

SUNY College at Brockport

The Effects of Imagery and Concreteness on Recall of Prose Passages Read by
Ninth Grade Students

by

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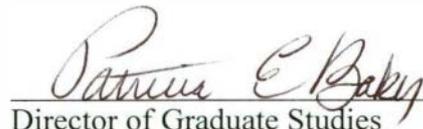
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Abstract

This research was designed to study the effects of imagery and language concreteness on retention of prose passages. Thirty heterogeneously grouped ninth-grade students from two separate English classes in a suburban high school outside of Rochester, New York were assigned to two treatment conditions. Both conditions required students to retell information and were then prompted for further information after reading two types of passages: one which was highly imageable, or concrete, the other which was less imageable, or abstract. After the first treatment condition, students received training designed to acquaint students with mental imagery and to help them use mental imagery strategies to aid them in recalling text. Subsequently, the students were again asked to read two different passages and tallies were taken for unprompted and prompted recall.

This research presents two hypotheses: that students would increase their ability to recall information from the passages they read by using mental imagery strategies, and that gains in recall would be greater for the concrete passages than for the abstract passages. The analysis of the data collected supported ($p < .05$) these hypotheses as well as many of the views detailed in the literature.

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CHAPTER I

Statement of Problem

Purpose

The purpose of this study was to determine the potential link between imagery and recall. This study was designed to indicate whether or not the concreteness of the passages has an effect on recall.

Need for Research

We live in a nation of youths whose idols are not scholars, whose entertainment is rarely provided by books, and whose communication is almost exclusively informal and conversational. These factors help to create a society in which reading and writing well are not highly valued. We educators must find better ways to increase literacy.

Television, VCRs, DVDs, video games, computers, the Internet, webcams, digital cameras—we are constantly bombarded with visual images. If educators can help students use the wealth of stored images to stimulate their reading ability and to gain retention that is more lasting, then we must undertake this effort. With statewide and nationally demanded increases in scores on new standardized tests, there is a need for educators to take advantage of every option possible to improve their students' circumstances. If tapping into a student's natural ability to create

and use mental images will help them to yield better results in literacy, then every educator must be aware of its effectiveness.

In addition, it is clear that the concreteness of language affects the amount of mental imagery produced by the reader. It has been established that imagery is recalled more readily and retained longer than more abstract ideas. In 1988, Hidi and Baird's study altered a biology text to make it more interesting, including more concrete and inviting information. These subjects recalled more of the concrete, specific, and personally involving material, than the more abstract, general, and scientific material (which was deemed more important by the researchers). However, when concrete examples were used to enhance main idea statements in texts, these ideas were recalled more readily. The results of studies involving the concreteness of language suggest that if the more abstract or general information, expected of all students, were written in a concrete, specific, and personally involving way, then students would comprehend and retain this information longer and with more accuracy.

Finally, there is surprising lack of research in the area of mental imagery using early high school students (grades 8 – 10). This study hoped to fill a portion of that void. A subset of mental imagery that this study examined was the effect of concreteness in both the formation of images, and its effects on comprehension.

CHAPTER II

Review of Literature

Purpose

The purpose of this study was to determine the potential link between imagery and recall. This study was designed to indicate whether or not the concreteness of the passages has an effect on recall.

Definition of Terms

Imagery – for the purpose of this study, the term *imagery* will represent the mental formation of visual pictures or images. It must be noted that when imagery is formed as a result of vivid or figurative language, it may also extend the mental image to include other sensory perceptions (for instance, sound, smell, et cetera).

Induced Imagery – imagery resulting from training or teacher-directed instruction.

Spontaneous imagery – imagery reported without instruction and with no prior indication that reports of imagery would be solicited.

Imagery

It is said that Albert Einstein thought almost exclusively in images, not words. His genius is a powerful reminder of the Chinese proverb: “a picture is worth ten thousand words.” Perhaps it is through images that one is best able to think without the restriction of words. For instance, imagine Van Gogh’s famous painting, *Starry Night*: one can see the painting holistically—the crescent moon in the upper right-hand corner; the jutting spires on the left; and a bevy of swirled stars forming the rest of the skyline. One may alternately focus on a single aspect of the painting—a singular, bold brush stroke. With a sufficient art background, one can see in that brush stroke a distinct contribution to the art world unique to Van Gogh’s vision. Additionally, one might recall the moment he or she first witnessed the work, which, perhaps, also happened in confluence with other positive or negative experiences that same day. All of the experiences surrounding this work could be triggered by another viewing of it. An image, as with the recollection of a famous painting, can be stored and recalled with minute detail or with superficial awareness and bring about a bevy of other memories and emotions. It is possible that our ability to recollect images gives us the best opportunity to remember what we read.

The mystery behind a child’s ability to create and store complex images derived from text is something that researchers and educators have been hoping to better understand and researchers have spent considerable energy trying to reveal.

The relationship between words and visual images is one that is not to be overlooked, since both are the “conscious manifestation of thoughts” (Thompson, 1990, p. 8). Imagery, like many functions of the brain, is a complex function requiring the brain to work on many levels. Bruer (1999) explains:

Generating and using visual imagery is a complex operation that involves, even at a crude level of analysis, at least five distinct subcomponents: 1) to create a visual image of a dog, you must transfer long-term visual memories into a temporary visual memory store; 2) to determine if your imagined dog has a tail, you must zoom in and identify details of the image; 3) to put a blue collar on the dog requires that you add a new element to your previously generated image; 4) to make the dog look the other way demands that you rotate your image of the dog; and 5) to draw or describe the imagined dog, you must scan the visual image with your mind’s eye. (p. 4)

Bruer’s statements about the complexity of visual imagery implies that it is not a purely “right-brained” function, but requires lateralization, or the use of both hemispheres of the brain in cooperation. It can, therefore, be hypothesized that as visualizing requires the brain to work globally, it has great potential as a mnemonic device (Bruer, 1999). This idea is expressed by Paivio (1986) in his conceptual-peg hypothesis, which explains how memories stored as mental images function as mental “pegs” onto which other associative memories cling. This hypothesis has major implications for instruction.

Whether mental imagery is induced or occurs spontaneously, it has been shown to have compelling effects on readers’ comprehension, recollection, and overall reaction towards the text (see Sadoski, 1998, for a review). Both induced

imagery and spontaneous imagery will be explored as significant contributors to the realm of studies involving imagery.

Induced Imagery

A study in 1972 by Anderson and Kulhavy asked high school students to make “vivid mental pictures” of what was described in a fabricated historical account. Students were given the reading passage and told they would be given a test on it the following day. Students were asked to make “vivid mental pictures” to aid them in comprehending and recalling the text. After the test was taken, students were asked to report their usage of vivid mental pictures while studying the text. Those who made mental images while studying the text outperformed students who did not by a statistically significant amount.

In 1976, Pressley gave a group of eight-year-olds the task of reading a 950 word story. Each child was trained to make mental images for progressively longer passages and was shown corresponding examples of images that expressed the intended message. The results showed the benefit of teaching mental imagery strategies. The experimental group, instructed to use the mental imagery strategies, correctly answered significantly more questions than the control group.

Gambrell and Bales (1986) conducted another study in which students were asked to make mental images. These researchers found that students who reported using mental imagery outperformed those who did not in

comprehension-monitoring tasks. Students who reported using mental imagery were more likely to find textual inconsistencies, showing superiority in error detection over the non-image-making' group. The researchers concluded that when mental imagery is used as a reading strategy, it increases readers' ability to assess their understanding of the material.

To further enhance comprehension and memory, additional studies employed induced mental imagery in conjunction with other strategies. Linden and Wittrock (1981) showed, with statistically significant data ($r = .44, p < .01$), that students instructed to create connections to the text with various strategies, of which mental imagery played a crucial role, comprehended more material than students not instructed to create associations. In 1984, Clark, Deshler, Schumaker, Alley, and Warner taught visual imagery strategies and self-questioning strategies to learning disabled students and found that the students were able to answer significantly more comprehension questions when employing either strategy. Gambrell and Jawitz (1993) asked a group of fourth graders to implement mental imagery strategies in conjunction with text illustrations. The results showed a dramatic percentage of increase in comprehension and recall for those students instructed to simply induce mental imagery. This study yielded even greater results for the group using a combination of mental imagery and text illustration, offering an encouraging incentive for educators to incorporate the two strategies in their teaching.

Illustrations

While Gambrell and Jawitz' (1993) study offers promising results from students who used a combination of mental imagery and illustrations, other researchers have hypothesized that only certain text illustrations are useful and that some could be counterproductive to the reading process. Elster and Simons (1985) investigated the difference between illustrations in first-grade texts. They established that there are two types of illustrations, ones dependent on to give meaning to the text (a reference to "that" demands an illustration portraying "that"), and ones independent of the text which simply enhance a reference or provided additional background information.(for instance., an illustration of a tall boy in a yellow hat corresponds with a reference made of a tall boy with a yellow hat). Elster and Simons theorized that having to simultaneously attend to text and the illustrations that are necessary to interpret that text only serves to slow down the reading process and make it a much more difficult task. On the other hand, the independent illustrations enabled readers to rely solely on the words and use the illustrations to merely enhance the text without interfering with the reading process. Rose (1986) investigated the effects of illustrations on reading comprehension of thirty-two elementary-aged learning disabled students. Rose found that his subjects correctly answered significantly more comprehension questions for non-illustrated passages than for illustrated passages. There was a

statistically significant difference of totals [$t(31) = 4.53, p < .001$]. These results seem to indicate that illustrations may ultimately interfere with comprehension.

Spontaneous Imagery

As an instructional tool, mental imagery appears to be a valid, effective and important strategy. Since inducing mental imagery has been shown an effective mnemonic, researchers became curious to see if creating mental imagery was indeed something that better readers did without instruction. Since readers instructed to use mental imagery outperformed those who did not, then, researchers hypothesized, that those who outperform others in comprehension and memory naturally use mental imagery as standard practice while they read.

Sadoski 1983 and 1985 are duplicate studies, with the latter done to corroborate the findings of the former. The 1985 study differed from the 1983 study in that it was conducted with students in a higher grade level (fifth graders, as opposed to third and fourth graders), and used a different text that did not contain illustrations. A significant difference between the two studies was that the students who read the unillustrated version reported more imagery. Both studies reported a significant increase in imagery involving the stories' climactic event, suggesting that there is a relationship between imagery and affect.

In a similar study, using fifth-grade subjects, Long, Winograd, and Bridge (1989) studied the reported spontaneous imagery produced from texts covering

three different genres: poetry, narrative, and expository: Students, who were asked to read aloud, were stopped at pre-selected points during reading, where the production of imagery was deemed likely, to share their thoughts at that point during the reading. The students were then asked to share their thoughts after they had finished reading. As Long et al. expected, students reported imagery even though they were not instructed to do so. Like Sadoski's (1983, 1985) findings, no significant correlation was found between reported imagery and comprehension scores; however, Long, Winograd, and Bridge (1989) suggest that their findings: 1.) indicate that imagery increases the capacity of working memory while reading; 2.) imagery is involved in helping the reader make connections to the text; and 3.) imagery is integral to storage of meaning obtained from the reading. So while reports of imagery could not be linked statistically to comprehension in either of Sadoski's (1983, 1985) studies or Long, Winograd, and Bridge's (1989) study, both groups contend that the impact of imagery on comprehension cannot be measured with the types of tests administered.

Sadoski, Goetz, Olivarez, Lee, and Roberts (1990) asked 72 community college students to recall a story and report any imagery experienced immediately following and again 48 hours later. Three distinct task instructions were assigned randomly, including, reading for theme, reading for pleasure, and reading for typographical errors. As a result of this study, Sadoski et al. found that although the verbal recall accounts declined after 48 hours, the reports of imagery did not.

This information leads to further assumptions that can be made about the relationship between imagery and memory: “Overall, this study has demonstrated, with one story, that imagery and verbal processes can be seen as basically separate processes that operate in a complex, integrated fashion in reading” (p. 69).

McCallun and Moore (1999) take a more critical look at imagery reported while reading. Specifically, these authors attempt to establish a dichotomy between types of imagery. They contend that it is the quality of the imagery, not the quantity, that counts in regards to memory, and, therefore, they categorized reported imagery as either: constrained imagery (imagery that relates directly to the text), and non-constrained imagery (imagery that is superfluous, or not related to the text). Their findings indicated that constrained imagery correlated positively with comprehension, and that non-constrained imagery did not enhance comprehension, and perhaps impeded the students’ understanding of the text. In other words, not all imagery produced during the reading process is helpful, especially if it distracts the reader from the actual content.

Dual Coding Theory

As some of the image-related research indicates, there is not necessarily a direct correlation between use of imagery, (induced or occurring naturally), and comprehension, though Sadoski (1998) contends that this is due to the nonverbal

nature of imagery. In order to understand how imagery works in conjunction with reading cognition, we must understand what our minds are doing when we read.

One of the more promising and well-known theories is derived from Paivio's (1986) dual coding theory. Essentially, dual coding is a theoretical explanation for the thought processes involved with reading, wherein verbal and nonverbal information are "processed in functionally independent, but interconnected, systems" (Hodes, 1994, p. 2). Dual coding theory seems to work due to the binary nature of the reading process and cognition in general. Paivio (1986) states:

Human cognition is unique in that it has become specialized for dealing simultaneously with language and with nonverbal objects and events. Moreover, the language system is peculiar in that it deals directly with linguistic input and output (in the form of speech or writing) while at the same time serving a symbolic function with respect to nonverbal objects, events, and behaviors. Any representational theory must accommodate their functional duality. (p. 53)

In other words, reading requires a constant shifting between verbal and nonverbal symbols that become coded in order to assign meaning and to ultimately make sense of what we read. Sadoski (1983) contends that visualization may, in fact, disrupt reading, since more miscues occurred during the most heavily reported visualized event. Sadoski's results help to corroborate a dual coding system, since, based on his findings, when visualization occurs, attention to verbal coding is neglected. Based on posttest interviews, Sadoski noted that students tended to verbally miscue at the same points they divulged that visualizing occurred. For

this reason, Pressley (1976) had instructed his students to turn to a blank page after reading each page in order to visually process what they had just read.

Regardless of the theory researchers subscribe to, the need to understand how the brain codes information is crucial to developing information retrieval strategies. Although there is some debate as to which of the theories is most accurate, several studies (Sadoski, Paivio, & Goetz, 1991; Sadoski, Goetz, & Fritz, 1993; Sadoski, Goetz, & Avila, 1995), along with brain-based research, supported by neurologists' knowledge of brain mapping, tend to confirm Paivio's dual coding theory (Bruer, 1999).

Concreteness and Affect

Anderson (1974) examined undergraduate students' ability to recall sentences after general nouns were modified using more concrete nouns and again after abstract nouns were replaced by concrete nouns. Results indicated that the subjects were able to remember fifty percent more of the sentences that contained concrete modifiers.

In 1980, Wharton studied the effects of revising narrative historical passages to include more concrete language. Approximately twelve percent of the words in the passages were changed. Also, a panel of history professors determined that the integrity of the passages had not been changed. It was

reported that students scored significantly higher on comprehension tests for the passages which were altered to include more concrete language. Furthermore, students found the altered passages more interesting and imagery evoking.

Several studies have been conducted which reveal that reports of imagery generally correspond with text that is concrete and/or emotionally charged. This is perhaps why the two studies by Sadoski (1983, 1985) found that the highest instances of reported imagery came at the climax of stories. However, more recent studies by Sadoski and his colleagues (Sadoski, Goetz, & Kangiser, 1988; Sadoski, Goetz, & Fritz 1993) found that the highest instances of reported imagery did not necessarily come at rhetorically designated key points in texts or at points deemed more important to the main idea of the text. Often, the imagery was rated highest at points considered more interesting by the reader, leading one to believe that affect and imagery are closely associated.

The possible link between affect and imagery is one that Sadoski, Goetz, and Fritz (1993) attempted to juxtapose with Paivio's dual coding theory. Since affective or emotional responses and imagery are nonverbal in nature, these authors proposed that they share the same coding and, therefore, can trigger memory in much the same way. As concrete language influences one's ability to create imagery, concrete language, imagery, and affect share responsibility toward understanding and remembering what has been read:

Dual coding theory predicts that concrete language should be better comprehended and integrated in memory than abstract language because two forms of mental representation—language and imagery—are available for processing concrete information. Hence, dual coding theory predicts that, with all else equal, concreteness will be the best predictor of comprehension and recall. (Sadoski, Goetz, and Fritz, 1993, p. 292)

The hypothesis, stated above, resulted from initial findings by Sadoski and Quast (1990) which suggested that concrete and vivid personal impressions are likely to be more easily retrieved than abstract information, regardless of its relevance to the text, especially if the abstract information is not associated with imagery and emotion.

CHAPTER III

Design of Study

Purpose

The purpose of this study was to determine the potential link between imagery and recall. This study was designed to indicate whether or not the concreteness of the passages has an effect on recall.

Research Questions

1. Is there a statistically significant difference between the mean combined totals of unprompted and prompted recall of the control passages and the experimental (visualized) passages?
2. If there is a difference, does it hold for passages of low imagery content (abstract) and high imagery content (concrete)?

Methodology

Subjects

The subjects of this study consisted of thirty heterogeneously grouped ninth-grade students from two separate English classes in a suburban high school

outside of Rochester, New York. Of the thirty students, fourteen were males and sixteen were females.

Materials

The materials used in this study consisted of four separate passages taken from various sources (see appendices A,B,C, and D). These passages were chosen for their parallel structure. The two concrete passages (appendices A and C) had similar topics: each was an animal, and each offered the reader vivid descriptions, designed to stimulate the production of mental imagery. The two abstract passages (appendices B and D) dealt with an aspect of earth science and had a negligible amount of description, offering minimal use of language intended to produce imagery. The four passages also had a similar word count. In terms of difficulty, the passages were similar, excepting that the passage about the marmot (appendix A), which was likely to be a less familiar animal than the polar bear (appendix C).

Procedures

This study took place over a period of four weeks. Each student was assigned two treatment conditions. There were four different passages used in this study: two passages were more concrete, containing language intended to produce imagery, and the other two were more abstract, containing minimal use

of language intended to produce imagery. In both conditions, the students were asked to read one concrete passage and one abstract passage. The passage each student received first (concrete or abstract), and which pair of the two concrete and abstract passages each student read, was counterbalanced throughout the two treatment conditions. Each student eventually read all four passages.

Condition one. Students were escorted individually from the classroom setting to a quiet room with their regular classroom teacher. Next, the students were instructed to read a total of two passages silently, one at a time, reading each passage in the way that they normally would in order to remember as much information as possible. They were told that they would be asked to retell each passage and answer questions about it upon completion. Students were also instructed to turn over the passage once they were finished reading. At that point, they were asked to retell as much information as they could remember from their reading. The teacher then asked probing questions in order to elicit more recalled information from the passage. Once the students could recall no further information, the same process was repeated for the second passage.

Condition two. The same students used for condition one were used for condition two. All students received three twenty-minute whole-group training sessions designed to help them visualize the assigned passage. A one-week semester break separated the initial testing, as outlined in condition one, with the beginning of the training sessions. Instruction was given during class every other

day over the course of one week. After training was completed, students were given the same instructions as outlined in the previous treatment with one addition: they were told to visualize as they read and were reminded to pause, if necessary, to create a complete mental image before moving on to the next sentence.

Training. The training sessions were designed to acquaint students with mental imagery and to help them use mental imagery strategies to aid them in recalling text. Since the students were required to read more than just imagery-evoking passages, time was allotted to aid them in visualizing abstract words and ideas as well. Students completed their training by reading full-length short stories, using their visualization strategies, and answering comprehension questions about the passages. The short stories used for the training differed dramatically from the passages used in the study to prevent compromising the integrity of the study. All students used in this study were able to correctly answer a minimum of ninety-percent of these questions.

Analysis of Data

The data collected for this study were analyzed quantitatively. After reading each passage, each student provided a verbal retelling, followed by prompting from the teacher to elicit additional recall. While some of the prompting questions required the students to show a deeper understanding of the

text, comprehension was not a measured factor in this study. Each passage was divided according to its key words or phrases on the teacher's tally sheet. Accordingly, a tally was marked if the students mentioned any key words or phrases, or any interchangeable words or phrases with the targeted key words or phrases (for example, "appeared" instead of "came out"). A mark was tallied for any accurate key words or phrases, or any words or phrases that could be interchangeable with the key words or phrases, uttered in the student's response to the prompting questions.

The only data analyzed in this study were the total number of responses tallied from each passage. The total number of responses was calculated by adding the combined unprompted and prompted responses. First, the combined totals of the concrete and abstract passages from one treatment condition to the other were analyzed for statistical significance. Then the totals of the concrete passages from one treatment condition to the other were analyzed for statistical significance. Finally, the totals of the abstract passages from one treatment condition to the other were analyzed for statistical significance.

CHAPTER IV

Conclusions

Purpose

The purpose of this study was to determine the potential link between imagery and recall. This study was designed to indicate whether or not the concreteness of the passages has an effect on recall.

Research Questions

1. Is there a statistically significant difference between the mean combined totals of unprompted and prompted recall of the control passages and the experimental (visualized) passages?
2. If there is a difference, does it hold for passages of low imagery content (abstract) and high imagery content (concrete)?

Findings

This study posed two hypotheses: 1. students would increase their ability to recall information from the passages they read by using mental imagery strategies, and 2. gains in recall would be greater for the concrete passages than

for the abstract passages. The following statistical analyses were chosen to test those hypotheses, both of which were supported.

Table 1

t-Test: Paired – combined concrete and abstract total responses

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	8.733333333	11.45
Variance	15.8259887	16.76016949
Observations	60	60
Pearson Correlation	0.357166435	
Hypothesized Mean Difference	0	
df	59	
t Stat	-4.597233291	
P(T<=t) two-tail	0.0000230934755900273	
t Critical two-tail	2.000997483	

The first hypothesis stated that gains in recall would be greater in the concrete passages. A *t*-test was used to compare the results from the control condition to the experimental condition. The data in Table 1 indicate a statistically significant increase in mean totals of both the concrete and abstract passages when the students used mental imagery strategies compared to the control condition, which did not specify use of any strategy other than reading to remember as much information as possible. The average total score before receiving imagery instruction was 8.7, while the mean total score after training was 11.4. Employing a 95% confidence level, with a *p*-value of 0.0000230934755900273, the research

hypothesis is clearly supported. The data indicate that using mental imagery strategies while reading can enhance recall.

The second hypothesis stated that gains in recall would be greater for the concrete passages than for the abstract passages. In order to test this hypothesis, the data were separated based on the type of passages (concrete or abstract) that the subjects were given.

Table 2

t-Test: Paired - total responses, concrete		
	<i>Control</i>	<i>Experimental</i>
Mean	9.833333333	13.73333333
Variance	18.90229885	12.54712644
Observations	30	30
Pearson Correlation	0.167185772	
Hypothesized Mean Difference	0	
df	29	
t Stat	-4.165310299	
P(T<=t) two-tail	0.00025494	
t Critical two-tail	2.045230758	

The data in Table 2 indicate a statistically significant difference ($df = 29$, $t = -4.17$, $p < .01$) among the concrete passages from the control condition to the experimental condition. The average number of recall responses per student before receiving imagery instruction was 9.8, while average number of recall responses per student after training was 13.7. These data supports the first half of

the second hypothesis. Mental imagery strategies have a significant impact on passages that have concrete language.

Table 3

t-Test: Paired - total responses, abstract		
	<i>Control</i>	<i>Experimental</i>
Mean	7.633333333	9.166666667
Variance	10.79195402	10.76436782
Observations	30	30
Pearson Correlation	0.376986552	
Hypothesized Mean Difference	0	
df	29	
t Stat	-2.29171737	
P(T<=t) two-tail	0.029372343	
t Critical two-tail	2.045230758	

The data in Table 3 do show a statistically significant difference ($df = 29$, $t = -2.29$, $p < .05$) among the abstract passages from the control condition to the experimental condition. The data indicate improvement of the average number of recall responses per student after receiving imagery instruction with an average difference of 2.29 responses. The second half of the second hypothesis is supported. Mental imagery strategies are effective with passages containing abstract language; however, the mental imagery strategies have a greater impact when implemented with passages containing concrete language.

Figure 1

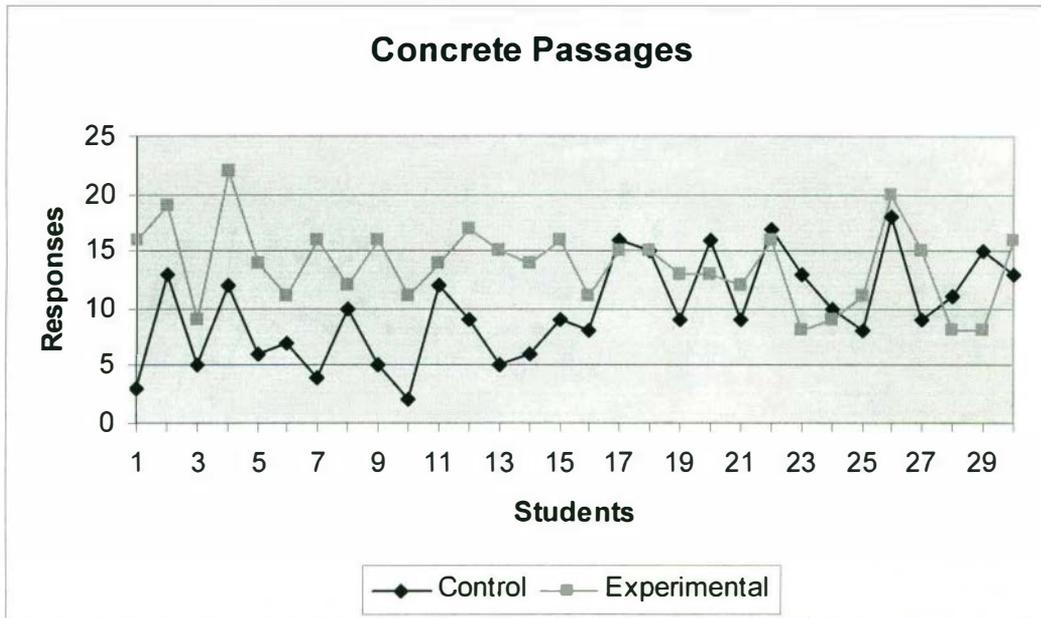


Figure 1 shows the contrast between the experimental and the control treatments for the concrete passages. Only seven of thirty students gave fewer responses after being trained to use mental imagery strategies with the concrete passages, while one student's score remained constant.

Figure 2

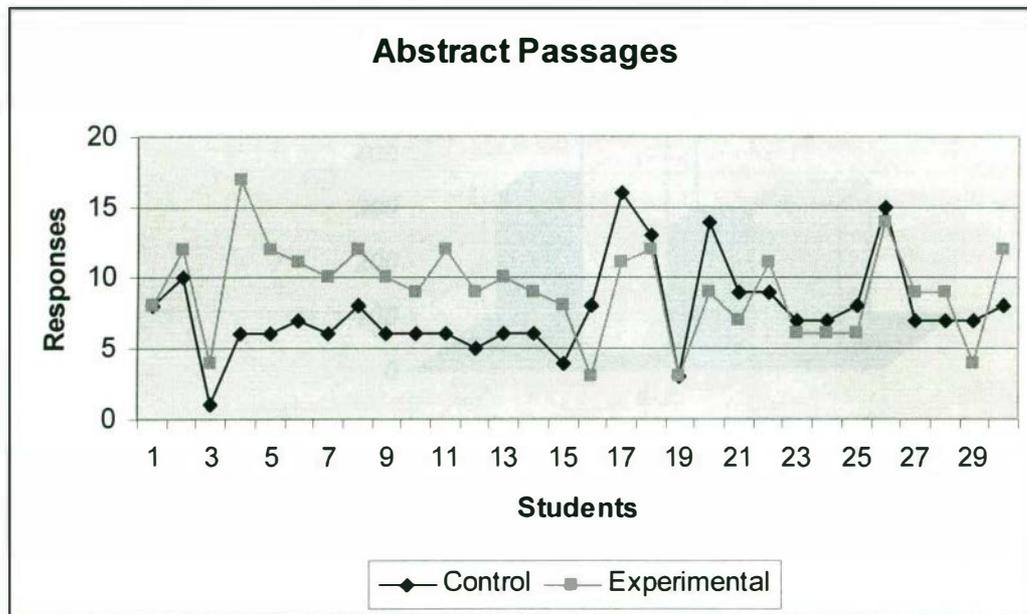


Figure 2 shows the contrast between the experimental and the control treatments for the abstract passages. Ten of thirty students gave fewer responses after being trained to use mental imagery strategies with the abstract passages, while two students' scores remained constant.

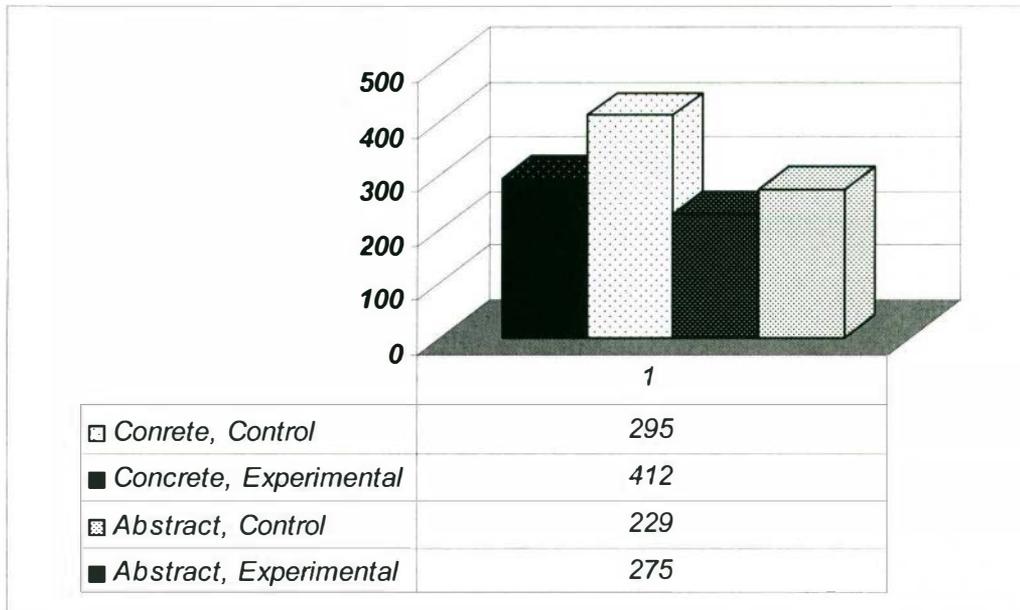
Figure 3

Figure 3 juxtaposes the total number of responses of both concrete and abstract passages from the control condition and the experimental condition. While the abstract passages yielded comparatively less responses than the concrete passages from either treatment condition, there is a clear increase of the totals in the experimental treatment from the totals of the control treatment in all passages. The data indicate that using mental imagery strategies has a greater impact on recall of passages containing more concrete language, and accordingly, have some, though not a statistically significant, effect on passages which contain abstract language.

CHAPTER V

Implications for Further Research

Purpose

The purpose of this study was to determine the potential link between imagery and recall. This study was designed to indicate whether or not the concreteness of the passages has an effect on recall.

Findings and Conclusions

The data seem to confirm that the use of mental imagery strategies was a viable method to increase students' ability to recall information from the passages they read. The general gains in the recall totals and the statistical tests support the claim that mental imagery had a positive impact on the students' recall ability. Of the sixty total observations made during this study, students recalled less information only seventeen times after mental imagery training, while there was no change only three times.

Secondarily, the data also validate the claim that the passage's concreteness positively correlates to its ability to be recalled. Both the concrete and abstract passages yielded statistically significant gains. There were, however, notably higher gains among the concrete passages when compared with the abstract passages from the control condition to the experimental condition.

Furthermore, there were twenty more responses tallied for the concrete passages in the control condition than there were for the abstract passages in the experimental condition after training completion. This fact is further solidified by emphasis on word counts for the passages. Although the combined word count of the abstract passages exceeded the combined word count of the concrete passages by sixty words, the students were still able to recall more total words and phrases from the concrete passages than the abstract passages. Since the recall totals were tallied according to key words and phrases, the fact that the average number of students recalled more from the concrete passages suggests that concrete language promotes better recall.

Although I had offered training for visualizing abstract concepts, the students in this study experienced difficulty with the abstract passages. While this was to be expected, it appeared that in place of actual information recall of the passages, students often relied upon their core science background in order to fill any gaps in their understanding of the passage. For instance, on several occasions students confused density (Appendix D) with mass or volume, and some stated the equation: “density equals mass over volume,” which did not appear in the passage, but is fundamentally correct. Several students reported difficulty conceptualizing the passage on heat energy (Appendix C), although the passage’s author attempted to supply the reader with a mental image of the process. These examples characterize the difficulty many students experience when reading.

abstract, yet typical, grade-level appropriate reading material of most science and core-curriculum classes at the high school level.

Initially, there were thirty-four students tested for the control condition. Three students were not used for the experimental condition due to absences at various intervals of the training and, consequently, their control condition scores were eliminated. Another student was eliminated after a conspicuously inferior performance during the experimental condition testing prompted me to inquire about his health. According to his mother, this student was undergoing a medication change which clearly altered his ability to focus on the testing.

Implications for Classroom

Examination of my weaker readers' shortcomings prompted my desire to explore the concept of mental imagery. Projecting a clear picture of what we read is the primary function of skillful reading. The ability to read and recall information read is an essential skill that students must master if they are to be successful scholastically and on most state-mandated standardized tests. While many of my students understood the importance of creating mental images, they did not seem to grasp how important it was, how it could increase their ability to remember what they read, and, ultimately, how much it could enhance their comprehension. It is essential, not only to train them to visualize what they read, but to draw upon multi-sensory resources whenever possible, even if they are not

directly called for in the print. If students routinely incorporate sensory textual enhancement techniques, they should not only retain more information, but find greater enjoyment in reading, because it becomes real and personally engaging. Cultivating student reading enjoyment is every English teacher's goal. Through the detailed instruction of mental imagery strategies, this goal is attainable.

Additionally, many of my students have implemented the mental imagery strategies that they learned in this unit and applied them to other subjects to complete their homework and study for tests with greater efficiency. They have found that the creation of a complete image of a word, person, or event, enhances their ability to recall the image than with greater success than the utilization of standard rote.

A critical reason for including language concreteness as a pivotal aspect in this study was to provide solid evidence of students' need for more than reading material containing abstract information. While many of the students in this study were able to recall words and phrases from the abstract passages, they were unable to link much of the information together cohesively. For instance, many students were able to report that when flame is placed underneath a frying pan (see Appendix D), molecules collide and the pan heats up. Many students could not report, even after prompting, what happens before the molecules collide and how the collision of molecules actually caused the pan to heat up. In other words, many students retold the pieces they believed to be of importance to the passage,

but could not place them into a meaningful whole. While this study's goal was not to test comprehension, it seemed apparent that many of the students tested clearly did not understand the abstract concept being explained in the passage.

Conversely, there was a very clear indication that the majority of students understood much of the concrete passages. Even though we must teach abstract concepts, the lesson to be learned from this study is that abstract concepts need to be taught through a variety of methods, with the student's expectation that conceptual acquisition of an abstract concept from reading alone is counter-productive.

Finally, teachers need to be aware of what their students do not know. As educators, we are constantly testing students for retention. Of utmost importance is the use of this skill to supply our students with the information they lack before we proceed. Unfortunately, for most teachers, tests are the end instead of a means. A student's ability to make a mental image depends upon his or her ability to conjure its likeness from memory. If the student lacks the word to image association, visualization becomes an impossible task. It is imperative that educators cultivate awareness of students' informational gaps and to creatively offer a variety of avenues in which the student can explore the sights, sounds, smells, texture, and taste, where applicable, whether they are places, historical events, people, or concepts. Connecting information with the senses assures powerful association to the information students must know and be able to recall.

Implications for Further Research

In consideration of the seventeen of sixty occasions upon which students did not improve following training, it should be noted that it was difficult to test for *mastery* in implementing mental imagery strategies. Although students may have successfully answered the preliminary comprehension questions during the final training session, and though students conceded that they did picture the assigned text during the training session, actual student usage was immeasurable during the testing, even with prompting. In one instance, a student confided that he was unable to picture anything, citing confusion of instructions, despite the training received. When asked why he didn't verbalize his confusion during the training sessions, he admitted a reluctance to call attention to himself. Upon closer inspection of my students and their scores, it seems that this student's explanation could easily account for a few of his peers who scored lower after the training. This type of behavior is consistent with many ninth grade students that I have taught over the years, and needs to be addressed through the condition of a similar study.

Since the passages were counterbalanced (meaning that fifteen students received this passage as part of the control condition, and the other fifteen students received this passage as part of the experimental condition), some potential problems with the study's design must be identified. Of the seven

students who registered a decline in recall totals, six of the seven scored lower on both the concrete and abstract passages. Additionally, all seven of the students scoring lower on the concrete passages were in the same English class, which suggests that the selection and order of the passages impacted the overall totals. This can be considered a flaw in the study conditions, as it may be that the two passages used for the control condition in this group of students (Appendices C and D) were less difficult than the two passages used in the experimental condition (Appendices A and B). This explains why, of the fifteen students in the first English class, in which the order of passages given in the control and experimental group were reversed, no student scored lower in the experimental condition. Observations and commentary from the students indicated that the passage with the marmot (Appendix A) appeared to be difficult for several students because they lacked adequate familiarity with this animal. In consideration of the fact that the main focus of this experiment was student visualization of assigned text, it was counterproductive to the experiment that several students seemed to inadequately visualize the primary subject of one of the passages.

Another valid explanation for the disparity of scores from one group to the next is that two of the passages paired together (Appendices A and B) contained a significantly lower word count than the other two passages by a combined total of sixty-two words. In other words, students would have been predisposed to score

slightly higher or lower depending solely on the order in which they received the passages.

While the aforementioned issues concerning this study's validity are anything but irrelevant, my opinion is that all of my students benefited greatly from this training. With less flawed test conditions, my students would have presented significant gains in recall. I witnessed some remarkable increases from students who had previously struggled with reading.

Summary

While mental imagery strategies are not a panacea for all students who may be struggling with reading, this and other research suggests that they can help students make significant gains in recall ability. Mental imagery strategies require students to use different ways of thinking in order to make a more lasting association, which improves reading skill and retention ability. Furthermore, encouraging the mind to take print and convert it into a mental picture is an active, creative process which prompts the student to view reading as an engaging activity, instead of glancing at the black print on the white page, half-heartedly hoping to be able to regurgitate the desired information at the appropriate time. Education has always been more than replication. The findings in this study, paired with the findings of the literature presented, demand the use of mental imagery as a viable, vital way to make reading more accessible to our students.

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Appendix A

Adapted from pages 2-4 of:

George, J.C. (1984). One day in the alpine tundra. Scholastic, Inc, Broadway, New York.

The Marmot

A marmot, the woodchuck of the high country, left his burrow in a boulder field beginning where the trees stop growing and climbed to his lookout post. Perched under the teetering chunk of rock, he whistled a shrill note reminiscent of a boy calling his dog. The whistle told other marmots who he was—the boss of this boulder field. Having made his statement, he sneezed, then sat up on his haunches. After slowly and carefully surveying his rocky kingdom, he returned to his underground burrow as naturally as he came out. He is one of the animals that have adapted to the harsh climate on the tops of tall mountains in boulder fields beginning where the trees stop growing.

<p>Unprompted Memories; Please retell the passage</p> <p>___ a marmot</p> <p>___ called woodchuck of the high country</p> <p>___ left his burrow</p> <p>___ boulder field</p> <p>___ beginning where the trees stop growing</p> <p>___ climbed to his lookout post</p> <p>___ perched under a teetering chunk of a rock</p> <p>___ whistled shrilly</p> <p>___ reminiscent of a boy calling his dog</p> <p>___ to show he was boss</p> <p>___ sneezed</p> <p>___ sat up on his haunches</p> <p>___ slowly and carefully surveying his rocky kingdom</p> <p>___ returned to his underground burrow</p> <p>___ as naturally as he came out</p> <p>___ adapted to the harsh climate</p> <p>___ on the tops of tall mountains</p> <p>___ in boulder fields</p> <p>___ beginning where the trees stop growing</p>	<p>Prompting Questions:</p> <p>___ What is the name of the animal? (marmot)</p> <p>___ What is the marmot also known as? (woodchuck of the high country)</p> <p>___ Where does the marmot live? (boulder field)</p> <p>___ Where was this boulder field located? (mountaintop, where trees stopped growing)</p> <p>___ What did the marmot do?</p> <p> ___ left burrow</p> <p> ___ perched on a rock</p> <p> ___ whistled</p> <p> ___ sneezed</p> <p> ___ sat up on haunches</p> <p>___ Why did the marmot whistle? (dominance)</p> <p>___ What did the author compare the whistle to? (a boy calling his dog)</p> <p>___ What was he looking at? (his kingdom)</p> <p>___ Where did he end up going? (his burrow as he came)</p> <p>___ What is special about this animal? (adapted)</p>
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Appendix B

Adapted from page 205 of:

Snyder, R.E., Mann, B.L., Ludwig, F.A., Brecht, W.A., and Stasik, J.H. (1991).
Earth science: The challenge of discovery. D.C. Heath and Company.
 Lexington, Massachusetts.

Density

All minerals have a particular density. Density is the amount of matter in a given space. No matter how large two samples of a mineral are, they always have the same density. A mineral's density is sometimes measured by comparing its weight to the weight of an equal volume of water. This is called specific gravity. For example, the specific gravity of silver is 10.5. This means silver weighs 10.5 times more than an equal volume of water.

Of course, you can also test the density of something by lifting it. You can tell which one has the greater density by judging which one feels heavier. For example, a sample of galena (which contains lead) feels heavier than an equal size sample of bauxite (which contains aluminum). Lead is a much heavier metal than aluminum. Therefore, galena is denser than bauxite.

<p>Unprompted Memories; Please retell the passage</p> <p>___ All minerals have a particular density</p> <p>___ Density is the amount of matter in a given space</p> <p>___ No matter how large two samples of a mineral are</p> <p>___ they always have the same density</p> <p>___ measured by comparing weight to the weight of an equal volume of water</p> <p>___ called specific gravity</p> <p>___ example, s.g. of silver is 10.5</p> <p>___ silver is 10.5 times heavier than = vol. of H₂O</p> <p>___ also test the weight of something by lifting it</p> <p>___ greater density by judging which one feels heavier</p> <p>___ galena (which contains lead)</p> <p>___ feels heavier than an equal size sample</p> <p>___ of bauxite (which contains aluminum)</p> <p>___ lead is a much heavier metal than aluminum</p> <p>___ galena is denser than bauxite</p>	<p>Prompting Questions:</p> <p>___ What does density measure? (amount of matter)</p> <p>___ Does the size of a mineral affect its density? (no)</p> <p>___ What is specific gravity? (mineral weight compared to weight of an equal volume of water)</p> <p>___ What is the specific gravity of silver? (10.5)</p> <p>___ What does a specific gravity of 10.5 mean? (10.5 times greater than an equal volume of water)</p> <p>___ How else could you test density? (lifting it)</p> <p>___ How would you know that a mineral is more dense than another? (if equal in size, one is heavier than the other)</p> <p>___ Can you explain why galena is more dense than bauxite? (galena has lead and bauxite has aluminum and lead is heavier than aluminum)</p>
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Appendix C

Adapted from page 1 of:

McGregor, E. 2001. The ice child. New American Library, New York, New York.

And:

Teel, S. (2002). "The Polar Bear." Teelfamily.com. Retrieved December 20, 2003 from <http://www.teelfamily.com/activities/polarbear/>

The Great White Bear

The great white bear lifted her head, narrowing her eyes against the driving Arctic snow. All around her the ice groaned as it moved, compressed by the pressure that flooded from the sea. She looked back along the rubble ice to the cub that followed her, waiting for him in the white-on-white landscape.

It was desperately cold. Colder, certainly, than a human-being could tolerate for long. But the bear did not register the temperature, padded as she was by four inches of fat and a thick layer of woolly fur made of long, hollow guard hairs that stick up at all times—hairs that look like plastic straws and keep the bear's hair from matting down while swimming in the cold arctic water. She was generally unconcerned, since she was in her country, her kingdom, impervious to any law but her own.

<p>Unprompted Memories; Please retell the passage</p> <p>___ great white bear (polar bear)</p> <p>___ lifted her head</p> <p>___ narrowed her eyes</p> <p>___ heavy snow</p> <p>___ Arctic</p> <p>___ ice groaned</p> <p>___ compressed by the pressure from sea</p> <p>___ looked back (along rubble ice)</p> <p>___ waited for the cub to catch up</p> <p>___ white-on-white landscape</p> <p>___ very cold</p> <p>___ too cold for people</p> <p>___ bear did not feel the cold</p> <p>___ padded by four inches of fat</p> <p>___ and thick layer of woolly fur</p> <p>___ fur made of long, hollow guard hairs</p> <p>___ look like plastic straws</p> <p>___ keep the bear's hair from matting down</p> <p>___ while swimming in the cold arctic water</p> <p>___ unconcerned</p> <p>___ ruled the country</p>	<p>Prompting Questions:</p> <p>___ What is the name of the animal? (great white bear)</p> <p>___ What was the weather like? (snowing, cold)</p> <p>___ What sound was made around the bear? (groaned)</p> <p>___ What caused the sound? (ice moving)</p> <p>___ Was the bear alone? (cub)</p> <p>___ What was the bear walking on? (ice)</p> <p>___ What was the temperature? (cold)</p> <p>___ Could a human survive for long in that temperature?</p> <p>___ Does the temperature bother the bear(s)? Why not? (No; 4 inches of fat and insulating fur)</p> <p>___ What is the purpose of the bear's special hair? (keeps it from matting down in cold water)</p> <p>___ Where does the bear live? (Arctic)</p> <p>___ Why is the bear "unconcerned?" (ruled her country)</p> <p>___ Even though it isn't mentioned in the passage, what is another name for this bear? (polar bear)</p>
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Appendix D

Adapted from pages 122-3 of:

Daley, R.B., Higham, J.W., and Matthias, G.F. (1986). Earth science: A study of a changing planet. Allyn and Bacon, Inc. Rockleigh, New Jersey.

Heat Energy

Heat energy can be transferred by conduction through solids, liquids, or gases. However, the solid form of any material usually conducts heat more effectively than the liquid or gaseous forms. The main reason for this is that the atoms or molecules of a solid are held together by strong forces of attraction. In a liquid or gas, the particles move more freely. Therefore, the motion of each particle in a solid has a greater effect on its neighbor than the motion of particles in liquids and gases.

For instance, when a frying pan is heated, its molecules and atoms move faster and faster, because they are gaining energy. So when a burner is turned on, the areas of the pan directly over the flames or in contact with the electric coils immediately begin to heat up. The molecules in these areas move faster and faster. These fast-moving molecules collide with neighboring molecules and transmit some of their energy to them. The neighboring molecules then collide with still other molecules, and so on. In this way heat is transmitted throughout the pan.

<p>Unprompted Memories; Please retell the passage</p> <p>___ Heat energy</p> <p>___ transferred by conduction</p> <p>___ through solids, liquids, or gases</p> <p>___ solid form conducts heat more effectively than the liquid or gaseous forms</p> <p>___ atoms or molecules of a solid are held together by strong forces of attraction</p> <p>___ In a liquid or gas, the particles move more freely</p> <p>___ each particle in a solid has a greater effect on its neighbor than the motion of particles in liquids and gases</p> <p>___ when a frying pan is heated</p> <p>___ molecules and atoms move faster</p> <p>___ they are gaining energy</p> <p>___ when a burner is turned on</p> <p>___ part of pan in contact with flame or coils immediately begin to heat up</p> <p>___ molecules in these areas move faster and faster</p> <p>___ fast-moving molecules collide with neighboring molecules</p> <p>___ transmit some of their energy</p> <p>___ neighboring molecules then collide with still other molecules</p> <p>___ In this way heat is transmitted throughout the pan</p>	<p>Prompting Questions:</p> <p>___ How is heat energy transferred? (conduction through solids, liquids, or gases)</p> <p>___ What does heat energy transfer through? (solids, liquids, and gases)</p> <p>___ What does heat energy transfer most effectively through? (solid)</p> <p>___ Why does heat energy transfer more effectively through solids as opposed to liquid or gas? (in a solid each particle has a greater effect on neighboring particle – in liquids and gases particles move more feely)</p> <p>___ What example was used in this passage? (heating of frying pan)</p> <p>___ What happens when a burner is turned on under a pan? (___ immediately heats pan, ___ molecules in area move faster, ___ collide with neighboring molecules, ___ heat transmitted throughout pan)</p> <p>___ (ADDITIONAL PROMPT) What happens to the molecules in the pan? (___ molecules in area move faster, ___ collide with neighboring molecules, ___ heat transmitted throughout pan)</p>
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