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Pictures and Words Together: Using Illustration Analysis and Reader- Generated Drawings to Improve Reading Comprehension

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THE FLORIDA STATE UNIVERSITY
SCHOOL OF VISUAL ARTS AND DANCE

PICTURES AND WORDS TOGETHER: USING ILLUSTRATION ANALYSIS AND
READER-GENERATED DRAWINGS TO IMPROVE READING COMPREHENSION

By

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This dissertation is dedicated to my family - Bill, Gene, and Katie Manger, for their love and contributions to my education and passion for visual art; to my partner, Andy James, for his encouragement and support; and to my students, whose energy and imagination inspire me.

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ABSTRACT

Comparing art learning activities with standard academic communications led to investigation of interactions between visual and verbal communication. The feasibility of working with pictures and words together to increase understanding and to determining whether thinking skills practiced in art class could be applied to non-visual materials was studied.

Reading comprehension tests determined effects of researcher-provided and student-drawn illustrations on understanding text. Two programs of instruction, analyzing and drawing illustrations, were study treatments for my art students. Reading comprehension pre- and posttests for study and control groups determined treatment effects. Statistical analysis indicated whether text illustrations and study treatments significantly impacted reading comprehension. Student profiles allowed consideration of individual characteristics in response to study variables. Qualitative descriptions of student and researcher behaviors provided additional data for analysis.

Results showed significant increases in reading comprehension with researcher-illustrated versus unillustrated texts. Inference and factual questions were answered more correctly. When drawing text illustrations, students answered factual questions more correctly than with unillustrated texts. Treatment of picture analysis instruction produced no significant effects. Treatment of illustration drawing instruction increased reading comprehension. Two subgroups of the study population, black students and reading-disabled, demonstrated greater improvement than cohorts with researcher-illustrated tests.

Inquiry into assisting teachers and students create effective text illustrations is called for. Development of guidelines to help educators create text illustrations and methods of instruction for creating effective drawn illustrations is recommended. Cooperation of art and language arts teachers to

promote learning with pictures and words could increase student success in building and demonstrating knowledge. With reading comprehension crucial to academic achievement, helping poor readers increase understanding by providing picture illustrations is imperative.

I continue researching learning activities involving pictures and words. My art curriculum focuses upon working with picture/text representations. Art critiques emphasize images' communicative content. Production activities include pictures and words in process and product and emphasize communicative content. Considering study findings, concurring cognitive science, and contemporary communication trends, I hope educators will evaluate their instructional methods and employ strategies of working with pictures and words to benefit students. Teaching visual communication in art class should secure art within the curriculum.

CHAPTER 1
INTRODUCTION

I have been a public school art teacher since the late 1980's, working with kindergarten through high school students in north and north central Florida. Throughout my career I have used art curricula that I, myself, developed. Through my experiences speaking with colleagues locally, at state conventions, and nationally via internet discussion groups, it has become clear that, primarily, art teachers design and implement their own highly personalized curricula.

Possessing the freedom to choose what to teach presents teachers with opportunities to share their enthusiasm with students in presenting ideas, artworks, artists, materials, and techniques that they themselves find most interesting and appealing. In my case, curriculum development has been influenced by my commitment to being knowledgeable and current with regard to trends in art education and the contemporary art world. My personal preferences for content have been developed within a discipline-based, comprehensive art education structure, which includes art history, criticism, and aesthetics along with studio production activities (Greer, 1984).

Along with the freedom to plan curricula comes a sense of responsibility. My burden of responsibility involves

questioning of what is being presented to students in the form of course content. I have aspired to provide content that is intellectually relevant and useful to the majority of students in a direct and immediate way. My personal philosophy of teaching art demanded that students get more from the art program than an attractive product, a chance for creative self expression, or a bit of art-related trivia to toss into future cocktail party conversations. I have not been satisfied with attempting to prepare a minority of students for careers in the visual arts but instead have been compelled to figure out how to teach students about art concepts, skills, cultural significance, and personal expression in a way that would be useful to all students in their present day lives. This desire intensified through my years of teaching. Classroom experience increased my confidence and success in the purely practical aspects of teaching, like managing time, resources, and behavior. This left me with energy to devote to the more philosophical issues of curriculum development.

About midway through my career I began attempting to evaluate the degree to which my students used what they studied and practiced in art class in their other intellectual pursuits. Students' responses to informal questionnaires indicated that they found topics covered in art class interesting, that they enjoyed learning about the products and processes of art, and that they learned things in art class that they did not learn anywhere else. However, they did not say that the perspective drawing activities from art class helped them to understand geometry concepts or those studies of an artist's life in art class helped them to write a biography for an English assignment. They did not mention sketching representations of atoms in Science to figure out how subatomic particles functioned and they did not relate their experiences looking at

and discussing Picasso's Guernica to coming to grips with the agony and horrors of war presented in history class. Similarly, I found that colleagues, teachers of other subjects, often spoke appreciatively of the beauty of students' work on display but rarely mentioned connections between the content of the artwork and concepts explored in the classes they taught. But I saw connections between what students learned in art class and what they learned in other classes, both in subject matter and in ways of learning, and believed that students could benefit from recognition and exploration of those similarities.

An additional factor influencing my area of inquiry was the reduction in art class offerings that have occurred throughout my tenure as an art teacher. I experienced this trend personally. Due to funding considerations and the demand to maximize scores upon state mandated achievement tests, two schools where I taught cut art classes in order to increase academic course offerings, specifically in the areas of language arts and math remediation. At the same time, art programs across the country were in a similar state (Eisner, 2000; Hanson, 2002; Jensen, 2001; Sealey, 2003; Van Harken, 2003).

In response to this crisis and with the intent of influencing educational decision-makers to preserve art programs, some advocates of art education began making claims that participation in art classes could increase students' test scores and help them be more successful academically (Bracey, 2001; Catterall, 1997; Winner, 2001). But since I and most of the art teachers I know have been creating unique, highly individualized curricula, the extreme variety and diversity of learning experiences in available to students in different art classes made it difficult to justify, in my mind, a general claim of art class attendance leading to increased academic success. Also, influential art educators have cautioned against

justifying art education solely by claiming it that improves learning in other subject areas (Hamblen, 1997; Winner, 2001). From this perspective, it is better to advocate art education by emphasizing the unique ways of learning, knowing, and expressing available to students in art classes (Singley and Anderson, 1989) and to highlight the benefits of providing students with a way to think that is not accessible through any other discipline (Winner, 2001).

But I suspected that it might be possible to identify and isolate valuable and specific types of cognitive processes taking place in art classes that could be paralleled and supported by learning in other subjects. I hoped to demonstrate that explicit cognitive operations of art could be utilized to attain generalized learning objectives by providing students with a specialized way of processing and expressing information. I hoped to validate artistic approaches to cognition and to assimilating and reporting knowledge that describes the communicative nature of art activities and that compares and connects artistic with verbal communication, the current dominant form of academic interchange (Darby & Catterall, 1994, Flood & Lapp, 1997).

It was my opinion, based on my own practice, and on the literature (Bickley-Green, 1995; Davis, 1999; Dreybus, 2000; Efland, 2002; Ewy, 2003; Kellman, 1998; Manifold, 1995; Niblack, 1995; Piro, 2001), art criticism and drawing, analysis and creation of imagery, are learning activities specific to art with strong potential to be linked with other forms of cognition. I see drawing as primarily visual communication and art criticism as verbal and written communication about visual form. Reduced to its essence, art criticism can be described as derivation of meaning from an image based upon knowledge of elements and principles of composition, familiarity with visual

symbols, and exposure to historical and contextual information surrounding the image (Anderson, 1993). Similarly, drawing can be described as an expression of an idea using elements and principles of composition, fluency with visual symbols, and contextual cues. Using these two strategies, my premise is that students could be taught specific skills for communicating with images. Could those visual communication skills be connected to and combined with verbal skills? The point is to enhance students' ability to critically examine and understand information presented to them in any class thorough the combined use of visual and verbal approaches.

It is the purview of art educators to facilitate learning through art experiences. By developing a sequence of art experiences to match learning objectives directly linked to reading comprehension tasks, I hoped to demonstrate a direct connection between understanding by using pictures and understanding by using words.

Statement of the Research Problem

As an art teacher I am interested in investigating whether students can use specific types of visual learning from art class to help their understanding of written communication, the form of communication through which most information is presented in other classes. It was my goal to investigate the relationship between working with pictures as done in art class and working with words as students do in most other academic classes (Darby & Catterall, 1994, Flood & Lapp, 1997). I attempted to identify modes of learning specific to art education that may be applied to improve understanding of written communication.

The approach taken involved the strategy of using pictures and words together as tools for transmission of information and understanding. The acts of looking at and creating visual images seem to be similar to reading and writing activities in that are all forms of communication (Goodman, 1978; Sigel, 1978; Sinatra, 1986). Just as expression in language possesses certain nuances of communication unattainable in any other form, so does visual expression (Siegesmund, 1998; Nelson, Reed, & Walling, 1976). Using language to describe the elements of a hurricane - its torrential rains and violently forceful gales - can create a more tangible idea of that weather phenomenon, for example, than a numerically based report of 4 inches of precipitation and 70 mile an hour winds. Furthermore, seeing a picture of a hurricane in progress with trees doubled over and sheets of rain slashing through the landscape elucidates the concept in yet another meaningful manner. Just as students in art class can find reading an invaluable tool in extracting the meaning of a painting as they research its historical context, I aspired to develop in students an ability to work with pictures to find meaning in texts.

Purpose of the Study

The purpose of this study was to develop, implement, and evaluate learning experiences in which students refer to pictorial illustrations in as they complete reading comprehension tasks. Toward that end I taught students to use pictures together with text toward the goal of understanding the information presented within the written material. Focusing on the concept of art as meaningful communication (Anderson and Milbrandt, 2005) with pictures, students in art classes practiced analyzing and creating pictorial illustrations for the

purpose of transmitting and receiving specific informational content. It was hoped that by focusing on the aesthetically framed, directly communicative aspects of pictures as illustrations, students, in addition to experiencing the emotion and aesthetic appeal contained within an artwork, would also experience a gain in factual information from a picture to clarify an intellectual concept.

If art teachers can teach students in art classes to use pictures as tools to support understanding of written material, perhaps students can apply the skills of combining pictures and words to reading comprehension tasks in other courses. That may positively affect students' performance in the many academic classes that emphasize reading comprehension.

Research Questions

The primary question of this study is:

Does instruction and practice in analyzing illustrations and drawing pictures to accompany text affect students' performance in reading comprehension tasks?

Supporting questions include:

Is there a difference in reading comprehension levels of text that is accompanied by an illustration and text that is not illustrated?

Is there a difference in reading comprehension levels of text that is illustrated by student drawing and text that students do not draw an illustration for?

Do provided text illustrations affect reading comprehension in a specific way?

Do student-drawn illustrations of text affect reading comprehension in a certain way?

When students are trained to analyze pictures that function as illustrations of accompanying text, will their reading comprehension of the illustrated text be affected?

When students are trained to draw pictures representing content of an assigned text, will their reading comprehension be impacted?

Do certain subgroups of the student population studied exhibit different effects than others from the study variables?

Objectives of the Study

The steps necessary to answer the research questions, stated as objectives were:

Review the literature to develop a conceptual framework from which the theoretical foundations for the study questions were constructed.

Construct and implement the study.

Test the outcomes.

Draw conclusions from the data generated from the study.

Rationale

Today, words are the dominant venue for delivering information to students in the classroom (Flood & Lapp, 1997). Most instruction is presented in lecture form or from textbooks (Darby & Catterall, 1994). However, limiting academic communications to this extent may have detrimental effects on students. Students who are not as fluent and comfortable with linguistic modes of expression may have difficulty learning and

expressing their knowledge (Hornig, 1981). Researchers have found more ways of knowing in addition to the linguistic (Gardner, 1983; 1999). Another way many students can process and assimilate information is through the use of visual information (Sinatra, 1986).

Looking from a bio-evolutionary perspective, using pictures to communicate significantly predates writing (Schramm, 1988; Shlain, 1998). Writing was actually developed from pictures (Harris, 1995). In terms of human development, pictures again precede written words. Babies observe and store images of their surroundings and begin to draw long before they learn the alphabet (Goody, 1987). An advantage of using pictures for communication is that pictures are directly more directly representational of their models; they need less translation or decoding than words, which are representative in a more abstract and symbolic way (Sinatra, 1986). Pictures are perceived and processed more directly as chunks of visual information (Paivio, 1991).

Along with their historical and developmental standing as a means of communication, pictures today have become ubiquitous within our lives. We are in the midst of what has been described as a visual culture with pictures dominating our surroundings (Anderson and Milbrandt, 2005; Duncum, 1997, 1999; Freedman & Wood, 1999; Horn, 1999; Moore, 1995). They greet us in the morning in the newspaper, on television and cereal boxes, they appear along our commutes on billboards, reside as icons on our computer screens at work, and entertain us in the evening in movie theaters. We are bombarded with a plethora of pictorial information on a daily basis. While schools provide an abundance of instruction and practice in communicating with words, there is little instruction provided for developing skills to communicate with pictures (Flood & Lapp, 1997; Twyman,

1985). Again, this limitation may lead to detrimental effects for students. If students have little or no practice using pictures to communicate during their schooling, it is unlikely that they will be well prepared to live and work in our visual culture (Freedman & Wood, 1999; Horn, 1999).

Promoting the picture as an effective and acceptable form of communication in the school setting and providing instruction to students on how to work with pictures may address the problem of overdependence upon linguistic expression in schools. Students who receive instruction in working with information from pictures will be able to choose to use them as a means of communication. They will not be limited to words as their only venue for gaining and expressing knowledge. Formally defining pictures as a distinctive form of communication creates another route for information to flow to and from students.

Since writing is so firmly entrenched as the premier communicative force within our schools, it makes sense to capitalize on that strength and introduce pictures as a sort of parallel approach to understanding. Research has shown positive results in increasing students' recall and comprehension of text materials that are supplemented with pictorial illustrations (Levie & Lentz, 1982; Levin, 1982; Horng, 1981; Dwyer, 1978). The aim of this study was to present students with regular, sequential instruction on analyzing and creating pictures to promote understanding of accompanying textual information. It was hoped that students could learn to access and utilize pictorial information along with the textual presentation to understand the ideas presented to them. Also, since students are often faced with the task of working with texts without illustrations provided, students in this study were instructed to produce their own pictorial illustrations to elucidate text content.

Once again, the overarching goal was to provide students with an additional way of understanding, a way that calls into consideration the highly visual and pictorial nature of the world beyond school. Such achievement could not only benefit students but may also be used as an argument for the value of art education within the school curriculum. If evidence of students' academic gains as a result of this specific type of art instruction was able to be consistently demonstrated and duplicated, it could help validate the position of art education in the eyes of those who make decisions concerning its status in the overall school curriculum. Perhaps art education, defined from the perspective of visual communication - "reading" and "writing" with images - could be deemed a form of communications instruction helpful in maximizing general learning.

At this point it is important to emphasize the role of the art teacher in this proposed equation for understanding. It is the purview of art educators to facilitate learning through art experiences. Art teachers are uniquely qualified as a result of their training and expertise to lead students through analyses of pictures and to direct students in creating pictures that effectively communicate an idea.

Procedures and Assessment

This study was designed to investigate whether instruction and practice in analyzing and creating illustrations for text passages affects students' reading comprehension. It is a multi-method study using both quantitative and qualitative instruments and strategies. I developed and implemented learning experiences intended to promote students' skills of picture analysis and picture production with respect to representing information contained in text selections.

Utilizing pre- and posttests with control and treatment groups of students, I attempted to determine the effect of instruction and directed practice in working with pictures and words together upon students' performance of reading comprehension tasks.

The study took place within my own art classroom during regular class time. Four classes of high school art students taught by me comprised the study population. Two classes functioned as the control group who received no treatment and two classes functioned as the treatment or experimental group who received instruction and directed practice in working with text and pictures. All students took a test to determine their starting level of reading comprehension of a regular text passage. All students also took a pretest and posttest to determine their level of reading comprehension of illustrated text passages. Students in the experimental group received their treatment of instruction and practice in picture analysis during the time between illustrated pre- and post-tests. In addition, all students took a pretest and posttest to determine their level of reading comprehension of text passages that they were instructed to illustrate by drawing. Students in the experimental group received their treatment of drawing instruction and practice during the time between pre- and post-tests with drawn illustrations. Students in the control group received no instruction or practice between pre- and posttests.

During the first phase of treatment, students in the experimental group were led by the instructor in reading a text passage, analyzing an accompanying illustration, and using the text and illustration together to answer questions about the text. In the second phase of treatment, students in the experimental group were led by the instructor to read a text passage, create simple line drawings which illustrated the most

important parts of the passage, and use the text and their drawings together to answer questions about the text.

I compared original baseline reading comprehension scores of all study participants to scores of reading comprehension with illustrated texts (texts with accompanying, researcher-generated illustrations) and scores of reading comprehension with texts that students themselves drew pictures to illustrate. This comparison provided data on the effects of illustrated text on reading comprehension and on the effects of student created illustrations on reading comprehension. I also compared reading comprehension scores of control and experimental groups with illustrated texts. This provided data on the effects of the first treatment, instruction and practice in working with pictures and words together. Finally, I compared reading comprehension scores of control and experimental groups with texts that students illustrated by drawing. Data provided from this comparison showed the effects of the second treatment, instruction and practice in drawing pictures to illustrate text content. Furthermore, I looked at reading comprehension scores of all subjects on all tests according to the type of reading comprehension question asked: factual, inferential, or vocabulary.

In addition to comparing reading comprehension test scores, a quantitative type of analysis, I created field notes - a daily journal of observations from the onset of the study to the conclusion. These qualitative data were employed in an attempt to create a holistic and vivid account of the study and its outcomes. Participants in the study also completed a biographical data sheet and the Multiple Intelligence Inventory (Gay, 1998). The Multiple Intelligence Inventory is an assessment instrument for learning style. Data from these instruments were incorporated into the analysis and

interpretation of control and study groups' pre- and post-treatment scores of reading comprehension.

Study Population

The population studied was a pre-determined intact group of beginning level art students assigned to classes taught by me, the researcher, in a public high school in Gainesville, Florida. Students within the sample population participating in the study were in grades 9 - 12 of high school, ranging in age from 13 to 19.

Instruments

Both quantitative and qualitative data collection methods were employed as components of the study. These methods were combined with the intent of creating a holistic and vivid account of the study.

Data collected and analyzed were as follows: biographical data of study participants including age, sex, race, and Exceptional Student Education (ESE) classification; participants' learning style as assessed using the Multiple Intelligence Inventory (Gay, 1998); students' baseline reading comprehension score from a researcher-designed test of reading comprehension modeled after the Basic Reading Inventory, form LE, grade level 12 (Johns, 1997); students' reading comprehension scores on researcher-designed tests with illustrated texts; students' reading comprehension scores on researcher-designed tests with student-drawn illustrations of texts. These tests compared reading comprehension scores of control and experimental groups, pre- and post-treatment, and provided disaggregated data about specific types of reading comprehension: understanding of factual, inferential, and

vocabulary information. I examined individual and group changes in reading comprehension scores with relation to respective variables and combined that data to create a quantitative description of the general effects of the variables.

Reading comprehension tests consisted of ten questions. Six of the questions required factual answers - information that came directly from the text. Three of the questions were inferential, requiring students to make and apply the information in the text to a slightly different situation. One question tested vocabulary knowledge, requiring students to define a word presented in context from the text. Tests were graded on a scale of 0 (no questions missed) to 10 (10 questions missed). Missed questions were also categorized by type - factual, inferential, or vocabulary. All data were managed and analyzed using SPSS 11.0. The method of data analysis used involved comparison of group means or averages to determine whether differences between groups or events were statistically significant.

Scope and Limitations

This study was designed with the intent of investigating the relationship between pictures and words as communicative devices toward the end of increased understanding of selected readings. I developed and tested two ways of using pictures together with text in performing reading comprehension tasks. Based on research which indicates a positive effect of pictorial illustrations upon reading comprehension (Peeck, 1987; Levie & Lentz, 1982; Dwyer, 1978) practice exercises were designed to build students' skills in analyzing and creating illustrations which contain information related to accompanying text

selections. Students' reading comprehension was tested using unillustrated and illustrated texts as well as with texts that were accompanied by student-drawn illustrations before and after students in the treatment group received instruction in working with pictures and text. This study's results, however, due to the quasi-experimental and qualitative nature of the study using non-validated instruments, cannot be claimed to be generalizable, although implications may be drawn for other students in similar contexts.

Due to predetermined curriculum constraints, time available for student training and practice of skills related to working with pictures was limited to a portion of class time (approximately 20 minutes) for each instruction and practice session with a total of twenty-six sessions. For the remainder of class time students worked on their regular art projects. All instruction and practice took place over a span of eighteen weeks, the second semester of the year. Different effects on reading comprehension may be observed with a longer duration of training and practice. It is unknown whether students will continue to utilize pictures for reading comprehension tasks after the conclusion of their participation in the study.

The type of training offered to students is a variable as well. One component of this study was the selection and development of training methods and materials. Other approaches to the cultivation of students' visual communication skills or utilization of different practice materials may produce dissimilar results. Additionally, as a function of the treatment, students practiced reading comprehension skills. It could be theorized that any type of practice might affect comprehension scores of students (compared to scores of students who had no practice). However, research points away from practice as a factor affecting reading comprehension enhanced by

the application of pictorial illustrations (Levin, Bender, & Lesgold, 1976; Ruch & Levin, 1977).

Finally, it is noted that all members of this study population were participating in an art class during the study. A similar study conducted with students who were not enrolled in an art class at the time of the treatment may yield different results. The treatment of instruction in using pictures and words together may affect students differently depending on whether they participate in an art class during the treatment process.

Definition of Terms

Basic Reading Inventory (Johns, 1997) tests levels of reading comprehension.

Cognition, defined by Eisner (1994) as thinking in its broadest sense, the process through which one becomes aware of the environment.

Conceptual drawing refers to drawn imagery that presents a mental formulation of a subject rather than a realistic representation from observation (Delahunt, 2002).

Conceptual text (also known as abstract text) is writing about ideas which have no physical referents (Friedlander, 2002). Examples of abstract words are *freedom, love, and responsibility*.

Concrete text is writing about objects or events which can be observed or experienced perceptually (Friedlander, 2002). Examples of concrete words are *spoon, hot, and walking*.

ESE (Exceptional Student Education) classification designates whether a student is officially classified through testing as emotionally handicapped, gifted, speech and language impaired, or possessing a specific learning disability in the area of reading or math (classifications found within the population of this study).

Language is designated as communication through written or spoken words.

Mental image, or what is "seen in the mind's eye", relates to internal visualization which occurs without perceptual stimuli and is stimulated by memory, perception, and thought (Thomas, 2001).

Multiple Intelligence Inventory is a self assessment of learning style categorized as verbal/linguistic, logical/mathematical, visual/spatial, bodily/kinesthetic, musical/rhythmic, interpersonal, intrapersonal, and naturalist intelligence (Gay, 1998).

Symbols connote an abstraction of what is unseen, not a likeness or image of a thing (Purves, 1998).

Pictures are substitutes for things viewed in the real world or a representation of ideas from the imagination (Denis, 1991).

Reading comprehension measures the level of understanding achieved by a reader of a written text (Scholes, 1999).

Representational drawing is a type of drawn imagery which depicts a subject as a recognizable likeness of its state in reality (Delahunt, 2002).

SLD-R is a categorization used to identify students with a specific learning disability in the area of reading.

Text denotes written communication.

Visual communication refers to pictorial expression of facts and ideas.

Summary

This study was designed to investigate the impact of illustrated text, text with student-drawn illustrations, and directed practice of picture analysis and drawing upon students' comprehension. Toward this end I developed and implemented exercises intended to promote students' skills of picture analysis and picture production with respect to representing information contained in accompanying text. A test was designed to assess this instruction by comparing reading comprehension scores of students in a control group who received no treatment with students in an experimental group who received the treatment of instruction and practice in working with pictures and text together. The results of this study show how working with pictures and text affected students' understanding of the ideas within the text and may provide a basis for the promotion of pictures as an additional means of communication within the school setting.

CHAPTER TWO
REVIEW OF THE LITERATURE

Dominance of Linguistic Communication at School

Traditional schooling today relies heavily upon spoken and written communications. Schools are oriented toward verbal literacy (Kress, 1997; Lankshear & Knobel, 2003; Olson, 1992). Students mostly receive information from textbooks and from teachers' oral and written presentations and record information by writing summaries of the materials presented to them. Learning frequently is evaluated with pencil and paper tests or, more informally, by oral question and answer sessions. A dominance of verbal communications in our schools may be viewed as problematic with respect to educational research findings suggesting people learn in different ways (Gardner, 1999; Posner, 2003; Sternberg & Grigorenko, 1997) and in consideration of the increasingly visual nature of our culture (Duncum & Bracy, 2001; Fischman, 2001; Freedman, 1998).

Following the reasoning of Gardner's (1999) theory of multiple intelligences which describes the existence of many independent intellectual competencies in addition to linguistic ones, instead of limiting students to verbal modes of communication alone, other ways of transmitting information should be utilized, too. Specific types of human intelligences are identified and described by Gardner (1999): linguistic,

logical-mathematical, bodily-kinesthetic, spatial-musical, interpersonal, intrapersonal, naturalist, spiritual, and existential. Gardner (1991) asserts that while our current educational system is characterized by the assumption that all students can learn in the same way, a way that is biased toward linguistic forms of instruction, there is an abundance of research that contradicts that assumption. Well-studied differences in how individuals learn call for presentation of learning materials in many forms.

One effect, according to Gardner (1991) of this disjunction between research and practice is that students who are capable of learning are judged to be failures because of their inability to operate successfully in the linguistic mode. Recognition of different ways of learning and demonstrating understanding and adaptation of instructional methods to accommodate a diversity of learning styles could benefit not only students who suffer under the current system but also would serve students who have been scholastically successful. If students are presented with learning activities that call for the engagement of multiple ways of thinking and representing knowledge, understanding of specific concepts and areas of study can be broadened and deepened. Students who are able to demonstrate comprehension of an idea or mastery of a skill in several different ways have advantages over those who are confined to a single mode of learning in that they will have a larger repertoire of intellectual operations to draw from and apply to the intellectual demands they will encounter throughout their lives.

Visual communication, an aspect of the spatial intelligence identified by Gardner (1999) which involves the abilities of visual perception, manipulation, representation - recognizing, working with, and reproducing what is seen, is the focus of this study. Furthermore, in The Role of Imagery in Learning, Broudy

(1987) cites the central role of imagery in children's ability to develop concepts and skills, particularly in the area of language. Although visual communication skills can be taught and utilized as a means for students to understand and express ideas, they are greatly underrepresented in the curricula of today's schools (Horn, 1999; Kress, 2003; Larson, Lankshear, & Knobel, 2002). Presently students may be exposed to some visual displays at school in the form of classroom bulletin boards, illustrations in texts, educational video productions, and computer generated imagery.

However, in contrast with reading and writing skills that are frequently practiced and reinforced throughout school, it is doubtful that students get much training in skills needed to understand and use pictures as a part of their studies. Pictorial information is viewed as secondary to words (McCloud, 1993; Olson, 1977). When students' visual skills are not practiced they are not confident with their visual thinking (Heinich, Molenda, Russell, & Smaldino, 1999; Kress, 1997; Kogan, Connor, Gross, & Fava, 1980). Therefore, even when pictures are offered as an alternative means of denotation in school, students may not be able to work with them successfully if they have not had adequate practice in doing so. In this case, all students miss out on the opportunity to expand their learning into the pictorial dimension; students who are better adapted to visual communications than verbal information processing could be at a serious disadvantage for learning.

A more complex problem of limiting children's communication choices to mainly words exists: they may be unprepared to assimilate the daily bombardment of images we receive in this, our increasingly visual culture (Ballengee-Morris & Stuhr, 2001; Childers, Hobson, & Mullins, 1998; Duncum and Bracey, 2001; Horn, 1999; Kress, 2003; Walsh, 2000). As discussed in the next

section, pictures have long served people as an effective means of communication and continue to be ubiquitous within our world.

An Historical Account of the Development of Human Communication

The historical development of human communication could be perceived as ironic in consideration of the dominance of words over pictures in our schools today. Pictures not only preceded words as the earliest recorded forms of our experiences, letters and words actually evolved from pictures (Fromkin, 1998). But in the very beginning, human communication was through gesture (Leroi-Gourhan, 1993; Shlain, 1998; Schramm, 1988). Ancient people used body movements like pointing and directional motioning to identify a designated object or to illustrate a certain action. Today we continue to use these methods. When I remind students how to achieve a three-dimensional effect by shading a sphere with curved lines, I make an exaggerated arcing motion with my hand through the air, saying "like this." Later in class as I make the rounds of the room, quickly checking on everyone's progress, one student asks which of her patterns would look best for filling in the background. I point to the one that seems to best complement her subject and move on. Gesturing is still a quick, direct, and effective mode of communication.

However, our ancestors eventually added a more abstract form of communication to their repertoire. It's not difficult to imagine the limitations of using only gestures. If someone were attempting to aim a spear or carry a bundle of sticks, gestural communication would be next to impossible. Verbalization was the next step in the development of human communication (Fromkin, 1998). Speech is preferable to gesture not only because the speaker is freed from having to use hands

to send messages (Leroi-Gourhan, 1993; Schramm, 1988) but also because of the human ability to produce a rich variety of vocalized sounds. Humans possess anatomical structures required for speech, or oral communication (Schneiderman & Potter, 2001; Scinto, 1986). As ancient peoples developed systems for connecting sounds with things, speech became an invaluable tool for clan members to pass on important lessons of survival to others; a way of transferring and preserving wisdom (Pinker, 2000; Shlain, 1998). For some contemporary cultures, speaking remains as the ultimate mode of communication and every culture, at some time in its history, has possessed a rich oral tradition of passing stories and wisdom from one generation to the next.

Relating the historic role of spoken communication to my classroom experiences, I consider a typical day with students. There, speaking is by far the most commonly used mode of communication - I read the class agenda aloud, talk while demonstrating techniques and pointing out specific parts of an artwork we are analyzing, and answer questions about the project as the class is working. Speech, in this case, is used to guide activities. However, I believe the most important form of communication in art class, more powerful than either gesture or speech, is, of course, graphic.

Drawings as a form of communication followed the spoken word (Harris, 1995; Mengham, 1993). Cave paintings dating beyond 35,000 BCE (Lacy, 1996) are the oldest artifact of human communication (Schramm, 1988). The abstract pictures of animals created with pigment smeared hands and sticks are thought to have functioned as educational tools, familiarizing young men with group hunting rituals (Schramm, 1988). The type of imagery contained in such cave paintings is pictographic, a symbolic representation of something. Pictographs also describe early writing that arose from similar symbolic pictures.

Writing began as an extension of drawing, as a type of pictorial representation developed in response to a need for record keeping (Harris, 1995). Clay tablets found in Mesopotamia dating from 4,000 BCE are marked with groups of identical indentations - tally marks for recording numbers of items in transactions (Harris, 1995; Purves, 1998). As commerce in the area continued to flourish, more advanced systems of record keeping were created. As well as marks representing the quantity of goods, descriptive marks were added to the records indicating what type of materials were being exchanged (Goody, 1987). Pictographs - simple, stylized, quickly drawn representational pictures (Schramm, 1988) were introduced to solve the problem of distinguishing between different kinds of items being counted (Harris, 1995).

Written labels became even more complex and abstract as they came to represent qualities of objects such as color and size (Harris, 1995). Next, sounds began to be associated with the written symbols as well (Harris, 1995, Schramm, 1988); the symbols could be "read" aloud. At this point correspondence between pictorial representations and written symbols was altered (Harris, 1995). As correspondence between written symbols (words) and spoken words increased, written symbols became further removed from their pictorial antecedents. Written communication changed from pictorial to scriptorial; distinct graphic signs were associated with verbal elements of language (Harris, 1995). The modern Western alphabets are derived from word signs, syllables, and letters which are equated with spoken sounds (Goody, 1987). The invention and adoption of an alphabet marked a turning point in the relationship of verbal versus pictorial elements of communication (Schramm, 1988). Written language became a basic structure around which concepts, ideas, relationships, and new

knowledge were built. Writing enabled knowledge to be collected, preserved, edited, and transmitted (Lacy, 1996).

As writing spread across civilizations, pictorial representations evolved as well. In the tradition of Western art (Ragans, 1988), painters created more and more realistic depictions of people, places, things, and events by deriving mathematical formulas to assist in correctly proportioning the human body, constructing devices to help create the illusion of depth within a scene, and turning the production of paints into a precise science, formulating colors and consistencies to accomplish their objectives of accurate representation.

The invention of the printing press during the fifteenth century increased availability of texts and accompanying illustrations and brought about an explosion in literacy (Shlain, 1998). The nineteenth century heralded another technological advancement for graphic communications: the invention of the camera. Communication technologies rapidly advanced throughout the next century with the introduction of motion pictures, radio transmissions, television, and computers. Capabilities for the reproduction and dissemination of print and pictures were tremendous. The popularity of and accessibility of photography, motion pictures, and television elevated the image as a mode of communication (Shlain, 1998). It is through these technologies that we have become immersed in a visual culture, constantly confronted with pictorial information that we may or may not be able to understand.

Taking into account the historical aspects of the development of human communication, from the evolution of written words from pictures to the highly pictorial nature of communication technologies today, it appears worthwhile to teach our children how pictures work as well as how words do and to offer them the option of using pictures for learning in school.

Next, how pictures and words function with relation to cognitive activities in individuals is addressed.

Learning with Pictures and Words

Individual learners have strengths and preferences relating to ways they accumulate and express knowledge (Gardner, 1999; Silver, Strong, & Perini, 2000; Sternberg, 1999). Pictures and words both have individual and unique attributes as methods of communicating information. Pictures are concrete representations of things that have been seen or imagined. When a viewer studies a picture, nearly instantaneous recognition and meaning can occur because visual information requires less processes of decoding than does written language (Paivio, 1991; Sadoski & Paivio, 2001). It is assimilated holistically as a complete unit of perception with simultaneous processing of all its parts (Sinatra, 1986). Comprehension of a picture occurs as one can relate to it as a representation of an object, event, or idea (Sigel, 1978). On the other hand, written words are processed in a serial and sequential order and then coded into memory as representations. Readers go through several stages of processing identifying letters and recognizing word groupings before meaning is arrived upon (Leipzig, 2001).

Research has demonstrated that pictures are helpful in acquiring and retaining knowledge (Goolkasian & Foos, 2002; Horng, 1981; Levin & Lesgold; 1978; Pressley & Levin, 1983; Schallert, 1980). Levie and Lentz (1982), in their meta-analysis of 155 experiments involving a total of 7,182 subjects (elementary through college level students) comparing learning from illustrated texts to learning with unillustrated texts, found strong and abundant evidence that illustrations can aid in learning of text materials. Similarly, Dwyer (1988), after more

than 200 research studies with over 50,000 students in which the effects of visuals upon learning were investigated, concluded that properly designed visuals can significantly improve student achievement.

Furthermore, studies have shown that information encoded in both visual and verbal stores - using pictures and words together - will be better remembered than information coded into only one (Flattley, 1998; Mustapha, 1995; Paivio, 1991; Pettersson, 1995; Price & Finkelstein, 1994). Images and words together can maximize meaning (Feldman, 1981). Using teaching materials that include pictures can help students who, due to insufficient verbal skills, have difficulty learning (Gambrell & Jawitz, 1993; Horng, 1981). Students who have adequate verbal skills may also benefit from learning with pictures as they access another mode of communication with the potential to expand their understanding of what they read (Anglin, Towers, & Levie, 1996; Carney & Levin, 2002; Flattley, 1998; Peeck, 1987).

Illustrations associated with text are defined as pictures that represent some of the content of the written material (Levin, 1982). A fundamental characteristic of these illustrations is that they provide a visual image of information provided in the text, taking information presented in written form and representing it in pictorial form (Peeck, 1987). Increased learning from texts accompanied by pictorial illustrations is theorized to be a result of the increase in concreteness of representation (Levin, 1982; Prabu, 1998).

Pictorial illustrations work in a variety of other ways to facilitate text comprehension. Illustrations can enhance and elaborate semantic processing by providing organization and connections for elements of text, bringing words and sentences together in a picture (Dean & Kulhavy, 1981; Koran & Koran, 1980; Levin, Anglin, & Carney, 1987; Tarquin & Walker, 1999).

Pictures can direct readers' attention to relevant aspects of text prior to reading and stimulate a review of the text when viewed after reading (Haring & Fry, 1979; Mayer, Bove, Bryman, Mars, & Tapangco, 1996; Peeck, 1987; Pettersson, 1995). Also, pictures can help readers process information more efficiently (Dwyer, 1978; Kinjo & Snodgrass, 2000; Warfield & Perino, 1999). Processing of pictures can occur much faster than that of letters and words; if a student can't turn words into meaning quickly enough, comprehension is impeded (Sinatra, 1986). Pictorial information is conveyed through symbolic representations that can be distilled to show only essential data and exclude irrelevant details (Dwyer, 1978; Houseman, 1997; Lordahl, 1961; Ramachandran & Hirstein, 1999; Zeki, 1999). Simple pictures can often more succinctly provide specific information than a lengthy collection of descriptive words and phrases (Twyman, 1985), think, for example, of explaining the features of a grandfather clock to someone who isn't familiar with the term, as opposed to showing them a line drawing of the object.

Just as reading and writing call for conducting operations with symbols (letters), so does interpreting and creating pictures (Emery & Flood, 1998; Holsanova, 1999; Hubbard, 1989). Both words and pictures can be used in cognition (Goodman, 1978). Pictures consist of visual symbols possessing certain features that enable them to function as referents for objects and ideas. A picture must exhibit an organization of visual elements - line, shape, texture, and so on - which is similar to the arrangement of the prominent visual attributes of the thing it represents (Langer, 1957). The organization of visual elements, also known as principles of composition, follows certain conventions and rules as does the organization of letters into words and sentences. Students who receive

instruction, practice, and encouragement in learning to work with letters and words can learn to read and write. Students who are taught how to work with visual elements and principles can learn how to communicate with pictures by looking and drawing (Ewy, 2003; Gardner, 1999). Researchers have found that adequate processing of illustrations involves more than simply making illustrations available to students (Dean and Enemoh, 1983; Gambrell & Jawitz, 1993; Verhaegen, 1983). Instruction in the skills of extracting information from pictures can improve students' responsiveness to pictorial cues (Levie, 1987). In addition, some (Richards, 2003) argue experiences gained from students studying design elements of art such as lines, colors, emphasis, and unity facilitate recognition of printed letters and comprehension of words.

In addition to using illustrations provided with text passages to better comprehend the written materials, students may also create their own illustrations of text that is not illustrated. When students draw pictures to illustrate text they spend significantly more time processing the text than students who are reading text alone or who are reading text accompanied by illustrations (Alesandrini, 1981; Dean & Enemoh, 1983). Research indicates learning gains can be made by students who create illustrations to go along with text passages (Levin, Anglin, & Carney, 1987; Neu, 1991; Rasco, 1975; Tirre, 1979).

Much research has been done with respect to how students learn using both words and pictures. Beginning with the general process of comprehension, Wittrock's (1991) generative theory of learning defines it as learners' constructions between their stored knowledge and experience and new information. The generative process of learning emphasizes the importance of students' creation of personalized models and explanations to

organize new information. Instruction according to the tenets of generative theory can increase retention and comprehension (Wittrock, 1977). Wittrock's theory is similar to Anderson's (1993) description of cognition involving elaborative processing. Again, memory is viewed as an interconnected network of knowledge. New information is added to the existing network creating subsets of knowledge. The idea of elaborative processing is that richer, more redundant connections of new stimuli to that which is stored in memory facilitate better recall of information. One of the most effective ways to induce elaboration, or creation of multiple memory connections for new information, is to encode a stimulus in both verbal and pictorial forms (Najar, 1996). A combination of verbal proposition and visual image establishes multiple pathways for information to be processed and be retrieved from memory. Memory and learning can be improved when information is presented simultaneously via the different processing channels of pictures and words.

Similarly, relating to the specific cognitive activities associated with reading, schema theory describes the importance of the reader's prior knowledge with relation to learning new materials (Mustapha, 1995). According to schema theory, knowledge is organized in the memory by related parts. Readers construct meaning by placing new material into a part of the memory that appropriately connects it with the reader's stored knowledge and experience. Reading is an interactive, hypothesis-generating process in which readers construct a meaningful representation of text by using their knowledge of the world and of language (Mustapha, 1995). Complexly structured schema aid in recall by providing many paths to reach stored information.

The situation of learners working with different forms of information, like pictures and text, has been described as

cognitive pluralism, a more effective memory process facilitated by working in multiple modes of cognition (John-Steiner, 1995). With respect to reading and understanding, the positive effect of illustrations on recall and comprehension of text material can be explained by viewing learning as a process of making connections between visual and verbal representations of information (Mayer, Steinhoff, Bower, and Mars, 1995). Learners are working in multiple modes of information. Use of two independent channels, words and pictures, aids in learners in reconstruction of information (Gombrich, 1982). In consideration of a global, holistic conceptualization of learning theory, the importance of unification of verbal and visual processes has been emphasized (Toth, 1980). Researchers have found that information stored in imaginal and verbal forms increased retention and recall abilities (Kozma, 1987; Mayer, 1993; Mayer, 2001) and have explained this phenomenon by positing that readers are able to easily connect their own prior knowledge and experiences to extract meaning from text illustrations. As described in the discussion of schema theory in reading, numerous paths from new information to that which is stored are constructed by learners. Information from illustrations can be applied to the task of understanding text material (Stewig, 1992). Some have even claimed that pictorial information is preferable to text with regard to ease of elaboration and memory in learning situations (Issing, 1994).

Cognitive scientists have developed theories about how images are processed by the brain. These ideas parallel the notions of learning expressed within generative, schema, and elaborative theories of cognition and support the idea that images and words are processed similarly. Areas of the brain have evolved to recognize and group visual stimulus into unified clusters (Ramachandran & Hirstein, 1999). A new visual stimulus

is sent to areas that contain stored information with similar attributes. The function of the visual brain is to search for similarities in new and stored knowledge in order to obtain information about the world (Zeki, 1999). Visual knowledge acquired about a specific object is stored with other information with similar characteristics. Analogous information connected with specific images is used to generalize about a wide category of things.

Illustrations are a specific type of image that can be used in learning tasks. Illustrations are defined as pictures stripped down to their essential meaning, with the meaning amplified beyond a realistic portrayal of the subject (McCloud, 1994). The kind of image required for thought is not a highly detailed, complete replica of some visible scene (Arnheim, 2004). Realistic, highly detailed representation is de-emphasized in favor of communication of the most relevant aspects of a form or idea. As with reading comprehension, extraction of relevant information from an observed picture is more important than remembering every detail (Mustapha, 1995). An awareness that pictures have meaning and an ability to extract relevant information from images and classify it into appropriate categories, connecting new and existing knowledge by making inferences and judgments about formation, are necessary components of understanding pictures (Heinich, et al., 1999).

Illustrations can function to direct attention to and increase comprehension of important information (Fleming & Levie, 1993; Levie & Lentz, 1982; Markel, 2002; Mayer, 1993; Pettersson, 1995; Schriver, 1996; Willows, Kruk, & Corcos, 1993). Illustrations are especially valuable in depicting things that can not normally be viewed in real life situations, like simultaneous viewing of interiors and exteriors, micro- and macro- presentations of objects, and comparative groupings (moth

and butterfly antennae, for example) (Mayer, Bove, Bryman, Mars, & Tapangco, 1996). Illustrations can help learning by making abstract information more imaginable (Willows & Houghton, 1987).

Today most students get lots of training in reading and writing in school. Reading and writing skills are practiced and reinforced in nearly all classes (Darby & Catterall, 1994; Flood & Lapp, 1997). In contrast, some students may receive instruction in looking at and drawing pictures in art class, if art class is available to them. Analyzing and drawing pictures are not skills that are typically practiced and reinforced across the curriculum, although pictures, like words, and in some cases, even better than words, can function to communicate information and ideas. Learning to understand pictorial language is essential if pictures are to be used as educational tools. It is necessary for learners to accept pictures as carriers of information (Twyman, 1985). There is a need for the development of curricula for learning with pictures so that students are able to create and use pictures to help with learning (Lankshear & Knobel, 2003; Larson, Lankshear, & Knobel, 2002; Levin, 1982). Perhaps if students were able to use pictures as well as words to make connections between the many disparate facts and disciplines of study they are exposed to in school, they would be more successful in building, managing, and demonstrating their knowledge. Advocates of integrated school curricula (Babiuk, 1999; Beane, 1997; Drake & Burns, 2004; Erickson, 2002; Kreuger, 2002; Parsons, 1998; Pate, Homestead, & McGinnis, 1996; Stephens & Walkup, 2000) stress the importance of emphasizing linkages in what is taught to students to optimize students' cognitive potentials and posit that productive thought uses many ways to find meaning (Hubbard, 1989).

Presenting students with the opportunity to learn and express themselves through dual modes of communication is an idea that must be seriously investigated. Art and language both involve manipulation of symbols, higher order cognitive activity, and representation of concepts (Engel, 1980). Gardner has called for consideration of all types of symbols and their various meanings in the learning process (Gardner, Howard, & Perkins, 1974). Connecting and combining visual symbol systems with other forms of communication is important with respect to acknowledging and providing for students' varied aptitudes. Working with both verbal and non-verbal forms of communication, using pictures and words together, becomes necessary when dealing with presentation of information via computer technology which often employs symbolic icons and text to relay messages. The recent explosion in daily communications via electronic media can even be characterized as dominated by imagery in favor of words (Emme, 2001; Edens & Potter, 2001). Students need skills for interpreting the information provided by these media technologies (Edens and Potter, 2001). Learning to view images as communicative tools, to "read" and interpret images as is currently done with language, is necessary for students as our culture becomes increasingly represented and perceived in visual terms (Couch, Caropreso, & Miller, 1994; Feldman, 1976).

Communicative connections which are made across academic disciplines are both significant and profound (Parsons, 1998). Art, as a system of visual symbols, provides opportunities for students to interweave words and pictures to communicate ideas and deepen understanding (Koster, 2001). Indeed, cognitive researchers have shown that students' drawings that elaborate texts allow learners to construct meaning and make personal connections using their own symbolic representations (Ritchie & Karge, 1996). Students who combine reading and drawing in this

manner can increase the depth of encoding of information contained within the text and picture (Sternberg, 1999). Students' levels of understanding and remembering complex text improve when the text is accompanied by illustrations (Duchastel, 1980; Hurt, 1987; Moore & Dwyer, 1994).

Although children without instruction acquire picture perception skills through their regular exposure to images (Cassidy & Knowlton, 1983), skills of extracting information from pictures can be taught (Higgins, 1979; Koroscik, 1984). Students' skills in working with pictures and text together to increase comprehension can be increased with instruction and practice. Teaching students to use provided illustrations together with text can lead to gains in understanding of reading material and increased abilities to draw inferences from pictures (Becker, 1991; Higgins, 1979).

As with picture perception skills, children produce drawings independently; drawing instruction is not required. Children often create drawings to accomplish a personal communication objective (Kindler, 1999). They use personal symbolism to visually describe information that is important to them. Children may draw a map leading to a desired object or portray a favorite pastime, for example. In these instances, children are using pictorial imagery to express what they "see" in their mind or imagination that relates to their experiences. Mental images can be translated into drawings (Lansing, 1984; Willows & Houghton, 1987). Making pictures is a way of enacting and illuminating experience (Noe, 2003).

In a similar vein, when students are asked to create pictures to illustrate text information, the process of synthesizing text information through drawing can foster construction of personalized meanings of the text material (Edens & Potter, 2001; Ritchie & Karge, 1996). Students have

the opportunity to relate the content of the text using a personal symbol system in their drawings. They can construct meaning across the symbol systems of words and pictures (Kindler, 1999). Students who have the opportunity to interweave their personalized visual symbol system with writing can attain a deeper understanding of information that is communicated to them (Koster, 2001). Studies involving students who create drawn illustrations of text materials have indicated this practice can lead to increased reading comprehension (Edens & Potter, 2001; Lansing, 1984; McConnell, 1992). In addition, researchers have found students demonstrate better conceptual recall and performance in problem solving tasks when they created their own representation of text materials, opposed to copying a provided illustration (Hall, Bailey, & Tillman, 1997). These studies support the significance of students constructing and utilizing a personally meaningful visual symbol system.

Descriptive drawing has been identified as a viable way for students to develop conceptual understanding (Edens and Potter, 2001). Researchers have described the use of student drawings as tools to identify main ideas and generate summary statements of text materials (Rich, 1994). They have noted increased comprehension of reading material and more participation and enjoyment of the reading process when students incorporated drawing into their reading activities (Cox, 1991). Specifically, student-drawn text illustrations seem to be most effective in situations that relate to conceptual recall, problem solving, and explanation of systems or processes (Mayer, 1993, 2001).

Students' illustrations of text materials can function as diagnostic tools as well. Class discussions about drawings created to illustrate text content can enable an instructor to identify and correct student misunderstandings relating to the material being learned (Edens & Potter, 2001). Once again,

verbal and imaginal modes of communication are being interwoven in the learning process. Students engage in talk about the pictures they have drawn. Connections between students' visual and verbal communication processes are strengthened.

Given the abundance of evidence of benefits that can be derived from providing students with instruction in learning with pictures and in combining picture learning and language learning, investigation of methods for doing so is of considerable potential consequence. Instructional strategies must be developed and tested to further the use of pictures as a learning and thinking tool (Edens & Potter, 2001). Effective teaching methods which involve using pictures and words together as reciprocative symbol systems for learning and displaying information need to be designed and implemented (Denburg, 1977; Duchastel, 1980).

CHAPTER THREE
METHODOLOGY

Overview

The guiding question of this study is: Does instruction and practice in analyzing illustrations and drawing pictures to accompany text affects students' performance in reading comprehension tasks. Supporting questions are:

Is there a difference in reading comprehension levels of text that is accompanied by an illustration and text that is not illustrated?

Is there a difference in reading comprehension levels of text that is illustrated by student drawing and text that students do not draw an illustration for?

Do given text illustrations affect reading comprehension in a specific way?

Do student-drawn illustrations of text affect reading comprehension in a specific way?

When students are trained to analyze pictures that function as illustrations of accompanying text, will their reading comprehension of the illustrated text be affected?

When students are trained to draw pictures representing content of an assigned text, will their reading comprehension be impacted?

Do certain subgroups of the student population studied exhibit different effects from study variables?

Overview of the Study

All participants in the study took a series of reading comprehension tests. The first test determined participants' reading comprehension of a text passage. The next tests administered were pretests of reading comprehension of an instructor-illustrated text passage and of a reader-illustrated text passage. Comparing results of these tests would indicate whether either of the two types of text illustrations, instructor-provided or student-provided, could affect reading comprehension levels.

Following administration of the pretests, over a period of nine weeks (see Appendix A), participants in the treatment group received instruction and practice in using instructor-provided illustrations to understand the text they accompanied. The control group received no treatment. Then all participants were administered a posttest of reading comprehension with an illustrated text passage. The pre- and posttests of illustrated text allowed for comparisons to be made between control and treatment group scores of reading comprehension on the illustrated tests. By comparing pre- and posttest scores of control and treatment groups, I could determine whether the instruction and practice in working with provided illustrations received by the treatment group may have impacted their performance on the illustrated tests.

Similarly, students in the treatment group also received instruction and practice in drawing illustrations to accompany text passages for a period of eight weeks. Again, the control group received no treatment. Pre- and posttests of texts with student-drawn illustrations allowed for comparisons to be made between control and treatment group scores of reading comprehension to determine if instruction and practice in

drawing illustrations affected students' comprehension of the text passages.

Study treatment consisted of presentation of researcher-designed instruction to participants in the treatment group. Treatment was presented in two phases. During the first phase I instructed students to use a specific system of picture analysis to derive information from images that function as text illustrations. Picture analysis involved studying pictures in a consistent, organized manner, describing observed features, comparing the picture to previously viewed images, identifying communicative design elements, and forming an evidenced conclusion as to the message of the picture. Over a nine-week period, students were led through demonstrations, exercises, and practice sessions in analyzing illustrations and combining picture and text information. In the second phase of treatment I instructed students to employ a specific drawing method to create illustrations for text passages. This drawing method is characterized by an emphasis on simplicity and accuracy in representing text information. The drawing process involves decision-making about essential picture content, use of basic forms, refinement, and addition of details needed for a congruent picture/text relationship. As with the first phase of treatment, during which students learned a specific method of picture analysis, the second phase, instruction and practice in drawing illustrations, was comprised of an eight-week period of demonstrations and training exercises.

To assess data collected throughout the study, I employed a method of data analysis that involved comparison of group means or averages to determine whether differences between groups were statistically significant. There are three aspects to the data analysis: comparison of reading comprehension scores of the entire study population on standard, researcher-illustrated, and

student-illustrated tests, comparison of reading comprehension scores of control and treatment groups on researcher-illustrated pre/posttests and student-illustrated pre/posttests, and comparison of reading comprehension scores of special groups within the study population to the general population. Special groups within the study population were analyzed by aggregating participant data according to age, gender, race, learning style, and Exceptional Student Education [ESE] classification.

To summarize, this study consists of examination of effects of the independent variables which were researcher-provided text illustrations, student-drawn illustrations, and instruction and practice in analyzing and creating text illustrations (study treatment), and dependent variables (participants' age and gender, for example) on students' ability to understand text information. Selection, design and implementation by the researcher of instructional instruments, the picture analysis and picture drawing techniques; and assessment tools, the tests of reading comprehension, learning style inventory, and biographical surveys, were principal research components.

Sample Group

Four classes of beginning art students (approximately 20 per class; total of 89 students) comprised the sample population. Two classes functioned as the control group and two as the experimental or treatment group.

The population was a predetermined, intact group and a population of convenience for me, as I was also the students' art teacher. The population included female and male students (fifty-five females and thirty-four males) from grades 9 - 12, ages 13 - 19 (one 13 year old, twenty-two 14 year olds, twenty-

four 15 year olds, twenty-one 16 year olds, thirteen 17 year olds, two 18 year olds, and one 19 year old).

Forty-five students were black, thirty-nine were white, four were Asian, and one was Hispanic. Seventy-five students were not classified as ESE (Exceptional Student Education), nine were classified as having a specific learning disability (SLD) in the area of reading, one was classified as speech and language impaired, one as gifted, and three as emotionally handicapped. Forty-five students rated themselves as strongly verbal/linguistic according to the Multiple Intelligence Inventory (score of 5 or better on a scale of 0 - 10) and forty-four students rated themselves as strongly visual/spatial. This group represented a typical population of high school art students in an entry-level art class.

Research indicates that there are varying levels of ability and likelihood of children employing imagery in communication according to their age (Travers & Alvorado, 1970). Younger students may not have matured developmentally to a stage of consistently and successfully using imagery in communication. Older children have shown a decline in reliance upon imagery in communication in past studies. Some believe this is due to the strong emphasis placed on verbal and written modes of communication in school (Kogan, Connor, Gross, & Fava, 1980). Within the sample population itself, variables that were considered to have possibly impacted research outcomes were the age, sex, race, Exceptional Student Education (ESE) classification, and learning style of participants.

The sample of those participating in the study contained students with diverse reading levels as well. Students who are poor readers may have had more potential for improvement as a result of the visual learning experiences than students who were strong readers may. Additionally, poor readers may have had

more interest in trying a new strategy for comprehension than strong readers had. However, the opposite may be supposed as well: poor readers, out of general frustration with the process of reading, may tend to reject an activity that involves reading. In the same vein, students who have had previous positive experiences working with images or students who are more inherently comfortable working with images may have been more receptive to the treatment. Similarly, students within the population who have participated in previous art classes may have received instruction about analyzing pictures and creating illustrative representational imagery in the past.

Setting

The research took place in my classroom, an art room at Eastside High School in Gainesville, Florida, USA, over an eighteen week period during the spring (January 13 - May 27) of 2003.

Rationale

Art teachers may be uniquely qualified as a result of their training and expertise to lead students through analyses of pictures and to direct students to create pictures that effectively communicate an idea. With the majority of regular art projects in the classes I teach, students are led through a critique of an artwork exemplar as an introduction to their assignment. Students analyze the artwork describing what they see and making evidenced assertions as to the meaning of the image. Students' understanding of the subject of the artwork they view is necessary to proceed with the project. As students

begin the studio component of their work, I direct them toward representing specific concepts. Success in the studio aspect of the project depends on clear communication of a certain idea. However, it is difficult to verify a transfer of this type of cognition - working with pictorial information - to cognition that involves words. By developing a sequence of specific visual art experiences to match learning objectives directly linked to reading comprehension tasks, I hoped to demonstrate a direct connection between developing understanding of ideas by working with using pictures and by working with words.

The way I chose to investigate a possible connection between learning with pictures and learning with words was to present students with reading comprehension tasks using three types of text passages, unillustrated, illustrated with images I provided, and illustrated with images drawn by the reader. I then observed how illustrations impacted comprehension of the ideas contained within the text. Since I also wanted to study whether a specific type of art instruction could affect students' abilities to work with pictures to facilitate understanding, I developed two kinds of art lessons toward that goal. I prepared activities to train students to analyze pictures, specifically those that function as text illustrations, as well as activities to train students to draw pictures that function as text illustrations.

In order to determine the effects of researcher-provided and student-drawn illustrations on reading comprehension and the effect of instruction and practice in picture analysis and drawing to accompany texts, I compared scores of reading comprehension on unillustrated and illustrated tests and control and experimental groups' pre- and post-treatment scores of reading comprehension on texts with illustrations provided by me and with illustrations drawn by students. Treatment consisted of

instruction and practice in analyzing and creating illustrations to accompany text. Instruction and practice materials and exercises were be created by me. I referred to previous work dealing with the promotion of skills for analyzing and drawing pictures (Anderson, 1993; Bertin, 1967; Brookes, 1996; Dwyer, 1978; Moore and Dwyer, 1994). All students in both treatment and control groups first completed a basic test of reading comprehension. Next, all students' reading comprehension of a researcher-illustrated passage was tested (pretest of reading comprehension of illustrated text) and all students' reading comprehension of text with student-drawn illustration was tested (pretest of reading comprehension of text with student-drawn illustration).

Students in the treatment group received two types of instruction: instruction in analysis of pictures that serve as text illustrations and instruction in production of drawings to serve as illustrations of text. Students in the treatment group were guided through practice sessions utilizing researcher-designed picture analysis techniques and researcher-designed illustration techniques. Finally, all students in both treatment and control groups were tested once again (posttest of reading comprehension of illustrated text and posttest of reading comprehension of text with student-drawn illustration) to determine whether reading comprehension was affected by the instruction and practice provided.

Due to the diversity of data taken into account, the study was mixed method, using both quantitative and qualitative strategies. The t test was the primary method of statistical analysis used in the quantitative portion of this study. When comparing the averages or means of one variable with a specific constant, as with the number of questions missed on the standard reading comprehension test (constant) and scores on illustrated

tests (variable), the one sample t test was employed. When comparing means for two groups of cases, as with reading comprehension scores of control and treatment groups, the independent sample t test was used. The t test helps determine whether an observed difference between a constant and a variable (one sample) or between two group averages (independent sample) is attributable to chance or represents an actual difference between the groups, a systematic effect (Shavelson, 1996).

A confidence interval of 95% was used throughout for this study. I used the value of $t \geq 2.0$ with a significance, or probability of finding a greater t, of .05. In other words, the results reported as statistically significant in this study meet the criteria of having a 95% likelihood of occurring again if the experiment were repeated. Equal variances were assumed in all cases as indicated by Levene's (1960) test for equality of variances (Sig. > .05). Two-tailed significance values of less than .05 were accepted. The value of zero is not contained within any confidence intervals. Reported results have been rounded to the nearest tenth.

The t test was used to compare differences of group averages on reading comprehension scores to determine whether the independent variable being examined is likely to have affected the differences. In the case of this study, researcher-provided text illustrations, student-drawn text illustrations, and a treatment all functioned as independent variables. In addition, the t test for was used for comparison of scores to investigate relationships among subgroups (such as those determined by age or gender, for example) of the study population.

Learning style data were also considered during the phase of quantitative analysis. Students' self-assessed scores of visual/spatial intelligence, verbal/linguistic intelligence, and

highest overall score on the Multiple Intelligence Inventory (Gay, 1998), all ranging from 0 to 10, were collected. In addition, biographical data were acquired from participants' completion of personal profiles and school ESE (Exceptional Student Education) specialists were consulted to determine each participant's ESE classification. This descriptive information relating to individual student characteristics allowed for identification and examination of special subgroups within the study population.

Qualitative data and analysis consisted of observations and informal conversations between students and me. I maintained a daily journal throughout the study to record observations and events as they occurred. My role was as a participant-observer (Patton, 1990); I administered tests to students/subjects and developed and delivered instruction to them in analyzing pictures and creating representational illustrations. During these processes I observed and talked to students and made notations with the purpose of gaining a holistic understanding of the role of the researcher/teacher, the role of students/subjects, and activities throughout the study, a procedure of ethnographic research (Emerson, Fretz, & Shaw, 1995).

Treatment and Assessment

Instruments

Study participants' initial pretest of reading comprehension (modeled after the Basic Reading Inventory, form LE, grade 12; see Appendix B) was used to determine a baseline score of reading comprehension for each student. The Basic

Reading Inventory (BRI), an individually administered reading comprehension test, consists of a graded passage and comprehension questions relating to the passage (Johns, 1997). Reading comprehension is assessed by students reading the passage and answering corresponding written questions in written short answer form. All study participants also took four additional tests of reading comprehension, all researcher-designed and modeled from the BRI. These four tests labeled pre- and post test of reading comprehension of researcher-illustrated text and pre- and post test of reading comprehension of text with student-drawn illustrations, provided data to determine whether researcher-provided text illustrations, student-drawn text illustrations, or researcher-designed instruction and practice in illustration analysis and drawing had any impact on subjects' reading comprehension.

The reading comprehension tests administered throughout the study and the treatment group's instruction and practice sessions in working with pictures and words together necessitated selection of more than twenty separate text passages to serve as reading material. To maintain consistency within this part of the study, I required a source of text passages that would be equivalent in length, reading level, and writing style. I also wished to utilize text I judged as potentially interesting to study participants, text that might be engaging to my high school students.

Scientific American magazine provides a web site open to the public which contains a segment titled "Today's News". Stories contained within this part of the online magazine were found to be suitable for use as text passages for this study. The Scientific American online resource (<http://www.sciam.com>) furnished a great number of text passages with a variety of

topics relating to current events from which I could choose texts to meet the needs of the study.

I selected texts for use in the study from the Scientific American web site (with permission) that contained between 260 and 278 words and were twelfth grade reading level according to the Flesch-Kincaid (Flesch, 1981) reading level formula. I chose texts from this reading level with the desired effect being that the texts would present a challenge for all students to read and understand. This was done to minimize the number of students missing no questions on the pretests. A perfect pretest score would prevent observation of a possible positive effect of illustrations or practice in using pictures and text together on reading comprehension. Also, research indicates pictorial illustrations are of more benefit to readers when text is challenging (Dean and Enemoh, 1983). Text passage topics were not limited to what one might consider as "hard" science using highly technical terms but instead contained information about subjects as diverse as air cells in basketball shoes, spicy foods, and mythological creatures.

Although all texts were nonfiction, many contained information about theories and ideas as well as factual information. Texts contained both concrete and conceptual writing, concrete text defined as writing about objects or events which can be observed or experienced and conceptual text as writing about ideas which have no physical referents (Friedlander, 2002). Some previous research has shown a positive relationship between concreteness of text and text comprehension (Sadoski, 1993) and that text illustrations can also function in a concrete way, as a direct representation of text (Levin, Anglin, & Carney, 1987), sharing a physical resemblance with the thing or concept they stand for (Peeck, 1987). However, others have demonstrated that illustrations can

also perform a transformational function, assisting the reader in recoding the content of the text through interpretation (Levin, 1982). This type of illustration would have a more concept-based appearance rather than being literally representational. Because it is difficult to determine the impact of concrete vs. conceptual text and illustration on reading comprehension, and since that was not a goal of this study, I chose to work with a combination of concrete and conceptual texts and illustrations for the sake of de-emphasizing text and illustration type differences as a variable.

Texts were presented to students, whether reading comprehension tests or practice passages, as single page handouts with medium sized (Arial 12 point) print on white paper. Reading passages were headed with a descriptor (i.e. "Reading Comprehension Pretest: Text with Student-Drawn Illustration"). This was followed by the text's title from the Scientific American online source. The body of the text came next, with a four-inch right margin used as space for inserting illustrations or student drawings. The text's bibliographic citation concluded the format.

In order to carry out the portion of the study investigating effects of text illustration on reading comprehension, I was required to provide illustrations for eleven of the text passages. Initially, hand-drawn illustrations created by me were considered. However, I wished to employ a method of illustration that would be possible for others to quickly and easily duplicate, especially in the case that illustrations proved to have a positive effect on reading comprehension.

Clip art seemed to be a resource worth investigating due to its accessibility and diversity of subject and style. Previous

experience with Microsoft Design Gallery Live, <http://office.microsoft.com/clipart>, an online clip art source linked to the widely used Microsoft Word software, led me to consider this as a option for procuring illustrations. Microsoft Design Galley Live features a collection of illustrations searchable by subject and style. Desired illustration characteristics were simplicity, clarity, and accuracy in representing the text they accompanied. This type of illustration was available at the Microsoft site.

Illustrations were selected from Microsoft Design Gallery Live and modified as needed. The process involved reading the text to be illustrated, making notes about the most important pieces of information contained within the text, and formulating an idea for an illustration to communicate this information. Past research has shown that pictures and text work best together when attention is drawn to critical attributes of text by the accompanying illustration (Tennyson, 1978).

Once critical aspects of the text were identified, I searched for components of the illustration to be created on the Microsoft clip art web site. When the appropriate clip art was located it was downloaded and printed. Often several searches were needed to obtain pictures that contained all the specific content of the desired illustration and in some cases, more than one image was required to illustrate the text topic. In these situations images were chosen separately using the web site search engine and were then combined by cutting and pasting them together using Adobe PhotoShop software (this could also be done manually by printing the images and using scissors and adhesive to create a composite image). I also edited the clip art using PhotoShop, removing unimportant details or those which did not support the text information the illustration was to accompany

(again, this process could also be done by hand using a blocking agent).

At times main ideas of the text to be illustrated included details not included with the images found in Microsoft Office Design Gallery Live. I used freehand drawing to fill in those important informational aspects of the text passage. For example, the illustrated pretest of reading comprehension conveyed information about basketball players who wore shoes with air cells suffering ankle injuries when landing from a jump. Although Microsoft Office Design Gallery Live provided a picture of a basketball player jumping to shoot a basket, I added the drawn details of a horizontal floor line to indicate the jumping player was landing afterwards. I also drew small dots in the shoe soles to represent air cells and jagged lines emanating from the player's ankle to show pain associated with injury. These details were deemed to be essential in conveying important information from the text passage.

Another example of the addition of small hand-drawn modifications and details needed to match the illustration to text content can be seen on the image used to illustrate the first practice text used with the treatment group of the study. The text describes a type of caterpillar that secretes a chemical from hairs running the length of its body. This chemical functions as a protective mechanism - it repels insects that might prey upon the caterpillar. To create the illustration for this text, I selected pictures of a caterpillar, an ant, and skull and crossbones from the Microsoft Design Gallery Live clip art library. The ant and caterpillar were positioned to face each other by cutting and pasting their images together. I added (by freehand drawing) small curved lines along the caterpillar's back to represent the chemical secreting hairs with tiny teardrop shapes at the end. The skull

and crossbones clipart was placed immediately above the "hairs" to indicate the poisonous nature of the drops at then end of them (see Appendix C). All text illustrations used in the study for reading comprehension tests and practice texts were created using the same process.

The style of illustrations used to accompany texts used in this study is simple line drawing. The illustrations contained no color; all lines were black. Value or shading was not included as an element of the drawings, either. Selection of illustrations of this type were based upon research indicating line drawings are the clearest link between imagery and cognition (Cutting & Massironi, 1998) and that, in learning situations, irrelevant details in visual illustrations can decrease student understanding of the materials (Dwyer, 1978; Lordahl, 1961). Dwyer (1978), in his research on visual learning, identified characteristics of effective illustrations relating to economy and simplicity in production, and Thompson (1994) related the elements and principles of design to the creation of effective visuals. Simple line drawing has been characterized as an efficient form of drawing useful to viewers in developing understanding of illustrated concepts (Kennedy, 1974).

Simple pictures can often more succinctly provide specific information (Twyman, 1985). When an image is stripped down to its essential elements, communicative content and meaning can be amplified. In fact, line drawings have been shown to employ supernormal stimuli to excite areas in brain more than naturalistic stimuli (Ramachandran & Hirstein, 1999). General awareness of our observed surroundings is represented mentally by simplified conceptual images - realistic appearance of the physical world is de-emphasized in favor of the idea of form

(McCloud, 1994). Selectiveness and investment in the essential is necessary (Zeki, 1999).

Benefits of utilizing the method of creating text illustrations explained above include ease and speed in creating appropriate illustrations and wide accessibility and reproducibility of the images (teachers have permission to use the publicly accessible web site resources for educational purposes). I believe others could easily duplicate the text illustration technique described here.

Students' reading comprehension of the text passages, both illustrated and unillustrated, was measured by the number of correct answers given to a set of questions that followed the passage. The ten questions designed to assess students' comprehension of the passage were based on the model of the Basic Reading Inventory (BRI) (Johns, 1997). Students were asked to write their answers to the questions after reading the text (and studying the illustration, if applicable). Six of the reading comprehension questions required factual answers - information that came directly from the text. Three of the questions were inferential, requiring students to apply the information in the text to a slightly different situation. One question tested vocabulary knowledge, requiring students to define a word presented in context from the text.

Tests were graded on a scale of 0 (no questions missed) to 10 (10 questions missed). Missed questions were also categorized by type - factual, inferential, or vocabulary. This format of questioning is based on the idea that reading comprehension is composed of three essential elements: a word meaning factor, a relationships-among-ideas factor, and a reasoning factor (Johns, 1997; Spache, 1976). In writing the questions to evaluate students' reading comprehension, I also took into consideration the relationship between the questions

and images provided to illustrate selected texts in an effort to match questions, text, and illustration content.

Reading comprehension tests were untimed. The basis for this decision is derived from studies which indicate that no effect or negative effects of text illustrations may be observed if students are not allowed adequate time to interact with the text and illustrations (Dwyer, 1978). Students in this study were allowed to use the entire 50-minute class period to complete their tests, although most students finished in ten to fifteen minutes and all students finished within half an hour of beginning any given test.

Comprehension tests were scored. Test scores ranged from 0 to 10, with a score of 0 indicating the test taker had answered no questions incorrectly and 10 indicating the test taker had answered all 10 questions incorrectly. Each individual overall score was recorded along with a disaggregated score which totaled the number of each type of question (fact, inference, or vocabulary) missed.

All participants in the study took a total of four reading comprehension tests. The first test determined participants' reading comprehension of a text passage. The next two tests, the pre- and posttests of illustrated text passages, were administered with a nine week period of time between tests when the experimental group received treatment. During this time participants in the treatment group received instruction and practice in using illustrations to understand the text they accompanied. The control group received no treatment. The pre- and posttests of illustrated text allowed for comparisons to be made between all participants scores of reading comprehension on the original unillustrated test and scores on the two illustrated tests. Pre- and posttests of illustrated text also allowed for comparisons to be made between control and treatment

groups with respect to working with illustrated texts. By comparing pre- and posttest scores of control and treatment groups I could determine whether instruction and practice received by the treatment group may have impacted their performance on illustrated tests.

Instructional materials

Instruction and practice materials for the two phases of study treatment, practice in picture analysis and practice in illustration drawing were researcher-designed. During the first phase of study treatment, working with picture analysis, I led students through a process of picture analysis and then connected this process with illustrated text analysis. Students in the treatment group of the study possessed resource sheets that they could refer to in reinforcing the picture and picture-text analysis techniques they were practicing. During the second phase of study treatment, instruction and practice in creating illustrations of text, students were also provided with resource sheets to support the methods they were learning.

For the first phase of study treatment, practice in analyzing pictures, a process of picture analysis was developed, field-tested, refined, and used with students as the method of studying illustrations. Although some picture perception skills are acquired without instruction through regular exposure to images (Cassidy & Knowlton, 1983), skills in extracting information from pictures can be taught (Higgins, 1979; Koroscik, 1984). The first component of the treatment, picture analysis practice lessons, was based upon the work of Bertin (1967), Anderson (1993), and Moore and Dwyer (1994), as well as attention to the elements and principles of design. Bertin (1967) defined seven graphic variables - shape, scale, value,

texture, color, orientation, and location - that he described as elements of pictorial language. Anderson (1993) developed a method for criticizing artwork through the process of reaction, description, interpretation, and evaluation of the work being viewed. Moore and Dwyer (1994) described a systematic approach to reading pictures consisting of observation and analysis of perceived forms within the picture, extraction of symbolic and expressive connotations, identification of associations, and construction of a hypothesis of meaning with regard to the picture.

Consideration of the elements defined by Bertin (1967) together with the critical and analytical processes set forth by Anderson (1993) and Dwyer (1994) led to development of the system of picture analysis utilized in the first treatment phase of this study, practice in analyzing pictures. The system of picture analysis used in the study involves orderly observation of a picture, searching for compositional principles that call attention to content (such as repetition, variety, and proportion), comparison of the picture to familiar referents, and identification of the informative content of the picture supported by observed pictorial components. This technique of picture analysis was applied to text illustrations by establishing a routine in which students first analyzed an illustration according to the established procedure, then read text that accompanied it, and finally compared the information gleaned from the illustration with that gleaned from the text.

The second phase of the study treatment, instruction and practice in drawing text illustrations, was based on the work of Dwyer (1978) and Brookes (1996). Dwyer, in his research to develop strategies for visual learning, identified characteristics of effective illustrations. Brookes created instructional techniques for improving representational drawing

skills based upon observation of objects and analysis and depiction using a limited number of basic lines and shapes. In addition, Brookes constructed drawing activities to practice making pictures to illustrate concepts.

Drawing practice activities employed in this study focus on simple line drawing, the oldest and most efficient form of drawing and most useful to viewers in developing understanding of illustrated concepts (Kennedy, 1974). Line drawings show essential features of objects or ideas; extraneous details are left out. Line drawings are the clearest link between imagery and cognition (Cutting & Massironi, 1998). In learning situations, increasing irrelevant details in visual illustrations can decrease student understanding of the materials (Dwyer, 1978).

The process of drawing practice I designed for the purposes of this study involves consideration of a referent - a concrete object or subject or a conceptual idea - and decision-making regarding aspects of the referent most important to its identification. When the drawer has identified the most important components of the referent by studying an actual object before them or by referring to a photograph or text passage, they are instructed to create a simple line drawing to represent the referent. Students in the treatment group of the study began drawing practice by creating representational drawings from observation, first using simple objects as models, then proceeding to more complex scenes (photographic sources), and finally using words and text passages as the subject of their drawings. The goal of drawing practice is to create pictures that accurately represent important aspects first of what is observed and then of what is read in text passages. Drawings that are complete, clear, and accurate have the most positive effects of enhancing text comprehension (Peeck, 1980).

Students in the second phase of study treatment, drawing instruction and practice, were taught to begin drawing by representing basic shapes of their subject. Students were next asked to add to and refine their drawing so that it became a representation of all principal features of their subject. The addition of details necessary to accurately describe the subject visually was the final step in image creation. Students were encouraged to compare their drawings with the subject of their work and aspire to a close match in representation.

Procedures

Participants in this study were divided into control and treatment groups. I selected a morning and afternoon beginning level art class to participate in each group in an attempt to control for the study variable of the time of day the treatment was administered. Second and fifth period classes were assigned to the control group and fourth and sixth period classes were assigned to the treatment group.

Participants in both control and treatment groups were introduced to the study. I explained that if students agreed to participate in the study they would be asked to complete a biographic questionnaire, a learning style checklist, and five tests throughout the second semester in which they would be asked to read a short passage and answer ten questions about the passage. I told students in the treatment group classes that they would also be asked to participate in weekly practice sessions throughout the second semester led by me and that the practice sessions would involve reading, looking at pictures, and drawing.

I explained to students that I was doing a study to find out how pictures and words work together. I told students it

was their decision whether or not to participate. If they chose to participate in the study they could change their mind at any time and drop out or not participate in any part they were uncomfortable with. The study was not related to students' art class grades in any way and there would be no negative ramifications for those who decided not to participate. Those who chose not to participate would work on their regular art projects during class time when study activities were taking place. Students who decided to participate would also continue working on their regular art projects during class time once the study activity was concluded for the day. I assured students that all of the information I gathered from the study would be confidential. Students who wished to participate in the study were required to sign a consent form and have their parents sign one as well to confirm their understanding of the study and agreement to participate.

All students in all classes agreed to participate in the study. On four separate occasions during the study, different individual students asked not to participate in a specific reading comprehension task due to health reasons (headache and general fatigue/illness). All other students participated fully in the study. Absenteeism was minimal. Students who missed a reading comprehension test were asked to make up the test upon their return and usually were able to do so, in addition to completing regular class work they had missed as well. Two parents of participants expressed reservations about their children participating, both out of concern that their child had been targeted to participate in a reading study due to a perception that the child was a poor reader. When I clarified the fact that all students had been asked to participate and that no students had been singled out for any reason, both

parents granted permission for their children to participate in the study.

Following the introduction to the study and completion of biographic data sheets and learning style inventories, all participants in both control and treatment groups took a standard reading comprehension test based upon the Basic Reading Inventory (Johns, 1997). The following day all students took a pretest of reading comprehension (also based on the Basic Reading Inventory) with an illustrated text passage. All students were directed to read the passage and answer the questions that accompanied it. Specific instructions to look at the picture that appeared next to the passage were not given to any students.

The next day, all students took a pretest of reading comprehension (also based on the Basic Reading Inventory) with instructions to draw their own illustration of the passage they were assigned to read (see Appendix D). All students were instructed to read the passage, draw a picture to illustrate the passage in the empty space next to the passage, and then answer the questions about the passage. All students read the passages silently and individually and answered the accompanying written questions in written form, working individually. Students had an entire class period, fifty minutes, to complete the tests, although all participants finished and resumed their regular art projects prior to the end of class.

At this point, activities of control and treatment groups diverged. For the next nine weeks, students in the control group had no further study activities and worked on their regular art class projects. Students in the treatment group received the first phase of treatment, an introduction to and weekly instruction and practice in analyzing pictures and using illustrations and text together to answer reading comprehension

questions. At the end of the nine-week period, all students in both treatment and control groups took the posttest of reading comprehension with illustrated text. During the second phase of treatment, instruction and practice in creating drawn illustrations, control group students once again participated in no study activities. Students in the treatment group students received an introduction to and weekly instruction and practice in creating drawings to illustrate text. At the end of the eight-week period, all students in both treatment and control groups took the posttest of reading comprehension with instructions to create a drawing to illustrate the text. This concluded all students' participation in the study.

Instruction and practice in picture analysis. Students in the treatment group began the first phase of treatment, instruction and practice in picture analysis, the week following administration of pretests to all study participants. Students started this phase of treatment by participating in four consecutive days of demonstration and practice sessions of analyzing pictures. I introduced the sessions by asking students to recall the process of critiquing artwork normally used in class wherein an artwork was described, analyzed, and interpreted with respect to its content and meaning. I told students they would be undertaking a similar process together - studying pictures, discussing what they saw, and deciding what the picture means or what it is communicating. I told students they would be practicing picture analysis - looking at simple pictures and talking about what information the pictures contained.

Students were instructed to look at an illustration beginning with its most prominent, central feature and to continue looking at the picture, scanning it in a clockwise

direction. As students looked at the picture I asked them to verbally describe what they saw. Students were asked to determine whether the picture looked similar to anything they had seen before. They were then encouraged to look at design qualities of the picture, such as variety, repetition, and proportion, that may cue them with respect to important pictorial information. Finally, students were asked to state the main idea of the picture and identify other information the picture contains, providing evidence from the illustration to support their answers.

This routine of picture analysis was supported by written instructions provided to each student in the form of a resource handout to keep and refer to throughout the study (see Appendix E). The handout contains an outline of the picture analysis process I wished students to follow. Pictures used in the demonstration and practice sessions were provided to all students as a handout as well, so they could be viewed easily and clearly. All pictures used in picture analysis practice sessions were clip art illustrations selected from the Microsoft Office Design Gallery Live, the source of all visual illustrations used with students in this study. Pictures consisted of large, simple black and white line drawings, the style corresponding to pictures students encounter later in the study as text illustrations.

On the first day of picture analysis practice, I led students through group oral analyses of two illustrations. I displayed a large copy of the illustration we were studying at the front of the classroom. Students were able to view that copy and/or their own copy on the handout they held. Picture analysis consists of a series of steps in which the main part of the picture is identified, the illustration is compared to something similar that has been seen in the past, and details of

the picture are identified. Next, students are asked to focus on specific visual aspects of the illustration that might relate to its meaning, such as variety, repetition, and proportion. Finally, students are asked to state the main idea of the picture and identify other information the picture contains, providing evidence from the illustration to support their answers.

Beginning with the central or most prominent part of the picture, I visually scanned the image in a clockwise motion and described what I saw, pointing to relevant parts of the picture on display in the front of the room as I spoke. The first demonstration picture contained three tools, a hoe, rake, and shovel, laid on the ground. Around the tools were star-shaped items of varying sizes. Above the tools were four medium-sized plants growing in a diagonal row. To the right of the tools were several diagonal lines that looked like rows.

Continuing with the demonstration, I mentally compared the picture to other things I had seen before and announced that the picture looked similar to gardens I had viewed previously. The second step of the picture analysis process is to try to associate the picture with something that has been previously viewed. I prompted students by posing the question, "This picture looks like a...?"

The elements and principles of design were posted in the study area for student use and referral during work on their regular art projects. I next directed students' attention to them and announced that several would be highlighted during the process of picture analysis because they could provide cues to important parts of the picture. Design principles of repetition, variety, contrast, proportion, and emphasis were highlighted and identified by me within the demonstration picture. Rows, plants, star shapes, and tools were repeated in

the picture. Variety was exhibited with three different types of gardening tools and in the size of the star-shaped figures. Contrast was seen in the relationship of the shapes and arrangement of the row of plants and the star-shaped figures scattered about the foreground, theorized to also be some type of plant life - seedlings, weeds, or grass. Proportion was evident in the difference in size between the plants in rows and scattered plants below. Emphasis was indicated by the thick, black outlines of the most numerous objects in the picture, the plants in rows.

After looking at the picture in a careful, organized manner, describing its components, mentally comparing it with previously viewed images, and identifying specific principles of its design, I told students we could then report on the idea of the picture, the information it contained, and the messages it communicated, using their previous observations as supporting evidence. Using the demonstration picture as an example, students and I decided together that the picture was about gardening. The plants growing in neat rows on clear soil were all the same size and shape and looked to have been purposefully planted in cultivated soil. The tools of gardening, a rake, hoe, and shovel, were lying together beside the cultivated soil. A diagonal line similar to that of those thought to be rows divided the cleared soil and an area in the foreground of the picture, where the tools were lying, presumably outside the garden. This area seemed to be covered with grass, weeds, or seedling plants. Since no person was visible in the picture and the tools were laid on the ground in a somewhat unorganized manner, it was guessed that the gardener had left the scene, possibly to take a break, or was working in some unseen part of the garden.



Figure 1. Picture analysis practice using a concrete illustration - garden scene.

Once this picture analysis demonstration was concluded I asked the students to follow the same procedure, guided by my prompts, with a second picture displayed at the front of the classroom (provided individually to students as a handout as well). Referring to the resource sheet containing the steps of picture analysis and prompted by me, the class group proceeded to orally analyze a second picture. This picture, like the demonstration image of the garden, represented concrete imagery. The scene portrayed was an academic setting containing a microscope and books. The process of picture analysis was repeated - students were directed to look first at the illustration beside the text and discuss the main part and details of the illustration, associate the illustration with something they have seen that looked similar, identify certain visual elements found within the illustration, and make a judgment about the communicative content of the illustration. I asked students what they thought the illustration was telling them and asked them to support their answers with evidence from the picture.

Two types of pictures were selected for and used during demonstration and practice of the picture analysis process: concrete pictures and conceptual pictures. Concrete pictures, such as the demonstration image of the garden scene described above, depict things that are observable or able to be perceived in a direct way - through a sense of touch, smell, hearing, or taste. Conceptual pictures depict ideas, process, or theories - abstract information - often through the use of symbols that call for interpretation. Studies have show different types of illustrations are most effective in communicating specific types of information (Hurt, 1987). Concrete pictures are best for communicating characteristics of a thing that can be perceived through the senses and conceptual illustrations are most effective in communicating abstract ideas.

I chose for students to work with both concrete and conceptual pictures during the picture analysis practice because students would be reading both concrete and conceptual texts throughout the study and viewing both concrete and conceptual illustrations which accompanied them. I wanted students to have experience working with both types of pictures in order to be best prepared for future picture analysis and reading comprehension tasks.

After students took part in an additional session of concrete picture analysis on the second day of practice, they began working with conceptual pictures. On the third day of practicing picture analysis, students were introduced to a conceptual image. I explained to students that they would be using the same picture analysis process to look at pictures that were a little different than the first set, which were labeled as concrete pictures and defined as containing images of things that were quickly recognized and understood without lots of translation.

The new pictures, conceptual pictures, were described as being similar to a puzzle or riddle in that once the images were identified, there may be some extra thinking needed to figure out what they mean. These types of pictures contained symbols - images that stood for something instead of directly representing it. I drew the shape of a heart on the board before students and asked what it meant. Students responded, "love" and I labeled the heart as a visual symbol. I asked students for more examples and was supplied with the peace sign symbol and the image of a light bulb over someone's head symbolizing an idea. I explained how these symbols stood for things, making a connection between words that did not have direct representations - love, peace, and an idea - and a picture, and told students these were the types of things they would be looking at when they practiced picture analysis with conceptual pictures.

I next demonstrated the same picture analysis process we had practiced the days before working with concrete pictures only this time I displayed a conceptual image to look at and analyze. The picture contained a scale balanced with an apple on one side and a stack of three large pills on the other. I began the process of picture analysis, identifying what I observed as my eyes scanned the picture in a clockwise motion. I declared that the picture reminded me of something I had seen before: the scales held in the hand of the mythical figure of Justice. The important design features I noted were repetition (of the pills), emphasis (relating to the size of the pills), and balance (the alignment of both sides of the scale). Since the scale was balanced, the apple and pills must be equal. However, the pills were very large - exaggerated in size - and this indicated a possible meaning beyond equal weight. We discussed how the meaning of this picture, the information it

held, probably extended beyond the concrete representation of a scale, apple, and pills and entered the realm of conceptual imagery, using symbols to communicate. Equal importance of healthy food, represented by the apple, and medicine or medical treatment, represented by the pills, could lead to good health, or a balanced life, represented by the scale. Students recalled the saying, "An apple a day keeps the doctor away." and compared it with the image of the scales, apple, and pills.



Figure 2. Picture analysis practice using a conceptual illustration - scale.

Next, students were led through the picture analysis process with a conceptual picture dealing with recycling. Again, students were able to view the picture at the front of the room and had their own copy as well. Students also had a handout outlining the steps of picture analysis. Students practiced analyzing another conceptual picture on the next day, too, the fourth day of the picture analysis phase of treatment. All together, students received a total of two demonstrations of picture analysis practice, one with a concrete picture and one with a conceptual picture used as an example. They practiced

picture analysis as a group four times, twice using concrete pictures and twice using conceptual pictures.

The fifth day of treatment marked the introduction of text into the picture analysis process. Students were given copies of a one-page text passage with an illustration created by me beside it. The illustration was located on the right side of the single-sided handout received by students; text was on the left side. A set of ten questions to evaluate reading comprehension was contained on a second page. Students were asked to look at the picture first, analyze the picture as they had practiced, read the text selection, and then go back to the picture to compare it with the text it illustrated.

When students studied the illustration that accompanied the text before them, they were encouraged to repeat the process of picture analysis they had been practicing- visually scanning the picture in an orderly way, describing what it reminded them of, and identifying individual components of the illustration. Students told me what they thought the main idea of the picture was and were asked to provide evidence from the picture to support their assumptions. Students were also asked to determine what other information they thought the picture provided to them.

The first practice text with illustration contained information about a type of caterpillar that secretes a substance through hairs on its bodies that repels predators (see Appendix C). The accompanying illustration depicts a caterpillar facing an ant. The caterpillar has hairs on the top of its body with droplets at the end of the hairs. A skull and crossbones symbol is placed above the droplets. Using the process of picture analysis, students described the caterpillar, hairs, drops, skull and crossbones, and ant. They said the picture reminded them of hairy caterpillars that are poisonous

and that sting when touched. Repetition was noted in the numerous hairs and droplets found on the caterpillar, variety and contrast in the difference in shape of the caterpillar and ant, and emphasis was seen in the thick outline around the skull and crossbones. Students theorized that the picture was communicating information about the caterpillar possessing a weapon - the poison on its hairs - to protect it against being eaten by the ant. They guessed that the ant would not want to eat the caterpillar and that if it tried, the ant would get sick or die.

Students next silently read the text that accompanied the illustration in which the caterpillar and its natural defense was described in detail. Students read along me as I read aloud to ensure all were progressing at the same rate through the text. After reading the passage, students were asked to compare the text and the illustration. I explained that this was an additional part of picture analysis students would be using when looking at pictures that accompanied texts, or illustrations. Students determined whether the information they had taken from the picture was correct and accurate according to the text. They also considered whether the text contained important information not found in the picture, and whether the picture contained additional or supplemental information to support any aspect of the text.

I next prompted students to use both the picture and the text together to answer questions that accompanied them. Students were given time to answer the written questions individually; they answered in written form. Once all students had completed the questions, I led the class in a review of the questions and correct answers. I read the questions out loud and asked students to take turns orally supplying the answers. The first of the set of ten reading comprehension questions

always refers to the main idea of the text. During demonstration and practice with students, I guided students to compare the main idea represented by the illustration and by text. I also directed students to refer to the illustration before re-reading portions of the text passage to find answers to the remainder of the questions. Practice sessions included time for students to answer the reading comprehension questions independently in written form on their own sheets of paper and then to review their answers as a group led by me.

When a student answered a question I asked where the student had gotten the information, from the picture or the text, or both. If the information needed for the answer could be found in the picture, I pointed out the specific location of the information within the picture to all students. Students who wished to correct their answers during these practice sessions were allowed to do so.

Students in the treatment group repeated this practice exercise of analyzing a text illustration, reading the text that accompanied it, and comparing the picture and text orally as a group. Treatment students answered reading comprehension questions based on the picture and text information individually in written form and then participated in an oral group review of the questions and answers. Students in the treatment group participated in this practice working with picture analysis and illustrated texts for nine weeks. During the first week students were led through demonstration and practice sessions in picture analysis. For the remaining eight weeks students practiced working with illustrated texts. Treatment group students received a total of two demonstrations and four practice sessions working with pictures alone and eight sessions of working with illustrated texts, pictures and words, together. All demonstration and practice sessions repeated the routine of

picture analysis and reading of the text as a group guided by me. Students compared picture and text information and provided written answers to reading comprehension questions. I led a group review of correct answers for each question. Demonstration, instruction, and practice sessions took an average of twenty minutes to complete.

At the end of the first phase of study treatment, instruction and practice in picture analysis and working with illustrated texts, students in the treatment group, along with students in the control group, took the posttest of reading comprehension with illustrated text. Students in the treatment and control group were given the same instructions for the posttest, to read the illustrated passage and answer the accompanying questions. Students in the treatment group were allowed to refer to their outline of the process of picture analysis while taking their posttest. All students read the posttest passage independently and silently and answered the questions in written form individually. No group or oral responses were permitted. I did not review answers for the posttest.

At the conclusion of the picture analysis instruction and practice sessions, all students in both treatment and control groups were presented with an illustrated text passage and given instructions to read the passage and answer the reading comprehension questions that accompanied the passage. This posttest of reading comprehension with illustrated text measured all students' reading comprehension of an illustrated passage. The posttest also determined whether a difference in performance on an illustrated test occurred between the control group of students who had received no instruction or practice in picture analysis and the treatment group who did receive instruction and practice. There was a nine-week period between the pre- and

posttests of illustrated texts that allowed time for instruction and practice with the treatment group.

Instruction and practice in drawing illustrations. The second phase of study treatment, instruction and practice in drawing and creating text illustrations, immediately followed students' experiences with picture analysis and using illustrations and text together. During the drawing treatment phase, students first participated in four researcher-led drawing demonstration and practice sessions on four consecutive days. Like the picture analysis instruction and practice, the drawing sessions resembled exercises undertaken by students during regular art class lessons but were tailored to meet the specific goals of the study: to provide students with instruction and practice in creating effective illustrations for text materials.

Drawing instruction began with me showing students how to create representational line drawings from observation, first with simple subjects and proceeding to more complex scenes. Students were then taught how to create conceptual drawings, beginning with a single word and progressing to sentences. This combined instruction in creating concrete drawings from models and photographs and in creating conceptual drawings from words and photographs mirrors the approach of the first phase of treatment, picture analysis, in philosophy. I wanted students to have instruction and practice in drawing both concrete and conceptual subjects since they would come across both types of topics within the text passages they read and were tested on. Finally, students were led by me in creating drawings to serve as illustrations for text passages they read and using their own illustrations to answer questions about the text.

Students in the treatment group were told that they would be learning how to create drawings used specifically for the purpose of communication, drawings similar to the illustrations that had accompanied the text passages in the previous phase of the study. As I referred students to the practice sessions they had just completed in which they had analyzed pictures used to illustrate text, I asked them to recall and describe characteristics of those illustrations. Students characterized the pictures as plain, simple, black and white, well drawn, and informative. I then displayed the illustrations previously viewed in the picture analysis portion of the study and re-emphasized their qualities of simplicity in design and accuracy in communicating messages from the texts that they accompanied. I explained to students that drawings that are complete, clear, and accurate are very effective for communicating information. This type of drawing also has the most positive effects of enhancing text comprehension (Peeck, 1980).

After re-acquainting students with these illustrations, I drew a smiley face on a marker board in front of the class. I then compared my drawing to a reproduction of a highly realistic portrait by Albrecht Durer placed on display next to the marker board. I explained that both the smiley face and the detailed portrait communicated the idea of a person's face to viewers. I then invited students to compare and contrast the two pictures. Students noted that the smiley face was simple, quick and easy to draw, and recognizable as the face of a person. They opined that the detailed portrait likely required a great degree of artistic skill and investment of time to create and that the person in the portrait could probably be recognized as an individual rather than as "just a generic face".

I suggested to students that if someone were asked to generate a drawing that communicated the idea of "a person's

face", both the smiley face drawing and Durer's portrait would meet the requirement. I acknowledged that Durer's portrait could also be admired for the skill involved in creating it, the incredible realistic detail, and that someone might want to hang it on his or her wall because of the beauty they perceived within it. However, I continued, Durer's work communicated many other things besides the idea of "a person's face" - the dress, hairstyle, and background elements of the composition could lead viewers to entertain many thoughts about the portrait - who the person was that was being portrayed, where and when he lived, and so on. I argued that these thoughts might be distracting if the goal was only communicating the idea of "a person's face" and posited that in that case, the smiley face would be preferable. It could be quickly and easily created as a simple drawing to efficiently communicate the idea of "a person's face". This demonstration was concluded by me expressing a preference for the smiley face type of drawing - a simple, quick, and recognizable image that efficiently communicated an idea - for the purposes of drawing for the study.

Following this demonstration, students began their first session of drawing practice. The goal of the first type of drawing practice, representational drawing, was to have students create pictures that accurately represent important aspects first of what is observed (from models and photographs) and then of what is read in text passages. I emphasized this mission throughout the drawing instruction and practice sessions, and I reminded students of my preference for simple, efficient, and accurate drawings in the context of our practice for the study. Students were asked to give special consideration to the informative content of their drawings. Not only should they carefully look at and accurately represent a subject with respect to its observable features, as with regular drawing

assignments in art class, during the study students would have the additional task of considering and representing qualities of a subject that corresponded to the subject's identity.

The first drawing exercises designed for the study began with careful observation of the subject to be rendered. I asked students to study their subject and to identify its defining features aloud. "Which parts are absolutely necessary in order for the object to be easily recognized?" I asked. After deciding upon the elements of the model most important to communicate its identity, students considered the types of lines and shapes of which the object or scene was composed. Students were then instructed to begin their drawings with an outline of the most basic shape of what they were viewing. Next they added lines and shapes to complete the overall layout of their subject. Shapes were then refined to closely reflect what was observed and necessary details were added to complete the picture. This process of drawn representation is in accordance with how images are thought to be represented mentally - hierarchically, beginning with global features and ending with details (Palmer, 1975).

I demonstrated drawing techniques using real-life models and photographs. A chalkboard eraser was my first subject. I drew a long, thin rectangle to illustrate the top or "handle" of the eraser and a thicker rectangle underneath. I asked students to evaluate my illustration of the chalkboard eraser and it was determined that while the drawing was simple and accurate, more visual cues might be necessary for the drawing to be easily identified as a chalkboard eraser. Students suggested I draw a hand holding the eraser along with words or lines on either side of the eraser, with the area the eraser had passed through shown as empty, or erased.

After my demonstration of creating a simple, accurate drawing from an observed model, students had an opportunity to try the process themselves. The first model for drawing practice was a cotton swab. Each student was given a cotton swab to observe and depict in a drawing. I asked students to draw a picture of the cotton swab that was simple and that clearly and accurately represented the swab. Students were reminded to use the representational drawing process they regularly employed in class and that was reinforced within the context of this study - carefully observe the model, draw simple shapes first, refine the shapes to match the model, and add important details. Students also were encouraged to add to their drawing aspects which they believed would emphasize the identity of the subject - illustrating what a cotton swab may be used for or the type of packaging it is found in, for example. This formula for drawing was also given to students as a handout to refer to as needed throughout the remainder of the treatment process (see Appendix F).

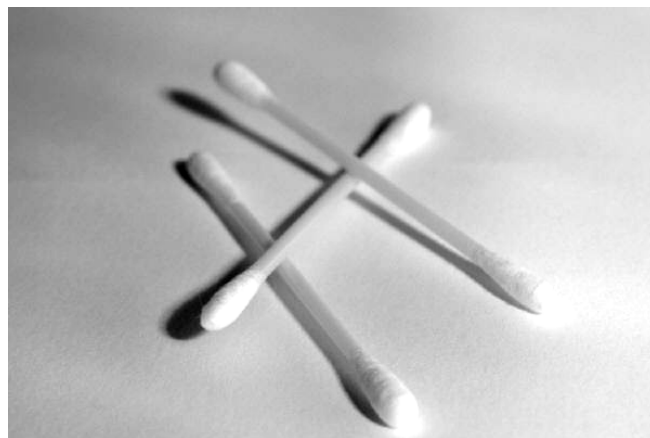
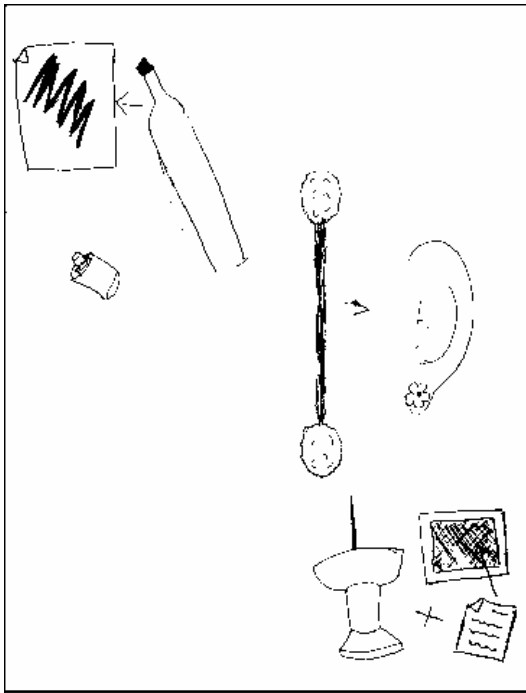
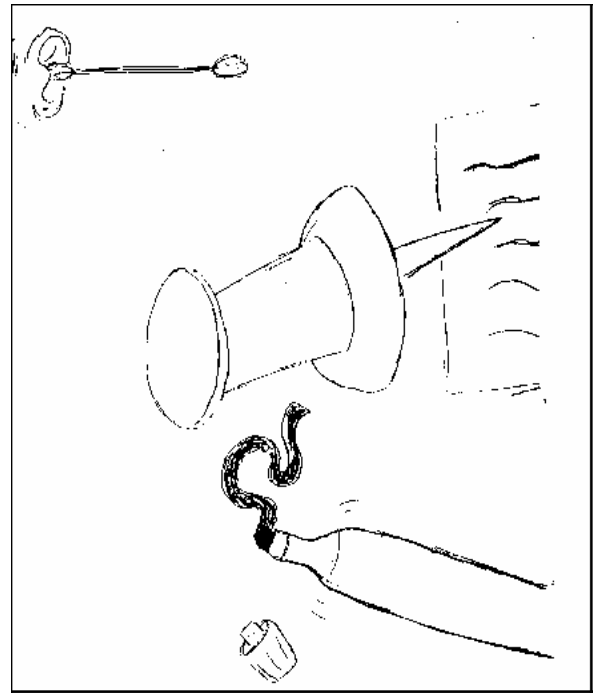


Figure 3. Drawing practice with models: cotton swabs

After all students had completed their drawings of the cotton swab, I initiated a discussion of the thought processes involved in creating their illustrations. Students identified what they believed to be important details in their drawings, such as the soft texture of the cotton. They shared different ways they had represented the subject, including additions they had made to the illustration of the cotton swab for the sake of communicating its identity, like an ear, or a hand holding the swab. This process of observation, drawing, and discussion was repeated for the remaining two models, a thumbtack and felt tipped marker during the first day of drawing practice.



Drawing Sample A



Drawing Sample B

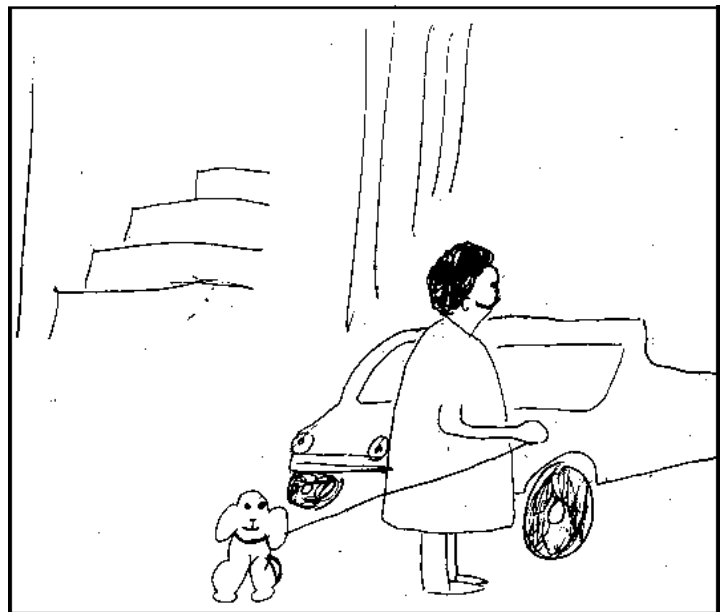
Figure 4. Drawing practice using real life models: cotton swab, thumbtack, and marker.

These objects were selected as models for their simplicity in design and ease and low cost of procurement. I wanted every student to have the same model to draw and for each student to be able to observe the model before them easily. These simple models were also chosen with consideration of varied drawing capabilities of students so less confident drawers would not be intimidated or frustrated by their task. During the first day of drawing practice students were asked to draw these three objects from observation.

The second day of drawing practice students worked with pictures as subjects instead of actual models, thus removing their subjects from reality by one step. Students were given handouts consisting of copies of black and white photographs depicting simple scenes. I chose the scenes from the Microsoft Design Gallery Live collection of images and based selections upon the level of complexity of the scene, variety, and consideration of interest to students. Again, students were directed to carefully observe their subject, the photograph, and then to use the same simple line drawing technique as they had the day before to create representative illustrations of the scenes.

Before drawing began, I led a group discussion concerning identification of the most important parts of the first photographed scene included in the drawing practice session. Students were able to view the reproduction of the scene displayed on the board in front of the class as well as their own personal copies of the scene at their seats. This scene depicts an elderly woman walking a poodle outside her home. Students took turns listing what they saw as the most important visual aspects of the scene - the entrance to the house in the background, which identified the setting of the scene, and the woman with the dog on a leash, the subjects of the scene.

As I demonstrated the drawing process on the marker board before them, students continued to make suggestions as to what should be included in my drawn representation and how certain elements of my picture should be illustrated. They discussed how to make a the very basic human form drawn by me into one recognizable as an elderly woman by adding curly hair, a slightly curved back, and an "old fashioned" dress coat. Students also advised me on how to make the dog identifiable as a poodle.



Dog Scene: Student Drawing A

Dog Scene: Student Drawing B

Figure 5. Drawing practice using a photograph as model - dog scene.

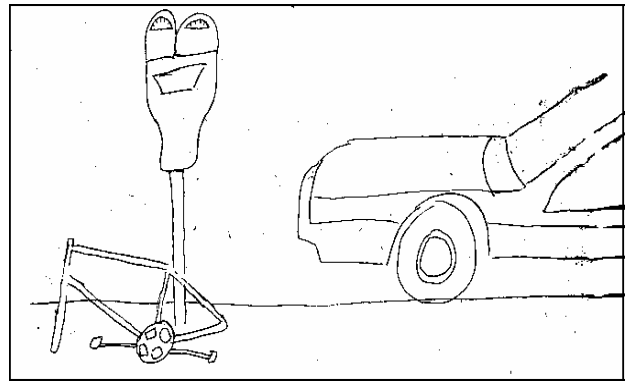
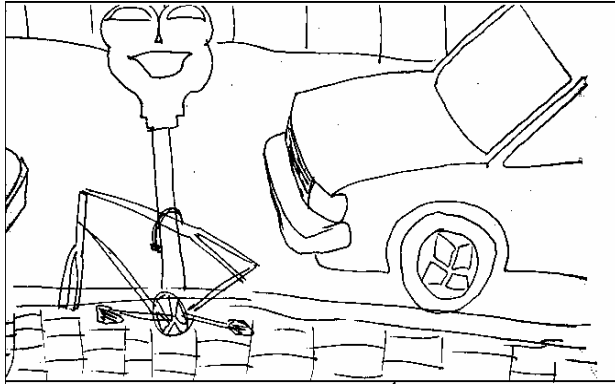
Following my demonstration, students were given the task of repeating the drawing procedure using the next photograph as their subject. This scene contains a car parked on a street next to a parking meter. A bicycle was attached to the meter with a bicycle lock but parts of the bicycle - wheels and handlebars - had been removed. Students surmised the car, meter, bike, and street were essential aspects of the scene that had to be included in their illustrations in order to accurately communicate the information of the photographic scene. Items deemed unnecessary were the cobblestones in the sidewalk, details of the building on the other side of the street, and the hubcap design of the car. These details were not to be included in drawings since students felt they were unimportant elements of the photograph.



Figure 6. Photographed scene used in drawing practice session.

As with the drawing exercise on the previous day, once all students had completed their drawings, they shared and discussed individual approaches to recreating the scene in a simple, efficient, accurate way. Students then applied this process once again to a third scene. At this point, students had

completed three drawings of objects from observation of models and two drawings of scenes from observation of photographs. The process of determining outstanding features of a subject to be drawn and representing these with basic shapes that are then refined and detailed to match the model was reviewed during each practice session.



Car Scene: Student Drawing A

Car Scene: Student Drawing B

Figure 7. Drawing practice using a photograph as model - car scene.

Students next practiced drawing conceptual images. As stated previously, the reading passages used throughout this study consist of a mixture of concrete and conceptual information. That is to say, passages contain facts about real-life objects and events which can be directly observed and perceived (like the first subjects described above in the drawing practice activities) as well as ideas and theories that are mental formulations or abstract processes. For this reason, drawing practice included instruction in creating conceptual illustrations in addition to the instruction for making concrete, representational drawings.

On the third day of drawing instruction and practice, I once again discussed with students the difference between representational, or concrete, and conceptual pictures. I provided illustrations of each type of image using pictures that students had encountered when they had been studying illustrated texts. I explained to students that concrete drawings are a representation of something you have looked at or directly perceived through sensory input, like hearing, touching, tasting, or smelling. Conceptual drawings, on the other hand, can be of things that are unseen and that don't exist as real objects.

Conceptual drawings are individual mental pictures of ideas. I pointed out that concrete drawings of the same thing by different people often look very similar, showing students drawings of the car they completed during the previous day's activities to illustrate this fact. I added that concrete drawings are also often easily recognized and their subject matter is readily identified by other viewers. Students recognized others' drawings of parking meters from the drawing practice activities of the preceding day.

Conceptual drawings, however, are different, I continued, in that they do not have to be modeled upon something we have seen or experienced in reality and often are very personal and recognizable only to the drawer, like a personal secret code. (It was acknowledged at this point, however, that some often-used conceptual ideas might be illustrated in a way that *is* widely recognizable - a heart symbol to indicate love, for example.)

I told students that the conceptual drawings they would be creating were to be done in the same simple line drawing style as the concrete drawings. However, when they set out to create a conceptual image, instead of looking at a model or photograph

to make their drawing, students would be "looking" inside their imagination in order to create their picture.

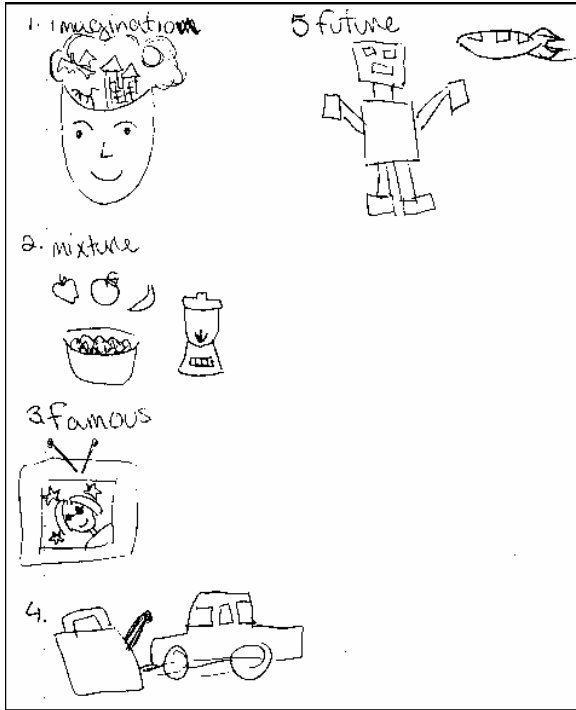
Rather than observing their subjects visually, students would have to consider the idea of their subject in their minds and decide what type of image to create to communicate the most important, identifying aspects of their subject and transform that mental image into a drawing. Students were encouraged to produce a drawing that had a strong personal connection to the idea they were trying to illustrate so that they would be able to remember what their drawing meant when they looked at it in the future.

I demonstrated this process for the students by illustrating the word "frustration". I described how "frustration" was not concrete, like a car or even a smell, something that could be perceived with the senses, but conceptual - an idea, a feeling. I shared my thinking and decision making process in creating a drawing to represent "frustration" by telling students about something I personally found very frustrating - the lack of strength in my arms. I then drew a simple line drawing of a person unsuccessfully trying to do a pull-up (another strong personal reference). The person in my drawing had very skinny arms, a frowning face with gritting teeth, and curving lines around the body to indicate trembling. I asked students to suggest possible meanings for the illustration. Responses included weakness, exercise, "wimp", failure, tired, angry, and scared. I posited that the success of a conceptual drawing was that while its meaning might not be easily understood by someone else, it would be very clear to the person who drew it. The reason for this is because it makes a strong connection between the subject of the illustration and the personal ideas and emotions of that person.

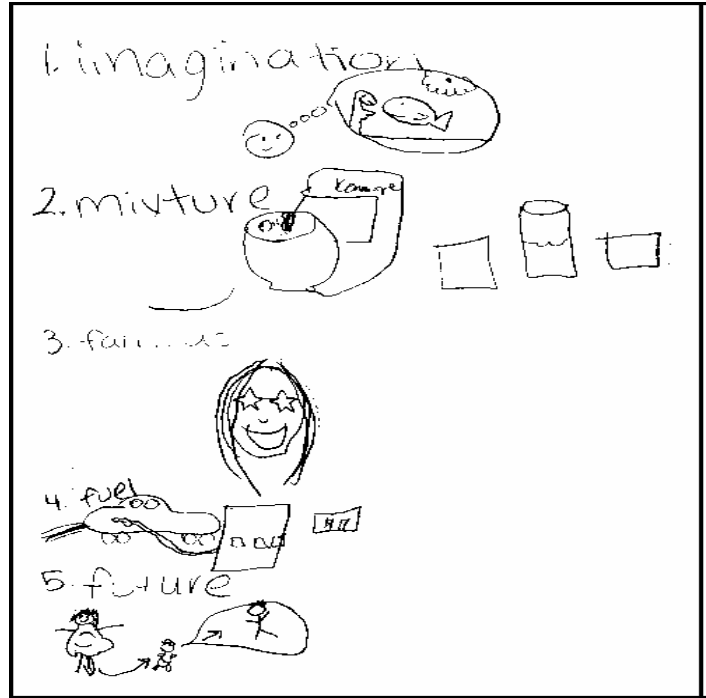
My drawing very clearly represented the idea of frustration to me.

Following the demonstration, students were given a list of five conceptual words to illustrate and were instructed to create a simple line drawing for each word that illustrated the word in a personal way. They were to use my demonstration as an example and to refer to their instructional drawing handout specifying the steps (observe, draw basic shapes, refine, add details) and characteristics (simple, accurate line drawings) of drawings needed for the study. Students were reminded that in the case of creating conceptual drawings, observation involved "looking" into their imagination to find personal experiences and connections with their subject and accuracy referred to their own ability to recognize what the drawing stood for in the future.

Students illustrated the word "imagination", "mixture", "famous", "fuel", and "future". When all students completed their drawings they shared and discussed their individual approaches to representing the words, noting similarities and differences. Students seemed especially intrigued when they shared what they saw as a highly unusual personal depiction, like a person wearing dark star-shaped sunglasses to represent "famous", and found that another student had drawn a similar representation. Equally interesting, or perhaps more accurately, entertaining, to students were illustrations that seemed difficult to understand until the drawer verbally explained the relationship between the word and their picture. One student shared their illustration of the word "imagination": a drooling dog with clouds that contained bones over its head. The student explained that the dog was imagining the bones and the clouds were his thought bubbles, "like in the comics".



Conceptual words:
Student Drawing Sample A



Conceptual words:
Student Drawing Sample B

Figure 8. Drawing practice using conceptual words as models - imagination, mixture, famous, fuel, future.

Day four of drawing practice expanded the idea of creating conceptual illustrations. Principles of conceptual illustration from the day before were reviewed and students were asked to draw pictures to represent conceptual sentences instead of single words. Students were instructed to decide on the most important ideas contained within the sentence and to include these ideas in their drawings. I demonstrated the process by illustrating the sentence, "Driving a car while sleepy can be dangerous." In the front of the room on the marker board where I had written the sentence to be illustrated, I talked students

through the process of deciding which elements of the sentence were necessary: driving, sleepiness, and danger. Basic representations of those objects and ideas involved a rectangular car with a stick person driver. The driver's face was refined by drawing one closed eye (a u-shaped curve) and one squinting eye. A detail of Z's were added over the driver's head to indicate snoring, accentuating the look of sleepiness.

I then identified "danger" as the most conceptual element of the sentence and I explained my personal interpretation of it in this context: I once swerved off the road when driving drowsily. I added my personally relevant conceptual representation of danger to the illustration by drawing a twisted path of parallel dotted lines and arrows in front of the car. Students assisted me in checking the communicative content of the picture I drew with that of the sentence.

After my demonstration, students illustrated these five sentences:

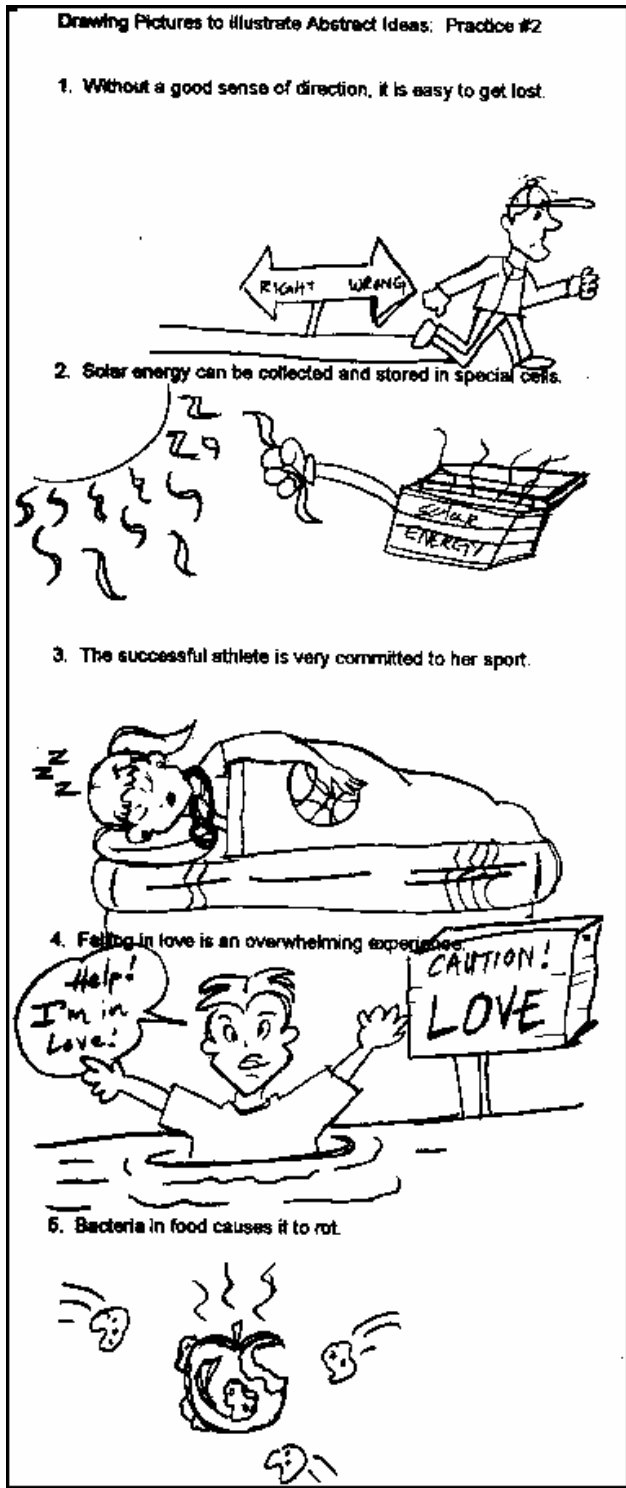
Without a good sense of direction, it is easy to get lost.

Solar energy can be collected and stored in special cells.

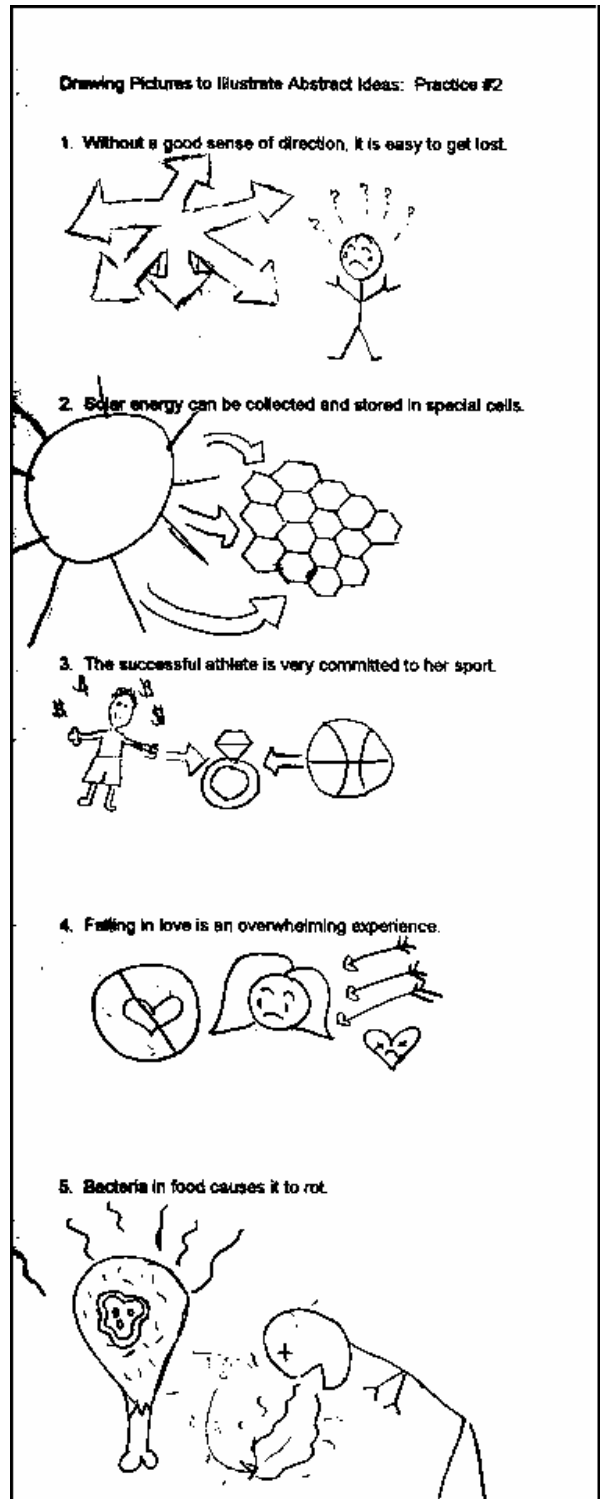
The successful athlete is very committed to her sport.

Falling in love is an overwhelming experience.

Bacteria in food cause it to rot.



Drawing sentences:
Student Sample A



Drawing sentences:
Student Sample B

Figure 9. Drawing practice using conceptual sentences as models.

When all students had finished drawing illustrations for the five sentences, results were compared and discussed. Again, students were highly enthusiastic about sharing and comparing their work. This was also noted as qualitatively significant in that it varies from the norm. When students create artwork in the guise of a regular art project, they are not often eager to share their work with the entire class and claim embarrassment or fear that the work will be laughed at or deemed "not good enough".

During the course of the drawing practice sessions for the experiment, I had strongly emphasized the difference in creating a very realistic, detailed, time consuming artwork and a simple line drawing illustration and stressed that the latter was a must for the purposes of the study. I wondered if de-emphasizing certain aspects of drawing indicative of an advanced skill level, such as realism and amount of detail, made students more comfortable with the work they had done. I also questioned whether students were thinking of the simple line drawings completed for the study differently than they did about drawings completed for a regular class drawing assignment.

Once students had practiced drawing both concrete, representational pictures and conceptual pictures, they began to practice reading and drawing pictures to illustrate text passages. During this portion of drawing practice students were advised to read the text passage they were assigned and then to draw an illustration that depicted the main content of the text. Text passages were supplied in handout format and were the same with regard to layout as the illustrated passages students had worked with during the first phase of treatment, instruction and practice in picture analysis. The only difference was that the passages they received during this phase were not accompanied by

illustrations. Instead, the area to the right of the passage was left empty to accommodate student drawings.

After reading a text passage, as they had done previously when drawing from observation, students identified the parts of their subject, the text in this case, that were most important for communicating its main ideas. I then queried students as to what was needed in a drawn illustration to show those ideas. I encouraged students to try to form an image in their mind of what was described in the text and added that they could close their eyes if they wished to do so.

Once students decided upon the subject of their drawing, they were instructed to create a line drawing of the image they had formed in their mind after reading the text and thinking about its most important parts. Students drew an outline of the basic shapes of the most dominant features of the text, refined it to match the text description, and added details as needed. Students were motivated to refer back to the text as they drew and to compare their final drawing with text for congruency.

After students completed their drawing they answered reading comprehension questions pertaining to the text they illustrated. I directed students to use both their illustration and the text to answer the questions. When all students had completed their questions I led the group in a review, first asking students to share and describe their illustrations. Then they explained why they had made the choices they had in their drawings. We went over answers to the reading comprehension questions and discussed how the answers corresponded to students' individual illustrations of the text. Students were allowed to correct their answers at this time if they wished to do so.

The first passage students worked with during this phase of treatment contained information about scientists discovering

five hundred year old Chinese lotus seeds that sprouted and grew despite their age. After the passage was read aloud by me as the class read along silently, the class as a group identified the most important information within the passage - the ancient seeds' ability to grow and being studied by scientists who tried to find applications for their knowledge.

Students illustrated the idea of the seeds' antiquity with drawings of flowering plants growing amidst dinosaurs, of a clock surrounded with many arrows, and of a very long horizontal arrow connecting two scenes of growing plants. Scientists were represented by drawings of people with glasses, lab coats, and notepads. Some students drew thought bubbles above scientists' heads filled with representations of crops to indicate how the scientists apply knowledge gained from studying lotus seeds to contemporary cultivation practices.

After completing and discussing the drawings they had created, students answered reading comprehension questions that accompanied the passage. During this time they worked individually and silently. When all students had finished answering the reading comprehension questions, I led a review of the answers, asking students to identify aspects of their illustrations that had helped them in reaching conclusions about the answers. If students wished to do so, they were allowed to correct their answers as well.

Creating Illustration to Accompany Concrete Text:
Practice Text 1

Centuries Later, Chinese Lotus Seeds Still Sprout

Nearly 500 years after forming in their parent plant, lotus seeds from a Chinese lakebed have sprouted seedlings of their own, researchers say. According to the lead author of a study detailing the findings, published in the current issue of the *American Journal of Botany*, the cultivation of offspring from seeds this ancient is "a first in plant biology."

Biologist Jane Shen-Miller of the University of California, Los Angeles, and colleagues collected 20 ancient lotus seeds on a trip to China's Liaoning Province. Radiocarbon dated at between 200 and 500 years old, the four seeds that the team tested for viability all sent up shoots. But the plants have not fully escaped the effects of time: all exhibit abnormalities in their leaves, stalks and underground stems. "Instead of standing up straight with strong leaves, these were smaller, the leaves were weak and bent, displayed abnormalities in color, and the underground stems were small and not getting enough food," Shen-Miller reports. The culprit, she surmises, is long-term, low-dose radiation from the soils in which the seeds resided.

Still, the radiation exposure does not appear to have hampered germination. "The lotus is so robust that it can sprout after centuries of exposure to low-dose gamma radiation," Shen-Miller observes. "We need to learn about its repair mechanisms, and about its biochemical, physiological and molecular properties. The repair mechanisms in the lotus would be very useful if they could be transferred to crops, such as rice, corn and wheat, whose seeds have lifespans of only a few years."

by Kate Wong Scientific American online February 2002

271 words

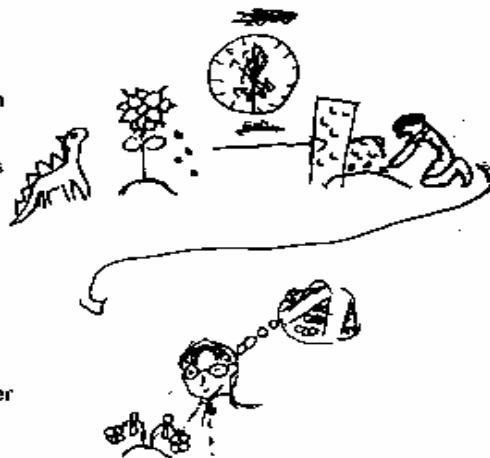


Figure 10. Student drawing practice using a text passage as a model.

Working with the treatment group alone, I administered a total of eight practice exercises during which students created drawn illustrations to accompany text passages. At the conclusion of the drawing instruction and practice sessions, all students in both treatment and control groups were presented with an unillustrated text passage and given instructions to read the passage, draw a picture to illustrate the passage, and answer the reading comprehension questions that accompanied the passage. This posttest of reading comprehension with student-illustrated text measured all students' reading comprehension of

a passage that they were asked to illustrate. The posttest also determined whether a difference in performance on a self-illustrated test occurred between the control group of students who had received no instruction or practice in drawing pictures to illustrate text and the treatment group who did receive instruction and practice in creating their own illustrations to accompany text. As with the pre- and posttests of illustrated text, there was a period between the pre- and posttests of texts with student which allowed time for instruction and practice with the treatment group. In the case of pre- and posttest of texts with student-drawn illustrations, there were seventeen weeks between administration of pre- and posttests, since all study participants took the pretest at the beginning of the study and the two treatment phases of the study lasted for a total of eighteen weeks.

CHAPTER FOUR
FINDINGS, DISCUSSION, AND CONCLUSIONS

Introduction

The primary question of this study was: Does instruction and practice in analyzing illustrations and in drawing pictures to accompany text affect students' performance in reading comprehension tasks. More specifically, I set out to determine the impact of the specific type of instruction and practice in working with pictures and words together that I designed and implemented upon students' understanding of text passages.

Along with testing the treatment I developed, it was necessary to test whether varying presentations of text passages, unillustrated passages, passages with provided illustrations, and passages with student-drawn illustrations, affected students' reading comprehension. Since the treatment focused upon working with two types of text passages, those with accompanying illustrations and those with illustrations drawn by the reader, it was important to know the significance of the passage type on reading comprehension.

I measured study participants' reading comprehension scores on unillustrated passages, illustrated passages, and passages for which illustrations were drawn by the reader to determine the impact of these variables on reading comprehension. Once I procured that data I was able to study the effects of the treatment, instruction and practice in analyzing text illustrations and in drawing text illustrations, on reading

comprehension by comparing test scores of treatment and control groups. By gathering other types of data about individual student characteristics such as age, gender, and learning style, I was also able to investigate the effects of the variable forms of passage presentation and of the treatment on specific subgroups of the study population.

Quantitative Findings

Statistical data analysis methods using the t test to determine whether an observed difference between a constant and a variable (one sample) or between two group averages (independent samples) is attributable to chance or represents an actual statistically significant difference between the groups, revealed statistically significant relationships among study variables and participants' performance of reading comprehension tasks. Results that are reported and discussed are statistically significant within a confidence level of 95%. This translates to the reported results having a 95% likelihood of occurring again if the experiment were repeated.

The following two tables contain statistical data pertaining to comparisons of groups and variables for this study. Reading comprehension scores of study participants working with specific types of reading comprehension tests are shown. Also, scores of study subgroups are provided within the data tables.

Scores Compared	N	Mean	Std.	Std.	t	df	Sig. (2 tailed)	Mean Difference	95% Confidence Level	
			Deviation	Error Mean					Lower	Upper
Researcher-illustrated vs. Unillustrated Tests	78	1.526	1.905	0.216	7.073	77	.000	1.526	1.096	1.955
Researcher-illustrated vs. Unillustrated Tests: factual questions	79	0.551	1.137	0.128	4.305	78	.000	0.551	0.296	0.805
Researcher-illustrated vs. Unillustrated Tests: inference questions	79	0.766	0.987	0.111	6.899	78	.000	0.766	0.545	0.987
Researcher-illustrated vs. Unillustrated Tests: vocabulary questions	79	0.146	0.440	0.049	2.943	78	.004	0.146	0.047	0.244
Student-illustrated vs. Unillustrated Tests	67	0.358	1.718	0.210	1.706	66	.093	0.358	-0.061	0.777
Student-illustrated vs. Unillustrated Tests: factual questions	69	0.449	1.231	0.148	3.031	68	.003	0.449	0.154	0.745
Student-illustrated vs. Unillustrated Tests: inference questions	69	0.333	1.149	0.138	2.409	68	.019	0.333	0.057	0.609
Student-illustrated vs. Unillustrated Tests: vocabulary questions	69	-0.159	0.388	0.047	-3.411	68	.001	-0.159	-0.253	-0.066

Figure 11. Statistical comparisons (t test) of average number of incorrect answers on tests of reading comprehension: Researcher-illustrated tests compared to unillustrated tests and student-illustrated tests compared to unillustrated tests. Scores disaggregated according to question type.

Figure 12. (next page) Statistical comparisons (t test for independent samples) of average number of incorrect answers on tests of reading comprehension: Control and treatment group scores with researcher-illustrated tests compared to unillustrated tests and with student-illustrated tests compared to unillustrated tests. Scores of study population subgroups compared to cohorts with researcher-illustrated tests versus unillustrated tests. Scores disaggregated according to question type.

Equal variances assumed in all cases - Sig. > .05 with Levene's Test for Equality of Variances

Groups Compared	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2 tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Level	
										Lower	Upper
(control/treatment)											
Control vs. Treatment: Researcher-Illustrated and Unillustrated Tests	32/46	0.156/0.544	1.762/1.312	0.311/0.193	-1.11	76	0.269	-0.387	0.348	-1.080	0.306
C/T Researcher-Illustrated and Unillustrated Tests: factual questions	33/46	-0.121/0.022	1.083/0.856	0.188/0.126	-0.66	77	0.514	-0.143	0.218	-0.578	0.292
C/T Researcher-Illustrated and Unillustrated Tests: inference questions	33/46	0.212/0.391	0.857/0.745	0.149/0.110	-0.99	77	0.325	-0.179	0.181	-0.540	0.181
C/T Researcher-Illustrated and Unillustrated Tests: vocabulary questions	33/46	-0.030/0.044	0.585/0.419	1.020/0.062	-0.65	77	0.516	-0.074	0.113	-0.299	0.151
Control vs. Treatment: Student-Illustrated and Unillustrated Tests	27/41	0.000/1.122	1.7797/1.435	0.346/0.224	-2.85	66	0.006	-1.122	0.394	-1.908	-0.336
C/T Student-Illustrated and Unillustrated Tests: factual questions	29/41	0.345/0.342	1.261/1.039	0.234/0.162	0.01	68	0.990	0.003	0.276	-0.547	0.553
C/T Student-Illustrated and Unillustrated Tests: inference questions	29/41	0.103/0.854	1.012/0.937	0.188/0.146	-4.07	68	0.000	-0.957	0.235	-1.426	-0.488
C/T Student-Illustrated and Unillustrated Tests: vocabulary questions	29/41	-0.276/-0.098	0.455/0.436	0.084/0.068	-1.66	68	0.102	-0.178	0.108	-0.393	0.037
(black/cohorts)											
Black Students and Cohorts: Researcher-Illustrated vs. Unillustrated Tests	37/37	2.300/0.770	1.835/1.774	0.302/0.292	3.64	72	0.001	1.527	0.420	0.690	2.364
B/C Researcher-Illustrated Tests: factual questions	37/38	0.784/0.368	1.058/1.223	0.174/0.198	1.57	73	0.120	0.415	0.264	-0.111	0.942
B/C Researcher-Illustrated Tests: inference questions	37/38	1.162/0.303	1.041/0.722	0.171/0.117	4.16	73	0.000	.86	0.206	0.448	1.271
B/C Researcher-Illustrated Tests: vocabulary questions	37/38	0.270/0.066	0.494/0.352	0.081/0.057	2.07	73	0.042	0.205	0.099	0.007	0.402
(reading-disabled/cohorts)											
Reading-disabled Students and Cohorts: Researcher-illustrated vs. Unillustrated Tests	7/68	3.714/1.287	1.604/1.802	0.606/0.219	3.42	73	0.001	2.428	0.709	1.014	3.841
RD/C Researcher-Illustrated Tests: factual questions	7/69	1.714/0.428	1.220/1.079	0.461/0.130	2.97	74	0.004	1.287	0.433	0.425	2.149
RD/C Researcher-Illustrated Tests: inference questions	7/69	1.429/0.696	0.787/0.990	0.297/0.119	1.90	74	0.062	0.733	0.387	-0.036	1.503
RD/C Researcher-Illustrated Tests: vocabulary questions	7/69	0.214/0.130	0.267/0.459	0.101/0.055	0.47	74	0.637	0.084	0.177	-0.269	0.436

Statistical analysis revealed statistically significant differences in reading comprehension scores of students when working with researcher-illustrated tests compared to unillustrated tests. Students answered on average 1.5 more questions correctly when working with researcher-illustrated tests than with unillustrated tests. By question type, statistical analysis showed significant increases on average of .8 more inference questions answered correctly with researcher-illustrated tests and .5 more factual questions answered correctly compared to unillustrated tests.

Statistical analysis of scores on student-illustrated tests compared to unillustrated tests of reading comprehension showed a significant increase of average correct answers only with factual questions. Correct answers to factual questions increased by .4 questions on average with student-illustrated tests versus unillustrated tests.

Data analysis showed no statistically significant differences in test scores of control versus treatment groups when working with researcher-illustrated compared to unillustrated tests. However, significant differences were found when comparing control and treatment group scores when working with student-illustrated versus unillustrated tests. On average, treatment group scores increased by 1.1 more correctly answered questions than the control group when working with student-illustrated tests versus unillustrated tests. Significant increase of an average of 1.0 more correctly answered inference type questions was seen with the treatment group compared to the control group when working with student-illustrated tests.

Statistical analysis also showed significant differences between reading comprehension scores of two population subgroups and their study cohorts. One subgroup consisted of black

students. The other was reading-disabled students. Both subgroups, black students and reading-disabled students, showed greater average increases in scores than their cohorts when working with researcher-illustrated tests compared to unillustrated tests.

Black students' scores increased on average by 1.5 more correctly answered questions than cohorts' increase of correctly answered questions when working with researcher-illustrated tests. Statistically significant increases of an average of .9 more correctly answered inference questions by black students compared to study cohorts when using researcher-illustrated tests were observed.

In addition, a statistically significant increase of an average of 2.4 more correct answers by reading-disabled students than that of their cohorts was observed when using researcher-illustrated tests. Correct answers to factual questions by reading-disabled students increased on average by 1.3 more correctly answered questions than study cohorts with researcher-illustrated tests.

Discussion of the Quantitative Findings

Statistically significant results were found in comparing reading comprehension scores of the study population when using different types of text passages to test understanding. Significant differences exist between students' performance with unillustrated, researcher-illustrated, and student-illustrated texts. On average, reading comprehension scores increased significantly when students worked with illustrated passages. Both researcher-illustrated passages and student-illustrated passages produced significant improvement in reading comprehension. Students answered more questions correctly with

both types of illustrated passages compared to unillustrated passages.

When comparing average reading comprehension scores of study participants taking unillustrated tests of reading comprehension versus researcher-illustrated tests of reading comprehension, a statistically significant increase in the number of correctly answered reading comprehension questions was observed with students using researcher-illustrated tests. Study participants answered an average of 1.5 more questions correctly when working with researcher-illustrated text passages than they did on the test with the unillustrated text passages.

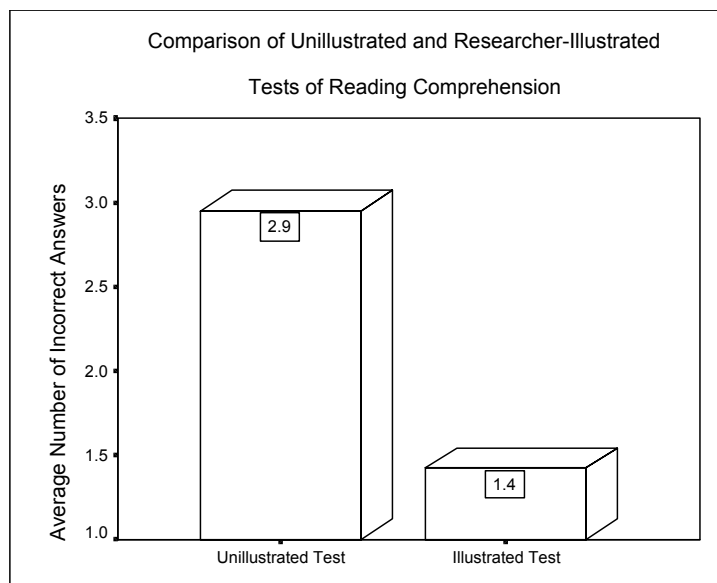


Figure 13. Reading comprehension scores: Unillustrated versus researcher-illustrated tests. Students' reading comprehension scores increased on average by 1.5 questions when using researcher-illustrated tests.

Analysis of differences in the number of correct answers to specific types of reading comprehension questions with unillustrated compared to researcher-illustrated tests revealed statistically significant results as well. The set of ten

questions for measuring understanding of text passages consisted of factual, inferential, and vocabulary questions. When using researcher-illustrated tests, students answered .8 more inference questions correctly and .5 more factual questions correctly than with unillustrated passages. There was a statistically significant increase in number of correctly answered vocabulary questions observed with respect to researcher-illustrated tests also. However, the increase observed when using researcher-illustrated versus unillustrated text was only 0.1 question improvement. Although statistical analysis defined the effect as significant, I believe such a small improvement did not merit further consideration within the context of this study.

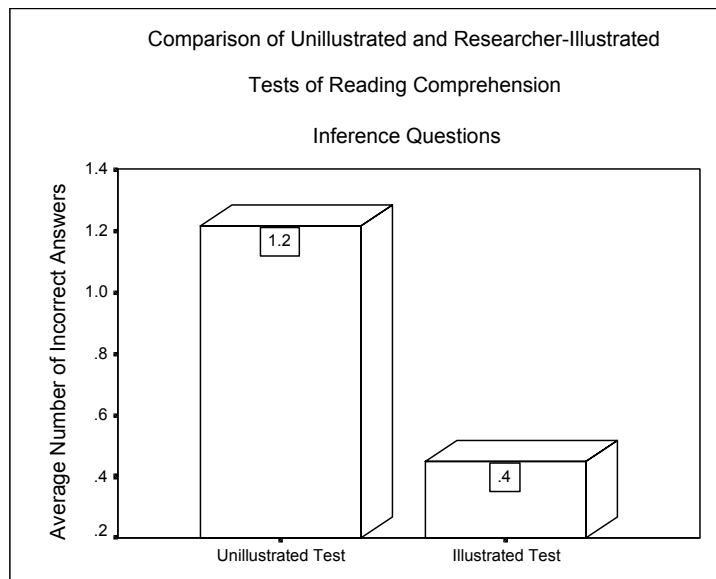


Figure 14. Reading comprehension scores: inference questions on unillustrated versus researcher-illustrated tests. Students' reading comprehension scores with respect to inference questions increased on average by .8 questions when using researcher-illustrated tests.

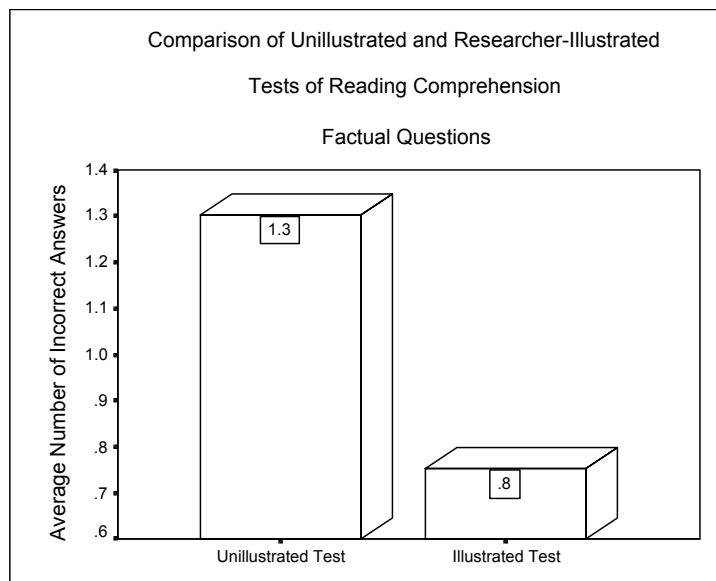


Figure 15. Reading comprehension scores: factual questions on unillustrated versus researcher-illustrated tests. Students' reading comprehension scores with respect to factual questions increased on average by .5 questions when using researcher-illustrated tests.

In contrast to the clear, consistent results obtained from analyzing participants' reading comprehension scores of unillustrated versus researcher-illustrated tests, analysis of scores with unillustrated versus student-illustrated tests produced less distinct results. Comparison of the unillustrated and student-illustrated tests involved looking at the average baseline score of reading comprehension with the unillustrated test compared to test scores from a pre- and post-test of student-illustrated text passages. In the first case, comparison of scores between both the unillustrated test and the researcher-illustrated pre-test and between the unillustrated test and the researcher-illustrated post-test generated statistically significant differences in scores. Students answered .6 more questions correctly on the test they illustrated compared to the unillustrated test, on average.

However, in the case of comparing unillustrated tests and student-illustrated tests, a statistically significant difference was found only in the case of unillustrated test versus the student-illustrated post-test was observed. When looking at students' scores with the unillustrated test compared to the student-illustrated pre-test, differences in scores were not found to be significant. In continuing to break down the data by looking at average change in number of correct answers on unillustrated versus student-illustrated reading comprehension tests by question type, a statistically significant difference is found when examining both the pre- and post-test with student-drawn illustrations. Students answered an average of .4 more factual questions correctly when drawing their own illustrations for the tests compared to scores on unillustrated tests.

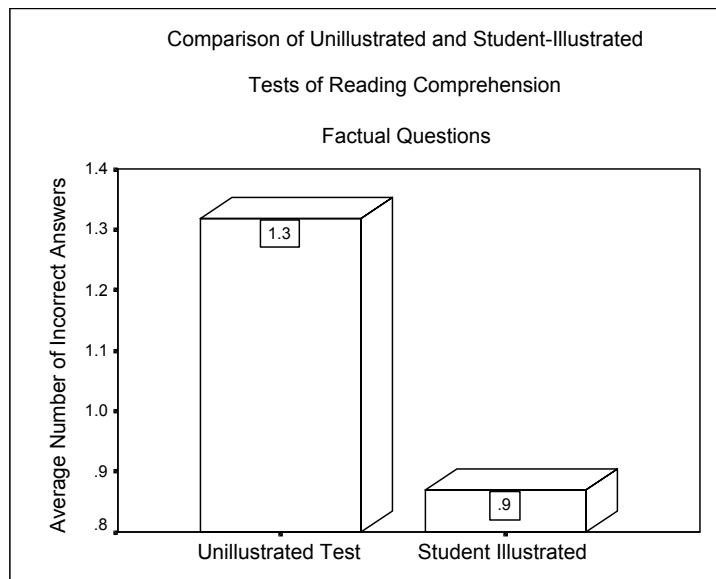


Figure 16. Reading comprehension scores: factual questions on unillustrated versus student-illustrated tests. Students' reading comprehension scores with respect to factual questions increased on average by .4 questions when they drew illustrations for text.

Correct answers to inference and vocabulary questions were not observed to be impacted by student-drawn illustrations. This finding, along with the significant difference found in unillustrated and illustrated post-test scores, seems to indicate a strong likelihood of correlation between general improvement in reading comprehension when students create illustrations for texts.

Discovery of the anomaly in data associated with student scores on the student-illustrated pretest led me to re-examine the pre- and post-tests of reading comprehension in search of a possible explanation. I noted a slight difference in the concreteness of the texts used for the tests, with the pretest text more conceptual than the posttest. Perhaps students found it easier to illustrate or answer questions about the more concrete posttest passage and more difficult with the conceptual posttest text.

Also, I noted a difference in text topics. The pretest text contained information about remote controlled rats with brain implants who performed surveillance operations and the posttest text described mannequins designed to sweat as humans do to aid development of clothing that can respond to harsh environments. During the pretest, some students complained that the treatment of the rats in the passage was cruel and several even made a note of this on their test response sheets. It is possible that students had a negative emotional response to the pretest passage that distracted them from their reading comprehension task. I also recognize the possibility of experiment conditions of which I was unaware somehow impacting test results. Again, since significant improvements in reading comprehension scores were observed in comparing the unillustrated test with the student-illustrated posttest and

also in correctly answering factual questions on both the pre- and post-tests illustrated by students, there is strong evidence for making the claim that student drawn illustrations improved reading comprehension.

Within the context of this study, statistical data analysis indicated a significant positive relationship between text illustration and reading comprehension. The average scores of reading comprehension of study participants increased when working with illustrated texts, both researcher-illustrated and student-illustrated. A greater increase was noted with researcher-illustrated texts than with student-illustrated. Text illustrations seemed to impact specific types of reading comprehension questions differently. While neither type of illustration had any effect on students' correct responses to vocabulary questions, both student-drawn and researcher-provided illustrations were associated with an increase in correct responses to factual questions. Also, researcher-provided illustrations were related to an increase in correct answers to inference questions.

During the next phase of statistical data analysis I compared average scores of reading comprehension of participants in the control group with those in the treatment group. I first looked at the impact of the treatment of instruction and practice in analyzing text illustrations. I saw no statistically significant effect of the instruction and practice upon students' scores of reading comprehension. Students in the control group who received no instruction and practice in working with text illustrations performed similarly on average in reading comprehension tasks as students in the study group who did receive treatment. Statistical analysis showed no significant differences in scores of control and treatment

groups with respect to working with researcher-illustrated tests of reading comprehension (see figure 12).

In contrast, when I examined the impact of the second study treatment, instruction and practice in creating drawings to illustrate text, I found significant improvement of average scores of reading comprehension within the treatment group. Students who received the study treatment performed better on average in reading comprehension tasks than those who did not receive the treatment. Among the treatment group, students answered an average of 1.1 more reading comprehension questions correctly compared to the control group.

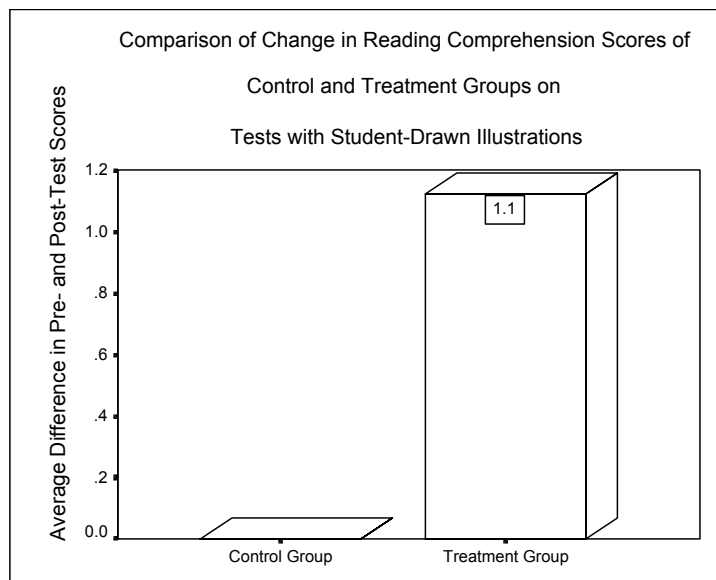


Figure 17. Difference in pre- and posttest reading comprehension scores with treatment of instruction and practice in drawing illustrations versus no treatment. Scores of students who received treatment increased on average by 1.1 questions compared to those who did not receive treatment.

Additionally, the treatment of instruction and practice in drawing text illustrations was shown to affect students' rate of successfully answering a specific type of reading comprehension question. There was a significant gain in the average number of correctly answered inference questions among the treatment group. Participants in the treatment group answered more inference questions correctly on average compared to the control group. Factual and vocabulary type questions were not shown to be impacted by the study treatment of instruction and practice in drawing illustrations to accompany text.

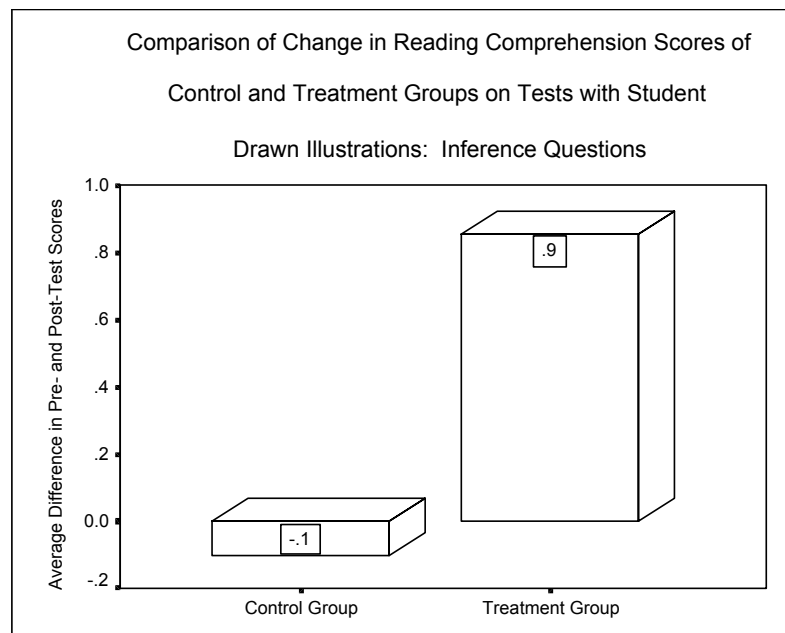


Figure 18. Difference in pre- and posttest reading comprehension scores with treatment of instruction and practice in drawing illustrations versus no treatment: inference questions. Scores of students who received treatment increased on average by 1.0 inference question compared to those who did not receive treatment.

To summarize the findings up to this point, researcher-provided text illustrations were shown to have a strong positive effect on participants' reading comprehension scores,

specifically when answering inference and factual questions. Student-drawn text illustrations also were statistically related to improvement in reading comprehension scores in the area of factual questions. The study treatment of instruction and practice in analyzing text illustrations that I designed and presented to treatment group students did not correspond to any significant change in their performance of reading comprehension tasks compared to the control group. In contrast, my treatment of instruction and practice in drawing pictures to illustrate text passages did positively affect reading comprehension scores with respect to an increase of correctly answered inference questions within the treatment group.

In addition to analyzing the effects of text types and study treatments on reading comprehension scores of participants, I also examined the statistical relationships of individual student characteristics and study variables. Student data was disaggregated according to age, gender, race, learning style, and Exceptional Student Education (ESE) classification. Data analysis ruled out significant effects of either text type or study treatments on population subgroups characterized by age, gender, and learning style compared to the general population. That is to say, study participants' age, gender, and learning style did not correlate with any significant difference in performance of reading comprehension tasks with relation to illustrated versus unillustrated texts with any difference in response to treatment. However, statistically significant associations were found within two of these study population subgroups. Race and Exceptional Student Education (ESE) classification were found to be variables which showed statistically significant differences in subgroup performance in comparison to performance by the general study population.

Racial data was self-reported by study participants and categorized by the following: Asian, black, Hispanic, white, and Other. Forty-five black students participated in the study along with thirty-nine white students, four Asian students, and one Hispanic student. No students placed themselves within the category of Other.

None of the racial subgroups showed significant differences in response to study treatments when compared to responses of the general population. Subgroups defined as those with students classified as Asian and Hispanic showed no significant differences from the general population in so far as reading comprehension performance. Significant differences were found, however, in comparing average reading comprehension performance and responses to different types of texts of black students with the general study population.

Compared to the general study population, the average of black students' incorrectly answered reading comprehension questions on each type of reading comprehension test, unillustrated, researcher-illustrated, and student-illustrated, was significantly higher than the average number missed by the general population. Black students on average incorrectly answered 3.4 more questions on the unillustrated test compared to the general study population. This outcome is generally concurrent with national reports comparing black and white students' reading test scores. White students in the United States, on average, score better on reading tests than black students (Binkley, 1996, "The Nation's Report...", 2002). The majority of questions missed more frequently by black students compared to study cohorts were inference questions (1.5 more missed) and factual questions (1.3 more missed). Differences in black and non-black scores on vocabulary questions were not statistically significant.

The largest percentage of incorrectly answered questions for black students was of the inference type, followed by factual questions. Interestingly, though, the difference in average number of incorrect answers given by black students compared to those of the general population significantly decreased when using researcher-illustrated tests. Black students' average increase in the success rate for correctly answering reading comprehension questions when using researcher-illustrated texts compared to unillustrated text was significantly higher than that of the general population.

Within the context of this study, there was a significantly more positive relationship between researcher-provided text illustration and increase in reading comprehension scores within the population subgroup of black participants. Student-drawn illustrations were not correlated with a significant increase in reading comprehension scores for black students compared to non-black students.

When working with the researcher-illustrated tests of reading comprehension, the average difference in number of correctly answered questions of black and non-black participants decreased. While black participants answered 3.4 more questions incorrectly on the unillustrated tests than study cohorts, that difference shrank to 1.5 questions when working with researcher-illustrated tests. When comparing test scores using unillustrated versus researcher-illustrated tests, non-black students on average experienced a gain of answering .8 more questions correctly using researcher-illustrated tests. In contrast, black students experienced a gain of answering 2.3 more questions correctly when using researcher-illustrated tests.

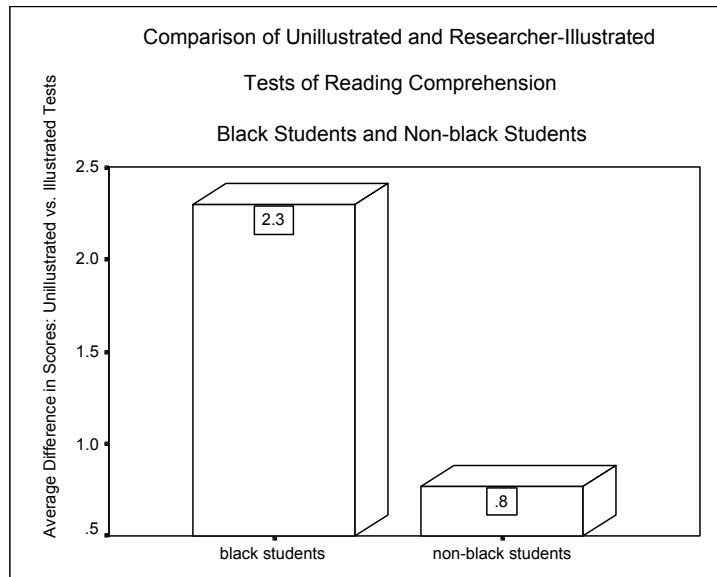


Figure 19. Difference in black students' and non-black students' reading comprehension with unillustrated versus researcher-illustrated tests. Black students' scores increased by 1.5 more questions than scores of non-black cohorts with researcher-illustrated tests.

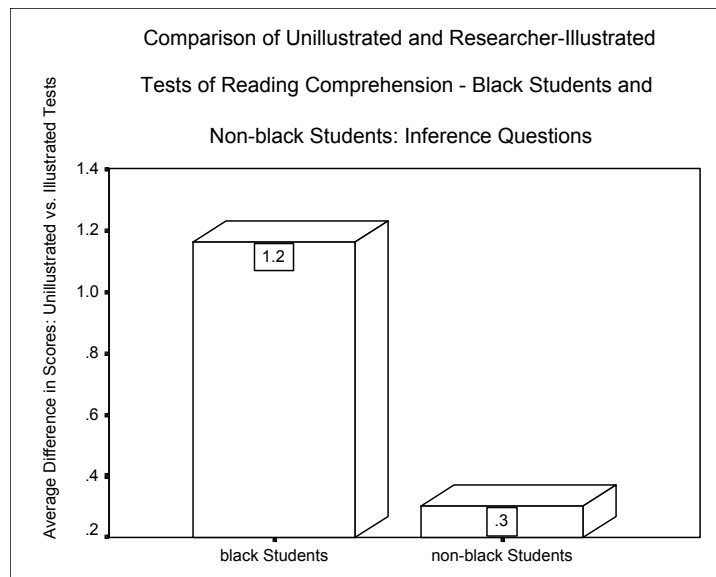


Figure 20. Difference in black students' and non-black students' reading comprehension on inference questions with unillustrated versus researcher-illustrated tests. Black students' scores on inference questions increased by .9 more questions than the scores with non-black cohorts using researcher-illustrated tests.

Most gain was experienced by black students on average in answering inference questions. An average increase of .9 more inference questions answered correctly was seen with black students using researcher-illustrated tests compared to non-black students.

There was not a statistically significant difference in improvement of black versus non-black students with respect to answering either vocabulary or factual questions using illustrated text. In comparing tests of reading comprehension with instructions for students to draw their own illustrations with unillustrated tests, the average number of questions missed by blacks compared to non-blacks was not significantly different.

One additional study population subgroup demonstrated statistically significant differences in reading comprehension scores when compared to the general study population. This subgroup consisted of ESE (Exceptional Student Education) students with a specific learning disability (SLD) in reading. Seventy-five students among the study population were classified as non-ESE students, three students were classified as emotionally handicapped, one as gifted, one as speech and language impaired, and nine as having a specific learning disability (SLD) in the area of reading. There was a correlation between race and classification as SLD in reading: seven of nine students classified as SLD in reading were black.

Study participants classified as ESE (Exceptional Student Education) students with a Specific Learning Disability in reading (SLD-R) on average answered more questions incorrectly on all tests of reading comprehension than the rest of the general study population. SLD-R students missed an average of 3.6 more questions on the unillustrated reading comprehension test compared to the rest of the study population. Factual

questions were answered more incorrectly by SLD-R students (1.9 more missed compared to non-SLD-R), followed by inferential questions (1.2 more missed compared to non-SLD-R). There was not a significant difference in the number of vocabulary questions missed in comparing SLD-R students and those who were not (see figure 12).

However, when compared to the general study population, students in this subgroup who were identified as having a reading disability made greater gains on average in reading comprehension when working with researcher-illustrated tests than those in the rest of the study population. When working with researcher-illustrated tests versus unillustrated tests, students in the reading-disabled subgroup achieved an increase of 2.4 more questions answered correctly on the researcher-illustrated tests than the rest of the population.

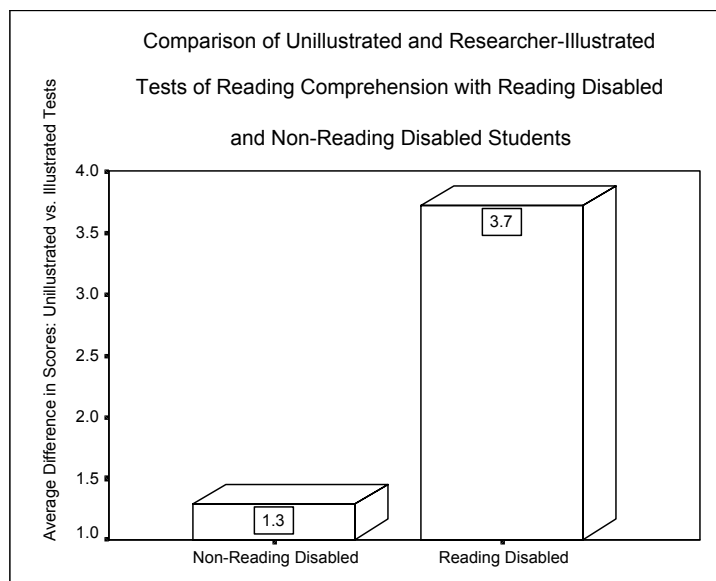


Figure 21. Difference in reading-disabled students' and non-reading-disabled students' reading comprehension with unillustrated versus researcher-illustrated tests. Scores of reading-disabled students increased 2.4 more questions than scores with non-reading-disabled student cohorts using researcher-illustrated tests.

The specific type of question that showed SLD-R students' significant area of gain was factual. When answering factual questions using researcher-illustrated tests, SLD-R students demonstrated a 1.3 question increase in correct answers compared to the increase in correctly answered factual questions shown by their non-SLD-R cohorts. The difference in improvement in answering inference and vocabulary questions between SLD-R students and non-SLD-R students when using researcher-illustrated tests compared to unillustrated tests was not found to be significant. Additionally, differences in scores on student-illustrated tests of reading comprehension within the SLD-R and non-SLD-R groups were not significant.

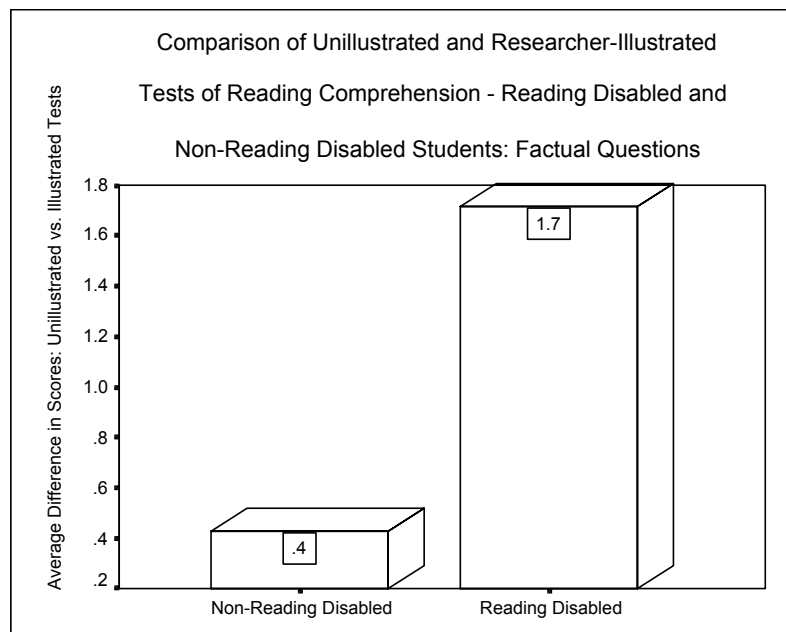


Figure 22. Difference in reading-disabled students' and non-reading-disabled students' reading comprehension scores on factual questions with unillustrated versus researcher-illustrated tests. Scores of reading-disabled students on factual questions increased on average 1.3 more questions than the increase of scores with non-reading-disabled student cohorts using researcher-illustrated tests.

Qualitative Findings

With respect to qualitative observations during the study, I was most surprised by the level of participation of the subjects, my students. No students declined to participate in the study and all parents agreed to give their children permission to participate. Students in both treatment and control groups did complain about their participation in the study taking time away from their regular art class work (treatment group students more so since they devoted a great deal more time to the study) but still agreed to participate and seemed to dedicate their time and attention to study procedures without rushing through them to return to their art projects. Throughout all study activities, whether administering a test of reading comprehension, a practice test, or instruction and practice in working with pictures and words, I circulated around the art room, ensuring students focused on the study task. Some students commented to me that text passages were difficult to read. I directed students to try their best to get through the passage.

Upon collecting and examining answers to reading comprehension practice and test questions, I was surprised to find that nearly all answers were serious attempts to correctly respond to questions. I expected some students to not take the tests seriously and to supply comical or sarcastic answers occasionally, as they had done on other written assignments completed in art class. Instead of this, I found some students wrote comments in addition to their answers. The comments functioned as students' commentary and were most abundant pertaining to a text passage about rats that were remote-controlled by scientists who implanted electrodes into the rats'

brains. Students wrote of their disapproval of the experiment and concern for the fair treatment and well being of the rats.

On several occasions study activities were moved ahead or behind by a day so as not to coincide with a field trip or other school activities such as pep rallies that could serve as a distraction to some students. During the administration of reading comprehension tests using illustrated texts, several students noted the similarity of the study tests and tests of reading comprehension contained within standardized achievement tests prepared for and taken by the student body in the spring semester when the study took place. Some students complained that since they were practicing for their standardized tests in other classes that they shouldn't have to read in art, too - they said they were "tired of reading and just wanted to draw (or paint)." One student said, "Yeah, we need to relax in art." Still, these students continued to participate in the study activities.

The control group only had seven days of study participation in total. They asked fewer questions about the study and its procedures than the treatment group of students did. Since there was a long delay between administration of pre- and post-tests to the control group to provide time for the treatment group to receive instruction and practice, control group students sometimes asked to be reminded of the nature of the study when I announced the beginning of a study activity. Students in the treatment group most often asked questions of how much longer the study would last, if I knew any results yet, what the study results would be used for, how I would obtain results from students' data, and whether or not text passages were factual.

When working with illustrated texts, one student commented that the illustration accompanying a text passage did not

contain all the information from the passage. I agreed and asked the student what the reason might be for not including all the text information in the illustration. The student replied that it would be difficult to make one picture that contained all of the text information. This, in fact, had been a concern of mine when developing the text and illustration materials for students to use - how much information in an illustration would be enough to adequately illustrate the main ideas of the text it accompanied without becoming overloaded with visual information and unclear to viewers. I also contemplated the possible effects of providing more than one illustration to accompany passages. These additional variables would be interesting to evaluate in the context of another study.

During the initial stages of instruction and practice in creating drawings to illustrate text passages a few students expressed concern that their drawing skills were not adequate enough to illustrate the texts. Some also complained after completing their drawings that they "didn't look too good." I queried these students as to what was required to make a good drawing within the context of the study exercises. One student replied, "That it works." I repeated and emphasized that quality of a good drawing - its simplicity, clarity, and effectiveness in communicating the most important information found in the text. I reassured students that the illustrations they created for this purpose weren't required to be beautiful.

With the treatment group who had weekly practice sessions in working first with illustrated texts and then in creating drawings to illustrate text, there were much less grumbling about the latter practice sessions than the former. Students seemed to enjoy the drawing practice sessions more than the picture analysis practice. Drawing practice was more interactive in nature than the practice sessions involving

illustrated texts. During both picture analysis and drawing practice sessions I would read a text passage aloud as students read along silently. Together students and I would identify the most important information contained within the passage. When practicing picture analysis, students would next discuss connections between the illustration I provided and the accompanying text. They shared interpretations of the text and the accompanying illustration.

However, during drawing practice sessions, students talked more about how the text could be represented through multiple forms with the individual and unique drawings they each would create. Students talked about thought processes and personal connections between text and drawings they were about to make. They considered a variety of approaches to represent text information with their own illustrations instead of just taking into account the singular approach I had taken in illustrating text during the picture analysis phase of treatment.

Once students had completed their drawings I asked them to share their final outcomes with each other. Students sitting in close proximity looked at one another's drawings and I circulated around the classroom to spot and display especially effective and novel drawings. Unlike the typical reactions of embarrassment, withdrawal, and protest demonstrated by students during a class critique of their artwork, students responded enthusiastically to sharing their drawn illustrations with others and to being in the spotlight when their illustration was displayed as an example. Often, following this interchange, I drew my own illustrative representation of the text on the board in front of the class. Discussion about similarities and differences in individual's drawings ensued.

In contrasting students' levels of enthusiasm when working with illustrated text versus drawing illustrations for text, I

considered that students may have preferred the drawing practice due both to the higher level of interaction among students and to the closer correspondence of drawing to what students expect to do and enjoy doing in art class, as expressed by students themselves. I myself found observation of students during drawing practice activities more intriguing than observation of picture analysis work. I also preferred the higher level of interaction among students and was interested in the diverse individual and creative approaches to drawing illustrations that students displayed.

With the drawing activities there seemed to be more room for what I considered artistic behaviors - use of drawing skills, creation of communicative imagery, and imaginative problem solving. In addition, my colleague with whom I worked closely and who followed the course of the study, was much more interested in observing drawing practice sessions and results than picture analysis work. My colleague discussed with me the idea of incorporating drawing exercises similar to those used in the study into his class activities with advanced art students with the goals of increasing his students' ability to communicate using imagery and thus improving their artwork.

The first days of instruction and practice in both picture analysis and drawing illustrations served as occasions for me to field test worksheet handouts created to supplement my direction of students in the practice processes. The picture analysis handout was determined to be too detailed and lengthy as originally designed - students commented that some questions were redundant. Students also seemed to lose interest in the process and were observed switching their attention away from the activity. In response to that feedback I pared down the picture analysis process and worksheet. Instead of asking students to separately consider the lines, shapes, textures,

space, repetition, variety, and proportion within each illustration, I focused on compositional factors which most often cued viewers to a specific communicative aspect of an illustration: repetition, variety, contrast, proportion, and emphasis. I asked students to identify repeated elements within the illustration, elements that stood out as different than their surroundings, to consider size relationships among elements, and to determine aspects of the picture that appeared to be accentuated in some way. The remaining steps of picture analysis, careful and orderly observation and description of components of the illustration, comparison of the illustration to similar previously viewed imagery, and evidenced interpretation of the illustration's informational content, were preserved.

The process of picture analysis with text accompaniment, also field tested during the initial stage of instruction and practice of the study, seemed to be effective and was not altered. This process was also supplied to students in the form of a handout to supplement my oral instructions.

Procedures for practicing picture analysis and for drawing illustrations to accompany text developed by me were linked with respect to content. I wished for students to create illustrations similar to those that had been provided to them along with text during the first phase of treatment - simple line drawings - since this type of illustration, according to research (Dwyer, 1978; Kennedy, 1974; Lordahl, 1961; Twyman, 1985).

Students, during picture analysis, carefully observed and identified image components. During drawing practice they were asked to carefully observe or imagine their subject and identify its components. As students were instructed during picture analysis to begin their study of an illustration with its

central feature, they were instructed during drawing practice to start with the most basic shape of their subject. Students then added to their drawings additional shapes as needed, refined their illustration to match their subject, and drew details necessary to accurately communicate important information about their subject. This process was similar to that of identifying elements of an illustration, comparing them to previously seen images, and making evidenced conclusions regarding the content of the illustration. At the conclusion of the drawing process, students checked the correspondence of their illustration and their subject.

At the conclusion of picture analysis, students checked the accuracy of their interpretation by citing visual evidence of their claims from the picture. I attempted to connect students' experiences with the process of picture analysis practiced during the study and the process of drawing illustrations by incorporating similar and related tasks within each type of practice. Field testing of the process for drawing practice and the worksheet handout led me to add a brief review of the basic features of the picture analysis process to the drawing practice routine to emphasize the connection between the two.

Preparation of illustrations to accompany text passages brought about consideration of differences between image manipulation, image creation, and art creation. I prepared illustrations to accompany text by selecting clip art images from an online resource and then combining, editing, and adding some hand drawn details. This process was determined to constitute image manipulation. Gratification came from belief that the prepared image would function well as a communicative illustration of specific text materials and from the belief that others could easily and quickly duplicate the image preparation process. Had I instead drawn my own images to serve as

illustrations, there would have been concern for personalization of the images which might affect clarity of content. I also realized that the process of creating illustrations by drawing would be very time consuming and most likely duplicated only by those who possessed some confidence in their drawing skills. I held a perception of clip art as possessing a generic quality, a widely recognizable type of imagery that is by its purpose largely informational and devoid of personal expression of the artist who created it, a quality that was judged appropriate within the context of this study.

Conclusions

To summarize the quantitative results of study data, reading comprehension scores of students within the general study population improved significantly when researcher-illustrated tests of reading comprehension were used compared to use of unillustrated tests. Students answered an average of 1.5 more questions correctly when using an illustrated text than when using text with no illustrations. The type of question with which students showed most improvement using illustrated tests was inference with .8 more inference questions answered correctly on average with researcher-illustrated tests. A significant improvement was noted in answering factual questions as well with a .5 question increase with researcher-illustrated tests. There was no notable difference in students' correct answers to vocabulary tests on researcher-illustrated versus unillustrated tests.

Use of student-illustrated tests correlated with a slight increase in reading comprehension scores compared to scores when using unillustrated tests. Students answered an average of .4

more factual questions correctly when they created illustrations for the text than compared to when they did not. Students in two subcategories of the study population exhibited significantly different responses to the variable of researcher-provided text illustration than the rest of the study group.

Black students, whose average scores of reading comprehension were lower than scores of non-black students, averaged more gain with illustrated texts than non-black students. A 1.5 question average increase in correct answers above non-black students was noted when using researcher-illustrated tests. Most of this increased gain occurred when answering inference type reading comprehension questions (.9 more inference questions answered correctly above non-black student gains).

Students categorized as learning disabled in the area of reading, SLD-R, also missed more questions on the standard test of reading comprehension than did their non-SLD-R cohorts. SLD-R students showed more improvement using the illustrated tests of reading comprehension, gaining 2.4 more points with the illustrated test than the general study population gained. SLD-R students showed significant improvement in answering factual questions when using illustrated text (1.3 question increase beyond non-SLD-R students). No significant differences in responses to researcher-illustrated or student-illustrated texts were found among any other subgroups of the study population.

In testing data corresponding to study participants' responses to the treatment of instruction and practice in analyzing text illustrations, no significant difference was found when comparing reading comprehension scores of students who had received treatment to those who had not. However, the treatment of instruction and practice in drawing pictures to illustrate text did significantly affect scores of reading

comprehension of students in the treatment group compared to those in the control group. Students in the treatment group averaged a gain of 1.1 more correctly answered questions between the student-illustrated pre- and posttest of reading comprehension than students in the control group. The most gain was made with inference questions, with a difference of an average 1.0 question improvement between pre- and posttest scores. There was no significant relationship found between treatment of instruction and practice in illustrating text and difference in reading comprehension scores on factual or vocabulary questions. Analysis of special populations within the treatment group categorized by age, gender, race, ESE classification, and self-assessed learning style indicated no significantly different effects of the treatment on any specific group.

The strongest effect of study variables was seen with relation to researcher-illustrated texts. Students' scores on reading comprehension tests improved significantly when working with researcher-illustrated tests compared to working with unillustrated tests. Improvement was seen when answering inference and factual questions. Instructions for students to draw illustrations also had a positive effect of reading comprehension scores. Students answered more factual questions correctly when they drew illustrations for text than when they did not. Black students achieved significantly greater gains than the general study population on average when using illustrated text compared to unillustrated text, specifically when answering inference questions. Students classified as reading disabled (SLD-R) also experienced a greater average gain than the general study population when using illustrated text versus unillustrated text. SLD-R students' specific area of significant gain was in answering factual questions.

No significant effects of instruction and practice in picture analysis were observed. Students in picture analysis treatment and control groups averaged similar scores on pre- and post-treatment tests of reading comprehension. A positive relationship was observed with the treatment of instruction and practice in drawing pictures to illustrate text. Students in the drawing treatment group of the study improved their scores of reading comprehension significantly from pre- to posttest compared to students who received no treatment. The most gain among treatment group students was with correctly answered inference questions. Instruction and practice in drawing illustrations did not appear to affect the number of correct answers of any other type of reading comprehension questions and did not have a significantly different impact upon any specific subgroups of the study population.

Qualitative conclusions were drawn from study data as well. Although the processes of the study were composed of activities with artistic content - analyzing pictures and drawing illustrations - student participants viewed the study as different and separate from regular art class activities. Study participants were highly cooperative and positive in general with regard to taking part in study activities but many students also expressed a desire to "get back to art projects" once study activities were completed.

Study participants were less interested in spending class time on instruction and practice in picture analysis and more interested in creating text illustrations. Students were enthusiastic about creating illustrations and expressed relief about "being able to use stick figures." Study participants viewed the text illustrations they created in the context of the study as very different from the more detailed, realistic, and

time-consuming artwork they produced in regular art class activities.

The most profound difference in participants' responses to the text illustrations they drew and to regular class art projects was students' willingness to share their work with others. With regular class projects, students almost invariably protested showing their work to classmates. They made comments about their work being bad and about being embarrassed for others to see it, even when I had praised specific outstanding aspects of their work.

In contrast, when creating text illustrations, students were eager to share their work with others. They were enthusiastic about displaying their novel, efficient, and accurate approaches to illustrating text content. Students were more receptive to compliments about their text illustrations than they were to praise of their class art projects. They were also anxious to see how others had solved illustration problems, identifying similarities and differences in their drawings and their classmates' drawings.

General Discussion

The contrast in students' enthusiasm for participating in illustration analysis versus drawing practice led me to consider whether students felt a sense of accomplishment or pride in reaching an understanding of an illustration or in understanding texts. Although I had certainly heard students express pride in earning a good grade on an assignment or a test from another class, I did not recall ever hearing a student brag about simply understanding information presented to them.

The process of drawing requires observable physical activity and produces concrete, real evidence of itself. The

evidence of the process of drawing is a picture that can be quickly and easily shared with others, as students were observed to do with their text illustrations within the context of this study. The process of understanding, on the other hand, is often an unobserved activity that takes place within the mind, producing little direct, concrete evidence of itself. Perhaps, for that reason, the process of physically creating something that can be perceived by others - a drawing - generates more pride for its producer than does the often invisible process of reading and understanding pictures or text. Whether this is a naturally occurring behavior or conditioned response is unknown to me, but the element of pride, of producing a demonstrable product and feeling good about it, that can be associated with the creation of an original drawn image, may be an attractive and important characteristic of drawing activities.

Further consideration of the drawing process with respect to the study involved comparison of drawing with the goal of creating effective illustrations, as done in the context of the study, and drawing with the goal of creating a highly realistic, aesthetically pleasing representation of a subject, as done commonly in art class. I considered this as a contrast between image creation and art creation. Thinking from a personal viewpoint, I conceded that I would prefer to be recognized for creating a beautiful artwork rather than a highly effective illustrative image and felt sure that most students in the study population felt the same. Thinking of the views of society, however, I perceived high value assigned to both effective image creation and creation of aesthetically pleasing art.

With respect to effective image creation, society especially values creation of imagery to sell products. Business invests heavily in product design, logo creation, and visual advertising campaigns to inform the public about their

wares and compel them to buy them. With respect to creation of aesthetically pleasing art, society expresses its value by supporting artists with funding, providing for public viewing of artwork in museums and other venues, and subsidizing security and maintenance of artworks. Recognizing the value society assigns to creation of both art and image, promotion of both types of skills through education seems sensible.

Prior to the study, I designed and implemented a curriculum of art education for my high school students that emphasized art production and appreciation. Students' work focused upon examination of artworks from made by artists from different times and places throughout history and upon creating largely realistic, aesthetically pleasing artworks. Within this portion of this paper, conclusions of the study will be presented along with potential applications, one of which being a modification of the curriculum I create and use with my students.

The intent of this study was to determine the effects of text illustrations - both researcher-provided and student-drawn - upon students' reading comprehension and to investigate the significance of specific types of art lessons - analysis and creation of illustrations that accompany text passages - when related to students' reading comprehension of text materials. The findings of positive effects of both researcher-provided and student-drawn illustrations upon students' reading comprehension points toward benefits of integrating pictorial communication skills with literal reading competencies.

The most dramatic effect observed within the general study population was an increase in correctly answered inference questions when using researcher-illustrated tests compared to unillustrated tests. Correct answers to factual questions were increased with researcher-illustrated tests as well. Within special populations of the study group, I observed more

pronounced gains with researcher-illustrated tests. Black students' average test scores increased more than non-black students' scores when using illustrated text, with specific improvement related to inference questions. Students who were learning disabled in the area of reading also showed greater test score gains on average than the general study population when working with illustrated texts. The gains of reading-disabled students were associated with factual questions.

In addition to the positive effects of researcher-provided illustrations upon reading comprehension scores within the context of this study, positive effects of student-drawn text illustrations were also noted. Correct answers to factual reading comprehension questions increased with student-illustrated tests compared to unillustrated tests.

The study finding of a positive relationship between a specific type of art lesson, practice in drawing pictures to illustrate text, upon an increase in students' reading comprehension abilities provides support for emphasizing that type of art lesson within the art curriculum. Likewise, lack of evidence, within the context of this study, for benefits of another type of art lesson, instruction and practice in picture analysis, calls for reconsideration of assumptions relating to the pragmatic nature of methods of art criticism employed within the study. As a researcher/art teacher, I seek to be informed and guided by the results of this study in making curriculum decisions that augment the practicality and enjoyment of art class activities for the students I teach.

Researcher-Illustrated Texts

With respect to the portion of the study comparing students' reading comprehension scores when working with

unillustrated texts and scores when using researcher-illustrated text, I found a statistically significant overall increase in reading comprehension scores when students worked with researcher-illustrated text. Students answered an average of 1.5 more questions correctly on a ten-question test using researcher-illustrated texts with reading comprehension tests compared with standard, unillustrated test of reading comprehension.

Since attempts were made to limit other variables such as passage type and length, illustration type, and method of administering the reading comprehension tests, there is a strong likelihood that students' increased test scores were due to the presence of illustrations accompanying texts. It seemed that students had observed the illustrations and utilized them in correctly answering a greater number of questions related to the reading passage than when working with unillustrated text. I did not instruct students to look at the illustrations or provide directions to use the illustrations in any way. Therefore it can be assumed that students themselves made the decisions to do so. What is not known is specifically which processes students employed in using the illustrations to answer questions of reading comprehension.

It would be useful to know if most students used a similar, generalized technique for working with the illustrations and text or if students took personal, individualized approaches to working with pictures and text. It would also be helpful to know which of the techniques used by students in working with pictures and words were the most reliable and successful. Interviewing or surveying study participants with respect to these areas of inquiry could lead to important information about how students used the illustrations.

Providing text illustrations appeared to assist students mostly in answering specific types of questions. Reading comprehension tests were composed of factual, inferential, and vocabulary questions. Researcher-provided text illustrations had no notable effect on the number of correct answers students supplied for vocabulary questions, but correctness of inference and factual answers was influenced by illustrations. Students on average answered .8 more inference questions correctly using researcher-illustrated text and .5 more factual questions. Since research (Beck, McCaslin, & McKeown, 1980; National Reading Panel, 2000) supports the process of answering vocabulary questions as being mainly context-based - students who do not have previous knowledge of a word in question refer to words immediately surrounding the unknown word as clues to its meaning - it is difficult to see how a text illustration could directly assist students in answering that type of question.

However, since illustrations can serve as a direct representation of a thing, it is apparent that the answer to a factual question, requiring a type of description or explanation, can be easily found within an illustration. For example, when students were asked the factual question, "What is the passage about?" they could refer to the illustration accompanying the passage for their answer. The answer, of course, could also be found within the text of the passage. However, if students were unsure of their answer derived from either source, either the text or illustration, they could consult the other for support.

Answers to inference questions were most positively affected by text illustration. The results of this study pertaining to inference questions being answered more correctly in the case of illustrated text than unillustrated text are

supported by previous research. Students are reported to be better able to answer inference questions correctly when text was accompanied by illustrations (Holmes, 1987). Test illustrations have been shown to facilitate inferential comprehension (Donald, 1983).

Answering an inference question correctly requires a reader to apply information from the text passage to another situation. Picture interpretation consists of two behaviors - observation and inference drawing, going beyond what is seen (Higgins, 1979). For example, students, in reference to a passage describing a caterpillar's natural defense against predators, were asked, "Why do you think caterpillars and plants use similar chemical compounds to protect themselves?"

The illustration accompanying the passage depicts a caterpillar and his protective chemicals facing an ant. Such an illustration may function as a cue in answering inference questions in two ways. First, students may compare the information supplied by the illustration - a caterpillar protecting itself against its predator, the ant - and the situation put for in the question - plants protecting themselves against predators - and look for commonalties. Both the caterpillar and the ant are using chemicals to protect themselves. The caterpillar's predator is an ant. What is the plant's predator?

Students could refer to the ant in the picture and see it as a potential predator to plants, as well. If the plant possessed a chemical protectant similar to the caterpillar's, it could work against the ant as the caterpillar's did. The illustration can facilitate students' process of making connections between the information presented in the story and illustration and the different situation presented in the

question so that they may deduce or infer the outcome of the new situation.

Also, an illustration can provide students with an additional perspective for understanding the situation proposed by the question. Looking at the illustration of the caterpillar and ant and comparing it to the query regarding plants, students could visually insert or imagine a plant in the picture with the caterpillar and ant and then make assumptions as to their relationships. Other researchers have found that recoding of information from text into a picture may provide students with an additional way to perceive the information and additional potential for expanding their understanding of what they read (Peeck, 1987). Perhaps employing such mental visualizations can assist students in formulating answers to inference type questions.

Certain special groups within the study population were affected differently by the variable of researcher-provided text illustration. Black students and students with a reading learning disability (SLD -R) appeared to receive increased benefits from text illustrations when compared to the rest of the study group. Using illustrated texts, black students on average realized a gain (number of correctly answered questions) of 1.5 more than non-black students and SLD-R students saw an average gain 2.4 more than non-SLD-R students, compared to scores on unillustrated tests. While black students' significant improvement was with inference questions, SLD-R students performed significantly better using illustrated texts to answer factual questions. It is important to note that both groups of students, blacks and SLD-R, scored lower overall on unillustrated tests of reading comprehension than their cohorts in the remainder of the study population. Also, the gap in number of correctly answered questions of these students and

their cohorts was reduced significantly when illustrated texts were used with reading comprehension tests. This phenomenon is supported by other research (Binkley, 1996; Meloy, 2000; National Assessment of Educational Progress, 2002).

Other researchers have noted similar findings with respect to the impact of illustrated text upon student populations that perform less successfully on tests of reading comprehension. One study found that text illustrations were most effective when they were used with students who had little prior knowledge of the reading material (Mayer, 1997, & Ollerenshaw, 1997). In their work to identify the most important functions of pictorial illustrations that accompany text, Levie and Lentz (1982) and Hibbing and Rankin-Erickson (2003) described the strong impact of picture cues in helping poor readers decode text (1982). Looking specifically at differences in black and non-black students' responses to illustrated versus unillustrated texts as demonstrated by reading comprehension test scores, the reading comprehension scores of black students with low socio-economic status improved significantly with illustrated texts in contrast to the scores of white students with high socio-economic status which showed no improvement when illustrated texts were provided (Rohwer and Harris, 1975).

Since a significant increase in reading comprehension scores was observed when study participants worked with illustrated texts compared to unillustrated texts and this result is strongly supported by other research (Feldman, 1981; Haring, 1979; Horng, 1981; Levin, 1982, 1983; Peeck, 1980, 1987), it is recommended for consideration that illustrations be included as a commonplace accompaniment to text passages, most especially in the cases of providing assistance to less skilled readers. Results of this study indicate a relationship between reading abilities and the potential of text illustrations to

augment reading comprehension. Study findings of significant increases in reading comprehension when working with illustrated versus unillustrated texts demonstrate the efficacy of combining pictures and text to help students learn and demonstrate their knowledge.

Development of guidelines and training to assist educators in creating effective illustrations for text passages could lead to increases in instructional and learning success. A cooperative effort by experts in visual communication (art teachers) and verbal communication (language arts teachers) to promote learning with pictures and words could be productive, too.

Within the context of this study, two groups of students, black students and reading-disabled students, showed significantly greater improvement in reading comprehension when working with illustrated tests. Both these groups of students who scored lower on standard unillustrated reading comprehension tests made greater gains on scores of reading comprehension when using illustrated texts. Providing students with effectively illustrated texts could help narrow the gap in achievement between proficient readers and less successful readers.

Since reading comprehension is crucial to academic success, it seems obligatory for teachers to help struggling students by any means possible. Presenting students who have difficulty understanding text with the opportunity to increase their understanding by simply adding picture illustrations is a practical approach that should be strongly considered by all educators. Inquiry into specific methods of assisting teachers and students in creating effective illustrations for text content is called for.

However, the quality of such provided text illustrations must be ensured as it is directly related to the usefulness of

pictures in assisting with comprehension. The type of illustrations used to illustrate texts should be characterized by consistent adherence to accepted standards of effectiveness. Additional studies relating to the effect of text illustrations on the reading comprehension of students who have difficulty performing reading comprehension tasks could be valuable.

Student-Illustrated Texts

Next I will discuss conclusions and recommendations with respect to the portion of the study dealing with student-illustrated texts. When comparing students' scores on unillustrated tests of reading comprehension and scores on tests when students were directed to create their own drawn illustration of the text, I found students on average performed better when directed to illustrate the text. Students answered an average of .4 more factual questions correctly when they illustrated texts compared to using the standard unillustrated test of reading comprehension. When students created their own drawn illustrations to accompany texts, the activity of drawing illustrations could have helped with correctly answering reading comprehension questions in that students were required to perform additional and different processing of the text information. I instructed students to read the text passage and draw a picture that illustrated the passage in the space provided next to the text. All students followed these instructions to create a drawing. In formulating ideas for the drawing, I theorize that students had to make decisions about which information from the passage to include in the illustration and about how to visually represent the selected information. Once students selected the information they wished to depict, I assume they created some sort of internal

visualization of what they wanted to draw and then attempted to transfer this image to paper.

If that were the case, students would have had to review the information contained within the passage to decide which parts to draw. Then they would have needed to translate the information from written language to visual representation. The processes of review and translation increased the amount of time students spent thinking about the text information and forced them to think about it in a different way -as a visual representation - compared to when were not instructed to illustrate the text and simply read the text and answered the questions, all in text form. Creating an illustration for the text demanded that students not only read and respond with words to the information within but also work with the information contained within the text in order to determine which aspects to include in their picture and how to best represent those elements in a drawing.

Findings of significant increases in reading comprehension when students illustrate texts suggest the need for more research in this area. It would be useful to study how text and drawings interact to produce greater factual understanding in order to develop instruction to guide students to draw highly effective pictures for assisting with comprehension. It would also be helpful to further investigate the effects of student-drawn illustrations on inference comprehension to determine whether drawing is truly without effect in that situation. A cooperative effort by visual and language arts educators to promote the technique of illustrating text toward gains in understanding would be fruitful.

Instruction and Practice in Picture Analysis

After observing that providing illustrations for texts increased students' reading comprehension within the context of this study, and seeing that giving students instructions to students to draw their own illustrations for text passages also increased reading comprehension, I was surprised to find no significant effect of instruction and practice in picture analysis upon pre-and post-treatment scores of reading comprehension. The control group, who received no instruction and practice in working with illustrated texts, and the treatment group, who received a total of seventeen weeks of instruction and practice, achieved similar scores on pre- and post-treatment tests of reading comprehension. There are several possible explanations for this lack of observable treatment effect.

First, since the students only received short-term treatment, participating in nine instruction and practice sessions in working with text illustrations over the course of nine weeks, it is likely that they did not have enough practice sessions to adequately master and apply the picture and text analysis skills they were exposed to during the treatment. Perhaps with more practice sessions over a longer period of time, different results would be seen.

Another possibility is that the specific type of researcher-designed instruction and practice in working with illustrations and text used in the study was not effective in increasing students' abilities to work with illustrated readings. Since the study population demonstrated a significant increase in reading comprehension when using illustrated texts opposed to unillustrated, it is presumed that students possessed their own methods of working with illustrations and text prior

to the treatment. They may have preferred these methods to those taught over the course of the treatment. If a different type of treatment, some other form of instruction and practice in working with pictures and words together, had been offered to students, it is conceivable that they would have performed differently.

An additional consideration is the similarity in the treatment exercises and critiquing of artwork all students in my classes had participated in previously. Possibly the critiquing process regularly employed involving reaction, description, analysis, and interpretation of artworks was so like the treatment of picture analysis that students did not learn a new skill through the course of treatment, they simply continued to apply skills they already had acquired through regular art class activities. Although there are differences in the critiquing process and illustration analysis procedures performed during the study such as the types of images analyzed and the slight modifications and streamlining of the analysis process, the principal difference between in-class art critiques and study treatment methods of picture analysis was the combination of picture analysis and text information integral to the treatment process and not found in regular class critiques of artwork.

During art critiques in regular class activities, more detailed, rich images were explored - drawings, paintings, and sculptures most often in color and created by recognized artists compared to the picture analysis sessions of the study, when students investigated simple black and white illustrations created by an anonymous person to function as clip art. Typical art class critiques included introduction of contextual information about the artwork being studied - details about the artist and the time, place, and culture in which the artwork was created - in addition to consideration of the visual and

communicative elements. Art critiques often involved a discussion of the mood or emotion represented by the artwork.

On the other hand, picture analysis during the course of the study dealt with only the visual elements and informational content of the images studied. However, it is my judgment that the defining difference between regular class art critiques and picture analysis performed during the treatment phase of the study was that while during art critiques students studied artworks alone and were not required to relate the communicative content of the artwork with text information, during the study students were asked to perform picture analysis together with text analysis. It would be interesting to study the effects of the treatment of instruction and practice in picture analysis upon students who were not in an art class participating in art critiques that were similar to the instruction and practice in working with text illustrations used in the treatment.

Although the specific type of instruction and practice in illustration analysis presented within the context of this study was not found to have an effect on students' ability to work with illustrated texts, this topic is still of great interest to me and I will continue to investigate it as an art teacher. One of the possible reasons for the lack of effect is similarity of the study treatment to what students have experienced many times in art classes critiques - maybe they weren't learning anything new. Another explanation may lie in the fact that students spend a large amount of time on their own practicing illustration analysis, when they look at signs, magazines, television, movies, and computer screens. In either case, it is a good thing that students possess skills to interpret meaning from images. However, it is likely that there are ways to help students increase and refine their image analysis skills. Further exploration of this idea is needed.

Instruction and Practice in Drawing Illustrations

In contrast to the lack of effect of instruction and practice in illustration analysis, I did observe a positive effect of instruction and practice in drawing pictures to illustrate text. Students in the treatment group who received instruction and practice in creating illustrations for texts showed significant improvement in pre- and post-treatment test scores of reading comprehension compared to students in the control group who demonstrated no significant change in pre- and post-test scores. Students in the treatment group averaged a gain of 1.1 more questions answered correctly than students in the control group on the post-test with instructions to draw an illustration for the text passage versus the pre-test with instructions to draw.

The only significant area of gain with instruction and practice in drawing illustrations was with inference questions, analogous to the most significant area of gain when comparing students' reading comprehension of illustrated and unillustrated texts. It is important to note that one of my considerations as to the lack of success with regard to the treatment of instruction and practice in working with text illustrations also applies to the treatment of instruction and practice in drawing illustrations for text. That is, the type of researcher-developed treatment employed in the study for drawing practice was very similar to regular art class activities. Students often were instructed to use the same steps for drawing in regular class projects - careful consideration of their subject, layout of overall basic form, refinement, and addition of details - practiced in the study treatment.

As with the study treatment, during regular art class projects students used real life, photographic, and imagined or conceptual referents as their subjects. The outstanding difference between study drawing activities and regular class drawing activities was the emphasis upon drawing simplicity and efficiency and very specific communicative content within the context of treatment drawing activities. During the study, students were asked to create simple line drawings to communicate specific information that corresponded to their subject, most of which was text-based. During art class projects, students create much more time-consuming, detailed, realistic drawings that represent a specific subject but also contain personal artistic expression. The emphasis of class drawing activities tends to be largely related to the creation of an aesthetically pleasing and individually expressive artwork instead of a simple, highly effective illustration of a thing or idea demanded by the study exercises.

The similarity in the two forms of treatment, instruction and practice in working with text illustrations and instruction and practice in drawing pictures to illustrate the text, makes it difficult to explain why one form of treatment was successful in significantly increasing subjects' reading comprehension scores and the other was not. One idea is that while picture analysis and picture analysis with text analysis may be something students typically practiced often during the course of their daily lives, drawing illustrations was not. Students viewed images throughout the day - photographs and illustrations in textbooks, icons and clip art on cell phones and computer screens, signage on buildings and roadsides, advertisements on billboards, in magazines, and on television, and symbolic logos on nearly all of the products they use. Many of those images mentioned are accompanied by text. Maybe students within the

study population had such an abundance of practice in working with text and images outside of the context of the study that the instruction and practice in analysis of text illustrations was useless. (This is not to say that some different, more advanced, specialized form of instruction and practice in picture and text analysis which takes into account the methods already performed by students couldn't be helpful in maximizing students' understanding of information presented in the form of illustrated text.)

Although students may frequently be performing a manner of the first form of study activity, picture and text analysis, on their own, I had no reason to believe that students often practiced the second form of study activity, drawing pictures to illustrate text, outside the confines of the study. It has been my observation that most beginning art students do not routinely draw independently outside of class, and that those few who do draw subjects of their choice for the purposes of personal enjoyment, self expression, and honing drawing skills and techniques. Therefore, although the second study activity, drawing practice, is something students have previously participated in during drawing class, it is most likely not an activity they perform often on their own. The relative novelty of the specific form of drawing instruction and practice presented to students in the treatment group of the study compared to the prosaic nature of the instruction and practice in picture and text analysis may explain the difference in effect of those two forms of treatment.

If it is the case that instruction in drawing illustrations for text information can increase students' reading comprehension, and that the this type of drawing instruction is not an ability that students already possess and practice on their own, it seems that teaching this skill in art class could

benefit students. Along the same lines, if it can be consistently demonstrated that this particular art skill, drawing illustrations for text, can be effectively taught by art teachers and applied by students to increase their comprehension when reading texts in other classes, instruction and practice in drawing illustrations for text may be identified as a specific art activity that helps students achieve in other subject areas. Discovering how to teach students to draw optimally effective text illustrations is the next step in this aspect of using pictures and words together. Again, cooperative efforts of visual and language arts educators to develop and present instruction would be optimal.

Art Curriculum Applications

With respect to personal application of study results as an art educator, I plan to place more stress on the development of drawing skills in representing conceptual ideas as well as real-life models as part of my curriculum. I want to concentrate on cultivating students' abilities in using drawing as an efficient form of communication in addition to using drawing as a means to create detailed, realistic, aesthetically pleasing images. Picture drawings made for the sole purpose of personal communication are important tools used to transmit information by children and adults. However, that type of drawing may be undervalued because it is not viewed as art (Kindler, 1999).

Drawn functional representations often include images and words together. Combining pictures and words, similar to the style of a comic book depiction is considered to be a trait children should grow out of, since good art and literature are separate entities (McCloud, 1994). Kindler, an art educator

herself, claims that art teachers are preoccupied with the creation of pictures that qualify as good art - pictures that have much in common with traditional fine art representations. She suggests art teachers recognize this bias and adjust their notions of good art to accommodate the intended purpose of the picture. If a picture is created with the purpose of communicating a message, the picture should be judged on its effectiveness in doing so, not in its resemblance to a fine art masterpiece. Kindler advises that art teachers make it a priority to help students become proficient in creating pictures that are useful to them in daily activities. Less emphasis should be placed on the purely aesthetically pleasing qualities of pictures. Personally communicative image making should be taught and encouraged. Kindler advocates inviting students to explore the use of signs and symbols and to combine visual and verbal elements to enhance both forms of communication in their works.

While I largely agree with Kindler's views, it seems to me that she may be suggesting an intrinsic contradiction between students creating visual displays that both effectively communicate ideas and that are aesthetically pleasing. Instead, I believe there is a strong relationship between effective communication and visual appeal. Aesthetic appeal can be characterized by a viewer's level of personal interaction with an artwork, as well by as qualities of the artwork relating to refinement and craft. It is difficult to think of a viewer finding an artwork aesthetically appealing if they are unable to establish any personal connection with it and consider it to be a sloppy mess. In the same vein, it is difficult to think of a viewer classifying an image as an effective form of communication if they are unable to extract its meaning and are

distracted from the informational content by a lack of refinement and clarity.

Not only is there is a strong, positive relationship between images that effectively communicate information and those that are aesthetically pleasing, art educators can assist students in creating works that demonstrate both these qualities simultaneously. While I allow that it is likely that I and other art educators (from personal observation of other teachers, perusing art lesson plans in leading professional publications, and viewing student art displays) have contributed to a history of over-emphasis of the aesthetic qualities and under-emphasis of the communicative ones in the imagery we guide our students to create, it would be a mistake to propose rejection of the aesthetic qualities as a solution to the problem. Instead, we can redirect lessons in skill building and technique development toward the goal of enabling students to effectively communicate specific, personal information and ideas through their artwork.

Presentation of an example of contrasting art activities, comparing a previous, pre-study lesson plan of mine with the restructured post-study lesson will hopefully clarify my point. In the past, pre-study lesson, I supplied my students with information on the style of Fauvism, represented by artist Franz Marc, and asked them to choose animals to research and depict in a style that embodies the defining characteristics of Fauvism. Concepts of abstraction and expressionism were emphasized. Color theory was reviewed as a part of the lesson and specific media techniques were taught as well. In this case, information communicated by students in their artwork pertained to the physical structure and living environment of the creatures they chose to represent. Other than the choice of their subject, and perhaps color selections, students were not asked to convey any

personally relevant or specific intellectual ideas with their work.

In reworking the Fauve-inspired lesson described above with respect to findings of this study, I have modified the activity as follows. After receiving the same background materials on Fauvism, Marc, and similar artists and participating in similar media and techniques exercises, students will be presented with two options of subject matter for the artwork they will create. They may elect to illustrate their personal views about a topic related to animal welfare, such species endangerment or pet overpopulation. The second option is to choose to represent a scientific understanding they possess about a specific creature - depiction of a bird in flight, from take-off to soaring, with sequential movements, for example. In my view, this approach expands the cognitive processes involved in creating the artwork from a somewhat removed artistic representation of an animal, in the first case, to an image making process that requires students to be more personally involved in deciding upon the message of their work and how to effectively communicate that information with the media and techniques practiced to produce an image that is rich in content and aesthetically appealing. With the restructured project, students have the opportunity to either consider and express their emotions and opinions relating to an issue involving animals or to demonstrate their knowledge of scientific information about an animal's physiology, behavior, or development.

Further consideration of study results that indicate benefits of combining pictures and text for learning, as well as concurring research from others, invites more curriculum modification, in this case with relation to encouraging students to work with pictures and text together to communicate ideas. In the context of the restructured Fauve-inspired art lesson

described above, students will be asked to research their selected animal-related topic (access to resource books, the Internet, and school library will be provided) and provide a brief written statement that identifies information they wish to communicate and outlines ideas for how they will represent the information visually. Students' text summaries and written proposals will serve as guidelines for creating their artwork and will be used to evaluate their final product.

"Codeswitching" is a term coined by art educator Paula Eubanks (2003) and refers to processes of combining visual and verbal languages when making art. Working with the idea that two approaches are superior to one in problem solving, students use both symbol systems alternately to generate more meaningful work and become more effective communicators. This is the type of activity and results I hope to produce with my students in working with pictures and text concurrently as I have described.

Students' artwork will function as illustrations of the text information they have written. In looking at text and illustrations, researchers have described a back and forth process of learning, with readers looking from text to picture and back again in an expanding concentration of understanding (Nikolajeva & Scott, 2000). By restructuring art lessons in my curriculum to provide for this type of multi-modal interaction, I hope to increase my students' artistic successes by helping them to create artworks that are valuable in their representation of specific, personal ideas, information, and knowledge as well as being valuable for their demonstration of artistic techniques and aesthetic appeal.

I also hope that these art class activities will demonstrate to students that they have the ability to communicate information both visually and verbally, and that when used together, visual and verbal expressions can enhance

each other. I want to persuade students to apply this strategy to their benefit in situations outside of art class as well - note taking, studying for exams, and presenting reports in other subjects, for example.

Another way in which I plan to modify my art curriculum to emphasize communicative aspects of images and capitalize upon the positive effects of working with pictures and words together involves adoption of multimedia technologies. These tools can provide students with access to viewing varieties of artistic picture/word presentations via the Internet. I am beginning to develop a resource of web sites that feature artists who work with images and text together (Jaune Quick-to-See-Smith, Barbara Kreuger, political cartoonists, and manuscript illuminators, to name a few) so that students will have examples to study before undertaking this approach themselves. Online resources can also serve as a starting point for students to procure images and text as raw materials for assembling their own multimedia, multi-modal representations. I will work to identify effective methods for teaching students to combine pictorial and verbal symbol systems for assimilating new and displaying learned information. A continued investigation of the relationship of pictures and words in communicating information, within and beyond art class, and a more balanced consideration of communicative and aesthetic qualities of art are my aims as a researcher/educator.

Additionally, I plan to share the results of this study - benefits of working with pictures and text together - both anecdotally and formally, with colleagues, locally and nationally. I want to encourage others to consider the advantages of providing students with learning opportunities in combining visual and verbal representation to increase understanding and to enhance and broaden communication skills.

I look forward to sharing lessons with other art educators who strive to emphasize the communicative aspects of imagery in their curricula and who work toward combining verbal and visual modes of learning and expression. I also anticipate future research that will provide additional information about the relationship of verbal and pictorial learning and that will direct us in designing and implementing art instruction that helps our students become successful multi-modal communicators.

Although I have great faith in the benefits of and the future of embracing a curriculum-wide pictures-and-text approach to communication, I realize such an advance must be preempted by an abundance of evidence to support the idea, followed by advocacy and cooperation from many educators and educational leaders. On a much smaller scale and within a much shorter timeframe, as an art teacher I have the opportunity to continue to collect and share evidence of the benefits of working with pictures and words together. I plan to develop, test, and implement instructional techniques to help my students use pictures to increase their understandings.

With respect to critiquing artwork with students, I am expanding the domain of our critiques from fine art to diverse imagery, focusing on images encountered in our everyday environment, like newspaper photos, product logos, and stills from computer games. Critiques will also emphasize consideration of the specific communicative aspects of images. Further development of a specialized method of critiquing, or picture analysis, with the intent of maximizing understanding of image content, is a goal of mine.

When instructing students in creating artworks, emphasis will be placed upon students' creating strong communicative elements within their pieces, as well as aesthetic and representational aspects. This will be achieved in part by

studying artists who combine words and imagery in their products and processes of art making. Also, students themselves will be asked to produce work that demonstrates usage of pictures and words together, both directly, by integrating words into actual works, and indirectly, by using words to plan and reflect upon their artworks. In this way, I believe I will be helping students expand their repertoire of visual communication skills and extend those skills beyond the art room. I also see students increasing the value of the artwork they create by infusing it with distinct, personal, communicative content.

APPENDIX A

Study Timeline

January 13 - May 27, 2003

Monday January 13	Study introduced to students; permission slips passed out
Tuesday January 14	Learning style inventory and bio sheet completed
Wednesday January 15	Standard reading comprehension test
Thursday January 16	Pretest 1: reading comprehension test with illustrated text
Friday January 17	Pretest 2: reading comprehension test with instructions for students to draw an illustration
Tuesday January 21	Experimental group: demonstration and practice - picture analysis (concrete)
Wednesday January 22	Experimental group: practice - picture analysis (concrete)
Thursday January 23	Experimental group: demonstration and practice - picture analysis (conceptual)

Monday January 27	Experimental group: practice - picture analysis (conceptual)
Friday January 31	Experimental group: practice - illustrated text
Friday February 7	Experimental group: practice - illustrated text
Friday February 14	Experimental group: practice - illustrated text
Friday February 21	Experimental group: practice - illustrated text
Friday February 28	Experimental group: practice - illustrated text
Friday March 7	Experimental group: practice - illustrated text
Friday March 14	Experimental group: practice - illustrated text
Friday March 21	Experimental group: practice - illustrated text
Tuesday March 25	Post test 1: reading comprehension test with illustrated text
Wednesday March 26	Experimental group: practice - drawing using objects as models

Thursday March 27	Experimental group: practice - drawing using photographic models
Monday April 7	Experimental group: practice - drawing using word models
Tuesday April 8	Experimental group: practice - drawing using sentence models
Wednesday April 9	Experimental group: practice - text with instructions to draw
Friday April 11	Experimental group: practice - text with instructions to draw
Friday April 18	Experimental group: practice - text with instructions to draw
Friday April 25	Experimental group: practice - text with instructions to draw
Friday May 2	Experimental group: practice - text with instructions to draw
Friday May 9	Experimental group: practice - text with instructions to draw
Friday May 16	Experimental group: practice - text with instructions to draw
Friday May 23	Experimental group: practice - text with instructions to draw

Tuesday May 27

Post test 2: text with instructions to
draw

APPENDIX B

Unillustrated Text Passage and Questions to Assess Reading Comprehension

Fossils Suggest Jellyfish Abounded in the Cambrian Seas

Finding fossils of large-boned dinosaurs is hard enough, but imagine searching for fossilized jellyfish. Good specimens of such soft-tissue organisms are extremely rare. As a result, scientists have very little information about their role in early ecosystems. But a recent discovery of hundreds of jellyfish impressions on what were once the shores of an inland sea in central Wisconsin suggests that they occupied an important position on the food chain.

In a report appearing in the February issue of *Geology*, James W. Hagadorn of the California Institute of Technology and colleagues conclude that the fossilized jellyfish, which are similar in size to their modern descendants but much bigger than previously uncovered specimens from the same time, were some of the largest and most important predators during the Cambrian period. In other words, Hagadorn says, "we may have been inadvertently omitting a huge amount of information about all of the soft-bodied animals that were swimming around in the water column, munching on other organisms, but which were rarely fossilized."

The discovery represents one of only two jellyfish mass-strandings known from the fossil record. The authors hypothesize that either wind blew the jellyfish into shallower water or the creatures swam there in search of prey. In any case, the ebbing tide left them ashore. Analysis of the fossils shows that some of the jellyfish tried to keep moving, ingesting sediment in the process and essentially anchoring themselves to the floor. Several tidal cycles later, loose sediments had entombed them. Fortunately for scientists, not much seems to have disturbed their remains since then.

by Greg Mone Scientific American online January 2002 260 words

Fossils Suggest Jellyfish Abounded in the Cambrian Seas

Reading Comprehension Questions and Answer Key

1. What is this passage about? *fossilized/ancient jellyfish*
2. Why do scientists have little information about the role of jellyfish in early ecosystems? *good specimens are rare*
3. Where were hundreds of jellyfish fossils recently discovered? *shores of an inland sea in central Wisconsin*
4. How did ancient jellyfish compare in size to modern jellyfish? *similar*
5. What were some of the most important predators of the Cambrian period? *jellyfish*
6. According to scientists' hypotheses, what are two possible reasons for the mass-strandings of the jellyfish? *wind blew them into shallow water/went to search for prey*
7. What is the condition of the jellyfish remains today? *undisturbed; good*
8. Why would ingesting sediment cause the jellyfish to become anchored to the ocean floor? *it weighed them down*
9. Why are scientists so interested in jellyfish fossils? *they're rare/to learn more about prehistoric creatures and ecosystems*
10. Explain what "entombed" means in this phrase: "Several tidal cycles later, loose sediments had entombed them."
buried

APPENDIX C

Researcher-Illustrated Text Passage and Questions to Assess Reading Comprehension

Caterpillars Make Their Own Insect Repellent

Scientists have discovered that certain caterpillars manufacture and secrete their own insect repellent, a new study shows. According to a report published today in the Proceedings of the National Academy of Sciences, this defensive mechanism could help explain how the creatures managed to become so widespread.

Scott R. Smedley of Trinity College and his colleagues studied larvae of the European cabbage butterfly, *Pieris rapae*. Native to North Africa and Eurasia, the species was accidentally introduced into Canada around 1860 and has since spread over most of North America. To try and help explain the creature's extraordinary adaptive fitness, the scientists investigated the properties of the clear oily fluid that the animal secretes, which collects at the tips of tiny hairs that run the length of its body. They tested the chemical composition of the liquid and found that it consisted of compounds that they dubbed mayolenes.



The team further determined that the chemicals are similar to those used by plants to defend against insects and disease. Ants that came in contact with a *P. rapae* caterpillar spent significantly more time cleaning themselves than did ants exposed to a mealworm lacking this protective mechanism. What is more, when given a choice between two meals--an egg that was doused in a synthetic version of the secretion and a control egg--the ants preferred the control egg, suggesting the caterpillar's fluid serves as a deterrent. In fact, the authors conclude that "the secretion could clearly be effective against arthropods other than ants, including such enemies as wasps, bugs, beetles, spiders, harvestmen, and parasitoids."

by Sarah Graham Scientific American online May 2002 261 words

Caterpillars Make Their Own Insect Repellent

Reading Comprehension Questions

1. What is this passage about?
2. What species of caterpillars is discussed in the article?
3. What kind of defensive mechanism do the caterpillars discussed in the article have?
4. Where were the caterpillars originally from?
5. What led to scientists' investigation of the caterpillars?
6. Where do the caterpillars discussed in the article carry their insect repellent?
7. What is one reason European cabbage butterflies have spread so quickly over the United States?
8. Why do you think caterpillars and plants would possess similar chemical compounds for protecting themselves?
9. Why do you think researchers tested only ants' reaction to the caterpillar chemical?
10. Explain what "secretes" means in this phrase: "Scientists investigated properties of the fluid that the animal secretes."

APPENDIX D

Text Passage for Students to Illustrate and Questions to Assess Reading Comprehension

Centuries Later, Chinese Lotus Seeds Still Sprout

Nearly 500 years after forming in their parent plant, lotus seeds from a Chinese lakebed have sprouted seedlings of their own, researchers say. According to the lead author of a study detailing the findings, published in the current issue of the American Journal of Botany, the cultivation of offspring from seeds this ancient is "a first in plant biology."

Biologist Jane Shen-Miller of the University of California, Los Angeles, and colleagues collected 20 ancient lotus seeds on a trip to China's Liaoning Province. Radiocarbon dated at between 200 and 500 years old, the four seeds that the team tested for viability all sent up shoots. But the plants have not fully escaped the effects of time: all exhibit abnormalities in their leaves, stalks and underground stems. "Instead of standing up straight with strong leaves, these were smaller, the leaves were weak and bent, displayed abnormalities in color, and the underground stems were small and not getting enough food," Shen-Miller reports. The culprit, she surmises, is long-term, low-dose radiation from the soils in which the seeds resided.

Still, the radiation exposure does not appear to have hampered germination. "The lotus is so robust that it can sprout after centuries of exposure to low-dose gamma radiation," Shen-Miller observes. "We need to learn about its repair mechanisms, and about its biochemical, physiological and molecular properties. The repair mechanisms in the lotus would be very useful if they could be transferred to crops, such as rice, corn and wheat, whose seeds have lifespans of only a few years."

by Kate Wong Scientific American online February 2002 254 words

Centuries Later, Chinese Lotus Seeds Still Sprout

Reading Comprehension Questions

1. What is this passage about?
2. Where did the lotus seeds come from?
3. How old were the seeds that sprouted?
4. What two kinds of abnormalities are seen in the plants sprouted from the ancient lotus seeds?
5. What probably caused the abnormalities?
6. What characteristic of the seeds was NOT negatively affected by the radiation?
7. Where did the radiation that affected the seeds come from?
8. What could we do to protect seeds from radiation?
9. Why would it be important to develop food crop seeds that grow even when they are very old?
10. Explain what "robust" means in this phrase: "The lotus is so robust that it can sprout after centuries of exposure to low-level radiation."

APPENDIX E

Picture Analysis Worksheet

Worksheet: Looking at Pictures and Illustrations

Picture Analysis

Step 1. Look at the picture carefully. Start with the main part of the picture, the part that seems biggest or most important. Continue studying each part of the picture, moving in a clockwise motion, until you have looked at each part.

Answer these questions about the picture:

What is the main part of the picture?

What else do you see in the picture?

What does the picture remind you of that you have seen before?

Are there any parts in the picture that are repeated? Which ones?

Which parts of the picture stand out because they look different than the others?

What is the largest part of the picture?

Which part of the picture seems to be emphasized?

Step 2. Use what you learned from thinking about the above questions to complete these statements.

The main idea of the picture is

The evidence shown in the picture to support the main idea is

Other information provided by the picture is

Analysis of Illustrations: Pictures and Words Together

You will use the process of picture analysis to study pictures that are illustrations of text passages. Then you will compare the information contained in the picture with information in the text passage.

Step 1. Look at the illustration. Study and analyze it using all the steps of picture analysis listed above.

Step 2. Read the text that goes along with the picture.

Step 3. Look at the picture again. Compare the picture and the text information. Was your picture analysis correct, according to the text? If not, what was different about the text and how you understood the picture?

Step 4. Did the text contain any important information not shown in the picture? If so, what was it?

Step 5. What information is the picture and passage communicating together?

Appendix F

Drawing Practice Worksheet

Worksheet: Drawing Pictures and Illustrations

Drawing from Models

Your goal is to create a simple line drawing that accurately represents what you see and communicates information about your subject. Your drawing must show the most important, outstanding features which represent the model. Details that are not important in representing the model should be left out. You may add things to your drawing that help identify your subject.

Step 1. Look at your subject carefully.

Step 2. Decide which parts of your subject are most important in identifying it and which details may be left out of your drawing.

Step 3. Begin drawing with an outline of the basic shape of the main or central part of your subject.

Step 4. Next draw outlines of the basic shapes of the rest of your subject. Start with the parts that are next to your first shape. Be sure to include everything needed to identify your subject.

Step 5. Now you will refine the basic shapes you have drawn. Start with the main part of your subject. Look at its shape. Change your drawing as needed so that it accurately represents your subject. Continue to refine all the shapes of your drawing so that it clearly illustrates your subject.

Step 6. Add details to your subject if they are needed. Only draw details that are needed to accurately represent the subject you are looking at. You may also add parts to your drawing to help it more clearly communicate the idea of your subject.

Drawing From Text - Representational Pictures

Your goal is to draw a picture that accurately illustrates what you read. Your drawing must represent the most important information contained in the passage. Details that are not important in creating a clear picture of the information should be left out.

Step 1. Carefully read the text.

Step 2. Answer the questions below.

What is the main idea or topic of the text?

What kind of details does the text give about the topic?

Step 3. Try to form an image in your mind of what is described in the text. Create a picture in your mind based on the information from the text. (You may close your eyes to do this if you want to.)

Step 4. Make a line drawing of the image you formed in your mind after reading the text. Start with the main part of the image and draw using basic shapes. Refine your drawing and add details so that it looks very similar to the image you created in your mind.

Step 5. Compare your drawing to the text passage it illustrates. Does your drawing contain the information provided

in the text? Is your drawing an accurate representation of the text material? Make any changes needed for your drawing to more accurately represent the text.

Drawing from Text - Conceptual Pictures

Your goal is to draw a picture that uses symbols you create to represent an idea or concept that you read about. You will not be drawing a picture that represents something you can literally see or imagine, like a window or the continent of North America. Instead you will draw a picture that is a personal symbol for a specific idea. This picture will be more like a sign or code. For example, you may choose to illustrate the concept of frustration with a drawing of small rectangles that resemble gritting teeth because you grit your teeth when you are frustrated. Your picture may not be recognizable to others. It is only important that your picture be meaningful to you.

Step 1. Carefully read the text.

Step 2. Answer the questions below.

What is the main idea or topic of the text?

What kind of details does the text give about the topic?

Step 3. Try to form an image in your mind of lines and shapes that could be used to express the idea of the text to you. (You may close your eyes to do this if you want to.) The image should have some connection in your mind with the idea you have read about. It should remind you of what you have read in some way. The image does not need to be recognizable to anyone else.

Step 4. Make a line drawing of the image you formed in your mind that represents the idea of the text. Use lines and shapes to create your drawing. Refine your drawing and add details that make it a more effective illustration to remind you of the idea you read about.

Step 5. Compare your drawing to the text passage it illustrates. Does your drawing symbolize to you the idea you read about in the text? Make any changes needed for your drawing to more accurately communicate the ideas of the text to you.

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BIOGRAPHICAL SKETCH

Education

Florida State University Doctoral Program in Art Education

University of Florida Master of Education, Educational Leadership

Florida State University Bachelor of Science, Art Education
Dean's List, School of Visual Arts

Certification

Florida Professional Teaching Certificate 628139, Art K-12.
Valid through June 30, 2009.

Publications and Presentations

Middle School Art North Florida School Days 1999

Exceptional Student Education in Art Classes presentation for the Critical Issues in Education conference University of Florida 1999

Art is What We Make of It Gainesville Sun 1998

Why Have a Personal Philosophy of Art Education? Forum: Anthology of the Florida Art Education Association 1997

An Aesthetics Resource for Art Teachers presentation for the Florida Art Education Association state conference 1997

Employment

August 2002 - present Art Instructor, Alachua County Schools:
Eastside High School
Supervisor: Sandy Hollinger; Mike Thorne

Responsibilities

Prepare and present instruction for beginning and intermediate drawing and painting classes.

Exhibit student artwork in a variety of public venues.

Co-sponsor of Eastside High School Art Club.

Supervise practicum and intern students of art education.

August 2000 - June 2002 Art Instructor, Alachua County Schools: Buchholz High School
Supervisor: Ron Nelson; Joan Longstreth

Responsibilities

Prepare and present instruction in drawing and painting techniques to students in grade 9 - 12.

Supervise practicum and intern students of art education.

Summer 2002, Summer 2001, Summer 2000 Arts Enrichment Program Instructor, Alachua County Schools
Supervisor: Christie Shaw

Responsibilities

Cooperatively prepare and present art, music, dance, and drama curriculum for grade 6 - 8.

Direct culminating dramatic performance.

Supervise members of teaching team.

August 1998 - present Adjunct Instructor, University of Florida, Department of Art Education
Supervisor: Craig Roland; Melanie Davenport

Responsibilities

Instruct general education majors in integrating visual arts into the regular classroom curriculum.

August 1996 - June 2000 Art Instructor, Alachua County Schools: Kanapaha Middle School
Supervisor: Mike Joyner, Janice McPhail

Responsibilities

Order equipment and supplies for new art facility.

Develop and implement interdisciplinary, multicultural art curriculum for grade 6 - 8.

Display student artwork in school and community.

Supervise practicum and intern students of art education and classroom aide.

Achievements

Received grant for students to research and recreate artwork of Native Americans indigenous to the area.

August 1995 - June 1996 Art Instructor, Alachua County Schools:
Lincoln Middle School
Supervisor: Dean Niederkohr

Responsibilities

Develop and implement art curriculum for sixth graders.

Achievements

Helped student aid plan and execute permanent mural in hallway outside art room.

August 1989 - June 1995 Art Instructor, Putnam County Schools:
Interlachen High School
Supervisor: Randy Newland

Responsibilities

Develop and implement beginning and advanced drawing and painting and ceramics curricula for grades 9 - 12 including studio experiences and art history and criticism.

Display student artwork in the school, community, and competitive arena.

Fundraise supplementary monies for student art projects and activities.

Achievements

Elected and served as Chairperson, Interlachen High School Improvement Team, 1992-1994.

Assisted in writing Tech Prep grant for tri-county consortium, served on Tech Prep public relations committee.

Completed advanced training in Facilitative Leadership and Assisting Change in Education (ACE).

Sponsored Sophomore Class and Art Club.

August 1988 - June 1989 Art Instructor, Gadsden County Schools:
Stewart Street Elementary
Supervisor: Douglas Black

Responsibilities

Develop and implement art program for prekindergarten through fifth grade including hands on art activities as well as art appreciation lessons.

Achievements

Received county mini grant for school art program.

Designed logo and mascot for school reading project.

Organizations

City of Gainesville Art in Public Places Trust, Vice Chairperson
2002 - 2004