample size was 28 students. The standard deviation of the sample was 1.74 and the variance was 3.02. Figure 3 provides a summary of the results for experiments five and six.

Figure 3. Quiz Scores for Concept Maps for Classes A and B as a function of experimental and control groups.



*Effectiveness of Strategies Based on Student Responses*

After all of the students had received the strategies, they were asked to rate the strategies on their effectiveness. The survey sampled 56 students and they rated the effectiveness of anticipation guides as a six out of 10. The students rated the effectiveness of think-alouds as an eight out of 10. Concept maps had the lowest rating with a four out of 10. The students indicated which strategy they found overall most useful. Twelve students found anticipation guides to be the most useful, 40 students found think-alouds to be the most useful, and four students found concept maps to be the most useful. Figure 4 graphically represents the data.

The students answered if they would be likely to use the strategy again. The survey provided the students with the options of answering yes or no. Anticipation guides were not applicable for this question because the teacher must provide the students with the anticipation guide. Fifty-four percent of the students, 30 out of the 56, responded that they would use the think-aloud strategy in the future. Seven percent of the students, four out of 56, responded they would use concept maps in the future. Thirty-nine percent of the students, 22 out of 56, responded that they would not be likely to use either strategy in the future. Table 2 summarizes these results.

Figure 4. Student reflections on the most useful literacy strategy.

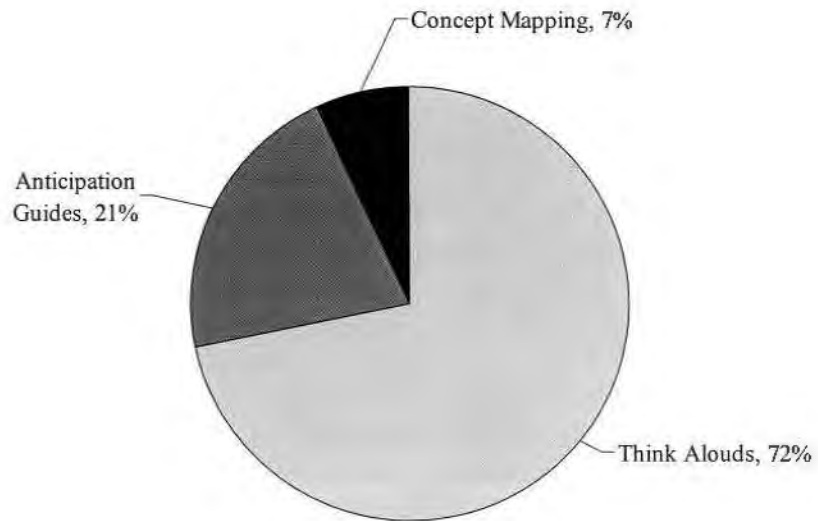


Table 2

*Student Responses to Most Useful Strategy and Likelihood of Using the Strategy Again*

Literacy Strategy	Most Useful	Will Use Again
Students (n = 56)		
Anticipation Guides	12	N/A
Think-Alouds	40	30
Concept Maps	4	4

### Discussion and Conclusion

The results from this study supported the hypothesis that if students are provided with the skills to interpret texts, they are more likely to comprehend what they have read and convey their knowledge during assessments. The results also supported the literature on the topic (Johnson and Martin-Hansen, 2005; Johnston, 1985; Kozen et al., 2006) that reading comprehension improves when literacy strategies are implemented. The results showed that quiz results consistently increased when students received a literacy strategy.

#### *Anticipation Guides*

In experiments one and two, the students that received the anticipation guide strategy performed 14 percentage points higher on the quiz than the students that did not receive the strategy. The students indicated that they had prior knowledge on the topic of the Nervous System. The students also indicated through discussion that they had an interest in the topics of the brain and the eye, which were the focus of the two readings. Prior knowledge and interest in the topic could explain why the control groups performed the best on these quizzes in comparison to the control group quizzes for the other strategies. According to the literature (Johnson & Martin-Hansen, 2005; Pressley et al., 1998), it is most useful to use anticipation guides when the students have prior knowledge on the topic. The purpose of an anticipation guide is to reinforce prior knowledge and challenge perceptions; therefore, the students must have some degree of understanding of the topic in order for the anticipation guide to be effective.

The students explained that anticipation guides were useful in preparing them for the information they should focus on in the reading. According to the literature (Duffelmeyer, 1994; Kozen et al., 2006), anticipation guides offer an interactive approach

et al. used in second edition within a paragraph not entire work

to initiate student thinking on reading topics. The anticipation guides were successful in stimulating the students' prior knowledge on the subject, which enabled them to incorporate new concepts into their framework of knowledge. The small group discussions were also useful in stimulating prior knowledge and exploring the topic.

The research conducted by Kozen et al. (2006) explained that the students should be able to support their beliefs through textual evidence. The students felt that it was helpful to refer back to the anticipation guide to see how their new understanding of the topic differed from their previously held beliefs. They also emphasized the importance of discussing their changes in perception because it reinforced their learning, which reinforces concepts from the literature (Kucan & Beck, 1997). The research by Duffelmeyer (1994) emphasized the importance for students to express their thoughts and opinions because it influences their level of engagement in the text. The acts of anticipating learning, reading, writing, and discussing had a positive affect on the students' comprehension of the text as is evident through their quiz scores.

In the future, it would be useful to include images in the anticipation guide because the quizzes included images (Appendices B and D). As suggested by the literature (Kozen et al., 2006; Lipson, 1984; Merkley, 1997), it may be useful to vary the degree of difficulty in the anticipation guides in order to accommodate a wider range of students.

### *Think-Alouds*

In experiment three, the students that participated in the think-aloud strategy for the reading scored 34 percentage points higher on the quiz than the control group. In experiment four, the students that participate in the think-aloud strategy scored 33



percentage points higher on the quiz than the control group. This was by the far the greatest increase in quiz scores for any of the literacy strategies. The majority of students, 54%, indicated that they would be likely to use the think-aloud technique while reading in the future. Those that replied that they would use the strategy in the future explained that the strategy was easy to implement and provided better understanding and retention of the text.

Similar to the anticipation guides, the students enjoyed the think-aloud strategy because they were able to express their thoughts and opinions. Through class discussions, the students explained that the act of talking to another person while they were reading was helpful in identifying and clarifying difficult concepts. The students expressed that it was often difficult to express thoughts in written form and it was useful to explore their thoughts orally to aid in clarification. Many of the students felt that reading aloud helped in processing the material because they examined the text critically and thought about the concepts.

The literature (Loxterman et al., 1994; Oster, 2001) explained that many students had difficulty determining when it was appropriate to reflect and question what they were reading. When using the think-aloud strategy, the students were more likely to take more time reading the text. The students stopped to reflect on the text by asking questions, summarizing, stating thoughts and opinions, examine vocabulary, and draw conclusions. The students used metacognition to check for understanding. It was helpful to have the students work in pairs because they were able to check each other for understanding. By expressing their thinking to a peer, the students were able to communicate and solidify their thoughts and ideas. Discussing the reading exposed the students to the thinking

process of their peers, which lead to deeper understanding. The literature on think-alouds (Kucan & Beck, 1997; Oster, 2001) supported the conclusion that discussing the concepts will lead to a greater comprehension on the topic.

Based on the study, it was useful for students to practice think-alouds in small groups. The research conducted by Harris and Storr (2005) suggested that pairs or small group think-alouds were most useful because they provided the opportunity for social interaction and exploration of the thinking process of others. For further research, it would be interesting to investigate the effectiveness of think-alouds when completed individually. It would be useful to include guiding questions along with the text to help facilitate the think-aloud strategy.

### *Concept Maps*

In experiment five, the students that created a concept map for the reading scored four percentage points higher on the quiz than those that did not create a concept map. In experiment six, the students that created a concept map scored five percentage points higher on the quiz than those that did not create a concept map. This literacy strategy showed the least improvement on quiz scores in comparison to the other strategies. Through the survey, the students explained that they felt concept mapping was the least helpful strategy. Only seven percent of the students surveyed said that they would be likely to use the strategy in the future.

Based on the literature (Novak et al., 1983; Santhanam et al., 1998), concept maps aid students in long-term retention of facts and ideas. In this study, the students felt that the concept maps were not useful in processing the text as they read. By the end of the reading, they had forgotten many of their questions, which caused their questions to be

unresolved. When completing the concept maps, they explained that they copied word for word out of the text instead of summarizing. Though the maps looked sophisticated, the students were not actively processing the concepts, just filling in spaces on their map.

The research conducted by Vanides et al. (2005) and Plotnick (2001) emphasized that concept maps allow students to brainstorm about the text and organize textual information. This enabled students to form connections between concepts. In this study, the students did not take the next step of organizing the information into their schema of knowledge. The students did not feel they would use the strategy in the future because it was time consuming and did not help them in understanding difficult concepts.

A possible source of error for the concept mapping experiments was that the quizzes used for these assessments consisted of entirely short answer questions (Appendices G and H). The quizzes for the anticipation guides and think-alouds consisted of fill in the blank questions and short answer questions (Appendices B, D, E, and F). The students tended to have more difficulty with the short answer questions, which could account for the low scores on these quizzes. In addition, it would be useful to see if student comprehension would increase if the students had more practice with creating concept maps.

### *Conclusion and Future Research*

Based on the results from this study, it was apparent that implementing literacy strategies had a positive affect on reading comprehension. The during-reading strategy was the most useful because the students were actively engaged in the text, verbally expressing their ideas, and sought answers to their questions. The before-reading strategy was nseful because it focused the stndents on key components of the text and provided an

opportunity for verbal expression. The anticipation guides and think-alouds caused the students to think critically about the text while they were reading. The after-reading strategy, concept mapping, was the least useful because the students felt that if they did not understand the reading while they were reading, the concept map would not aid them in understanding the material. The students did not think critically while they were reading, so the concept map did not deepen their understanding.

Future research could address how using a combination of reading strategies would affect reading comprehension. Future research could also examine if other before-, during-, and after-reading strategies have the same results. This study found after-reading strategies to be the least useful, but perhaps another strategy would be more effective. The study conducted each strategy twice; therefore, it may be useful to implement the strategy more times to determine its overall effectiveness.

In conclusion, literacy strategies are an essential component for improving reading comprehension. When students were asked to complete tests based on memory alone, they usually only remembered about half of the information from the text. Regardless of the strategy, reading comprehension improved with implementation of literacy skills. Providing students with the appropriate literacy tools increases chances for success in reading assessments.

*Tess,  
Excellent work!  
A on paper  
A in class*

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## Appendix A

## Anticipation Guide #1

Name \_\_\_\_\_

Period \_\_\_\_\_

Anticipation Guide for the Nervous System

Date \_\_\_\_\_

1. The Nervous System controls all of the activities of the body.

True False Unsure

2. If a nerve is damaged, it can be repaired by the body.

True False Unsure

3. A stimulus is a change in the environment that causes a reaction.

True False Unsure

4. The central nervous system consists of the brain, network of nerves, and sense organs.

True False Unsure

5. The cerebrum sends out impulses that help control balance and posture.

True False Unsure

6. The medulla is located at the top of the brain.

True False Unsure

7. Most of the mental activities that make human beings different from other animals takes places in the cerebrum.

True False Unsure

8. The right side of the brain controls the right side of the body.

True False Unsure

9. The medulla controls automatic body processes such as breathing and blood pressure.

True False Unsure

10. A nerve impulse travels at four meters per second.

True False Unsure



## Appendix B

## Nervous System Quiz #1

Name \_\_\_\_\_  
 Quiz on the Nervous System

Period \_\_\_\_\_  
 Date \_\_\_\_\_

**Completion**

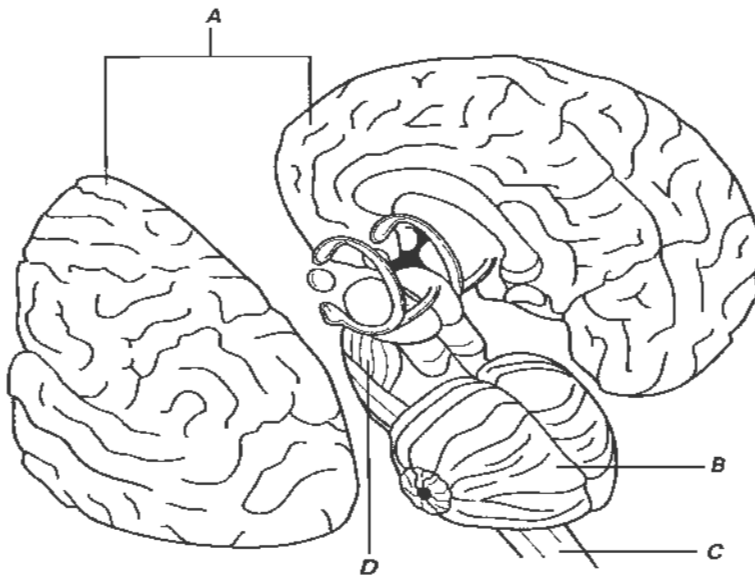
*Complete each sentence or statement.*

1. The traffic light turns green, and the driver steps on the gas pedal to make the car move forward. The green traffic light acted as a(n) \_\_\_\_\_ that caused a response in the driver.
2. The type of neurons known as \_\_\_\_\_ neurons pick up stimuli from the external or internal environment and convert those stimuli to nerve impulses.
3. In order for a nerve impulse to pass from an axon tip to the next structure, it must cross a space called a(n) \_\_\_\_\_.
4. In the part of the inner ear called the \_\_\_\_\_, receptors convert sound vibrations into nerve impulses.
5. A muscle contracts in response to an impulse carried by the type of neuron known as a(n) \_\_\_\_\_ neuron.

**Short Answer**

*Use the diagram to answer each question.*

**The Brain**



6. What part of the brain is indicated by A? Identify three functions of structure A.
  
7. What part of the brain is indicated by B? What is its function?
  
8. What part of the brain is indicated by D? What is its function?
  
9. What is the role of the brain in enabling you to hear? What part of the brain — A, B, C, or D — is involved in hearing?
  
10. What part of the central nervous system is indicated by C? What is its function?

## Appendix C

## Anticipation Guide #2

Name \_\_\_\_\_

Anticipation Guide on the Eye

Period \_\_\_\_\_

Date \_\_\_\_\_

1. Your eyes are made of three layers of tissue.

True False Unsure

2. Smooth muscles control eye movement.

True False Unsure

3. The iris is the colored part of the eye.

True False Unsure

4. The lens focuses the light rays coming into the eye.

True False Unsure

5. A human lens focuses light on the back surface of the eyeball, also known as the retina.

True False Unsure

6. The brain receives images from the eye right side up.

True False Unsure

7. Sense organs respond to various stimuli and detect changes in the body position.

True False Unsure

8. The iris is the center of the pupil; it relaxes and contracts to allow light into the eye.

True False Unsure

9. Rods react to dim light and cones react to colors.

True False Unsure

10. The optic nerve carries impulses to the vision center in the brain.

True False Unsure

## Appendix D

## Nervous System Quiz #2

Name \_\_\_\_\_  
 Quiz on the Nervous System

Period \_\_\_\_\_  
 Date \_\_\_\_\_

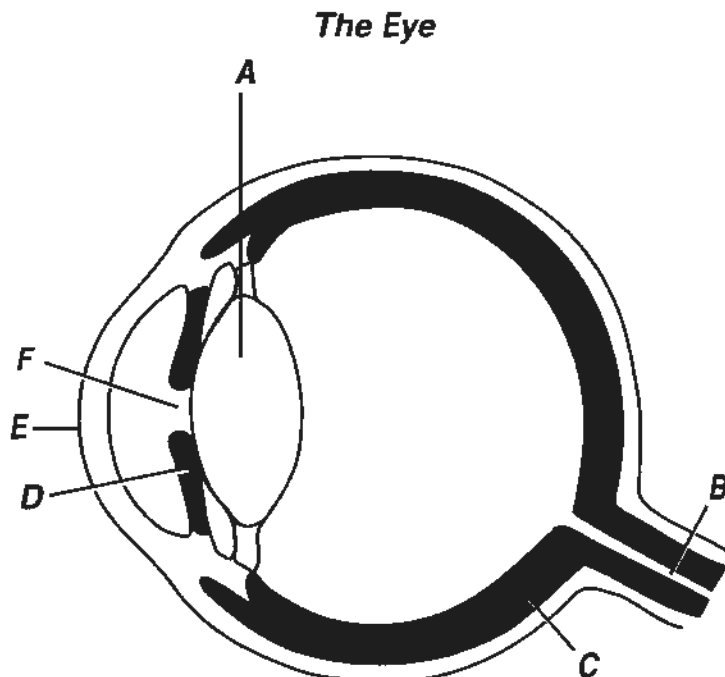
**Completion**

*Complete each sentence or statement.*

1. One function of the nervous system is to maintain \_\_\_\_\_, or stability within the body.
2. Each specific \_\_\_\_\_ organ picks up a different kind of information about the environment.
3. The \_\_\_\_\_ of the eye bends light rays and focuses them.
4. Eyes convert light into \_\_\_\_\_ that travel through the optic nerves to the brain.
5. The peripheral nervous system consists of \_\_\_\_\_ that link the central nervous system with all parts of the body.

**Short Answer**

*Use the diagram to answer each question.*



6. Identify structure A and describe its function.
  
7. Identify structure B. Explain what would happen if this structure were damaged.
  
8. Identify structure E and describe its function.
  
9. Identify structure C and describe its function.
  
10. When images focus in front of structure C, what condition results? How does this condition affect people's vision?

Appendix E

Circulatory System Quiz #1

Name \_\_\_\_\_  
 Quiz on the Circulatory System

Period \_\_\_\_\_  
 Date \_\_\_\_\_

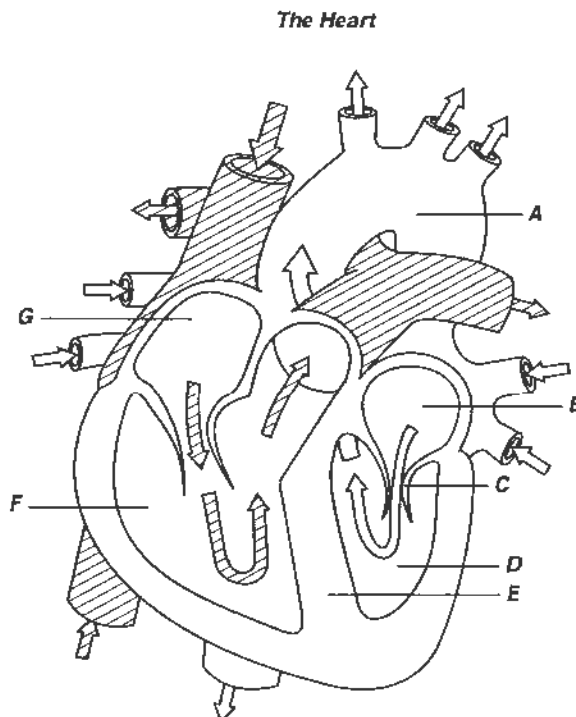
**Completion**

*Complete each sentence or statement.*

1. The circulatory system carries the needed materials oxygen and \_\_\_\_\_ to the body cells.
2. A flap of tissue called a(n) \_\_\_\_\_ separates the right atrium from the right ventricle.
3. Blood that contains a lot of carbon dioxide flows from the body into the \_\_\_\_\_ atrium of the heart.
4. Blood that is rich in oxygen leaves the heart through the blood vessel known as the \_\_\_\_\_.
5. Blood returns to the heart from the body through blood vessels called \_\_\_\_\_.

**Short Answer**

*Use the diagram to answer each question.*



6. What is the name for the structure labeled A? To where does it carry blood?
  
7. Identify structure G. Give the letter and name of the structure into which blood flows after leaving G.
  
8. What is the structure labeled C? What is its function?
  
9. Identify the structure labeled D. When blood enters structure D, is the blood low in oxygen or high in oxygen? Explain.
  
10. Identify structure E. What would happen to a person who had a hole in this structure

## Appendix F

## Circulatory System Quiz #2

Name \_\_\_\_\_  
 Quiz on the Circulatory System

Period \_\_\_\_\_  
 Date \_\_\_\_\_

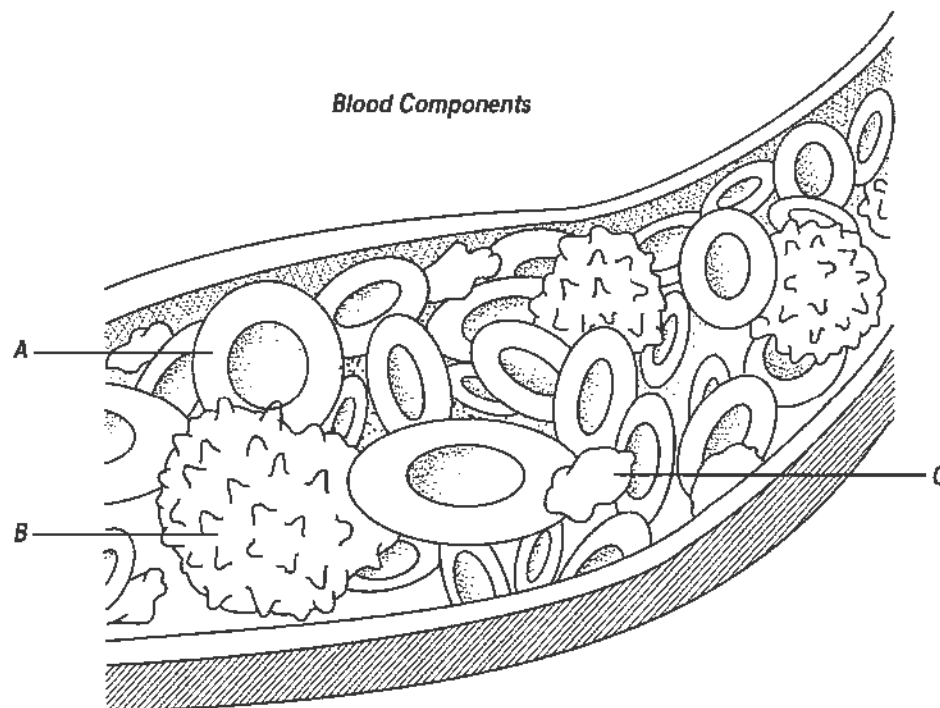
**Completion**

*Complete each sentence or statement.*

1. Substances are exchanged between the blood and body cells in the blood vessels known as \_\_\_\_\_.
2. Red blood cells contain \_\_\_\_\_, a protein that carries oxygen from the lungs.
3. The marker molecules on red blood cells determine a person's \_\_\_\_\_.
4. Fluid that has leaked out of capillaries is returned to the blood by the \_\_\_\_\_ system.
5. Tissue fluid that has entered lymphatic vessels is known as \_\_\_\_\_.

**Short Answer**

*Use the diagram to answer each question.*





6. Identify the type of cell shown by A. What is the function of the type of cell indicated by A?
  
  
  
  
  
  
  
  
  
  
7. What is the function of the type of cell indicated by B? If the body did not have this type of cell, what would probably happen?
  
  
  
  
  
  
  
  
  
  
8. What blood component is shown by C? In what body process is it important?
  
  
  
  
  
  
  
  
  
  
9. Which type of cell does blood contain more of—A or B?
  
  
  
  
  
  
  
  
  
  
10. What component of blood is not indicated by either A, B, or C

## Appendix G

## Respiratory System Quiz #1

Name \_\_\_\_\_  
Quiz on the Respiratory System

Period \_\_\_\_\_  
Date \_\_\_\_\_

**Short Answer**

*Answer each question with a complete sentence.*

1. What two substances pass from the blood into the alveoli? \_\_\_\_\_  
\_\_\_\_\_

2. What is the process called that releases energy from glucose? \_\_\_\_\_  
\_\_\_\_\_

3. How are the trachea and the bronchial tubes related? \_\_\_\_\_  
\_\_\_\_\_

4. What would happen if your larynx was damaged or infected? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. What type of connective tissue makes up the trachea? \_\_\_\_\_  
\_\_\_\_\_

6. Why is it better for a lung to be made up of millions of air sacs instead of being one big air sac like a balloon? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7. When you talk, is air entering or leaving your lungs? \_\_\_\_\_  
\_\_\_\_\_

8. Where would you find cilia? \_\_\_\_\_  
\_\_\_\_\_

9. What is the function of the cilia? \_\_\_\_\_  
\_\_\_\_\_

10. Explain what happens to your ribs, diaphragm, and lungs when you inhale.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Appendix H

## Respiratory System Quiz #2

Name \_\_\_\_\_  
 Quiz on the Respiratory System

Period \_\_\_\_\_  
 Date \_\_\_\_\_

**Short Answer**

*Answer each question with a complete sentence.*

1. What is the function of the respiratory system? \_\_\_\_\_  
 \_\_\_\_\_
2. During the process of respiration, oxygen is combined with what to create energy?  
 \_\_\_\_\_  
 \_\_\_\_\_
3. What are the two passageways that allow air into the lungs? \_\_\_\_\_  
 \_\_\_\_\_
4. What are the two functions of the nose in preparing air to enter the lungs?  
 \_\_\_\_\_  
 \_\_\_\_\_
5. What is the function of the epiglottis? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Why is it important to have tiny hairs in the trachea (windpipe)? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
7. The larynx, or voice box, is made up of cartilage and contains vocal cords. How are sounds produced in the larynx? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
8. How is oxygen transferred from the lungs to the blood? \_\_\_\_\_  
 \_\_\_\_\_
9. As your chest expands, there is more room in your lungs, but the same amount of air. Does this cause the air pressure in your lungs to increase, decrease, or stay the same?  
 \_\_\_\_\_  
 \_\_\_\_\_
10. What is the muscle that contracts and pulls down at the bottom of the chest?  
 \_\_\_\_\_