Envisioning the Mind:  
Children's Representations of Mental Processes

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(ABSTRACT)

Inspired by writings on creativity and by Howard Gardner's theory of multiple intelligences, I conducted a series of ten "exercises"—each of them a guided visualization followed by an opportunity to produce art—with nine- and ten-year-old students. The visualizations, which were designed to encourage the students to explore some of the many ways our minds have of knowing and learning, began with a simple relaxation exercise and proceeded to more challenging exercises involving, for instance, kinesthetic learning, sensory awareness, the logical and linguistic mind versus the spatial mind, and intra- and interpersonal intelligence. Following each visualization the students discussed what they had experienced (transcripts of the visualizations and the discussions are included in the thesis). The students responded in visual terms as well: after each visualization, each student created a two- or three-dimensional piece of art from materials such as matboard, construction and origami paper, glue, felt-tip pens, pipe cleaners, and plastic-coated wire. These visual responses have been photographed, described, and scored according to the number of materials used, the number of colors used, and the dimensionality of the piece (photos, descriptions, and scores are included in the "Gallery"). I found, surprisingly, that the visualizations in which the students were the most imaginatively engaged did not always produce the most interesting art, and that girls were much less likely than boys to create three-dimensional pieces, although girls tended to use more colors and occasionally used relief on otherwise two-dimensional pieces.
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Introduction

0.1 Overview: The Use of Multiple Intelligences in Architecture

For those in any profession, a unique array of skills is essential. Many would argue, for example, that a musician must have a special attentiveness to sound, including a sensitivity to pitch and rhythm. In a musician likely to achieve excellence, that attentiveness to sound might well be accompanied by a keen awareness of others (fellow orchestra members and the audience), or perhaps by a talent for turning that awareness inward when focused intensity is needed. The array of necessary skills might be quite different for a visual artist, a writer, a teacher, or an architect.

For an architect to become successful, in fact, an unusually wide range of skills may be required. The list of skills—or, more accurately, the list of strategies, approaches, or modes of communication—that an architect needs certainly includes:

- Spatial analysis and visualization, with an ability to create visual products that communicate this spatial sense
- Verbal skills for oral and written communication with clients, team members, public officials, and contractors
- Logical and mathematical accuracy

For an architect designing specific types of buildings, the list would almost certainly also include:

- Acoustic and auditory sensitivity
- Kinesthetic feeling for how people will move in the space

The Harvard educator, psychologist, and cognitive scientist Howard Gardner proposed in *Frames of Mind* (1983) to call these skills, strategies, and approaches "intelligences." I will do so here, setting aside any discomfort I feel about the idea that there are many separately measurable intelligences, in order to fully explore his theory in relation to education and design. At the time, Gardner specified seven intelligences, although he mentioned then that there might well be additional ones. (Since then, and since the time at which I conducted the classroom exercises for this study, Gardner has published an eighth, the "naturalist intelligence," which he describes as an ability to recognize and categorize features of the environment.) According to Gardner's theory, the seven intelligences are:
- **Linguistic intelligence**, which involves using language to accomplish goals, remember information, and express oneself. This has typically been valued in schools and, as I noted above, is also essential to the architect.

- **Logical-mathematical intelligence**, which is the capacity to analyze problems, detect patterns, and reason deductively. Again, this is valued in schools and is essential to the architect.

- **Musical intelligence**, which includes the capacity to recognize pitch, tone, and rhythms as well as the skill to perform and compose. This might be essential to the designer of a symphony hall and is useful for supportive acoustics elsewhere.

- **Bodily-kinesthetic intelligence**, which uses mental abilities to coordinate bodily movements, both large and small. A strength in this kind of intelligence might be essential to architects in creating drawings and models as well as in thinking about how people will move in the space.

- **Spatial intelligence**, which involves recognizing and being able to manipulate various sizes and configurations of space.

- **Interpersonal intelligence**, which allows people to work effectively with others.

- **Intrapersonal intelligence**, which involves having an effective working model of ourselves.

My curiosity was piqued. What if a student arrives at architecture school without some of the requisite intelligences? Can these intelligences be taught or enhanced at that point, or is it too late to help the student acquire or develop them? How do these intelligences interact with creativity, the development of which had seemed to me to be a major goal of architecture school? And finally, as the art teacher of five- to twelve-year-olds in an elementary school, I wondered about my own students' development. What would help them become creative human beings, and could creativity be measured? I hoped that sharing Gardner's theory with my students would be useful in stimulating creative responses that could be evaluated. To this end, I designed ten exercises, based on the concept of multiple intelligences, to conduct with them.

Kosslyn’s studies comparing the three-dimensional rotation abilities of adults with those of children of various ages (1980) indicated that my nine- and ten-year-old students should be similar to adults in these abilities Piaget and Inhelder’s work with spatial transformations (1971) provided clues that children of this age would probably be receptive to concepts in this arena. Yet my reading of Bruner (1979) convinced me that there would likely be an order in which Gardner’s intelligences might emerge in a person. It seemed possible to me that my students might not yet have developed certain intelligences to the point that they could grasp information that I planned to present about these ways of knowing. So as not to introduce developmentally inappropriate material early in the sequence, I placed near the beginning the exercises based on ways of knowing and learning that are known to be present even in the very young. Thus the exercises in the study came to have a range of topics inspired by Gardner in an order inspired by Bruner.
0.2 Children and the Creative Mind

Underlying the study was the notion that creativity can be encouraged or invited or taught. Overlapping and sometimes contradictory descriptions of the creative mind by Arnheim (1974), Bruner (1979, 1987), Duckworth (1987), Brittain (1979), Brittain and Lowenfeld (1982), Martin Gardner (1978), and Howard Gardner (1980, 1982) all provided stimulation for this notion. I read that each of us is inherently creative, that we each have the potential to come up with fresh responses to problems, that creativity is as important to the scientist and the mathematician as it is to designers and musicians, that the ability to function creatively is essential both for ourselves as individuals and for society as a whole.

As a teacher, I wanted to be sure that my teaching would bring my students to their own moments of creativity, perhaps identifiable by novelty, abundance, and individuality of expression. Many of the children had been team members in Odyssey of the Mind, a program developed specifically to help children practice creative problem solving. As an Odyssey of the Mind coach, I had seen what astonishingly creative ideas students could come up with if they were relaxed and if they opened their minds to new approaches to problems. Studies referenced by Murdock (1987) have indicated that creativity may be increased by jogging, being in a relaxed frame of mind, or meditating. I hoped during this study to stimulate the creation of artwork that might be measurably more colorful, use materials in a unique way, or otherwise create surprise.

0.3 Guided Visualizations

My use of visualizations for the ten exercises that I conducted with students was inspired by Spinning Inward (Murdock, 1987), which explores the value of guided imagery in helping children with relaxation, creativity, and learning. I had used visualizations from the book in my coaching of Odyssey of the Mind teams with students aged five to thirteen, and had been impressed with the way these sessions seemed to help my teams relax and focus. After a guided visualization session my team members tended to improve specifically in the fluency of their ideas during brainstorming. Following Murdock, I saw the use of guided imagery in the classroom as a way to enhance students’ receptivity to ideas and information that might otherwise seem too difficult to understand. In addition, I was persuaded that guided imagery would enable students to attain a greater level of creativity in expressing their understanding.

Each exercise began with my helping the children to relax their bodies, breathe slowly, and get into a calm state. I handled this process in a variety of ways, depending on the initial state of the group. People often find it easier to achieve full relaxation while
lying down, but the room in which we did the activities was not conducive to lying on the floor, and generally the children sat instead. In a relaxation exercise of this kind, the initial tension is released limb by limb, muscle by muscle. Breathing together, creating spaces to breathe and to pay attention to the breathing amid the instruction, is a crucial part of moving participants toward a calm and receptive state. During the first exercise I allocated more time for bringing the children to a noticeable calmness; later in the series of sessions, the children tended to relax faster, and less time was devoted to this stage. Once the children were relaxed, I introduced the imagery of the exercise. The conclusion brought the children back to an alert state.

Following each guided visualization was a brief discussion during which children described their experience and answered any questions I posed. The guided visualizations and the discussions afterward were taped and transcribed for each of the two classes I worked with; the transcripts can be found in the second and third sections of each exercise.

During the remainder of the forty-five-minute period, the children had a brief period of time in which to make art projects that reflected what they had experienced during the visualization. Generally the time period left for this was between fifteen and twenty minutes. The assortment of materials and tools was constant throughout the study (a list is provided in the Appendix). Each child's product was photographed, described, and scored (see below for details on the scoring procedure). The works can be seen both in a mini-gallery at the end of each exercise and in a complete gallery, organized alphabetically by student name, immediately following the Appendix.
0.4 Discussion of Results

For each exercise, there are two areas of student response that are considered in this study. First, in the discussion following each visualization, the students commented on what they had experienced. These “verbal responses” are included in the transcripts for each exercise (sections 2 and 3), and some of the responses are also quoted in the Discussion of Results for that exercise (section 4), particularly in cases where what a student said in the discussion elucidates, or perhaps contrasts with, the piece of art that he or she produced afterward. The verbal responses have not been scored, as they do not provide sufficient evidence regarding the participants’ level of understanding of the material. Second, the students responded in a visual way, each of them producing a piece of art at each session. The “visual responses” to each exercise appear in a mini-gallery following the discussion of that visualization (section 5). In addition, all the visual responses to all the exercises appear together in the Gallery near the back, following the Appendix.

Because of my hypothesis that complexity in a visual response might indicate greater interest, understanding, or creativity on the part of the participant, I scored visual responses in multiple ways. The number of materials used in the production of the piece, the number of colors used, and the dimensionality of the piece were all evaluated.

The materials scores are strictly numerical: a project that used six materials (for instance, railroad board, pipe cleaners, glue, felt-tip pen, origami paper, and string) received a score of 6. The same is true for the colors score: every color was counted, with variations of the same color being counted separately. A project using black construction paper with black pipe cleaners would have been given a score of 2, because the darker black of the pipe cleaner could be readily distinguished from the lighter black of the construction paper.

Dimensionality presented a more difficult scoring problem. A simple (and somewhat simplistic) picture can be gained by looking only at whether a student’s product was three-dimensional. Overall, boys made three-dimensional products 66% of the time, with a low score of 40% on one visualization and a high score of 100% on another. Girls made three-dimensional products 35% of the time, with a low score of 18% and a high score of 50%. This difference along gender lines was striking, and there was no reason for it that I could discern. I was interested to notice, however, that many of the two-dimensional pieces had relief. Graph 0.1, below, shows the percentage of three-dimensional projects created by girls versus the percentage created by boys, next to the percentage of projects involving relief for each of the two groups. (In the Discussion of Results within each exercise, a similar graph is shown for easy reference at the top of the section, with the data for that exercise compared to the average data.)
Looking for additional insight into the differences between the girls and the boys in their approach to creating art, I felt that it was important to come up with a more complex scoring system for dimensionality, one that reflected other factors. Not only did many of the two-dimensional pieces have relief, but a smaller number of pieces were reversible or had intentionally moving parts. (Note the word “intentionally”—if something wobbled, it was not counted as intentionally moving.) Taking these factors into account led me to give each piece a composite dimensionality score of between 2 and 3.5. A two-dimensional piece received a base score of 2, a three-dimensional piece received a base score of 3, and an extra half point (0.5) was given to a piece that had relief, was reversible, or had intentionally moving parts.

Scores for dimensionality (D), use of materials (M), and use of colors (C) are included in the descriptions that accompany the photographs of the pieces, arranged alphabetically by student name in the Gallery following the Appendix. (The mini-gallery located at the end of each exercise, which is for the reader’s convenience in viewing all the pieces made for that exercise only, gives the names of the creators but does not provide descriptions or scores.)
Graph 0.2 shows the results based on a more complex scoring system, again from each of the ten exercises, plus the combined average. This more complex scoring adds materials, color, moving parts, and reversibility to the foundation of three-dimensionality and relief. (A similar graph is shown within the Discussion of Results for each exercise.)

Graph 0.2  Dimensionality, Colors and Materials (Exercises 1 through 10)

As Graphs 0.1 and 0.2 indicate, the results from exercise to exercise show neither steady growth nor decline in scores. Possible reasons for the variation of results will be explored in the **Discussion of Results** for each exercise. These reasons include the students’ reaction to novelty, their confusion about information I gave within the guided visualization portion of the exercise, their confusion about instructions I gave at the onset of the work period, specific suggestions I made (sometimes unintentionally) in regard to materials, and my mention of the word “model.” Despite the variations, there are some patterns as well, especially those having to do with differences between the visual responses produced by boys and the visual responses produced by girls. Simply put, boys were consistently more likely than girls to make three-dimensional products. This difference was surprising to me, in spite of the many studies that would have predicted this result.
0.5 Gallery

The gallery within each exercise contains the visual response of every participant who chose to turn in a project, so that all the visual products from that exercise can be seen at a glance. Descriptions and scoring information are located with the pieces in the Gallery at the back (following the Appendix). The Gallery is arranged alphabetically by student name; each student’s complete collection of pieces, from all ten visualizations, thus appear together.

The caption for each image contains the first name of the student who created it and the number of the exercise. In two cases, students produced two separate responses to the same exercise, so that number is succeeded by (a) and (b). In several cases multiple views are provided; top, bottom, side, and close-up views are indicated.

Figure 0.1 Adrian 1 (Side View)  
Figure 0.2 Adrian 1 (Bottom View)
Exercise 1: Relaxation Exercise

1.1 Overview

The first exercise—a modified version of Murdock’s "Relaxation Exercise" (Murdock, 1987)—had three purposes:

- Introducing relaxation techniques, including stretching and breathing, to the students.
- Allowing the students to become accustomed to the format of the sessions.
- Familiarizing the students with the materials and tools available for making art after the visualization.

This first visualization shared certain basic characteristics with the later ones. Each exercise began with the children relaxing their bodies, breathing slowly, and getting into a calm state. As the guide, I handled this in a variety of ways, depending on the beginning state of the group. People often find it easier to achieve full relaxation while lying down, but the room in which we did the activities was not conducive to lying on the floor, and generally the children sat instead. In a relaxation exercise of this kind, the initial tension is released limb by limb, muscle by muscle. Breathing together, creating spaces between the instructions to breathe and to pay attention to the breathing, is a crucial part of moving participants toward a calm and receptive state. During this first exercise I allocated more time for bringing the children to a noticeable calmness. Later in the series of sessions, the children tended to relax faster, and less time was devoted to this stage. Once the children were relaxed, I introduced the imagery of the exercise. In this first visualization it consisted of an imaginary trip in on a breath, through their body, to their brain. The conclusion brought the children back to an alert state. (Transcripts of the visualization as it was conducted with each of the two classes are provided in sections 1.2 and 1.3.)

Following each guided visualization was a brief discussion during which children described their experience verbally and answered any questions I posed. For this first exercise I was curious about whether they were able to imagine floating, what they noticed while visiting their brain, and whether they felt especially peaceful or calm at some point during the event. (These discussions were taped and transcribed—see the second half of sections 1.2 and 1.3 for the class discussions about the first visualization.)

During the remainder of the forty-five-minute period, the children had a brief period of time in which to make an art project that reflected what they had experienced during the visualization. Generally the time period left for their art was between fifteen and twenty minutes. The assortment of materials and tools was constant throughout the study. (A list is provided in the Appendix.)
Each child's product was photographed. I have described each one and scored it according to the number of colors used, the number of materials used, and its dimensionality.

For each exercise, in the section following the transcripts I consider the students' verbal and visual responses to the guided visualization (see section 1.4 for a discussion of their responses to the relaxation exercise). The works themselves are presented both in a mini-gallery at the end of each exercise (see section 1.5) and in a complete gallery in the Appendix.

1.2 Transcript of Guided Visualization with Pat's Class

Relaxation Exercise

[Lots of restless behavior; the students take a while to settle on the floor.]

I'm going to tell you a little bit about what we're going to be doing. I'm working on my master's degree in architecture, and for your master's degree you make a book called a thesis. For my thesis, which is really about how to teach people to do design work well, to grow up and be able to think like architects need to think, I started looking at what scientists think about how people think. There are lots of different kinds of scientists who've thought a lot about how minds work, and they're called cognitive scientists. But you can be an anthropologist and also be a cognitive scientist, you can be a psychologist and be a cognitive scientist, you just have to be interested in how minds work. So people have lots of different ideas about it. There's one thing nobody has any disagreements about, and that is: we have bodies and we have brains. [Joking about whether everyone in the class has brains.]

What I'm going to be doing for these ten times we're going to get together is, each time we're going to start with something called a guided visualization or guided imagery, where I'm going to have you shut your eyes and listen to something I'm going to be telling you and try whatever I ask you to do, and it will be different things different times, and after the guided imagery we'll always have an art project where you'll make something pretty fast—not something for weeks and weeks but something in fifteen minutes flat—that shows what you saw, or what you experienced, or what you felt inside your mind while I was taking you through that experience. So you'll make a little model of what you experienced, or a drawing, or you'll write a story, but it would
be especially nice if you’d make a little model. And then I’ll use those things that you draw or that you build for illustrations in my book.

So, I want you to sit very comfortably. Today the guided visualization is mostly just a relaxation exercise. We always start visualization by relaxing. And today that’s mostly what we’re going to do. When we completely relax our bodies, our brains have a chance to work in a different way from the way they work when we’re active. Our brain is always sending signals all through our body to tell different parts of us to move. If you want to move your arm, your brain has to tell you to move your arm. It does it very fast and very quietly. Well, if you keep your body very still and very relaxed and you aren’t busy thinking about things, it gives your brain a chance to do other kinds of work. (Are you excited by the machine [the tape recorder], Joey? That machine is not as smart as you are.) When we let our brains be calm, our brains have a chance to create lots of images inside of them. I’m hoping, after we finish with this exercise, we have lots of ideas. (Joey, sit back, please.)

All of you, close your eyes. Be very quiet. Feel the weight of your body where it touches the floor. Try to imagine the shape of the part of you that is touching the floor. [Giggling from many students.] Let that part spread out a little bit more. Let your body be still. (Close your eyes, please, and try; I know this is very embarrassing, doing this.) Without moving the outside of your body, tighten all of your toes, see if you can make them tense inside your shoes... OK, and now relax them. Now tighten your whole legs and feet, all the way up... and relax them, letting go of all the tension in them... Now tense your fingers, you can make tight fists if you want to, and tighten your arms all the way up to your shoulders...and let go of them... Now tighten your back and shoulders... and release them... This one you’ll like—tense your forehead, scrunched your eyes, and make a terrible, horrible face with your mouth... and relax your face. Keeping your eyes closed, feel your body sitting very still and heavy.

Now breathe quietly, in... and out..., in... and out... Keep feeling your breath. As your breath moves out of your mouth, let other air move into your lungs. While you’re breathing in... and out—(You guys are the loudest breathers I’ve ever heard, can you hear me still? Keep your eyes closed, and I want you to try to imagine something. This is hard. Breathe quietly, and imagine this.) Try to imagine a very, very, very tiny version of yourself, maybe as big as a speck of dust. Try to imagine yourself that little. Let it sort of float around on your breath. Right in front of you. Breathe out and let that little-tiny-speck-of-dust-size-of-you just sort of float on that air. This time, breathe in that air and breathe your self in with it, into your lungs. (A student: Oh, awesome.) In your lungs, imagine that you are in a tiny little boat, that little tiny you, and start traveling through your veins and your arteries. (Can you imagine that? Just feel it. If you’re moving your body too much, your brain will have trouble imagining this, so just keep your body still.) Let that little tiny version of yourself keep traveling down your legs, and down your arms, keep breathing, but breathe quietly. Can you let that little boat with you in it drift up to your brain? Your brain is processing more information right now,
even when you are relaxed, than the fastest computers in the whole world. In fact, you are a lot smarter than any computer anyone has ever built. [Giggling and comments.] I’d like you to try to notice the work your brain is doing, just very quietly.

In a minute I will count to six and you will open your eyes. One... two... three... four... five... six...

[Off-topic comments from Jonathan and Joey.]

R: Joey and Jonathan, we’ve already heard enough from you, I’d like to hear from everyone else about how that was. Real fast, let’s go around in a circle. Let’s start with Erin.

Erin: That was weird.

R: Could you imagine any of it? Could you let yourself get that tiny? (Joey, interrupting: It makes you smarter.) Was that hard to do?

Erin: No.

R: When you went to your brain, could you see the work it was doing?

Erin: No.

R: You didn’t have any kind of imagining about what it was doing? Did any of you have any kind of imagining when you were in your brain?

Joy: One part of each area was full of file cabinets and the other part had a super, super, super smart computer, and each part, one for math, one for dreams one for jokes, so on. They were all full of ideas and they’re practically bursting. And the boat I was in was a glass-bottom boat.

Whet: I had a big purple blob, it was my brain working a computer. The boat I imagined was a little rowboat. It ran in the blood. It was brown.
Shannon: I imagined a big thing and I was little and I was in my boat in my blood and my boat was blue, I don't know why it was blue. [Kids giggle about the color.]

R: Your brain does that for you, it's going to make images. I'm not going to say, ever, in any of these visualizations, "Get in a blue boat," or "Get in a brown boat." You can make yourself those things. Your boat is going to look like your idea of a boat. Those ideas that you have in your mind are special, those are unique to you. You are the only person who, when you hear "boat," thinks up a blue rowboat or a glass-bottom boat or... There may be someone else in this room who has a similar boat, but there's no way of predicting it. You can't sit there and guess which people in this room are going to have blue boats, and neither can I.

Jenny: I was in a black boat on a red sea, and I was going to a far-off place. I went looking for it, and I found it in my brain. It was weird.

[Off-topic comments from Jonathan.]

Adrian: I saw me traveling through these roads on my boat, and my boat was like a steamboat. When I got to my brain it was like I saw all these gears working together.

Graham: Not anything really. [He had spent the visualization time wiggling and muttering under his breath.]

Christine: My boat was dark blue and it had these pink polka dots on it. I had a rowboat, I had to row backwards because there was this waterfall the other way. It started getting really windy and I fell in. I swam and got back on it. It was pretty high up, on a mountain type thing. And then when I got up to my brain it was kind of like Adrian's was, it had all these gears working in it.

Joey: My boat was a pulsing blood-cell submarine. It was red. (Another student: Sick!)

Joy: Mine was a glass submarine. (R: Glass-bottom?) It was all glass. (Joey: Bulletproof?)

Jaime: I was in a green boat. It was strange, when I was going through my body there were all these posts, it was like there were these boxes with men in them with walkie-talkies. When I got up to my brain, it was file cabinets. A guy would open the file cabinet, check it over, and start talking through the walkie-talkie.
R: The next thing we need to do, we have twenty minutes, you need to think of something that’s very vivid and very fast and get started.

1.2 Transcript of Guided Visualization with Betsy's Class

Relaxation Exercise

You have an extra-short time today, unfortunately. You could come in after you finish your jobs and do a little bit of finishing up. (Evelyn G: I have to go somewhere. R, to Evelyn G: Then just do something really, really fast for your art project. These are supposed to be fast projects anyway, they’re not supposed to be sit-and-agonize-over-them projects.)

I’m working on my master’s degree in architecture, and when you do that, you write a book about something, usually with lots of pictures in it. What your art projects are going to be are the pictures in my book. I’m not going to use all of them. (Justin: Only the good ones, right?) It’s hard to define what a good one is. It’s going to be ones that make sense for different parts of it. What we are going to be doing them about is a whole series of guided visualizations.

Have any of you ever meditated? Do any of you have parents who meditate? (Several students: Yeah. Maybe.) We’re not going to be doing that. (Ian: Are we going to do those little circle things? Tarot cards?) Tarot cards? No, we’re not going to do tarot cards, sorry. In a way we’re going to do something a little related to those two things. What happens when you do a guided visualization is that you give your brain a chance to get very, very, very relaxed. When your body is totally relaxed and your brain is relaxed and you don’t have stuff that you have to think about, it gives your brain a space to think about other kinds of things in new and creative ways. You know at night when you dream, and your dreams are really bright colors and really exciting, they’re really more interesting than the things you can just think up during the day. (Evelyn G, pointing at Lecia: She has a stress card) Are you under stress at the moment? (Lecia: Yeah. Evelyn: I am.) Evelyn is not going to be under stress in a moment because what we’re going to do is:

We’re going to sit so we’re not touching our neighbor, and we’re going to close our eyes. As you sit comfortably with your eyes closed, feel the weight of your body where it touches the floor... Try to imagine the shape of you where you touch, where it spreads out a bit. Let yourself spread out a bit more. Without moving the outside of your body, tighten all of your toes... And now relax them. Tighten your legs and feet... and relax them, letting go of all the tension in them... Now tense your fingers into a tight fist... and tense all the way up your arms, up to your shoulders... and relax them... Now tighten your back and shoulders... and
release all the tension in them... Tense your forehead, scrunch your eyes, and make horrible faces with your mouth... And relax your face. Keeping your eyes closed, feel your body sitting very heavy.

Breathe quietly, in... and out... and in... and out... Keep breathing in... and out... Try to imagine a little tiny version of yourself, floating on that breath that you’re breathing in and out. Just a little tiny you. About as big as a speck of dust, just floating around on that breath. This time, as you breathe in, breathe in that little speck of you, right into your lungs. Once you are down there in your lungs, get into a little boat. (Ian, close your eyes, please, and relax.) Try to imagine your tiny self in a boat, traveling through your arteries and your veins, that’s pretty hard, just picture a little tiny person in a boat. (Evelyn G: I’m not me.) If it needs to be somebody else, but you want to be able to see through those eyes, too. Travel through your body down to your toes, back to your heart... out to your fingers, and back... and now to your brain.

When you get to your brain, notice that your brain is processing information. Even when you are completely relaxed, your brain processes information faster and better than any computer anyone has ever, ever invented. Let yourself notice the work your brain is doing.

I am going to count to six and you will open your eyes. One... two... three... four... five... six...

Who could not even imagine floating? Lecia, was there any piece of it where you could imagine yourself, could you get inside your brain at all?

Lecia: No. (R: Do you feel calm and relaxed, did your body feel pretty heavy and solid to the floor?) No. (R: What does your stress tester say?) It said stressed. (R: At the end, you’re still stressed. I guess you didn’t relax too well.)

Katie: I would think it would say calm.

Ian: I don’t think it works.

Evelyn G: I got calm.

R: Did any of you imagine yourselves in the brain?
Colleen: Yeah, but it was hard.

Brooke: Well, I was imagining a little magic carpet, it was going through this big noodle, and I saw digits going on and answering questions and stuff.

R: Can you think of a way you could show that, in a really fast art project? You’ll have seventeen minutes. What would be a really fast way you could show that, maybe not just flat as a picture, but make it 3-d. As you’re sitting here, listening to other people talk, start to think about ideas that might work, what you could make the magic carpet out of, whether you would want to write on a piece of paper for the ideas, how you could begin to structure it. We’ve got wire and pipe cleaners and lots of different colors and types of toothpicks and straws. (A student: Do we have to make us?) You don’t have to make you, you could make any part of this. You could show the boat, the trip, how your brain was working, what you saw, or you could show yourself seeing.

Colleen: Mine wasn’t really quite a boat, more like a carpet or something.

Evelyn G: Mine was a canoe without any paddles.

Evelyn T: Mine was a sailboat.

Katie: I had wings. I saw the shapes, when you said veins I saw the round side of veins and when I saw my shoes [inaudible] and when I got to my brain it looked like a piece of brain coral, it had all these weird colors.

Evelyn G: My brain looked like little doubles floating around in the air and they had answers to problems.

Justin: It was neat in mine. The first one I didn’t get any picture, I was imagining it, but I didn’t get any. Then I imagined when I got to my brain it was wire-y.

Ian: My brain looked exactly like a person’s brain really does. (Another student: Have you seen a real brain?) Yeah, I’ve seen a real brain.

Colleen: I was floating on a pencil through my brain. My brain looked more like a picture than a brain.
Evelyn G: Could I do the outside of my brain?
R: If that's how you experienced it, was from outside, then you could do it from outside.

Evelyn G: I went inside. I saw outside, but I went inside.

R: Basically what you're going to show here is what you feel is the most important thing for you to show. OK? So that is entirely your decision, I cannot make that for you.

Justin: I'm going to make a model of my brain.

Colleen: Does it have to be in your brain?

R: No, if your main experience was something else, go ahead and do that.
1.4 Discussion of Results

Overall, the responses to the Relaxation Exercise were among the most three-dimensional of any set of visualization responses throughout the ten exercises. Every boy made a three-dimensional project, and four of the eleven girls present for this exercise did so. Thanks to the use of relief by six girls, the average dimensionality score for the eleven girls present was 2.64, which was one of their three highest scores during the study. (During the second and fifth exercises, six of the twelve girls present made three-dimensional projects and four of them used relief, resulting in a very slightly higher score.) The average score for the ten boys present for this visualization was 3.00, a level they achieved during only one other exercise. The use of colors and of materials scored very high as well—second place for both overall, with the boys achieving their highest scores and the girls scoring their fourth highest.

Graph 1.1 Use of Three-dimensions and Relief (Relaxation Exercise)

Graph 1.2 Dimensionality, Colors and Materials (Relaxation Exercise)
It is notable that every girl used paper or cardboard as the base for her work, whether it then became three-dimensional or not (four girls created three-dimensional projects on their flat base). One boy began his three-dimensional project on a shoebox lid, and another based his in a shoebox. All the remaining boys made completely three-dimensional projects.

One pattern that emerges here is the production of similar responses—projects that look quite a bit alike because students have selected the same materials or have reproduced images described in the visualization. For this exercise, three girls in Pat’s class made similar drawings of a river of blood with a small boat (two have relief, one does not) placed in the river. Two projects, made by boys in Betsy's class, are similar tubular structures made of pipe cleaners (one has a paper boat and figure inside, implying that it may be intended as a blood vessel—neither boy gave any explanation of what he saw or intended). Altogether, of the twenty-one pieces of art made following this visualization, ten show boats and/or rivers, six show brains as blobs or masses of circuitry, and three show brains in a manner that reflects process.

In both classes, children spontaneously noted that the boat they traveled in through their body was of a specific color, material, and type. Their descriptions included a glass-bottom boat, a little brown rowboat, a blue boat, a black boat, a boat "like a steamboat," a pulsing blood-cell submarine, a glass submarine, a canoe without any paddles, and a sailboat. One traveled in her body on "a little magic carpet," one "had wings," and one found herself "floating on a pencil." In examining the art that the children produced in response to the visualization, we see that many of the pieces can be considered literal representations of what the children said they had seen—thus we could describe them fairly as visual descriptions of their mental images. Keep in mind that the children had only fifteen to twenty minutes to work on these projects; they had to work fast in order to share what was in their heads. These are sketches, really, whether in two or in three dimensions.

Several of the responses moved substantially beyond the words used in the exercise or in my instructions to the children. Notable among these are Jaime’s response, which shows little men with walkie-talkies communicating between his brain and "posts" in his body, and Adrian’s response, showing "gears working together" in his brain. Both of these projects are unusually well crafted and complex, as are the projects of three other boys—Sean’s tubular pipe-cleaner structure with a boat inside, Joey’s pulsing blood-cell submarine, and Graham’s origami boat with a clear acetate floor. Among the girls, only Evelyn T produced work of the quality and complexity that these boys attained.
1.5 Gallery

Figure 1.1 Adrian

Figure 1.2 Brooke

Figure 1.3 Christine

Figure 1.4 Colleen

Figure 1.5 Erin

Figure 1.6 Evelyn G
Figure 1.19 Shannon

Figure 1.20 Taylor

Figure 1.21 Whet
Exercise 2: Creative Thinking

2.1 Overview

"The creative process cannot be summoned at will or even cajoled by sacrificial offering. Indeed, it seems to occur most readily when the mind is relaxed and the imagination roaming freely." (Kline, 1955)

The idea that creativity can be encouraged or invited or stimulated or taught was the seed for my research. Overlapping and sometimes contradictory descriptions of the creative mind by Arnheim (1974), Bruner (1979, 1987), Duckworth (1987), Brittain (1979), Brittain and Lowenfeld (1982), Martin Gardner (1978), and Howard Gardner (1980, 1982) all stimulated and excited me. I read that each of us is inherently creative, that we each have the potential to come up with fresh responses to problems, that creativity is as important to the scientist and the mathematician as it is to designers and musicians, that the ability to function creatively is essential both for ourselves as individuals and for society as a whole. It is in the creative response that new solutions may be found for problems of all kinds.

As a teacher, I wanted to be sure that my teaching would bring my students to their own moments of creativity. Creativity is generally noted for flexibility, novelty, abundance, and individuality. Programs, such as Odyssey of the Mind, have been developed to help children practice creative problem solving. Studies indicate that creativity can be increased by jogging, being in a relaxed frame of mind, or meditating. How might we measure creativity? I hoped that my students' creative responses might be more colorful, use materials in a unique way, surprise me.

For this visualization I wanted to explore the concept of creativity with the students. What did they think about it? How did they show it? As time progressed, would their increasing comfort with the guided visualizations and relaxation have an impact on their creativity? This visualization is repeated later, the ninth in the series, so that we can compare students' use of colors, materials, and dimensionality in their two explorations of the same concept.
2.2 Transcript of Guided Visualization with Pat's Class

Creative Thinking

[Adrian explains to David and Shari what they missed the previous time: "We first relaxed ourselves and then we took a trip through our bodies. Then we tried making a picture of what we experienced. It could be 3-d, 2-d, 1-d."]

The exercise today is called creative thinking. This one is a little bit different from all the other ones, because it's the only one you're going to have to do twice. We're going to do it today and we're going to do it again, almost at the very end of doing all these, we're going to do it again in four weeks, the same one. I want to see what changes over time in how you think about how you think. Remember that I talked on Monday about what cognitive scientists are, the people who are interested in how your minds work. All the different cognitive scientists out there have what they call models, but it's not little three-dimensional things that they make, it's idea models, for what they think about how your mind works. I'm asking you today to think about what you think about how your mind works. And I'll be asking you again after I've shared a lot of different cognitive scientists' models with you during these things. Today I'm not going to share any, today I'm going to ask you what you think about it. After I've shared a whole bunch of theirs I'm going to ask you again what you think about it, and I'm going to see if you've changed it, see whether you still think the same way about your mind or whether you think differently about your mind.

Adrian: Are we going to draw or anything?

R: In the same way that we will every time, after we have the guided visualization, then we'll have an art project. So again, you will want to think about how to convert what you experienced during the visualization into some sort of project.

Here we go. I want you to sit comfortably. You need to sit comfortably so that your body is not touching your neighbor. [Quite a bit of time is spent settling the students down into appropriate spots.] Close your eyes and try to imagine that you are all alone in a very dark place. Begin to breathe slowly and very quietly, out... and in... and out... and in... This time, as you breathe in, feel the oxygen travel through your body to each muscle; as you breathe out, let each muscle release any tension inside it. Continue to breathe quietly, in... and out... and in... and out..., not thinking about anything except your breath.
Now, keep on breathing quietly and slowly, keep your eyes closed, and imagine that inside your brain the darkness is changing to light. It might get brighter slowly, the way a day gets brighter before the sun comes up, or it might switch on suddenly. Notice what color the light is. Does it have a sound? Your mind is not exactly like anyone else’s in the whole world. You think about things in your very own way. Take a minute of clock time, equal to all the time you need, to think about what is unique to you about your thinking. I want you to remember a time that you had an idea that you or someone else noticed was special. How did your mind think about it? [Pause.] Now let yourself notice the light coming through your eyelids. When you feel ready, quietly open your eyes.

I have a question for all of you. What did you notice is special about your mind? When you are feeling especially imaginative or creative, what is it that happens inside?

Shari: I feel happy. I feel like I might never do this again.

Jonathan: When I think about baseball, I feel terrific. [Laughter.]

R: What I’m asking you here is that almost anything can be creative thinking. Whoever invented baseball thought very creatively.

Joy: I’m making a present for my mom for Mother’s Day. I feel happy when I’m working on it.

R: When you’re feeling good about how you’re thinking and what you’re doing, and you’re doing something that is really creative, what process is it that’s going on in your mind?

Jaime: My head hurts when I’ve been thinking very hard.

Shari: I get tired if I work a long time, and I feel I’m going to fall asleep.

R: When I asked you to take that time during the visualization to think about how your mind worked, did you think of something, any of you? (Several students: No.)

Jaime: A lot of how I think is weird, it just happens.
Joy: My brain is under a clear cover, a purple glob under a clear cover, attached to the clear stuff are wires, covered wires. They end up with their ends uncovered at the very top of it. That's where the ideas go out, the ideas go to the ramp area and so on.

R: So you have different areas in your brain, Joy?

Joy: Yeah, I have different areas, and once an idea comes, it goes out.

Adrian: When you said about the creative, I thought my brain would be working much, much faster than it would be at any other time.

Jaime: When we thought of one time when you thought you were thinking really creatively, it was really strange. I actually wasn't thinking creatively. What went through my mind was something that happened when I was a baby. [He tells a story about washing his hair.]

Jonathan: [Talks about baseball cards and getting rich.]

R: Let me ask some specific questions, I want to go around and have every single one of you answer.

Shari: Well, I'd like to tell you what my brain looked like. It looked like a miniature earth with a big room in the middle. When I had to think of something a question popped up. And a fire started, and it started burning the question down, either burning a short while if I knew the answer, or it took a long time to go out for when I'm really thinking hard. And then after the fire burns out there are little sparks that fly out and travel through tunnels and that leads to my mouth if I say it.

R: OK, everybody close your eyes. Think about what your favorite kind of tree is. When you think of that favorite kind of tree, do you see that tree in your mind, is it a picture of a tree, is it a live tree that you know and love, or is it the name of a tree? That's the first thing I want to know.

Adrian: First of all I think of the name, and then it turns into a picture of the tree.

Jenny: I already have the picture in my mind.
R: You have the picture first. Fine. The first thing you guys need to know is that there are some cognitive scientists who believe that everybody does it all in pictures, and some cognitive scientists who believe that everybody does it all in words, and some cognitive scientists who believe that some of us have pictures and some of us have words. [Chorus of "That's right."]

Shari: I saw this big mountain and I almost ran into a tree, and then I found out what kind of tree it was.

R: Raise your hand if the first thing that went through your head when I asked you to think of your favorite kind of tree was the name of the kind of tree. So: Shannon, Whet, Jonathan, Christine, Joy, Jaime. If you saw a specific live tree, raise your hand. Jenny, Adrian, David, Graham, Joey, Erin, Shari, Joy. Some of you are doubling up. Stop a second, let's start this again. [After some discussion, the categories seem to be as follows: Name first—Jaime, Joy, Jonathan, Shannon, Whet, Christine. Tree first—Shari, Jenny, Adrian, Graham, Joey, Erin, David, Joy. Specific live tree—Joey, Erin, Adrian, Joy, Graham.]

Now I have another set of questions. I want you to close your eyes again. This time I'm going to ask you about the kinds of signals your mind is sending, inside of itself. On Monday, some of you talked about having little men with walkie-talkies in your brain, some of you talked about wires, some of you talked about your brain as a big blob. What I want to know today is: When your mind is sending signals around, what are they like? What's another way of thinking about those signals?

Adrian: Mine is that it sends numbers and letters: if it's sending information in words, it sends letters, like when I'm talking it sends letters; when I'm doing math or something, it sends numbers, it also sends numbers to make my legs move.

Jonathan: My kind of signals are like what coaches use. [Shows body signals used by baseball coaches, explains that it isn't the same as sign language.]

Joy: Mine is wires, sort of like an upside-down tree with a very stubby stalk, more like a spiral of wires.

Christine: My brain is like a little paper airplane, it unravels and delivers a message or it doesn't. If it's going to go to this side of the body it comes out that side [shows opposite sides], it goes out of a little slot.

[Discussion of ways to put her idea into practice.]
Whet: I have a picture of my brain. There’s a red background inside my brain with red laser shots traveling very, very fast.

Shannon: I thought of a rabbit carrying little slips of paper, into the places.

Jenny: Mine was a bird calling out, telling me what to sing and stuff.

Adrian: [Describes how he will put his letters on wires.]

David: Window in the side of my face. I see ideas inside on the other side of the window.

2.3 Transcript of Guided Visualization with Betsy’s Class

Creative Thinking

Today there’s one different thing about what we’re going to do from any of the other times. There are ten times we’re going to get together. This time, and the second-to-last time, in about a month, I’m going to be doing the same guided visualization with you, not to be boring, but for a reason. This one has to do with how your mind works and how you think your mind works. One of the things I want to find out, between this time and the other time, I will have been doing a whole series of things based on what different cognitive scientists think about how minds work. Cognitive scientists are people who study the mind and come up with ideas for how the mind works. What I'm asking you to do today is to think about what you think about how your mind works, and then toward the end, after you know what a lot of different cognitive scientists think about how people’s minds work, I'll be asking you again to see if you still think the same about how your mind works, or if it changes a little bit.

Sit in a comfortable position. Close your eyes and try to imagine that you are all alone in a very dark place. (A student: Are there spider webs? R: There may be spider webs in your dark place, but there are not in my dark place.) Begin to breathe slowly, and very quietly, in... and out... and in... and out... As you breathe in, feel the oxygen travel through your body to each muscle in your body; when you breathe out, feel the muscle relax its tension. Continue to breathe quietly, in... and out..., not thinking about anything except your breath.
Now imagine that inside your brain the darkness is changing to light. It might get brighter slowly, the way a day gets brighter before the sun comes up, or it might switch on suddenly. Notice what color the light is. Does it have a sound? Your mind is not exactly like anyone else’s in the whole world. You think about things in your very own way. Take a minute of clock time, equal to all the time you need, to think about what is unique to you about your thinking. Remember a time that you had an idea that you or someone else noticed was special. How did your mind think about it? [Pause.] Now let yourself notice the light coming through your eyelids. When you feel ready, quietly open your eyes.

What did you notice is special about your mind?

Lecia: It was bright, very bright.

Evelyn G: I took my hands off. See, I was going like this, and I moved it away [shows how she moved her hands from her eyes], so it was still light behind my eyelids, and I didn’t know you were going to say that.

Ian: The thing I thought was special about me was, all my brain did was thought about how to draw it, my hands thought about what it would look like.

Dandridge: It was sort of neat.

Katie: [Inaudible.]

Evelyn T: The light was kind of orangy-red, it wasn’t through my eyelids. (R: Did it come on fast or did it come on slowly?) Sort of fast.

R: How about for the rest of you?

Brooke: The light was immediately light green, it came on really fast.

Evelyn G: At first it was the lights through my eyelids, then it changed, turquoise to green to blue.

Evelyn T: It went from red to light orange.
Ian: Mine was all multicolored and then it turned to just white. There were birds chirping.

R: Does anybody else hear anything?

Brooke: I heard a humming sound. [Demonstrates.]

Colleen: You know what water sounds like when it boils?

Evelyn G: I heard wind through trees.

Colleen: I heard a piercing sound. [Screeches.]

Ian: Kind of like my guinea pig.

R: When you think, when you're having a good idea, how does it feel? How do you notice that you're having a wonderful idea?

Ian: I don't.

Brooke: Lots of times when you have an idea, it's already planned out for you.

Evelyn T: I get mine in bed, when I turn the light off.

Evelyn G: When I get my good ideas, sometimes I get that light I was talking about, and sometimes I have my eyes closed.

Ian: Sometimes I think of something weird, then I think, "No way, I was just like kidding around," then... Hey...

R: When you have an idea, is it a bunch of words or a bunch of pictures? (Sean: Pictures.) Are they sounds? Somebody in Pat's class had ideas they could feel with their body (A student: Yeah, that's what I had), like hand signals, they said it was almost like sign language.

Justin: Mine is feelings.
Evelyn G: Mine is usually sounds and pictures.

Colleen: Mine's a picture and then a sound of it.

Lecia: I say it to myself. (R: So you do words, but they're words out loud, not words silently.) Yeah.

R: Some people see words and some people hear words too. What I'm asking you to do is to try to identify what it is about your thinking that is how you do it. Cognitive scientists are pretty sure by now that not everybody does it the same way. There are a few people out there who really think everybody thinks in pictures, or everybody thinks in words. But there are only a few of them. Most cognitive scientists by now believe that different people do it different ways. There are kinds of categories, clumps of people who may do it one way or another way.

Justin: Can I do that again? I didn't get a really good impression.

R: Everybody close your eyes for a minute, and think about how you think. Try to remember yourself solving a problem. If you were in OM [Odyssey of the Mind], how you maybe would solve a spontaneous problem. (Panicky voice: We didn't solve it!) Not how you didn't solve the one on Saturday, how we do solve them, and we do solve them. When we're practicing and we have a really easy time coming up with answers, or when I asked you to do your art project on Monday, most of you came up with good ones really pretty fast. What was the process that you went through in your mind? Sometime recently that you solved a problem that you feel good about.

[Very disorganized discussion, at first dominated by the upset that several of them shared about their failure to solve a problem the previous week at the state OM finals. Then they start discussing how they want to show their particular ideas.]

Ian: I need yarn.

Evelyn G: I need some tissue paper.

Dandridge: It's hard to make it three-dimensional, I was having rocket ideas, sort of like fireworks, just different.
2.4 Discussion of Results

Graph 2.1  Use of Three-dimensions and Relief
(Creative Thinking Exercise)

Graph 2.2  Dimensionality, Colors and Materials
(Creative Thinking Exercise)

In response to this visualization, half of the girls created a three-dimensional project, their highest number ever, tying with the fifth exercise. Although the boys created a larger percentage of three-dimensional responses than the girls did, this was the boys’ fourth-ranked response. The average score for the twelve girls present was 2.58, and the ten boys dropped down to 2.85, so their combined score was third highest overall. The average number of materials used was the highest ever, with the girls using a greater number of materials than the boys used in any exercise. Color use ranked fourth overall, with the girls again using more colors than the boys.

Four girls created three-dimensional projects that did not use a rectangular paper or cardboard base this time, although three did use paper for their base in a way that fully integrated it into their design. Seven girls used unmodified panels of paper, cardboard, or matboard as a base for their work; of these, not a single one became 3-d. Six boys used unmodified panels of paper, cardboard, or matboard as a base for their work (of these, four became 3-d), while four did not use an unmodified panel as a base.
One boy, Dandridge (absent for the first visualization), used matboard as the base for his spectacular 3-d response. Before he made it, Dandridge said, "It’s hard to make it three-dimensional, I was having rocket ideas, sort of like fireworks, just different color lines."

Most of the verbal and visual responses from students in Pat’s class related directly to questions I had asked: "When your mind is sending signals around, what are they like? What’s another way of thinking about those signals?" Adrian said, "Mine is that it sends numbers and letters: if it’s sending information in words, it sends letters, like when I’m talking it sends letters; when I’m doing math or something, it sends numbers, it also sends numbers to make my legs move." Joy’s description was also very specific and vivid: "My brain is under a clear cover, a purple glob under a clear cover, attached to the clear stuff are wires, covered wires. They end up with their ends uncovered at the very top of it. That’s where the ideas go out, the ideas go to the ramp area and so on." Joy’s exuberant 3-d piece illustrates both that and her later statement, "Mine is wires, sort of like an upside-down tree with a very stubby stalk, more like a spiral of wires."

Christine made a complex 3-d piece to illustrate her concept: "My brain is like a little paper airplane, it unravels and delivers a message or it doesn’t. If it’s going to go to this side of the body it comes out that side [shows opposite sides], it goes out of a little slot." Whet told us, "I have a picture of my brain. There’s a red background inside my brain with red laser shots traveling very, very fast." A few children had an eloquence to their verbal statements which was not matched by the details in their visual responses, although they were consistent about the topic. Examples of this include Shari’s description: "Well, I’d like to tell you what my brain looked like. It looked like a miniature earth with a big room in the middle. When I had to think of something a question popped up. And a fire started, and it started burning the question down, either burning a short while if I knew the answer, or it took a long time to go out for when I’m really thinking hard. And then after the fire burns out there are little sparks that fly out and travel through tunnels and that leads to my mouth if I say it." Her drawing is complex and interesting, but doesn’t appear to be closely related. Lecia’s striking matboard cut-out head with a 3-d pipe-cleaner person in the brain appears to be unrelated to her statement that when she has an idea she hears the words in her head.

Projects look less similar to one another this time than they did in the first exercise. Those few not showing aspects of how the students think their minds work can be loosely grouped into responses to the idea of trees (there are four very different responses) or to the idea of light (two responses show light bulbs). Sean’s 3-d construction portrays a light bulb inside of a brain; Taylor’s mysterious construction may be intended to show light as well. Evelyn G shows a light bulb in addition to a tree. Many students, including Shannon, Jenny, and David, directly responded—in both words and images—to the concept of words and images. Shannon said, "I thought of a rabbit carrying little slips of paper, into the places," and she made a collage of toy animals
holding recipes. Jenny drew exactly what she described, "a bird calling out, telling me what to sing." David, responding both to the idea of a tree and to the idea of having ideas, created a 3-d version of what he had imagined: "Window in the side of my face. I see ideas inside on the other side of the window." These projects are literal to the images in the students’ minds, not to images specific to the guided visualization.

Unlike most others, Jaime’s verbal response—"When we thought of one time when you thought you were thinking really creatively, it was really strange. I actually wasn’t thinking creatively. What went through my mind was something that happened when I was a baby"—doesn’t seem to match what he made; instead, his beautifully constructed 3-d project again shows little men, this time outside of tall paper boxes, holding objects made of coated wire. This may have been a continuation of his project from the first visualization, as his description the first time included the idea that "when I was going through my body there were all these posts, it was like there were these boxes with men in them with walkie-talkies." His project for the first visualization appeared to be based on a portion of his vision related specifically to his brain, while this project seems based on his description of the men with walkie-talkies. He may well have decided to create a second model based on the first visualization, rather than on a vision that he had (but did not discuss) during the second visualization.
2.5 Gallery

Figure 2.1 Adrian

Figure 2.2 Brooke

Figure 2.3 Christine

Figure 2.4 Colleen

Figure 2.5 Dandridge

Figure 2.6 David
Figure 2.19 Sean

Figure 2.20 Shannon

Figure 2.21 Shari

Figure 2.22 Taylor

Figure 2.23 Whet
Exercise 3: Kinesthetic Learning

3.1 Overview

The third through the eighth exercises have a range inspired by Gardner (1983) in an order inspired by Bruner (1973). As I explained in the Introduction, I was fascinated by Gardner’s theory that each individual has a unique blend of intelligences, or ways of knowing or learning. My reading of Bruner convinced me that there would likely be an order in which these might emerge in a person. It seemed possible to me that my students, at nine and ten years old, might not yet have developed certain intelligences to the point that they could grasp information that I planned to present about these ways of knowing. So as not to introduce developmentally inappropriate material early in the sequence, I ordered the exercises beginning with ways of knowing and learning that are known to be present even in the very young.

This exercise, on kinesthetic learning, relates to our first year of life, when we learn to reach for objects, learn to walk, and begin to develop skill in controlling our muscles with our minds. I wanted to bring to the students’ attention an awareness of how they learn new physical skills and to help them see their imagination as a potential aid in learning new skills. I patterned this visualization after an exercise of Murdock’s entitled "Use Your Imaginary Body." Before starting the visualization I engaged the children in a brief discussion of "one minute of clock time," a phrase that I borrowed from Murdock, who in turn borrowed it from Jean Houston (1987). (This discussion is transcribed below, at the beginning of section 3.2.)

Because the kinesthetic intelligence develops very early in life, I was sure that the students would be able to understand the ideas presented in this exercise, and I hoped that this understanding would build a platform for comprehending the idea of many separate intelligences. I expected that the idea of imagining themselves doing a new activity well, and then in fact being able to do that activity better, would be intriguing to them. As well as focusing on the control of mind over body, I hoped that they would also be able to focus on the difference between mind and body.

During this exercise, unlike the previous two, the light was left on and the participants were asked to stand so that actual physical movement during portions of the exercise would be possible.
3.2 Transcript of Guided Visualization with Pat's Class

Kinesthetic Learning

R: Last time you may have noticed that I used a phrase, "one minute of clock time." Did any of you wonder what it meant?

Adrian: I thought that meant we were supposed to think it over real quick.

R: Here's what happens. How long is a microsecond, does anybody have any idea? (A student: A zillionth of a second?) Something around there. In a microsecond your brain can process millions of images, so in a minute, how many images do you think your mind can process? [Lots of numbers are mentioned, ranging from zillions to googles.] So when I give you a minute of clock time, I'm really giving you enough time for your brain, if it's feeling relaxed and calm, to make up a whole huge long story, or think up four hundred answers to whatever the question is, or just have an incredible number of different responses to what I'm asking you to think of, not just one idea. If you think about one idea, pretty much you'll end up having only one idea, but if you just leave your brain alone with one idea sort of sitting there on the edge of your mind, your mind can create billions of ideas. So that's what the clock time is for. I'm going to be using clock time a lot during visualizations. I just wanted to clear that up in case any of you wondered.

The guided visualization today is called **Kinesthetic Learning**. Have any of you ever heard the word "kinesthetic" before? The kinesthetic sense is our "imagined muscular sense of our body." We can take advantage of that—let me give you some examples and then see if it starts to make more sense to you.

When a baby is learning to walk, they watch other people... [Lots of restless behavior.] Should we do some breathing to settle ourselves before we have this conversation, would that help? Close your eyes and breathe in (quietly, Joey), and out...

How many of you have a younger brother or sister? (Jonathan: I got an older.) I'm asking about younger for a reason. If you have a younger brother or sister, have you noticed anything while they were learning to walk? Did you notice what age they were when they were learning to walk, for instance?

Joy: Mine hasn't learned yet.
R: David, how long ago did Ginny learn to walk?

David: I know it was sometime when she was one.

R: Do you remember while she was learning to walk, do any of you remember your younger brother or sister learning to walk, do you remember what it looked like?

Joy: My sister thinks that she can just stand up and take off.

R: Joy, very good description. Why do you think she thinks she can get away with doing that? (Joy: Because she doesn't know.) No, she does know something, what does she know about how other people walk? (Joy: They just stand up and take off!) So what's she doing? She's thinking that she's like other people that she's watched, and that she can do it just their way. Now, if a child has no older brothers and sisters and doesn't know any other little kids who are just learning to walk and they only know grownups, sometimes they don't get the idea quite so fast that they can learn to walk because they don't identify themselves with someone else who's small who's walking, but if you're the younger sibling of an older child who walks, you see that older child walking, you think to yourself, "That could be me," and then you just do it.

How about when you learned to ride a bicycle? Do you remember learning to ride a bicycle? Do all of you know how to ride bicycles? Raise your hand if you know how to ride a bicycle.

Jaime: I just learned a few weeks ago.

R: Jaime, since you're the most recent, what do you go through learning to ride a bicycle, could you tell us about it?

Jaime: For a long time I thought I couldn't do it, so then once I just got up on the bike and I went.

R: And after you could do that, you could always do it, right? Now what if, before you'd ever gotten on a bike all those times when you didn't think you could do it and you fell down, you pretended that you could do it, and you fantasized about doing it, and you watched somebody else do it, and you felt inside your body the feelings that you know now you need to feel on a bicycle. You know how you balance, you know how the bike really does hold you up off the ground and you don't just go flop over sideways right away or anything? What if you could feel those feelings in your body before you ever rode a bicycle? Could you
ride a bicycle faster if you did? [Interruption to deal with open glue bottles.] When you managed finally to learn to ride a bike, those of you who ride bikes, can you imagine, now that you know how to ride a bike, not knowing how to ride a bike? Just forgetting? Do you think you could just forget? (Several students: No.)

Adrian: I can if it was from a long time ago, if I didn't ride a bike for the next three or four years, the next time I got on I probably would at first have trouble, but then I'd remember how.

R: Well, I got a new bicycle recently, and I hadn't been on a bike in ten years, but when I got on that bike every single muscle in my body still knew exactly what to do. My mind might not have remembered how to ride a bicycle, but my body sure did. If I was worried about whether I remembered how to ride a bicycle, I could have sat down and closed my eyes and thought to myself about how it feels to ride a bicycle, imagined riding a bicycle, opened my eyes, gotten on a bicycle, and done it. No problem, because that's a kind of learning that your body knows how to do.

Today I'm going to give you the experience of trying that, not on a bicycle. I want you to stand where you are, move your chair back a little to be out of the way. [Lots of classroom movement.] Close your eyes, stand up straight, on both your feet with your feet a little bit apart from each other, just so you've got all your weight balanced really well over your feet. Close your eyes. Breathe deeply and quietly, in... and out... Now open your eyes. [Some students are upset that I left the lights on; I explain that we're going to need them.] I want you to raise your right hand out like this [demonstrating] and look at your thumb. Your hand should be about eye level. Focus your attention on your thumb. Keeping your feet still, move your arm around to your right, keeping on looking at your thumb. Move it as far to the right as you can. Now mark a spot on the wall—look at where your thumb is on the wall, and remember that exact spot.

Now you can move your arm back to the starting position, you can put your arm all the way down. We're going to do it just with our eyes this time. This time, look around with your eyes, as if you were following your thumb. Imagine that your arm is out in front of you and follow your imaginary thumb, all the way around, to a spot that's a little bit farther than where you were able to go with your real physical thumb, and mark that spot.

Now come back to center. Keep your feet still. Relax; stand still, please. Breathe deeply. This time we are going to do the exercise with our kinesthetic body. That time all you had was an imaginary arm. But you were still looking around with your eye, as if you had your thumb right out in front of you. Any skill you practice with your kinesthetic body is learned by your physical body. You may even feel your muscles moving as you do this exercise, but you won't be consciously moving your
physical body. You won't be trying to move your physical body, you'll just be imagining your physical body. Close your eyes. Lift your kinesthetic right arm. This is not your physical right arm, this is your imaginary right arm. Get a sense of your imaginary right thumb, imagine where it is, and begin to move your imaginary right arm around to the right as far as you can go. Just imagine it. You go past the first spot you marked and past the second spot you marked, and mark a spot on the wall with your imaginary right thumb as far as you can go. Now slowly bring your imaginary body back to the starting position and lower your imaginary arm. Open your eyes.

Now we will repeat this exercise with your physical right arm. Take a deep breath, lift your physical right arm to eye level, rotate your right arm all the way around to the right. Go as far as you can go without straining, keeping your feet still. Mark a spot on the wall. Now bring your arm back to starting position and notice how you feel. (Jaime: Ouch. Joey: I feel gooood. Joy: I could go even farther!) How many of you could go farther this time than you could earlier? Every one of you. [Lots of comments about the spots they got to.]

I have a question for you. What other skills can you imagine improving through imaginary practice?

Adrian: I could imagine my bicycle riding getting better, and when I caught balls, I'd be able to get better. If I pretended that something was coming, I'd pretend I'd get better at catching.

David: I'd get better at pogo ball.

Jaime: I could get better at aiming with a slingshot. I could get better at video games.

Shari: I could get better at horseback riding. I could imagine that I'm riding a horse, trotting, I could post him [showing it physically].

Jonathan: I'd get better at my hitting in baseball. After the game I'd always think of me hitting a home run out of the park.

Whet: Same thing, I'd imagine myself hitting a homer.

Joy: I'd get better at art.
R: When you think about getting better at art, what is it that you would like to be better at? [Joy shows with her hands and describes making a craft project for a gift.] You want your hands to do exactly what your imagination tells it to? Kinesthetic imaging is something that you can use to get better at all kinds of things you do, not just sports. Sports are a great one for learning that you can do kinesthetic imaging, but in fact, you’re absolutely right, Joy, that you can use that skill, that imaging skill, all by your very own self, in bed at night while you’re falling asleep, to get really good at anything that involves you doing something with any muscles in your body. You can learn to make your eyes move faster across a page to read faster, you can make your little tiny muscles in your fingers do very subtle little careful things, or you can make big muscles in your body do things.

Christine: I’d get better at volleyball.

Jenny: I’d get better at running.

Erin: I’d get better at basketball.

R: What is it about basketball that you’d get better at—throwing baskets, jumping, or tricking people, or what? Well, those are all parts of basketball, right? (A student: Fancy moves. Erin: All around.) It does help to break it down into little chunks, it helps a little bit if you think about the piece of it like the connecting with the ball if you’re trying to hit a home run, or the way your feet leave the ground while the ball is leaving your hands while you’re making a basket. So that you just take that little tiny piece of the action and you imagine it going exactly the best possible way. You can do it with every single tiny piece of a game. In a series of different imaginings or even in one imagining, but it’s good to visualize each little tiny piece.

Here’s what I need you to do. Close your eyes… [Complaints of “Oh, no, again…” from students.] Yup, this is the last time today. Close your eyes and breathe deeply. Think about the skill you would most like to improve. Take a minute of clock time to imagine yourself doing this thing in precisely the way you wish you could do it. Every detail. (Adrian: What happens if you have two or three things?) Pick one, just pick the first one that pops into your mind, and take all sixty seconds for it. Here we go. [Sixty-second pause.] When you feel ready, open your eyes.

Shari (dreamily): I won first place in the horse show.

Jonathan: [Shares his baseball fantasies.]
R: We don't have time to hear what everybody wants to improve. What I'm going to ask you to do today for your project (we only have fifteen minutes left) is to find a way... This is hard, I'm not asking you to show what you just imagined, I'm going to ask you to find a way to express the relationship between your kinesthetic body and your physical body. I want you to do an art project on the relationship between your kinesthetic body and your physical body. Go for it. [Some start working, some express total confusion.] It's the same kind of projects it has been. You can make a picture or a model or whatever, but what I'm asking you to do it about isn't you hitting a home run, or forty home runs, or anything like that, but is in fact that difference in you between being a physical person—we're all here in our bodies, right?—but when I asked you to close your eyes and think about you doing something, that person who was doing it was not your body that is here right now, that person who was doing that in your mind was your kinesthetic body. That was your imaginary body. What's the difference between your imaginary body and your physical body? How would you want to share that idea? This is a chance to think about the relationship between your body and your mind.

3.3 Transcript of Guided Visualization with Betsy's Class

Kinesthetic Learning

[By accident, the tape player was not turned on during the first part of this exercise. Because I was concerned about the extra time the exercise had taken with Pat's class, I stayed closer to my original plans the second time around. What follows is what I had planned to say.]

Last time you may have noticed that I used the phrase "one minute of clock time." I was surprised that none of you asked about it, but I thought I should explain it today anyway. Your brain processes millions of images in microseconds, so when I give you a minute to visualize something, you have plenty of time to see lots of things, even very complicated things which it might take much longer to say or to illustrate. We'll be using clock time again today during the guided visualization.

The guided visualization today is called Kinesthetic Learning. The kinesthetic sense is our "imagined muscular sense of our body." We can use this image of our body to learn something new. When a baby is learning to walk, they may do it faster if they watch someone else walk, imagine that they are walking, and then try it themselves. When you learned to ride a bicycle, you may have used your kinesthetic sense to feel how to hold your body and tilt for curves, or you may have fallen loads of times before
your body felt what it needed to do. If you did it well on practically your first try, your kinesthetic body probably was helping you.

Today we’ll begin the visualization standing where we are. Close your eyes for a moment... Breathe deeply in... and out... Now open your eyes. Balance your weight evenly on both feet (move them a bit apart if you need to), and breathe quietly. Raise your right hand to eye level, and focus your attention on your thumb. With your feet still, move your arm around to the right, looking at your thumb, and see how far around you can go. Don't strain yourself. Now mark an imaginary spot on the wall where you have turned, and bring your arm back to starting position.

Now we’re going to repeat this exercise without moving our arms, using only our eyes. Without lifting your arm, move your head around again to the right, leading with your eyes, and mark an imaginary spot on the wall. This spot will probably be farther than the first one you marked with your thumb. Now come back to center. Relax and breathe deeply.

We will now do this exercise with our kinesthetic body. The kinesthetic body is our imagined muscular sense, or imaginary body. Any skill you practice with your kinesthetic body is learned by your physical body. You may even feel your muscles moving as you do this exercise, but you won't be consciously moving your physical body.

Now close your eyes and lift your kinesthetic right arm. This is not your physical right arm but your imaginary right arm. Now get a sense of your imaginary right thumb, and begin to move your imaginary right arm around to the right as far as you can go. You go past the first spot you marked and past the second, and you mark a spot on the wall with your imaginary right thumb as far as you can go. Now slowly bring your imaginary body back to starting position and lower your imaginary arm. Open your eyes.

Now we will repeat this exercise with your physical right arm. Take a deep breath and lift your physical right arm to eye level, and rotate your right arm all the way around to the right. Go as far as you can go without straining. Mark a spot on the wall. Now bring your arm back to starting position and notice how you feel. Did you move farther this time than you did at the beginning of this exercise?

[In the unrecorded discussion that followed the visualization, I asked students, "Could you move farther?" and "What other skills can you imagine improving through imaginary practice?" Toward the end of the discussion, I discovered the not-turned-on tape recorder and turned it on. Some students were surprised that I was recording the visualizations.]
Evelyn T: Why were you recording us?

R: I have to keep track of what the differences are between the kinds of things that we say here and the kinds of things that Pat's class says. When I go back and look at your art projects, it helps to be able to say, "Oh yeah, so-and-so said this," and then I know something about the relationship between the projects you made and what you were saying.

Close your eyes and breathe deeply. Think about the skill you would most like to improve. Take a minute of clock time to imagine yourself doing this thing in precisely the way you wish you could do it, in every detail. (Evelyn G: Can it be anything?) Umm, anything that you can do with your kinesthetic mind for your physical body. [Sixty-second pause.] When you feel ready, open your eyes.

For your project today, I want you to find a way to express the relationship between your kinesthetic body and your physical body.

Ian: Impossible! That's too hard.

Justin: There is no relationship.

R: Between your kinesthetic body and your physical body? How about when we did the spot together? When we were doing the imaginary spots on the wall with our imaginary right thumbs, what was the relationship between your kinesthetic body and your physical body?

Justin: None.

Ian: You were both moving your arms.

R: No, when you guys were doing your kinesthetic body, I did not see any arms going around. I saw some bodies rotating a little bit...

Katie: I did feel my arm heavy, like it was in the air.
Lecia: Mine too.

R: ...but those arms were not up. My eyes were open, and your arms were not up.

Katie: They weren't?

Ian: They feel like it.

Katie: It felt like it was tired, up like that.

R: Your arms were not up. Your kinesthetic arms were up, and we know that your kinesthetic arms were up because later, when I had you do it again with your physical arms, you were able to rotate much farther than you had been able to before. (Justin: Yeah.) But your kinesthetic arms and your physical arms are not the same thing. Learning it with your kinesthetic arms gives you a chance to do it with your real arms later, but you were not doing it with your real arms. I want you to think about that relationship between your imagined body and your physical body, and I want you to find a way to express that.

Katie: Like last time I said that I could feel things, I could feel the weight and...

Justin: I'm not sure that I could do that.

R: Here's my physical body, OK? My physical body is here, but I can be thinking about something else, right? And even if I'm sitting here and I'm thinking about swimming, say I'm thinking about swimming extremely fast and doing my arms and my kicks in the right sequence and my breaths all coordinated properly which I always had trouble with... [More about swimming.] Well, I can sit here, and my physical body is here, but my mental body, I can sit here and I can be like you were with your eyes closed just now. Were some of you doing something with your minute of clock time?

Justin: Yeah, but I was right here. (R: You were doing something that was right here, what were you doing?) Imagining. (R: You were imagining yourself imagining even better than usual? I see, OK.)

Evelyn G: See, you know when I was talking about, I decided, I would make a picture when I get ideas. I had a picture in the glue.
R: What's the difference between your body and the things that you think about?

Ian: You're limited with your body but not with your mind.

R: No, because I'm saying that anything you can do with your kinesthetic body you can do with your body—things you can truly do with your kinesthetic body you can also do with your physical body.

Ian: Yeah, breathe under water.

R: OK, your physical body has more limitations than your kinesthetic body.

Katie: With your physical body you can't do as much before. And then once you imagine yourself doing it, you're different. It's like, umm, you can go for it, it's like a teacher.

R: You can use your kinesthetic body as a teacher, exactly.

Evelyn G: See, I was imagining me kicking the ball, part of my foot hurt when I kicked it.

R: All right. The next time you do that kinesthetic exercise with yourself you might want to go very deliberately after imagining where your foot connected with the ball and it didn't hurt. So that each time that you do this you might improve it a little bit. You might say, "OK, that's not quite perfect yet."

Evelyn G: You can feel it. I can feel it.

R: You do. Your kinesthetic body is going to have those real feelings. It's going to have the heavy arm, it's going to have the hurt toes if you didn't hit it quite in the right direction. It's going to have not hurting toes but an incredible sense of impact if you hit it exactly right. You can feel those things in your body.

Colleen: I visioned me, or whatever you call it, myself running in the Olympics, you know how exercise people say, "Feel the burn"—I felt it in my leg.
R: You’ll be able to do that. The question here is, the project today, in the ten minutes we have left, needs to somehow go after that difference, or that not-difference if it’s a not-difference for you, between your kinesthetic body and your physical body.

Ian: Let’s start.

Justin: Then I’ll just get a sheet of paper and I’m done, since there is none.

Brooke: Can we draw what we imagined?

Evelyn: I don’t know how I’m going to do it.

R: You may draw, you may build a model, you may use anything that’s in here. Again, as other times, you’re welcome to use fabric or fake fur or yarn or anything like that that’s not in here; I’ll go get it for you.

Dandridge: I don’t know. The first time we imagined or the second time?

R: You don’t need to in any way look at anything you already imagined today. What you need to look at is what you learned about the difference between kinesthetic and physical. [Inaudible question.] If that’s the most you learned about the difference between the kinesthetic and the physical, sure. If you can think of something that expresses that difference between those two better than that, then go after that.

Dandridge: Oh my God, how am I supposed to do that?

R: I don’t know, Dandridge. What’s the difference for you?

Dandridge: There’s no relationship. They’re two different bodies.

R: If they’re two different bodies, then show them as two different bodies. And if they’re the same thing, show them as the same thing. And if one of them has a different number of dimensions than the other, show the different number of dimensions from the other. You are going to do something that in some way shows for you the difference between the kinesthetic body and the
physical body. [By this time, many are busily at work, several are still confused.] Anybody who still needs to talk about it, come on up here. Anybody who is happily at work, stay happily at work.

Sean: I'm going to draw a picture of what I imagined. (R: Fine.)

Justin: The kinesthetic body is there, but it's not there.

Ian: OK, Justin, you're making a lot of sense today.

R: How would you show what's imagined, or more pretend?

3.4 Discussion of Results

The responses to this visualization were among the least three-dimensional, with equally limited use of colors and materials. Most students began by using flat materials as a base. Several students reversed their boards, and a few built up three-dimensional portions using pipe cleaners. A small number of students did 3-d projects—about half of the boys and one fourth of the girls—but even these were unusually flat in character.

Most of the students in both classes had a hard time with the specific assignment. When I said to Pat's class, "For your project today, I want you to find a way to express the relationship between your kinesthetic body and your physical body," Ian said, "Impossible! That's too hard." He went on to make a beautiful three-dimensional depiction of his physical self in his brain. Most students didn't complain as vocally as Ian but made relatively uninspired drawings, often depictions of themselves successfully accomplishing a physical goal or representations of themselves doing a pair of identical activities with physical motion indicated in one of them. Among the few 3-d versions of these are Lecia's and Evelyn G's constructions of sports accomplishments and Evelyn T's double self-portrait on skis in motion and on stationary skis. The most abstract response, and probably the one most directly linked to the stated assignment, is Joey's simple 3-d piece using fishing line and black pipe cleaners.
The concept of kinesthetic learning seemed to appeal to the students, and they did appear to grasp the concept. During the visualization they were all successful in following the instructions to reach a spot with their imaginations that was farther than they had been able to reach physically, and then trying to point physically to that same spot. They were readily able to come up with activities (including Joy’s suggestion of making artistic objects) when I asked what they might want to get better at if they could use their mind to help their body. (Later discussion, after the fourth visualization, confirmed this.) As Katie said, "With your physical body you can't do as much before. And then once you imagine yourself doing it, you’re different. It's like, umm, you can go for it, it's like a teacher." Perhaps students found this to be a difficult exercise because I gave the specific instructions after I had concluded the visualization, which left them less time to consider what they might want to make. Perhaps the instructions required a level of abstraction which they were not engaged by. In any case, their responses typically reverted to the part of the exercise that focused on improving physical skills.
3.5 Gallery

Figure 3.1 Adrian
Figure 3.2 Brooke
Figure 3.3 Christine

Figure 3.4 Colleen
Figure 3.5 Dandridge
Figure 3.6 David
Figure 3.19 Shannon

Figure 3.20 Shari

Figure 3.21 Whet
Exercise 4: Intra- and Interpersonal Knowing

4.1 Overview

"The competences achieved during the first year of life fall roughly into five broad headings of which four are quite straightforward: feeding, perceiving or attending, manipulating the world, and interacting with members of the species. There is another that is somewhat more subtle; it has to do with control of internal state." (Bruner, 1973)

The personal intelligences are essential to human survival. Our relationships with family and with community become more and more conscious over time, with substantial development in the first two years of life (Bruner, 1973, 1987). By the time children are four, they generally have an interest in other people and remarkable attention to others’ motives and feelings (Dunn, 1987).

Learning how to communicate with others is so fundamental to human beings that those few who cannot learn to do so ("autistic") are considered truly disadvantaged. This communication does not necessarily include the use of language, as it begins before children are able to talk and can also be observed between humans and other species.

On the other hand, an awareness of self in more sophisticated and verbal terms that reach beyond basic needs is unlikely to occur before adolescence (Bruner, 1973). Because the children in the study could not be expected to have reached that higher level, and indeed might not have the vocabulary to describe their relationships in more sophisticated terms, I thought it best to provide an open-ended guided visualization. Specifically, I wanted my students to have the experience of wishing to communicate with someone else without the benefit of spoken language, because I wanted to see what they imagined that communication might consist of. I also wanted them to have an opportunity to imagine sharing that communication with a person familiar to them, partially to see whether their experience was richer in one area or the other.

In this exercise, I asked the students to look around the room at everyone in it before they closed their eyes. Then, in a darkened room, I led them through the experience of meeting an unnamed animal that was not described. I asked them to find a way to communicate with that animal, and then asked them to return eager to communicate with a person familiar to them. I was curious about what sort of animal they would meet, what they would regard as communication, and who they would look forward to sharing the experience with. In their visual responses, would the students be more likely to show their nonverbal experience or their return to a familiar person?
4.2 Transcript of Guided Visualization with Pat's Class

Intra- and Interpersonal Knowing

[The students come in extremely hyper, ask to sit on chairs, take a while to get quiet.]

On Monday, someone in Betsy’s class asked an interesting question. That’s whether next time I was going to teach them how to read minds. [Various responses: “Oh yeah, yeah, yeah,” “We’d love it”....] I thought that was an interesting question, because in a way that is exactly what this time is about. Think about this: there is one person in the world whose mind you can pretty predictably read—who’s that? (Several students: Yours.) Now, as far as everybody else goes, you can tell what they are thinking sometimes, or maybe even all the time, or maybe never, depending on how well you know somebody and how good you are at looking at other ways of communicating than words. There’s a whole set of ways we communicate, other than how we use our words, that show this. What are some things? (Various students: Sign language. Facial expressions. Body expressions. Lip reading. Hand expressions.) What are some other things? (Several students: Writing. Drawing.) Writing implies words. Direct from people, not intervened by tools. (Another student: Eyes.) When you can tell what someone is thinking, you’re picking up on a lot of nonverbal signals, right?

Today the exercise is called intra- and interpersonal knowing. Intrapersonal knowing is the stuff you know about your own self, and interpersonal knowing is stuff you know about other people.

Sit comfortably. Before you close your eyes, I want you to look around the circle and notice that you are part of a group that you know everyone in quite well. You’ve known each other for a long time. Right? This whole school year, if nothing else. Now I want you to close your eyes and listen to our quiet breathing as we all begin to breathe slowly, in... and out..., in... and out..., in... and out. As you begin to breathe more slowly, let go of any tension you feel in your body. Your body relaxes more and more, and you can feel your heart slowing down slightly. As you keep your eyes closed and your body still, you begin to feel quite calm.

Keeping your eyes closed, begin to imagine you are walking alone through a forest. Beneath your feet you feel last year’s leaves gently padding your footsteps. As you walk past the different kinds of trees, their shade is cool on your skin. You are enjoying your walk alone in the woods and begin to consider how you might want to spend your time. Gradually, you realize that you are not alone in the woods. A small animal is watching you from a shady hollow. You suddenly find that you are quite small and
follow it to its home under the earth. Take a minute to get to know this animal. It wants to communicate with you, and you find you can understand it quite well. [Pause.] You know you will want to share what you have learned. Leaving the animal’s home, you slowly walk back through the forest. As you leave the shade of the trees, you see the person you are especially eager to tell about your adventure.

In a moment I will begin to count to ten. You will join me in counting after I reach six. You will feel relaxed and eager to share your experience. One... two... three... four... five... six... (With students: Seven, eight, nine, ten.)

R: Was it weird? (Several students: Yeah...) Did you meet an animal? You all met animals?

Shannon: I met a rabbit.

Shari: A bunny rabbit.

Adrian: I met a squirrel.

Joy: But squirrels don’t live under the ground.

Graham: That doesn’t matter.

R: That doesn’t matter. What else did people see? This isn’t a rational experience here, this is your subconscious mind. You notice I didn’t tell you you had to have a furry animal. Who had a not-furry animal?

[Unidentified voice]: I just had a little blob staring at me.

David: I was cold.

Adrian: I feel a little cold.

R: It is a little cold in here, actually, and walking through the shady woods made it worse, there’s no question. I got real cold as soon as I started reading about it. Who had other kinds of animals?
Jaime: A neat, neat wolf. They’re one of the easiest animals to understand beside dogs.

Whet: I had this little light brown guinea pig [starts complete description].

R: Did any of your animals tell you anything?

Joy: Mine showed me its babies. (R: That’s pretty important.)

David: Mine was a squirrel with a little miner hat with a light, and he had these gloves on, it took me down a little cart he was in, and he dug a big hole which was neat.

Shari: My rabbit was trying to tell me how hard it was for him to live because of all the mountain lions out in that woods.

Christine: My rabbit showed me its family album. (R: I love it, what did it look like?) It had all these rabbits running around with balloons tied to their ears. (Adrian: Were they helium?)

Whet: Mine didn’t tell anything, it was sitting by this tree in a rocking chair.

R: Jaime, did your animal try to communicate something specific to you, that you were able to figure out?

Jaime: Just teach the language, mostly, the language of the wolves.

Joy: My animal gave me a key that if I touched I’d be back there.

R: Cool, did anyone else have an animal that gave them something?

Jenny: Mine took a big rock and threw it at me. (R: Ooh, it wasn’t very friendly then. Adrian, to Jenny: What was yours?) A chipmunk.

Adrian: Mine gave me some nuts.
R: Was it like getting to know a person?

Jaime: Sort of, just it's harder to learn. (R: What was harder about it?) Because it's not the same language.

Christine (squealing and giggling): When I walked out of the woods, you said if you see someone, well, I saw half of Erin and half of my mother.

R: Who else saw someone interesting when they came out?

Shannon: I saw my mom and I guess it was Kristen.

Jaime: It was either Justin and Adrian or it was half Justin and half Adrian.

Shari: I saw Missy; she's a girl that goes to my church.

Joy: I saw my sisters, both of them.

Shari: For a minute I saw ants walking through the rabbits' tunnel, like they dug through there and they never got out and they were really like that big or at least their head was.

Whet: I saw Adrian.

R: Today, same deal: I'm not asking you to make something that is terribly hard to imagine. I want you to make something about your experience. It can be anything about either this experience or about how you know people or how you know yourself. You can share your experience today in any way you want, or anything else you know about inter- or intra-personal knowing.

I'm going to remind you that in addition to the materials that are right in this room it's OK to use yarn, cloth, fake fur, magazines, other scraps that are around. Just if you're using the stuff that's always around, check with me.
4.3 Transcript of Guided Visualization with Betsy's Class

Intra- and Interpersonal Knowing

Go ahead and sit down, everybody; if there's stuff in your way, just push it aside. Yes, I turned on my tape this time. Remember, on Monday, one of you asked whether we were going to work on reading minds. Who was it who asked, Dandridge? And I said yeah, actually, that was sort of what we were going to do today. Whose mind you can pretty predictably read? (Various students: My mom's. My dad's. Yours.) There are a lot of people you can sometimes read, whose mind can you always read? (Ian: I can read my mother's like a book.) Can you read your own minds? (Another student: I can't read my own.) [Interruptions from students from the other session who are trying to finish and leave.]

Evelyn G: You know that thing we did last time... (Someone else: Kinesthetic.) I tried it before my soccer game and it worked.

R: Did anyone else have any experiences with kinesthetic learning? [Sports, music, and ballet are mentioned.] So it turned out to be useful. That's cool.

Those of you who can tell what other people are thinking besides yourself, which sounded like everybody in here has somebody who they can pretty much tell... [Students talking all at once about who, and what, with a focus on angry parents.] When you can tell, what can you tell from? (One student: By her face.) [Long digression from hyped-up students—they are all anticipating an exciting afternoon and are extremely unsettled.] Other than using words... [More interruptions from the group.]

I'm going to ask you to do something today while we are doing guided visualizations. Today you're going to have a chance to get to know a creature very, very well that can't do words with you, so you have to look for other ways. [More excited talk.]

Let's go ahead and start this. I'd like you to put down anything you've got in your hands, and fold your hands in your lap... and sit comfortably. Before you close your eyes, I want you to look around the circle at everybody, look around the circle, look around the room, and notice that you are part of a group of people who you know quite well. I'd like you to close your eyes and listen to our quiet breathing as we all begin to breathe slowly, in... and out..., in... and out..., in... and out. As you begin to breathe more slowly, let go of any tension you feel in your body. Notice that as your body relaxes more and more, you can feel your heartbeat slowing down slightly. As you keep your eyes closed, you begin to feel quite calm.
Now begin to imagine you are walking alone through a forest. Beneath your feet you feel last year’s leaves gently padding your footsteps. As you walk past the different kinds of trees, their shade is cool on your skin. You are enjoying your walk alone in the woods, and you begin to consider how you might want to spend your time. Gradually, you realize that you are not alone in the woods. A small animal is watching you from a shady hollow. You suddenly find that you are quite small and you follow it to its home under the earth. Take a minute to get to know this animal. It wants to communicate with you, and you find you can understand it quite well. [Pause.] You know you will want to share what you have learned. Leaving the animal’s home, you slowly walk back through the forest. As you leave the shade of the trees, you see the person you are especially eager to tell about your adventure.

In a moment I will begin to count to ten. You will join me in counting after I reach six. You will feel relaxed and eager to share your experience. One... two... three... four... five... six... (With students: Seven, eight, nine, ten.)

R: What sort of animals did you meet?

Colleen: I met a little midget thing about as big as this, that looked like a big puffball. (R: What did it want to let you know? What did you find out about it?) Let the [inaudible] go, I was in a black forest.

Evelyn T: Mine was like a baby raccoon. And it asked me if I wanted to have something to drink, and it offered me tea.

Evelyn G: Mine didn’t look like any kind of animal, it was a mixture between a whole lot of animals, and it’s about that big [indicating about eight inches]. It just, it wanted me to sit down and rest, and it wanted to play a game with me, it was this thing that was like Monopoly with cards.

Katie: Mine was my cat and she wanted me to stay with her.

Brooke: Mine was a lion and he wanted to tell me—well, he gave me this knuckles thing, and he said if I wore it through the forest I could get back safely.

Lecia: I wasn’t in the forest, I was in my house, and my animal was my cat and she was telling me she wanted to go out.

Ian: Mine was my little guinea pig, it told me what it always told me, it wants food or water, or it wants to be petted.
Taylor: Mine was a worm, a long nightcrawler. It was this teensy little hole, I sort of shrunk and crawled in the hole. (R: Was it nice in there? Did you change into a nightcrawler too, or were you a little you?) I was me and it said, "A cup of coffee?"

Dandridge: I was like a little rodent of some kind, kind of green. I got down in the shelter or hole or whatever it was, and it said, "Let's go raid the refrigerator." It was a real refrigerator.

Evelyn G: My shady hollow was in a telephone pole.

Evelyn T: Mine wasn't, it was in an oak tree.

Sean: Mine was like a worm about that long and about that fat. (Dandridge: It sounds like Sean and Taylor are exactly alike.) No, mine was like this long. (R: Did it tell you anything?) It didn't try to tell me anything.

Justin: I don't want to tell about mine.

R: Let me ask another question. At the end when I said you saw the person you want to tell all about it to, did everybody have somebody? [Most say they did, but not all.]

Evelyn G: Mine was a bird.

Katie: Mine was my cat's mother.

R: On Monday I asked you to do something really hard with the visualization, remember? Today, in all those sidetracks we had at the beginning, did I remember to tell you what this one was called? (Ian: Reading somebody's mind?) No. It's called intra-personal and inter-personal knowing. Intra-personal is what you know inside yourself, whether you know what's going on in your body and what's going on in your mind and how you're feeling and what you're thinking and where you hurt or where you feel good—that's intra-personal, that's inside you. Inter-personal is that stuff you can do between you and the other people who you know; it varies how well we are able to do it. We vary a lot from person to person, how good we are at picking up on those clues, and we also vary ourselves in how well we can do it with the different people who we know. There are people who, I look at them and I never know what they're thinking. They're like a brick wall, I have no idea what's going on in them. And other
people, it's like you each described with mostly family members, where you just know what's going on in their mind, you can tell from lots of little tiny clues they send out.

For your project today, you can either share something about this experience you had in the woods, or you can share anything you want about those kinds of knowing. (Dandridge: Do you do the same stuff with Pat's class? R: I do pretty much the same stuff; they have very different responses to it. That's one of the reasons I do it with two different groups. There's always the chance in a group that everyone will suddenly decide to do a project that looks like everybody else's, because they think they saw a great idea. With two different groups I'll at least have two different sets of ideas. That's one reason I don't leave their stuff out for you to look at.) Same materials. Again remember that there is always cloth and yarn and fake fur and old scraps and magazines and stuff that you are welcome to use. And anything else of Cherry's, something that she would have gone out to buy, check with me first. You may draw a picture, you may make a collage, you may make a model, just go for it.

4.4 Discussion of Results

Almost as many girls as boys created three-dimensional responses to this exercise, and as many girls did so for this as in the second exercise. Yet the overall scores are quite low, because only one boy and one girl used relief. Fully half of the ten exercises had more multi-dimensional responses than this one. Nearly all other exercises had responses using more colors and materials. The most notable feature is the liberal use of fake fur, which had been available to them to use in the earlier exercises, but which no one used prior to this one. (I may have unintentionally tipped that balance even further by reminding the students that fake fur was available—a response on my part to their many descriptions of furry animals.) Responses using fur are scored as two-dimensional with relief if the fur is glued to a background, and scored as three-dimensional if the art is reversible (as when fur has also been placed to cover the back side) or if it has additional 3-d parts attached.

Verbal responses about the students' visits with animals were descriptive and interesting. For example, Christine said, "My rabbit showed me its family album. It had all these rabbits running around with balloons tied to their ears." Joy said, "My animal gave me a key that if I touched I'd be back there." And Evelyn T explained, "Mine was like a baby raccoon. And it asked me if I wanted to have something to drink, and it offered me tea." In each case, the imagined animal bears a fair resemblance to the ones that inhabit children's storybooks: all these animals behave like people, act in predictable human ways.
Graph 4.1  Use of Three-dimensions and Relief
(Intra- and Interpersonal Exercise)

Graph 4.2  Dimensionality, Colors and Materials
(Intra- and Interpersonal Exercise)

Only Jaime, in his verbal response, indicates the need to understand communication on the animal’s terms: "A neat, neat wolf. They're one of the easiest animals to understand beside dogs." He indicated what the communication consisted of: "Just teach the language, mostly, the language of the wolves." Interestingly, Jaime was the only participant who made a portrait of himself communicating with a friend in his visual response.

Altogether, ten girls and five boys made visual responses to the portion of the visualization in which they were communicating with an animal. These responses were almost entirely literal representations of specific visions the children had during the visualization. Only one student besides Jaime made a visual response to the final vision of the exercise, drawing the people they saw when they returned from their adventure. As far as I can tell, no one successfully created an abstraction about the idea of communication, although both Joey and Adrian made somewhat mysterious projects that may have arisen from that idea.
4.5 Gallery

Figure 4.1 Adrian

Figure 4.2 Brooke

Figure 4.3 Christine

Figure 4.4 Colleen

Figure 4.5 David

Figure 4.6 Erin
Figure 4.19 Shari

Figure 4.20 Taylor
Exercise 5: Sense and Perception

5.1 Overview

I wanted to include all of Gardner’s posited "intelligences" in my study, which was conducted in 1989. At the time Gardner wrote that he thought there might well be other intelligences, and since then he has published thoughts on additional ones. After investigating possible justification for "naturalist," "spiritual," and "existential" intelligences, Gardner concluded in 1995 that there is sufficient evidence for adding the "naturalist intelligence" to the list ("Multiple Intelligences After Twenty Years," paper presented at the American Educational Research Association, Chicago, Illinois, April 21, 2003). Had he proposed the naturalist intelligence prior to my study, I would likely have chosen to include the concepts in this very exercise, as his "musical intelligence" has been expanded here to include all intelligences that are, in their earliest development, based on sensory input.

The design of this fifth exercise, Sense and Perception, arose from my reading of Arnheim (1974), Brittain (1979), and Bruner (1973). These writings convinced me that children of nine and ten—the age of my participants—should be capable of understanding concepts about sensory input. Further, Bruner and Murdock (1987) both presented data on the frequent overlapping of sensory input (synesthesia), typically experienced as the color of a sound (as the artist Wassily Kandinsky was persuaded was the case) or the taste of a color.

An important factor that contributed to the design of this exercise was my concern that some participants might be unable to understand intelligences that they did not themselves have. For me, Gardner’s musical intelligence is the most difficult to understand, presumably because I am utterly lacking in ability in that area. If everyone has a unique blend of intelligences, with one’s ability within each intelligence independent of one’s ability in other intelligences, then a group of students might have widely differing abilities to learn different types of information or through different types of presentation. As students were being exposed to ideas that might be beyond their ability to comprehend, I didn’t want them to feel overwhelmed or confused. By clustering musical and spatial intelligences and adding the other senses as a combined block of different sensory inputs, I hoped not to leave anyone out. I saw this exercise as a chance for all the students to express what they themselves perceived to be their most important sense, whether it was related to sound, sight, smell, taste, or touch.
5.2 Transcript of Guided Visualization with Pat's Class

Sense and Perception

This one I don’t think needs an introduction. Could you each sit comfortably. (Joy: I'll never be comfortable.) Close your eyes, please. Close your eyes and begin to breathe slowly, as usual, in... and out... [the group has trouble settling down] and in... and out... and in... As you begin to breathe more slowly, let go of any tension you feel in your body. You feel more and more relaxed.

Keeping your eyes closed and your body still, begin to imagine you are walking through a field. You are aware of each of your senses. You can feel your feet touching the earth. A breeze is blowing, moving plants and touching your skin. [Pause.] The sun is warm. Buds on the plants are bursting open in colors and shapes you have never seen before. You touch a plant and feel the texture of its leaves. You gently break the stem and smell the juice in the plant’s stem. Touch it with your tongue. The taste is not what you expected. Smell the fragrance of its flowers. You can hear birds singing. You pay careful attention and are able to learn their songs. You feel the breeze lift you gently into the air, and you begin to fly above the field in larger and larger circles. Looking down, you can see the paths your feet made through the grass in the field where you walked. You can see a very long distance, but it is time to begin your flight back to the place you began.

You land, and you get ready to open your eyes. Your senses will remember everything you saw or heard, smelled, touched, or tasted. You will feel relaxed and alert and ready to share your experience. One... two... three... four... five... six...

Which sense was the most vivid for each of you? What are your senses? Which is the one you noticed the most in this visualization today?

Joy: Touch.

Shari: Smell.

Whet: Sight.

Jaime: Sight.
Adrian: Tasting.

Graham: Sight.

Joey: Touch.

[Three others all say "Sight."]

Shannon: Touch. (R: What was the thing you touched that you remember the feel of the most?) The flower.

Shari: I had two actually, the air rushing against me flying. I could see it equally as well as I could smell. The smell was like sweet poppies, and all the flowers [inaudible]. [Interruption.]

R: Did any of you hear the birds singing?

Shari: I heard the birds singing, it was mockingbirds, and I heard "Toot." [Assorted bird sounds from many students.]

Christine: [Makes loon sounds.]

Graham: I didn't hear anything specific.

R: Which ones of you could taste really well?

Adrian: I didn't really taste. When I tasted the juice from the flower, this red stuff went down a little tube. (R: Was it sweet or sour or what?) I don't remember exactly what it tasted like, this red stuff just went zzp zzp down a little tube.

R: Graham, I looked around the room when I was asking you guys to touch your tongue to the plants, and you were the one person who actually put their tongue out of their mouth, to taste that. I wondered — [Interruption.] In terms of people just concentrating and listening to the instructions, I noticed that Graham stuck his tongue out of his mouth a little bit, and I wondered whether while his tongue was out of his mouth, he was tasting anything.
R: Now I have a really hard question and I want you all to listen to it really, really carefully. This one’s a tricky one. This one has to do with why we did this exercise. Remember that what all these exercises are about is how your mind works? Well, there are some scientists out there who think that there is no thinking that you do that doesn't have to do with your perceptions. What I was having you do today, with that exploring with your different senses, was to sort of give all the different ways that you perceive a little bit of exercise. Because you perceive with each of your senses, you perceive by touching and by smelling, and by seeing and by hearing, but you may or may not think in ways that don't have anything to do with perception. Now all of us know that we do do some thinking that has to do with our perceptions, right? [Background questions.] Our perceptions, our senses, what we acquire from our senses. You do thinking, visual sorting or verbal sorting of information, because of what you perceive. The question is, did you today, during the visualization, have any thinking that took place that didn't have anything to do with your senses? That didn't have anything to do with what you were experiencing, that was sense related?

Adrian: Sort of, I went real fast when you said, "Go back to where you started." As soon as I could fly I was always going very fast.

R: When you flew, could you feel any muscles in your body moving? (Several students: Yes.) What muscles moved, I'm curious?

Jaime: Arm muscles.

Shari: I could feel my legs pulling up like that so they wouldn't drag at the ground when I first went up.

Jaime: My eye muscles.

R: For some of you then there's a little bit of kinesthetic stuff going on during this, right? It doesn't have necessarily to do with perception.

Shari: I really lifted my feet off the ground when you said fly.

Joy: I sprouted wings.
Jaime: You know how I flew—little wings sprouted out of my arms, and then I lifted up my left foot, and I lifted up my right foot, and I was up. But that might have been from a book I read where this man was floating and this other man said, "How do you do that?" and the man said, "Pick your left foot up and now put your right foot up, no, don't put your left foot down!"

R: Here's what I want you to do. What was the thing that you experienced today—remember the first question I asked you had to do with which sense was the most vivid. Do you think that the sense that was the most vivid for you during the visualization is also the sense that's the most vivid for you the rest of the time? (Several students: Yes.) Or do you think that the one that was vivid for you during the visualization was different from your usual "most there" sense?

Shari: It was sort of different, sort of the same. I notice mostly touch, sight, and smell, and when I'm eating I notice taste.

Joy: My main two usually are sight and touch.

R: What I want you to do today with these is, I want you again to build a model of some sort. This time it would need to be a model that expresses the sense that is the most powerful for you. (Adrian: All the time or today?) Either all the time or during the visualization today. If they were different but the one during the visualization today was particularly strong or particularly interesting, feel free to use the one that's during the visualization today.

Adrian: I'm doing the most interesting.

Shari: I'd like to know how I can do smell. Go out and pick all sorts of flowers and glue them on to my model?

Joy: They would dry up.

R: It's going to be tough. They'll change before I get around to photographing these things. Remember I'm not photographing them until the summer and the fall, so these things are going to sit in a box till then.

Joy: I think I'm going to be doing sight, then.

R: If you have an idea about what it is about the smell that gets you, if you can find a way to show that, you don't have to recreate a smell, necessarily. You could show something about how you think you recognize smells or how you think you process smells.
Joy: I think I’m going to do sight. It isn’t easy to do poppies and all sorts of things, the smell of grass and pine sap and all sorts of things.

R, still to Joy: You can show those things and you can say that the thing that’s vivid about those is their smell, not so much their colors or their textures or whatever, if that’s how it is for you. [To the group:] Is everybody set? Same thing. If you need a material that’s not in here, holler, there’s all that stuff in the other room.

5.3 Transcript of Guided Visualization with Betsy’s Class

Sense and Perception

I’d like you to close your eyes. Sit comfortably. Breathe slowly, in… and out… and in… As you begin to breathe more slowly, let go of any tension you feel in your body. You feel more and more relaxed.

Keeping your eyes closed, begin to imagine you are walking through a field. You are aware of each of your senses. You can feel your feet touching the earth. A breeze is blowing, moving plants and touching your skin. The sun is warm. Buds on the plants are bursting open in colors and shapes you have never seen before. You touch a plant and feel the texture of its leaves. You gently break the stem and smell the juice in the plant’s stem. Touch it with your tongue. The taste is not what you expected. Smell the fragrance of its flowers. You can hear birds singing. You pay careful attention and you are able to learn their songs. You feel the breeze lift you gently into the air, and you begin to fly above the field in larger and larger circles. Looking down, you can see the paths your feet made through the grass in the field where you walked. You can see a very long distance, but it is time to begin your flight back to the place you began. As you land, prepare to open your eyes.

Your senses will remember everything you saw or heard, smelled, touched, and tasted. You will feel relaxed and alert and ready to share your experience. One… two… three… four… five… six…

Ian: I had a crash landing!

R: I have a lot of different questions today, but we’re going to answer them fast, one-word answers, most of them. We’re going to go all the way around. Which sense was the most vivid for you?
Evelyn G: My sense was feeling.

Katie: Seeing.

Evelyn T: Mine was smelling.

Sean: Seeing.

Ian: Mine was feeling.

Justin: Feeling.

Colleen: Mine was kind of tasting.

R: How did it feel flying?

Justin: It was weird.

Colleen: I was on a cloud.

Evelyn G: I had wings, but I was just soaring, I wasn't flapping.

Ian: I was doing a swan dive, I was going like this. When I had my crash landing I went like this. [Demonstrates both.]

Evelyn T: I was going pretty fast, but I don't know what was moving me.

Lecia: Flying like a balloon, a hot-air balloon.

Katie: I got real small and I went into a flower and then a butterfly picked me up and brought me here.

Colleen: I was in space, it was real weird.
Evelyn G: I flew not very fast, it wasn't as slow as a hot-air balloon, but it was a little bit faster.

Taylor: Mine wasn't very fast, but it wasn't very slow.

Justin: Mine was sort of like Katie's—I tumbled into a flower, and when you said pick a flower, it fell off its stem and I started rolling. It first opened when you said fly and I was in the petals.

Dandridge: Nothing really happened, I just sort of floated up, I couldn't really control it. I was relaxing sort of, in the air looking at everything.

Colleen: I was just lying on this cloud and it was moving.

R: Another question. This has to do with why I did this model with you. There are some people out there who believe that all the thinking that you do is directly related to your perceptions, to your senses, to what you perceive and take into your mind through your touch or your sight or your hearing or your smelling or your tasting. Those people believe that there's no other kind of thinking that you ever do that isn't in some way a mixture of those perceptions. There are other scientists who really believe that there are totally other ways that we also think. I was wondering whether, during the visualization, there was any kind of thinking that you experienced that had nothing to do with your perceptions.

Ian: I wasn't thinking.

Evelyn G: I don't know, but I wasn't a person in the thing, I was a cat.

Taylor: I was a person, but it wasn't me.

Katie: When you said you pick the flower, the flower picked me up. (R: Do you get surprised by those things happening to you during these visualizations?) Uh-huh.

Evelyn T: When you said flying, it doesn't necessarily mean me flying. I usually end up on something else.

Evelyn G: When you do flying, the cat was flying, I don't know, the cat was flying, but it wasn't really wings, it was kind of wings, like invisible wings or something, but I could barely see the outline.
Ian: I was a stick figure. I was a pipe-cleaner stick figure.

R: Was there any thinking that you did that doesn't have to do with your perceptions? (Several students: No.) Is there ever any thinking that you do that doesn't have to do with your perceptions?

Ian: Yes, when I imagine anything that I haven’t felt.

R: That you’ve never in fact experienced, you’re saying? You don't think that those imaginings have anything to do with a combination of other senses? See, that's what we were doing today. We were imagining, and all those things that we came up with did have to do with some other piece of experience we have. Even imagining colors that you’ve never seen before, what that’s based on is that range of colors that we have seen.

Lecia: I didn’t see a color I’d never seen, I saw a flower that was shaped like a buttercup, but each petal was a different color.

Evelyn G: Mine was shaped, you know, one of those double jonquils or something? It had like twenty flowers on one stem, they all had different color petals, none of them were the same.

Justin: I fell into a dark purple flower. It doesn't have to do with perception when I fell off the stem of the flower.

R: Today, try to do something that reflects that one of your senses that you think you get the most from. It can be what you got the most from today while you were doing this, or if the sense that you mostly were in touch with during the visualization is different from the one you’re in touch with most of the time… [Questions from the group; some students want to talk about where the ideas for the visualizations come from. Finally we get back to the subject of today's project.] You can share the visualization or you can share something about your senses. If what you saw was a particular kind of a color or a kind of a texture or a kind of a feeling or whatever, find a way to share that. If it was a floaty feeling and you want to share your floaty feeling, you could...
5.4 Discussion of Results

Multi-dimensional responses to this exercise on sense and perception tied for first place for girls, with large numbers of responses using either three dimensions or relief. Boys made a greater percentage of three-dimensional responses than the girls, but there were two other occasions on which boys produced even more 3-d responses. During the discussion following the visualization, I may well have directly influenced the results in Pat’s class by saying, "I want you again to build a model of some sort. This time it would need to be a model that expresses the sense that is the most powerful for you.” However, I did not specifically mention models to Betsy’s students, who (as was generally the case) received a higher rating for three-dimensionality than Pat's students received.

In addition to their high score for three dimensions, students used their third-largest number of materials on these projects. Surprisingly, although the score for the number of colors was sixth, the impact of the projects is particularly vivid—not through the use of many colors, but through the use of contrast and large areas of color. Frequently, the number of colors is greatest on two-dimensional projects, especially those involving the extensive use of felt-tip pens. In this situation, many more students made three-dimensional constructions than made drawings, so the impact of any given color was greater.
A number of the projects involved objects floating (flying) high above a base—as much as ten inches above it. These pieces were scored as 3-d but were not given an extra half point as being movable, even though they do wiggle. We could infer that these students had an intention to show movement, but it is also easier to make a tall support that wiggles than one that remains stable, so I felt that extra points were unwarranted.

Six of the projects depicted a person flying or floating, four of the projects depicted a person on the ground examining a flower or butterfly, and six of the projects showed a flower or a landscape. One student, Graham, showed a sequence of steps from an object to an eye to a brain, which fit with his statement during the discussion that sight was his most vivid sense. Overall, this visualization seemed particularly accessible to the students. The focus on sensory perceptions, and especially the imagery of flying, was something the students really enjoyed, and both their verbal and visual responses showed that enjoyment.

Several students made statements that indicated that they had had a synesthetic experience. Adrian said, "I didn’t really taste. When I tasted the juice from the flower, this red stuff went down a little tube... I don’t remember exactly what it tasted like, this red stuff just went zzp zzp down a little tube." And Shari explained, "I had two actually, the air rushing against me flying. I could see it equally as well as I could smell. The smell was like sweet poppies, and all the flowers..."

In descriptions of flying, the responses were dreamy and full of surprise. Katie said, "I got real small and I went into a flower and then a butterfly picked me up and brought me here." Justin continued along the same lines: "Mine was sort of like Katie’s, I tumbled into a flower, and when you said pick a flower, it fell off its stem and I started rolling. It first opened when you said fly and I was in the petals... I fell into a dark purple flower. It doesn’t have to do with perception when I fell off the stem of the flower." Dandridge explained, "Nothing really happened, I just sort of floated up, I couldn’t really control it. I was relaxing sort of, in the air looking at everything." Evelyn G said with surprise, "I don’t know, but I wasn’t a person in the thing, I was a cat. When you do flying, the cat was flying, I don’t know, the cat was flying, but it wasn’t really wings, it was kind of wings, like invisible wings or something, but I could barely see the outline."

Even the flowers created surprise for the students. Katie said, "When you said you pick the flower, the flower picked me up.” Lecia explained, "I didn’t see a color I’d never seen, I saw a flower that was shaped like a buttercup, but each petal was a different color.” And Evelyn G said, "Mine was shaped, you know, one of those double jonquils or something? It had like twenty flowers on one stem, they all had different color petals, none of them were the same."
5.5 Gallery

Figure 5.1 Adrian

Figure 5.2 Christine

Figure 5.3 Colleen

Figure 5.4 Dandridge

Figure 5.5 David

Figure 5.6 Erin
Figure 5.7 Evelyn G
Figure 5.8 Evelyn T
Figure 5.9 Evelyn T (Closeup)
Figure 5.10 Graham
Figure 5.11 Ian
Figure 5.12 Jaime
Figure 5.13 Jenny

Figure 5.14 Joey

Figure 5.15 Joy

Figure 5.16 Justin

Figure 5.17 Katie

Figure 5.18 Lecia
Exercise 6: Imagery

6.1 Overview

"My own bias has it that the arts fulfill, first of all, a cognitive function. All knowledge we acquire about our environment comes to us through the senses; but the images we receive through our eyes and ears and through our sense of touch are far from easily readable diagrams of the nature and function of things. A tree is a confusing sight, and so is a bicycle, or a crowd of people in motion. Sensory perception, therefore, cannot limit itself to simply recording the images that hit the receptor organs. Perception must look for structure. In fact, perception is the discovery of structure. Structure tells us what the nature and function of things are and what order they interact. A painting or sculpture is the result of such an inquiry into structure. It is a clarified, intensified, expressive counterpart of the artist’s perception.” (Arnheim, 1986)

Although the fifth exercise already touched on "spatial intelligence" in relation to sensory input, this intelligence is of such particular importance to architecture that I felt it merited additional attention in my study. The research and writings of Kosslyn (1980, 1983), in relation to the biological functions of the brain and mind, influenced Gardner's development of the concept of "spatial intelligence" (1983, 1987). Gardner was further influenced by the work of Piaget and Inhelder (1971), who identified the growth of these abilities during childhood and adolescence. I turned directly to the writings that had influenced Gardner in order to clarify for myself what issues seemed to be involved. Kosslyn's findings on differences in spatial visualization based on age and gender had a direct bearing on my choice of participants for the study. Kosslyn reports that by age nine the difference between girls and boys in their ability to do spatial visualization is statistically identical to the difference between adult males and females. In contrast, the findings of Piaget and Inhelder indicate that nine- and ten-year-old children, while probably capable of consciously organizing visual information, would probably not be capable of showing how they do so, on maps, in drawings, or in spoken or written information.

In this sixth exercise I wanted the students to explore structure. Could they both organize their perceptions and come up with a way to show me what they noticed about the process? To find out, I brought their attention, both with their eyes open and with their eyes closed, to their classmates, so that they could explore the issue of what perceptions they had and whether these perceptions were accurate representations of what was actually there.
6.2 Transcript of Guided Visualization with Pat's Class

Imagery

You’ll have to sit where you can see everybody else, down on the floor. You need to sit where you’re not quite touching each other. [Suggestions for seating readjustments are made and acted on.] Last time, Jonathan, what you missed was a visualization where we were basically exploring all of our senses. What we were looking at was seeing and hearing and touching and tasting and smelling and any other perceptions like the feeling of moving through space that came up.

I’d like you to look around the room and notice who is here today. Take a good look at each person. Look at each person, not just at the people you’re sitting next to (and don’t talk while you do it, Jonathan, just carefully look at each person). Now, has everybody looked all the way around? You need to sit still, because among other things I’m going to ask you to remember. Move in a little bit if you can’t see people. Sit where you can see everybody. Sit comfortably and let your body relax before you close your eyes. Now close your eyes, and no peeking. Without peeking, I want you to think about where each person in the room is sitting and what their body position looked like when you looked around earlier. Make a mental map if you are able to. Your mind, especially if you are feeling very relaxed, has the ability to visualize things you have seen and places you have been very accurately.

Let’s breathe in... and out... and in... and out... Let your body relax completely. I’d like you to open your eyes and look around the room at each person. This time, spend a few seconds looking at each person, noticing exactly how they are sitting and what they are wearing. You see these people every day. Close your eyes again, as soon as you’ve looked at everybody. [Pause.] With your eyes closed, let your mind look at each person, without using your eyes, one at a time. How do you recognize this person when you see them? What color is their hair? What color are their eyes? Are they as tall as you are? Are they taller than you? In your mind, rearrange everyone in the class in some order, perhaps by height or by their coloring or by some other visual feature. Take a minute to make a rearrangement of all of the people in this room. Don’t peek while you’re doing it, just think about how you can put them in some kind of order. Try to visualize that. [Inaudible questions.] I just want you, in your mind, to put everybody in order; include yourself in it. [Pause.] (A student: I can’t do it.) Go around the room again in your mind and look at each person, remember who is in here, remember what they look like, remember how they’re sitting, remember how tall they are, remember everything you have ever seen about them, and then think about some way of organizing them so that you could show who they all were, with some sort of a system to it.
In a moment I will count to six and you will open your eyes. You will feel relaxed and alert and ready to share your experience. One... two... three... four... five... six...

I'd like to know, first, were you able to visualize each person in the room? If you were, raise your hand. If you could visualize every single person in here, look around and make sure that you didn't skip somebody. If you think you could visualize everybody in the room, keep your hand up. I'm going to name you: David, Joey, Jaime, Whet, Shannon, Joy, Christine, and Erin. Who could visualize most people in the room? If you could visualize five children or more, raise your hand: Adrian and Shari. If you couldn't visualize anybody in the room: Jonathan, the rest of today is going to be hard for you, but I still want you to try. The next question is, I would like to go around and, one at a time, I'd like to hear how you arranged them, the people in the room, in your mind. Let's start with someone who could visualize everybody.

David: I just put them in order like they were. (R: The physical order going around the room? Was that words or was that pictures?) It was pictures.

Joy: I put people who had blue and green eyes come in one group, people who had brown and black eyes come in another group, and people who had hazel and any other color eyes in another group. (R: OK, so which people had blue eyes?) [It turns out that Joy has assigned blue and green eyes to all the girls and dark eyes to all the boys, regardless of each classmate's actual eye color. After some discussion she acknowledges that her system was in effect a girl/boy classification scheme.]

Jaime: I didn't really see the physical body, I saw, sometimes you see in like medical charts where people have stripes on them, you don't see the outside of the body, it's sort of like that. All the stripes are different colors, and some of the blocks are filled in, different colors, and that's how I organized them. Joey had some kind of dark reddish, and Adrian has a light blue color. (R: So it was the color of the clothing of the people that organized them?) No, it's their mental colors. (R: OK, go on around the room and tell me what other people had colors for you while you did that.) Jonathan was brown— [Jaime is interrupted by sounds of surprise; he continues:] I'm not talking about your outside, Jonathan. Whet has green, David has dark yellow, Shari has...I don't know. Christine has pink, and Erin has dark blue [more sounds of surprise]. (R: Not on; this is your emotional color; this is how he sees you.) Joy has a sort of orangish, and Shannon, black. Shari is hard. I think she has something like hazel. (R: What color do you have?) I think I have light blue. (R: What color do I have?) [He indicates that he doesn't know.] (R: Close your eyes again and just relax for a second. Obviously you didn't put me into your list while you were doing that, right?) Purple, no, you have gray.
Jonathan: Well, that would really match her hair, Jaime.

R: Most of the other ones didn’t match hair, so it’s not a hair-color thing. Who else had a way of organizing people?

Christine: I did height. (R: Are you pretty sure you were accurate about the heights in your mind?) Shannon was the tallest. (R: Would you like everybody to stand up for a second so you can just check, just out of curiosity?—everybody stand where you are.) [Major hubbub.]

Whet: I split them into boys and girls and then I did heights. I don’t think I was accurate about the tallest person. I thought it was David.

R: That’s OK. When you do your art project today, I’d like you to do it the way you imagined it when your eyes were closed, and not the way it is in real life.

Jonathan: [Describes his grandfather.]

Erin: I did people by how tall they were, except for Shannon was the smallest, Christine was the tallest. [Lots of giggling.] (R: where did you get that from?)

Shannon: I did hair color. I put the blondish grays, blondish browns like Erin in one group, the blonds in another, the blacks… [Argument about hair colors in the class.]

Adrian: I put them in order of how nice they were. [Off-topic discussion of spacemen.]

Shari: Boy, girl.

R: What I want you to do is, I want you to find a way to show, and it doesn’t have to be flat, it doesn’t have to be on a flat piece of paper. It can be, you could just draw it, or you could make a collage, you could cut and paste. Or it could be something three-dimensional. But I would like you to find a way to show me how you organize people. I’m going to ask you one other question first. During the visualization, when I asked you how you recognize people when you see them, what came up for you? (Several students: Hair color. Jaime: The color of the boxes in the lines.) If the way that you recognize people usually has to do with the
way that you organize them right now, then that’s fine. If the way that you usually really recognize people does not have to do with the way that you organized them just now, that is fine too. Of the two things, I’d rather that you showed me how you organized them during this visualization.

6.3 Transcript of Guided Visualization with Betsy's Class

Imagery

Everybody go ahead and sit down. (You are so hyper, I cannot believe this.) [Readjustments of seating so that the students form a rough circle on the floor.] I’d like you to look around the room and notice who is here today. (Brooke, when you weren’t here last time, what we were doing was something that had to do with sensory perceptions, with all of our different senses, so we did a visualization where we basically did a bunch of explorations with seeing, with hearing, and with touching and smelling and tasting.)

After you’ve looked around the room and you’ve noticed who’s here, I’d like you to let your body relax before you close your eyes. Get a little bit comfortable, get in a really relaxed way. And now close your eyes, and it’s important that you not peek during this one, so if you’re going to be tempted to open your eyes, go ahead and use a hand to cover them. I’d like you, with your eyes covered, to think about where each person in the room is sitting, and as you go around the room in your mind, looking at where each person is sitting, think about what their body position looked like when you looked around earlier. Make a mental map of the room if you are able to. Your mind, especially if you are feeling very relaxed, has the ability to visualize things you have seen and places you have been very accurately. Still keeping your eyes closed, I’d like you to breathe in... and out... and in... and out... Let your body relax completely. You can open your eyes and look around the room at each person. Right now, really and truly open your eyes. Spend a few seconds looking at each person, noticing exactly how they are sitting and what they are wearing. Don’t talk about it, just mentally tick it off. You see these people every day. I’d like you to close your eyes again. Again, let your mind look at each person, one at a time. How do you recognize this person when you see them? What color is their hair? What color are their eyes? Are they as tall as you are? Are they taller than you? Keep looking around in your mind at each person, and get a feel for just exactly how you see them. After you’ve looked at each person, I’d like you to rearrange everyone in the class in some order, mentally, perhaps by height or by their coloring or some other visual feature. Some way of
arranging them, think about a way to arrange them, try to get a visual image of that new arrangement. Take another half minute to think about that. Just get as many pictures as you can. Don't think about it too hard, just let them fly in there.

In a moment I will count to six and you will open your eyes. You will feel relaxed and alert and ready to share your experience. One... two... three... four... five... six...

I'm going to ask some questions and I'd like you to raise your hands. How many of you were able to visualize every single person in the room with your eyes closed? If it's every single one, raise your hand. If there's anybody missing, don't raise your hand yet.

Dandridge: Do I have to say what I visualized them as?

R: No, I just want your hand up if you were able to visualize every person here. OK, so Evelyn G— (Lecia, you're sure? Is there anybody missing? If there's anybody missing, don't put your hand up yet. Then don't put your hand up.) Colleen, and Evelyn T, and Brooke, and Sean, and Dandridge, and Taylor, and Katie. [Pause.] If you were not able to visualize anybody in the room, raise your hand. Justin.

Justin: I didn't have enough time to look the first time.

R: Who was missing, Lecia?

Lecia: I was missing Justin.

Dandridge: I was missing two people actually, Colleen and you.

R: How many people didn't have me in it? [Discussion of whether it mattered (no) that some students didn't visualize me.]

R: When you arrange people in your mind, and you rearrange them, and put them in some kind of an order, I'd like to know from each of you what your order was based on. (Various students: No. What? I didn't understand. Say that again.) Who thought that they understood what I meant when I asked you to rearrange everybody? (A student: I thought I did.) It can be a very strange order.
Brooke: By shoe size. (R: In your mind, with your eyes closed, how did you organize people by shoe size? It doesn't matter if you were right or wrong about their real shoe sizes, I just would like to know how they were ranked.) Well, see, when I did that, that was the first thing that came to my mind. What I thought of was, it was just like the other day I was at the shoe store, buying these shoes, and the guy measured my feet with that shoe thing. So everybody took turns putting their feet in the thing. (R: So you would want to organize them by shoe size? Did you put them in an order by doing that, a tentative order?) Mm-hmm. (R: OK, who was the biggest, try, close your eyes while you talk so you don't get worried, who do you think was the smallest? Which end did you start at, small or big?) I started at the big end. (R: So who was the biggest?) Justin! [Other students laugh.]

R: You know everybody in Pat's class, you know how tall and short they are—one person with their eyes closed ranked people from tall to short, and they ranked Shannon as the shortest and Christine as the tallest. [Lots of laughter.] So don't you worry about this at all. Your mind does these things without necessarily making any sense. (Dandridge: God, and you think hers was weird!) So Brooke said that Justin's shoe size was the biggest, who was the next biggest?

Brooke: I can't exactly remember, but I remembered the smallest. Dandridge!

Dandridge: You were the smallest in mine. You were down there looking up at everybody. (R: Was there anybody else in there who stood out in a particular spot?) Yeah, there was one thing about Sean's, he had these weird deformed feet, so it was hard taking his shoe size. [Lots of laughs.]

R: Our minds do very weird things when we close our eyes and let them do them. This is fine.

Katie: I arranged mine by if I like their pants or not. (R: So whose pants did you like?) I went backwards. (R: So whose pants did you hate the most?) [Katie laughs.] (R: Is it too embarrassing to say, would you rather not say?) Mine! (R: You hated yours the most. So you ranked everybody up from you, you were at the bottom. Who was at the top?) Probably somebody who wasn't wearing pants [she laughs again]. You were second because you weren't wearing pants.

Colleen: Mine was really weird. Mine was heads. And everyone in the whole room had someone's different heads, all the boys—well, Dandridge, you were Justin's head. Justin's head was Sean's head. Sean's head was Ian, and you were Katie. Katie was Brooke, and Evelyn, you were Lecia. [Lots of exclamations and comments.] (Dandridge: Did Taylor have Katie's voice still?) I'm not sure.
Lecia: Hair color. (R: If you look around briefly, did you have everybody’s hair color more or less right?) Sort of, I got sort of mixed up with the brown hair. (R: So you had everybody in a lineup from blonde to dark? What did you do with me?) I left you out.

Evelyn G: Mine was by the color of socks. (R: Were you pretty much right about the colors of socks?) No. I had them all mixed up. You had Brooke’s socks, and Katie had Lecia’s socks, I’m pretty sure.

Dandridge: I had by body shapes, by what they look like. Sean, don’t kill me for this, you were standing there, your body was in a square shape. Part of it was here and another part was here [gesturing with hands]. Some of it was sticking out, the lower level was sticking out there. Some people were taller or shorter. Brooke was sort of wide, but she was laying right there looking up at me. Like her legs came up like this.

R: When you do your art project today, think about how to create that lineup of those different shapes. You don’t need to label them, you don’t need to say this was Sean and this was Brooke, but it would be nice if you would show what those different forms turned into, and what kind of order they were in. If they were in the order that people were actually sitting in the room, put them in that order; if they go from short and wide to tall and thin, put them in that order—however you had it.

Sean: I did mine by height. Rebekah was tallest and Justin was shortest.

Justin: I couldn’t see anything, so I did mine by nothing.

R: Today, what I want you to do, it doesn’t have to be flat, it doesn’t have to be three-dimensional, it can be whatever seems right—I’d like you to think a minute about what the visual image was, while you were thinking about how to arrange people. While you were arranging people, if you had a visual image, we’ll use Brooke’s as an example here, Brooke had this shoe-sizing thing, she created basically a lot of different foot sizes, she probably needs to create something that shows ranked feet in some way, or ranked shoes. [Lots of comments, questions, discussions among children about drawings as they start work.]
6.4 Discussion of Results

Graph 6.1  Use of Three-dimensions and Relief (Imagery Exercise)

Graph 6.2  Dimensionality, Colors and Materials (Imagery Exercise)

This exercise, Imagery, ranked seventh in both the percentage of three-dimensional responses and in the use of materials, yet it was third in the use of colors. Students talked freely about what they had experienced; they described having organized the others in the room by height, eye color, hair color, and the like. Almost all of the students were substantially incorrect in the details they imagined about one another with their eyes closed, and thus they described ranking students in ways that were completely irrational. They appeared to be engaged and clearly enjoyed the activity, but they also produced substantially less complex work than usual.

Dandridge said he organized his classmates "by body shapes, by what they look like. Sean, don't kill me for this, you were standing there, your body was in a square shape. Part of it was here and another part was here. Some of it was sticking out, the lower level was sticking out there. Some people were taller or shorter. Brooke was sort of wide, but she was laying right there looking up at me. Like her legs came up like this." His project is a pictorial representation of his vision in three dimensions.
Jaime explained: "I didn't really see the physical body, I saw, sometimes you see in like medical charts where people have stripes on them, you don't see the outside of the body, it's sort of like that. All the stripes are different colors, and some of the blocks are filled in, different colors, and that's how I organized them. Joey had some kind of dark reddish, and Adrian has a light blue color." He continued by describing most of the students in the class, stimulating a great deal of discussion about whether he had been influenced by clothing color. His collage is of labeled classmates, cut out of gridded paper he made with a different shade of felt-tip for each one. Five other students created arrays of labeled classmates, based on physical (real or imaginary) attributes. Three others created organized ranks of unlabeled classmates.

Brooke ranked her classmates by shoe size, explaining, "Well, see, when I did that, that was the first thing that came to my mind. What I thought of was, it was just like the other day I was at the shoe store, buying these shoes, and the guy measured my feet with that shoe thing. So everybody took turns putting their feet in the thing." Her project shows process (that is, the measuring contraption) rather than results. Projects by three other students also organized by clothing but concentrated on the array of clothing rather than on the process.

Three students created exactly two categories of classmates, girls and boys. One abstract piece ranked six different thicknesses of wire from thick to thin; another organized five pieces of fur from dark to light.
6.5 Gallery

Figure 6.1 Adrian

Figure 6.2 Brooke

Figure 6.3 Christine

Figure 6.4 Colleen

Figure 6.5 Dandridge

Figure 6.6 David
Figure 6.13 Joy
Figure 6.14 Justin
Figure 6.15 Katie
Figure 6.16 Lecia
Figure 6.17 Sean
Figure 6.18 Shannon
Figure 6.19 Shari

Figure 6.20 Taylor

Figure 6.21 Whet
Exercise 7: The Logical and Linguistic Mind

7.1 Overview

Gardner's "linguistic intelligence" and "logical-mathematical intelligence" are combined in this exercise. Bruner explains that adolescence is the first time (and not even in all societies, as some never achieve this) that language and "symbolic apparatus" become important as a "medium of thought" (1973). This would indicate that the nine- and ten-year-old participants in this study might not yet be functioning in these intelligences sufficiently to reflect on them or even to represent them.

When I first got interested in how people think and what the interactions are between thought and the creative process, it was at least partially due to Edwards' Drawing on the Right Side of the Brain (1979). Although my later readings in cognitive science, particularly Kosslyn, convinced me that Edwards' idea of a split between "right brain" and "left brain" is not necessarily useful in understanding how the mind works, it seemed to me that this seventh exercise would be particularly aligned with the "left brain," if such a category indeed exists. I expected that as a "left brain" exercise it was less likely than most to produce vivid mental images for the participants.

In a departure from the usual format, this guided visualization took place in two sections, with discussion following each portion. The first addressed the logical and linguistic mind; the second sought to provide contrast by addressing the spatial mind. My goal in this exercise was to give the children the experience of noticing the contrast between their mental processes when they are thinking in logical ways and when they are thinking in sensory-perceptive ways, if indeed they turned out to be capable of grasping this distinction.
7.2 Transcript of Guided Visualization with Pat's Class

The Logical and Linguistic Mind (in opposition to the Spatial Mind)

Today we’re doing one that’s a little bit tricky in a way, but probably not as unfamiliar as you might expect. Let me explain this to you. This exercise has a lot to do with why we are doing the guided visualizations as a technique. (Shari: To make you smarter and better at things? R: Well, that too.) You may be able to figure this out by the end on your own, so I’m not going to explain it to you until we talk about it afterwards. I know from things which some of you have said about the way you think that your minds work, back on the second — [Outside interruption.] Some of you have said things about thinking in two different ways. Joy, I remember you were one of the ones that said something way back, probably in the second visualization, that made me think you had probably heard a little bit about this, but I want you to pay really careful attention anyway, because this may be a new way to think about it.

Before we do our relaxation exercise, the first half of today is without doing the relaxation exercise first, the second half we’ll be doing one. So before we relax, you still need to close your eyes. [Students rearrange themselves.] Close your eyes, and sit very still even though we won’t yet have relaxed, and I want you to think. Try to use words inside your mind this time. This is different from the other ones. Use words inside your mind about what we do during our guided visualizations, as though you were telling a story that makes sense. Tell about relaxing each of your muscles and breathing slowly together, using words in your mind. Now think about the pictures you have unexpectedly found in your mind during some of the visualizations. Remember, using words, how you tried to describe those to the group. Right now, using words inside your mind, you are using your mind in a logical and organized way. Some people prefer using their minds logically, most of the time. Most people find there are some situations which they handle best in a step-by-step linear way. Think of some times at school when logical thinking was especially useful to you. That’s thinking something through from a beginning to an end in a linear fashion. [Pause.]

Has everybody thought of a time, at least one? I’d like you to open your eyes, and we’ll take several minutes to discuss what you know about logical thinking. We’re just going to go around one time, you each get one sentence. When was a time that logical thinking was useful to you?

Shannon: The first time I did long division.

Adrian: When I’m doing math.
Shari: When I write stories.

Joy: When I saw the great big dome at Epcot and I wondered how it was put together. I was trying to think of how it was. (R: So you thought about it in a logical way? Joey: That's not logical! (Simultaneous negative comments about Joy's logical abilities.) R: That may be the most logical that she gets, because we are all different, Joey, and it is not necessarily better or worse to think more logically or less logically. It is just a different way of thinking.)

Christine: When I'm typing on a typewriter, trying to write a story.

Erin: When I'm doing my math.

Jenny: When I make up my stories.

Joey: When I make things, like make stories and all that kind of stuff. And make art things, and stuff like that. (R: You're thinking logically then, step-by-step logically? How about when you do your music, is that logical?) It's too logical, sometimes.

Whet: When I'm doing my math.

Jonathan: [Talks about his grandfather.]

Jaime: When I do word problems. (R: In math? Can you describe how you do a word problem in math in a logical, step-by-step way?) Not really. (R: I was just curious.)

R (beginning the second half of the exercise): This time it's going to feel a whole lot more like our usual relaxation exercises. Sit comfortably. Get ready to relax your body. If you're not going to be comfortable on your stool, sit down on the floor next to where you were. I want quiet in here. Close your eyes. This time we're going to try to trick your logical mind into staying away while we do some visualizations. Let's begin by relaxing our bodies, one group of muscles at a time. (You can leave your body still, Joey. Let's all close our eyes.) Curl your toes up, very tightly, and relax them. Now tighten your legs... and relax them. Clench your fingers, and relax them. Tense your lower arms, and now your upper arms, and relax your whole arms. Tighten the muscles in your bottom... and relax them. Tighten your stomach, and your back, and your shoulders... and relax. And now tense your jaw and your whole face, and relax. Breathe quietly, in... quietly, and out... More quietly this time, in... and out...
Let yourself imagine that you are in a beautiful place. Look around, in your mind, and notice each detail of that place. You can save millions of images at the same time. Send them wherever in your mind you want, knowing you can retrieve them at any time you desire. Keep paying attention to the place you are in, and notice any sounds or smells you may encounter. You can move around the space, in any way you want. Take a moment to completely explore where you are... [Pause.] Now gradually return to the place your body is sitting. Notice that you have been using your mind in a different way these last few minutes than the way you used it earlier. As I count to six, organize the contrasts in your mind. One... two... three... four... five... six...

R: I want to know how it felt. Was it different from the time before? Did your mind flow in a different way? [Interruption.] Let's start with Jaime this time. Was it different at all?

Jaime: It was strange—you said a very beautiful place and my mind reacts immediately with a giant bowl of different colors of chocolate. I'm like a giraffe, with a mouth, and it would eat, it would close on chocolate, and some chocolate would spurt out, and some would pop up and I could eat it. (R: Now, was that logical and linear?) No. (R: That was very vivid, it was images, it was pictures in your mind, right, and taste too. Did the chocolate taste good?) Yeah, and there was dark chocolate and milk chocolate, and then there was light chocolate, and then there was chocolate mousse. (R: Obviously that was very vivid, but how was that different from thinking about a word problem in math?) Because I hate word problems and I love chocolate.

Whet: I was in a jungle and it had all these ferns, and you could hardly see the sky there were all these trees. (R: Was it a beautiful place that you would have expected?) No.

R: Joey, did you go to a beautiful place?

Joey: Of course. (R: What was it like?) It was like, I don't know what it was like, it wasn't logical. (R: Can you find any words at all to describe it?) Not logical. (R: Would you be able to make pictures or models of what it was like, more easily?) Mm-hmm.

R: Who else experienced that same kind of thing, that it was a beautiful thing that would be easier to show than to explain? OK, Shannon could show it, Jenny could show it, Whet could show it, Jaime could show it. Erin, did you experience something you could describe more easily than you could show? What was your beautiful place like?

Erin: It was just this great big field with flowers. (R: So you could describe each flower, you wouldn't need to show it?) I'd need to show it also.
Jenny: I was out in this wheat field with all these animals. (R: Were they friendly?)

Christine: Mine was an ice castle. It was glitter and it was ice. It was huge, in the shape of a castle.

Joy: Mine was a palace. It was a huge room, with about six others streaming off of it, sideways like a little corridor. And then [inaudible] spring up, and all of them had all kinds of neat things. Like one had jewels and the other had this little bedroom, and then a bridge was bigger than this room. (R: How did you move around when you went from one room to another? Walking?) I just wished. I flew. You could wish "Alligator" there and you’d be there.

Shari: My land was a beautiful field. It just started as our field. Then the grass became short, and a river started flowing through the middle. And then steers and horses and cows and sheep started appearing and flowers were scattered and birds were chirping. And as I moved around, I smelled all the flowers and looked at all the animals, and there were all sorts of animals. I was walking and then I started feeling like there was something right growing there, and I felt it and there were feathers, and I started flying.

Shannon: Mine is at Smith Mountain Lake. It is quiet.

R: I want you to think about the contrast between how you are when you’re thinking logically—step-by-step, orderly, planned-out—and when you’re thinking in pictures and vivid images and having an experience like that in your mind. Your mind is very, very talented, it can do both kinds of things, right? All of us here can do both kinds of things; do we all agree about that? [Some uncertainty from students.] Who doesn’t think their mind can do both kinds of things? There are some people in the world whose minds cannot do both kinds of things. I am only asking you to look at your very own self. If you think that in very own self, you sometimes can think in a logical, step-by-step way, and sometimes you think in a whole-field, vivid-images way, raise your hand. If you can sometimes do one and sometimes do the other, raise your hand. I don’t care which one is easier, I just want to know if you know you can do both. (Whet, Joey.) If you think you are better at thinking in images, raise your hand. (Whet, Jaime, Jenny, Shari, Shannon, Joy.) If you think you are better at thinking in words, raise your hand. (Christine; Whet changes his mind.) If you are sure you are equally good at each kind of thinking, raise your hand. (Jonathan, Whet, Joey, Christine, Shari you’re not positive, Adrian, Erin.) It does not mean you are smarter if you think one way or the other way, it does not mean you are stupider if you think one way or the other way. It does not mean you are smarter if you can think both ways, and it does not mean you are stupider if you can think both ways. It is just that each of us has our very own mind. Next time you’ll hear about
some theories that some scientists have that you think in a lot more than just these two ways. A lot of people agree that most people have the ability to at least think in these two kinds of ways.

Today, for your art project, I want you to make something that shows the contrast between those two ways of thinking. (Jonathan: Oh, I can only do them both separately.) You can do them both separately if you have to. If you can somehow connect them together into the same piece of art, so I don't lose them, or at least put them on the same sheet of cardboard, or the same piece of paper, or the same something or other, or back and front, or side to side, or up and down, or in and out, then go for that. If you can't even do that, then write on each of them, on the back of each of them, so I'll know what they were intended to be, that they were both yours and that there were two things, that'll be fine.

7.3 Transcript of Guided Visualization with Betsy's Class

The Logical and Linguistic Mind (in opposition to the Spatial Mind)

This exercise is in two parts. This has a lot to do with the general idea behind why we are doing the guided visualizations. I think you'll see why, but feel free to ask about it afterwards if you don't yet see why. I noticed that some of you have some ideas about the idea; this particular cognitive model is one that's pretty popular. A lot of people talk about it a lot, and some of you are going to recognize it by the end, you're going to notice that it's something that you've heard of before, and I know you've heard of it before because you've said things that kind of clued me in to that you have. So it's OK if you want to ask about that too, afterwards. Right now, I'm not going to tell you any more.

We're going to do this in two parts. The first part we're not going to do a relaxation exercise for. We're just going to close our eyes, sitting right where we are [settling noises]—sit right where you are, and close your eyes. I'm going to ask you to think, using words, for this first exercise. (Dandridge: What?!) Try to use words, inside your mind, as I have you do this first exercise. I want you to think, as though you were telling someone a story, about doing a guided visualization. Tell about relaxing your muscles, use words, just tell a story inside your mind, words about relaxing your muscles and breathing slowly together. Now think about the pictures you have unexpectedly found in your mind during some of the visualizations. Remember how you tried to describe those in words to the group (or to somebody else). Right now, using words inside your mind, you are using your mind in a logical and organized way. Some people prefer using their minds logically, most of the time. Most people find there
are some situations which they handle best in a step-by-step way. Think of some times, maybe at school, when logical thinking was especially useful to you. What were you trying to learn or to do, when doing it in linear way, a step-by-step way, was especially helpful? [Pause.]

Now I’d like you to open your eyes, and we’ll take several minutes to discuss what you know about logical thinking, and then we’ll do a relaxation exercise afterwards. What do you know about logical thinking?

Evelyn G: I don’t know, I didn’t understand.

R: You didn’t understand what I meant about logical thinking? Was anybody else confused about what logical thinking was? Let’s close our eyes again. When you want to give somebody directions to get from one place to another, but you don’t have time to draw a map, and you give a set of instructions using words, where you say things like "First you’ll go until such and such a street, then you’ll turn right, and you go along that street till you get to a big white church, and then you’ll turn left." Even though some of those are images, that person doesn’t have those images, and you’re describing it in a logical, step-by-step fashion. Many people when they’re doing math things [a student chimes in, "Yeah, story problems"] do it in a logical, step-by-step way. Story problems are a real typical step-by-step kind of thing. Think about something that you do. It may be that this is hard for you to understand because it may be that your mind mostly thinks in pictures and not in a logical, step-by-step thing, and that is fine. I would just like you, as much as you can, to get in touch with the way that some people choose to think or are only able to think, in some cases, that is a step-by-step-by-step-by-step rational progression from A to Z. If this is really hard for you to understand, that’s fine, you can just say so. Do try to think about some time in your life, even if it was the only time in your life, that thinking something through in a logical way helped. When you go home and your parents ask you "What are you doing with Rebekah?" what do you tell them?

Evelyn G: I say [laughing]—she usually doesn’t ask that, she asks what we’ve been doing today with Rebekah.

R: And you mostly just tell her about the art project or what your most spectacular image was, or what do you tell her?

Evelyn G: No, I tell her what we were doing and how we made the art project.

R: You start by saying, "Well, first we all sat in a circle—" (Evelyn G: No, I don’t.) ”—and we closed our eyes, and we turned off the lights, and we relaxed our bodies one muscle at a time, and then we all breathed together very, very quietly, and then after
that Rebekah started talking and we just tried to pay attention and let pictures form in our minds.” Do you do that? (Evelyn G: No.) "First I had this picture, and then I had that picture”? Well, I was asking you in this first little not-relaxed time, I was asking you to take yourself, step by step, through that. You weren’t able to do it, fine.

Justin: Well, I definitely couldn’t do it, ’cause you never asked.

R: So, let’s go around real fast, and you tell me a time logical thinking might have been useful to you.

Sean: When I was learning to spell.

Evelyn T: When I was doing story problems.

Brooke: When I was learning rain dance stuff we learned at camp. (R: And you learned it in a logical, step-by-step fashion?) Well, we had to go over and over it.

Ian: All math.

Dandridge: Reading. (R: How come reading works that way for you, because it’s words, or because you go along in a line, or what?) It’s like, ’cause you [inaudible], or you don’t understand a word, or you try to explain what it is or something.

Lecia: When I’m about to get in trouble.

Colleen: It would either be math or a tongue twister I did.

Evelyn G: When I was in music camp. (R: What did you do at music camp that was logical and step-by-step?) Well, see, when I was learning new songs. (R: So you broke it apart phrase by phrase and learned each phrase? Was there ever a time when you did that and it changed back from being phrase by phrase to being suddenly the whole piece?) Yeah.

Brooke: When I was learning the Hebrew letters.
R (beginning the second half of the exercise): This next one is more like your normal relaxations. I want you to close your eyes again. This time we'll try to trick your logical mind into staying away so we can do some visualizations. Let's begin by relaxing our bodies, one group of muscles at a time. I'd like you to curl your toes up inside your shoes, very, very tightly, and relax them. Now tighten your legs... and relax them. Clench your fingers, and relax them. Tense your lower arms, and now your upper arms, and relax your arms. Tighten the muscles in your bottom... and relax them. Tighten your stomach, and your back, and your shoulders... and relax. And now tense your jaw and your whole face, and relax. Breathe quietly, in... and out...

Let yourself imagine that you are in a beautiful place. Look around and notice each detail. You can save millions of images at the same time. Send them wherever in your mind you want, knowing you can retrieve them at any time you desire. Keep paying attention to the place you are in, and notice any sounds or smells you may encounter. You can move around the space, in any way you want. Take a moment to completely explore where you are. [Pause.] Now gradually return to the place your body is sitting. Notice that you have been using your mind in a different way these last few minutes than the way you used it earlier. As I count to six, organize the contrasts in your mind. What's different about the two ways of using your mind? One... two... three... four... five... six...

[They all talk excitedly at once.]

Taylor: I was in this forest and my dog went everywhere, it was all white, there were these, I was in this little circle of the forest, there was this eagle sitting there, when I tried to get out they [inaudible].

Sean: I was in a garden.

Evelyn T: Mine, it was on a cloud, there were these overhanging things, I don't remember what they were, it was weird.

Brooke: I went on a flower thing over the weekend, it turned out to be nice and everything, but there was this little square of flowers and then in the background there was like a mountain with snow and pine trees on it. It was like I was in China, though; there was a Chinese house thing and Spock was smelling the flowers.

Justin: [Doesn't want to talk about it.]
Ian: Well, mine, I was in Paris, France, and I was right around the Eiffel Tower and there was this garden in front of me, I was just floating around and then suddenly I go "Yiiiich," Peppy LePue started to walk through the garden.

Dandridge: I was like up on like a meadow in a really high mountain. It was real foggy, sort of real wet, you know. It was wet in the air and on the ground. I was on a square hill with castle walls around it, and there was a tower and a little building under it with four sides, and it smelled really wet and weird and mildewy.

Lecia: I was in Castle [unclear], it's this place that's in Canada, I went there with my cousins one time, it has a conservatory that in winter they have wild [unclear].

Colleen: I was like me except I was like Alice in Wonderland in that garden she was trying to get in, except I could get out a lot easier.

Evelyn G: I was sailing to an island, but I wasn't sailing on water, I was sailing on a pink cloud, and I was just floating on it. It was like a cloud in the water and the water was all different weird colors that I'd never seen before, and then on the island it was covered with flowers.

R: None of you have any trouble thinking up gorgeous visualizations. Here's what I need you to do. I need you to think about how it's different when your mind is coming up with all those kinds of visual images from when your mind is doing something that's logical, rational, step-by-step like a math problem. [Buzz of questioning.] I want you to think—OK, I'm going to say it again, just listen very, very carefully—I need you to think about how it's different when your mind is coming up with all those kinds of visual images from when your mind is doing something that's logical, rational, step-by-step like a math problem.
7.4 Discussion of Results

The Logical and Linguistic Mind exercise ranks last among the boys for three-dimensionality and ranks ninth overall. The use of colors and the use of materials are also in the lower third of responses for boys, although it’s interesting to note that the girls used their second-highest number of materials, including many used to add relief to their projects.

Departing from the general practice, this guided visualization took place in two stages, with discussion following each stage. The first portion addressed what is commonly referred to as left brain thinking—linear thinking, logical, mathematical. Discussion after that portion of the guided visualization was restrained, with students indicating confusion about what I meant and when they might use it. (Their puzzlement makes sense if Bruner is correct that such thinking appears in adolescence.) Many students, particularly those in Betsy’s class, expressed doubts that they ever used this type of thought. Following the guided visualization in the second half of the exercise, which focused on sensory and spatial thinking, students were talkative and described their visions in detail. It would not have been surprising if students had chosen the easy path of representing the visions from the
second stage; they clearly found these exciting. Instead, interestingly, their projects seem quite restrained; rather than indulging themselves in the visions, most students struggled to show the dichotomy.

Nine students divided their drawings or projects into two sides, one illustrating pictures, the other using words. Most of these are flat projects, depicting simple pairings of words and images. A tenth student, Joey, used wire to create a three-dimensional abstract piece, in this case depicting linear thinking on one side of a board (with pipe cleaners of a single color neatly lined up) and spatial thinking on the reverse side (wild three-dimensional corkscrews of wire in multiple colors). Two projects, both three-dimensional, stand out as potentially complex interpretations of the concepts. Neither Taylor nor Dandridge spoke about anything remotely related to what he made, so it's hard to tell what either of them had in mind, but both Taylor's model of the number 4 and Dandridge's math worksheet with active 3-d pencil hint suggestively at a merging of math and pictorial thought.
7.5 Gallery

Figure 7.1 Adrian

Figure 7.2 Brooke

Figure 7.3 Christine

Figure 7.4 Colleen

Figure 7.5 Dandridge

Figure 7.6 Erin
Figure 7.7 Evelyn G

Figure 7.8 Ian

Figure 7.9 Jaime

Figure 7.10 Jenny

Figure 7.11 Joey

Figure 7.12 Jonathan
Exercise 8: Multiple Intelligences

8.1 Overview

In this exercise, having introduced the students to the various "intelligences" in previous exercises, I intended to put Gardner’s "multiple intelligences" back together as a whole. To review, the intelligences were presented as follows:

♦ "Kinesthetic intelligence" was explored in Exercise 3.
♦ "Intra- and interpersonal intelligences" formed the basis of Exercise 4.
♦ "Musical intelligence" was combined with other sensory inputs, including visual, in Exercise 5.
♦ "Spatial intelligence" was explored in Exercise 6.
♦ "Linguistic intelligence" was combined with "logical-mathematical intelligence" in Exercise 7, and contrasted with spatial.

Can nine- and ten-year-old children, even if they were successful previously at transforming simpler ideas and mental images into works of art, transform the complexities of this theory? If Piaget and Bruner are correct, children at this stage cannot be expected to process such thoughts. Yet my study was based in my belief that these students would be able to do so, as long as they had the opportunity to express their ideas in a medium in which they were comfortable.

8.2 Transcript of Guided Visualization with Pat's Class

Multiple Intelligences

I’d like you to close your eyes, and breathe in... and out... and in... and out... Find a group of muscles in your body that isn't relaxed, and tighten them... and relax them. Now find another group of muscles, and tighten them... and relax them. Each of you uses your body and your mind differently from everyone else. Keep relaxing any parts of your body which may be tense, breathing quietly but deeply. Keep your eyes closed; you need to listen really carefully today.
The cognitive model I'm going to share with you today is pretty complicated. The idea that this model is about, this idea about how we might possibly use our minds, is called "multiple intelligences." You were each born with a mind that is amazingly fast and ready to learn new things. As I describe each way of using your mind—[Shari walks in late; I ask her to close her eyes and relax.] You were each born with a mind that is amazingly fast and ready to learn new things. As I describe each way of using your mind, take a moment to imagine yourself using your mind that way. This is going to be a lot of different ways of using your mind.

You have each learned to move your body, even to imagine how you might want to move your body and then to do it accurately. (This is called your kinesthetic intelligence.) Think about using your body.

You have each learned to feel, inside yourself, who you are and how that is similar to other people and different from other people. (This is your intra- and interpersonal intelligence.) This is the way of using your mind that helps you get along in the world with other people.

By using your senses, you have learned to visualize things you may never have seen, and to imagine combinations of sounds you may never have heard. (These sensory intelligences are musical and spatial. Take a moment for each one of those. I know you can do the visual. Think about the musical intelligence.)

You are able to think in an organized way in order to solve all sorts of problems, including math. (Your logical-mathematical intelligence is very systematic.)

You have each learned to speak words and to combine them in intelligent ways. (Human beings' linguistic intelligence is one of the remarkable differences between us and most other animals.)

Probably you have noticed that although you can think in all those ways, you use some of them a lot more than you use others. Keeping your eyes closed, breathe quietly in... and out... Try to imagine that you are inside your mind. It is enormous and you can watch and hear it working. Notice exactly what it is doing. The combination of things it can do well is unique to you. There may be some ways of working which you are especially good at. Does your mind have a special way to move from one way of thinking to another? Take a minute just to experience your mind, to notice and appreciate your very own mind.

In a moment I will count to six and you will open your eyes. You will feel relaxed and alert. One... two... three... four... five... six...
Were you able to visualize each way of using your mind? How many of them could you visualize, David?

David: When you were talking I saw most of the things go by. And when you were talking about [unclear] inside your mind I saw me inside this big place and it had everything inside the world, and this little thing goes down over one of the things and projects it on a camera, and that shows it.

Adrian: When you said words inside your mind, I thought words are smashing into each other, and also when I went and looked at my mind, there were all these little minds sitting around in it, and then I went inside each one of them and they all had different things in them.

Jaime: I thought you were going to say they had little minds and those had little minds.

R: How many little minds were there inside the big mind, about fifty? That's something that when you do your project today, I would like you to show. However many, or however it was laid out, if there was a way that the pieces of your mind, or that your different minds, depending on how you thought of that, interacted, I want you to show that.

Jaime: It's the same thing that's been happening before. (R: Walkie-talkies?) Yeah, one thing I hadn't seen, every time I thought I had heard something, little rays would hit a computer and it would bleep out the answers. (R: Do you use walkie-talkies for all those different kinds of using your mind?) Most. But mostly I was in my brain, my mind is a whole different case than the brain. (R: Think about your mind then some more, while we go around and see how different it really is, as you think about it.)

Shari: The first thing that happened was that I first started in a sort of house in the middle of my bedroom, I went down the stairs, and I went through the door. There was a series of tunnels, like [inaudible], and every day I went to there was some kind of door, and it said like math, and then I went inside the math room and there were these other small rooms going off to the side, like nines, eights, sevens, six... When I finally found the way out I was walking through meadows, then I found myself in forest, then in rain forest. Seemed like a whole new earth.

Joey: What could I visualize? It was a big room with weird walls, do I have to tell? (R: No.)

Graham: I didn't see that much really.
R: Were there any ways of thinking that you never do? Any of you, when it gets to you, be sure to think about that. If there were certain of those ways of thinking that you just flat-out don’t do, you’ve never tried them out in your whole life, say so. That’s useful to me to say that.

Graham: I just, there were different levels of slightly different things. (R: Can you translate that into what you could make, thinking about it in terms of those levels?) I guess so.

Whet: Let’s see, in my brain there were all these gears and they took these cards and put them in these slots [inaudible]. (R: But what about the way you were thinking? Not just sending the signals, but doing the thinking?) Everything my brain did went in the cards and all of them went in the slots.

Jenny: I visualized [inaudible] walking down this big hallway, and there were all these doors. One door would have like math and stuff like that. (R: So it’s actually a lot like Shari’s.)

Shannon: When I went in my mind, it was like all these gears going around and it was telling all these answers and things.

[Interrupted by something outside the room.]

Christine: It was a circular room and all around it it had file cabinets and it would say on those little slot things, math, the other would say science, the other would say spelling, it went all the way through. (R: What about other ways of processing information, not just subjects? Things like how you get along with other people. Did they have filing cabinets too, or were they not in it?) It went in a computer and it would turn it out.

Erin: A real maze, it had trucks, were driving up and down the road, [inaudible] spelling and all that stuff [inaudible].

Joy: Mine was sort of like, the bottom was clear so I could see the whole way down, the tube hole, there was this weird thing, a colored tube, that let a little light come in. There was writing on the floor, it’s color coded. Green was for math, red was for gymnastics and stuff. (R: When you do your thing, make sure that you use that sort of color coding.) I’m going to take a piece of that plastic stuff and put spray on it.

R: I’m going to make a recommendation to you guys: please don’t try using the markers on the clear acetate again, it comes off so easily... Everybody may go ahead and get their materials and get to work.
8.3 Transcript of Guided Visualization with Betsy's Class

Multiple Intelligences

I'd like you to close your eyes. Relax. Breathe in... and out... and in... and out... I'd like you to find a group of muscles in your body that isn't relaxed, and tighten them... and relax them. Now find another group of muscles, tighten those... and relax them. Each of you uses your body and your mind differently from everyone else. Keep relaxing any parts of your body which may be tense, breathing quietly but deeply.

The cognitive model I'm going to share with you today is pretty complex. This idea about how we might possibly use our minds is called "multiple intelligences." You were each born with a mind that is amazingly fast and ready to learn new things. As I describe each way of using your mind, take a moment to imagine yourself using your mind that way.

You have each learned to move your body, even to imagine how you might want to move your body and then to do it accurately. (This is called your kinesthetic intelligence.) Remember when you used your kinesthetic intelligence.

You have each learned to feel, inside yourself, who you are and how that is similar to or different from everyone else around you. (This is your intra- and interpersonal intelligence.)

By using your senses, you have learned to visualize things you may never have seen, and to imagine combinations of sounds you may never have heard. (These sensory intelligences are musical and spatial. Take a moment to imagine yourself doing each of these.)

You are able to think in an organized way in order to solve all sorts of problems, including math. (Your logical-mathematical intelligence is very systematic.)

You have each learned to speak words and to combine them in intelligent ways. (Human beings' linguistic intelligence is one of the remarkable differences between us and most other animals.)

Probably you have noticed that although you can think in all those ways, you use some of them a lot more than you use others. Keeping your eyes closed, breathe quietly in... and out..., in... and out... Try to imagine that you are inside your mind. It is
enormous and you can watch and hear it working. Notice exactly what it is doing. The combination of things it can do well is unique. There may be some ways of working, some ways of thinking, which you are especially good at. Does your mind have a special way to move from one way of thinking to another? Take a minute to notice and appreciate your very own mind. Notice what’s special about it.

In a moment I will count to six and you will open your eyes. You will feel relaxed and alert. One... two... three... four... five... six...

I have a question. I want to start today with Brooke. I want to know whether you were able to visualize each way of using your mind. And how many of them do you think your mind uses? And which is the one you feel the most confident with? And what was it like? In any order.

Brooke: Well, it was strange. The way I imagined it was almost like, you know those things where it says the time and the temperature?, it said the ways that I think and like how I do it. (R: So me telling you what the different kinds of intelligences were came through as if you were listening to a time temperature recording?) Kind of like when the words go across. (R: The ticker-tape stuff. Times Square. How do you feel about each of those intelligences, do you feel pretty confident about how you use each of them? Is there one that you hardly ever use?) There are a few.

[Long interruption from outside the group.]

Since I just wasted time, let’s do it this way. Raise your hand if you felt, as I went through the different intelligences… I’m going to go through them in the same order I went through them in. If you know that you at least sometimes use your kinesthetic intelligence, raise your hand. Remember what the kinesthetic intelligence is, it’s when you are able to plan how you want your body to move, and then have it move the way you planned it. It doesn’t have to be all the time, it has to be at least once a year. So you’re all aware of your kinesthetic intelligence.

Next one, intra- and interpersonal intelligence. Are you all aware of what goes on inside your own mind and inside your own body? That’s the intrapersonal. Now how about the interpersonal? Are you aware that you know what goes on between you and other people? Everybody feels comfortable with that? [Rumblings of "Sort of..."] But those things take practice. You’re all getting better and better at those things. The point is to be aware that at least some of the time that stuff operates for you, with you, as you wish it to. You all have that? [Sounds of agreement.]
How about spatial? That's the visual intelligence, that's being able to imagine visual things. [Everyone agrees.] You all feel very comfortable with that one.

How about musical, do you all make up little tunes, think up new combinations of sounds, yeah? (Ian: I write music.) Sean, do you feel comfortable with that? (Sean: I don't make that up, I just sing what's on my paper.) How many of you guys read music? Do you play an instrument? Do you sing? [Lots of simultaneous talking.] The musical intelligence is not critical to our survival. Some of these things are critical to human beings' actual survival. The musical thing is maybe not critical to survival. On the other hand, it may be one of those human things that are so fun that most of us want to go after that. Now, it's critical for a bird's survival, because that's how they communicate, and that part of a bird's brain where those things get stored is very well developed.

How about thinking in an organized way, the logical-mathematical intelligence? I know on Monday that some of you didn't feel like that was very well developed, but do you all at least feel like you use it sometimes? [A student: Yeah, during math. I use it a lot of times.] If you want to plan something that you're going to do day after tomorrow, and you know that before you can do the thing that you want to do day after tomorrow that you've got to get six other things done first in a particular order, that's logical thinking. You also use logical thinking if you're just doing a math problem, figuring out how to do a word problem, two people are traveling along at different speeds on the Appalachian Trail, and one is going north and one is going south, when will the other one get there? Like when we all met for lunch... The logical and math skills are pretty much related.

How about the linguistic stuff, how about the words, do you all feel pretty comfortable around words? How comfortable are you with words compared to your dog or your cat? [Lots of joking around.]

How about when you went inside your mind? How did you see the way your different intelligences interact?

Katie: You know in the library, those little things that you open up to find where a book is? Mine was sort of like that except they were big folders and you open them up and see everything, not in words but in pictures, you can go inside, go through and find anything.

R: Is it the same if you want to use your mind for kinesthetic stuff as for visual images? Who had different ways of using their minds for the different things? That were recognizably, visibly different.
Evelyn G.: Remember when I said that thing about lights? They were different color lights, each thing, like if it was kinesthetic, it was peach, if it was logical it was black and white. Visual it was all different bright colors all at once. Musical, there were stripes I think.

Justin: I didn't get to see everything. (R: Then what you need to be thinking about while we go on talking is what you think the relationships in your mind between those different ways of using your mind are. If you didn't see anything, try to think out that relationship.) I almost never really see anything. (R: You probably don't have a very strong visual mind, you probably have a mind that's more logical.) No, I don't. I barely ever use logical. (R: Well, what do you use in your mind? Do you use words in your mind? What do you use in your mind?) Pictures. (R: Well, you should have seen something, if you had pictures in your mind.) It's sort of hard to explain. I didn't see anything visual.

Ian: Can we get started?

R: You're going to make something that in some way shows how it happens in your mind, what the relationships between the different ways that you think are. Or how it was laid out. (Evelyn T: What you saw in your kinesthetic mind?) I would prefer you to show not just one of those minds, but that combination of minds.

Taylor: Can I just do a brain with legs and arms, it's sort of like, there are like all these wires coming out of it, sort of like phones or something, responding to me what to do.

Justin: I didn't see anything visually, I saw it more mentally. I don't know what to do. (R: I don't know what to do either.) I can't do this one, Rebekah.
8.4 Discussion of Results

The Multiple Intelligences exercise came in fourth for three-dimensionality overall, and it holds the distinction of being the exercise with the largest discrepancy between boys’ results and girls’ results. All but one boy made a three-dimensional project, and with additional points for relief and motion the boys averaged a score of 3.00, tying their highest rating. Only two girls made three-dimensional projects, their lowest number ever, and even with additional points for relief and motion they achieved an average score of only 2.41, their second-lowest rating. In the use of materials there was a large discrepancy as well, again with boys quite high and girls quite low. The use of colors is the highest of any exercise, probably because of the extensive use of felt-tip pen in drawings; these do not look particularly colorful or vibrant, however.

Both girls and boys provided vivid verbal descriptions of what they experienced during the visualization. In general, the boys made products that match their descriptions and are three-dimensional as well. David said, "When you were talking I saw most of the things go by. And when you were talking about [unclear] inside your mind I saw me inside this big place and it had
everything inside the world, and this little thing goes down over one of the things and projects it on a camera, and that shows it.” Adrian said, "When you said words inside your mind, I thought words are smashing into each other, and also when I went and looked at my mind, there were all these little minds sitting around in it, and then I went inside each one of them and they all had different things in them." Jaime’s description was lively also: "Every time I thought I had heard something, little rays would hit a computer and it would bleep out the answers."

Among the girls, only Katie made a product that expressly matches her vision: "You know in the library, those little things that you open up to find where a book is? Mine was sort of like that except they were big folders and you open them up and see everything, not in words but in pictures, you can go inside, go through and find anything."

Shari’s simple abstract 3-d piece seems to be related to the tunnels in her vision: "I first started in a sort of house in the middle of my bedroom, I went down the stairs, and I went through the door. There was a series of tunnels, like [inaudible], and every day I went to there was some kind of door, and it said like math, and then I went inside the math room and there were these other small rooms going off to the side, like nines, eights, sevens, six... When I finally found the way out I was walking through meadows, then I found myself in forest, then in rain forest. Seemed like a whole new earth."

Other statements made by girls make it clear that they were able to form mental images in response to the concepts presented, but their visual products carry the concepts rather than the images forward. Evelyn G said, "Remember when I said that thing about lights? They were different color lights, each thing, like if it was kinesthetic, it was peach, if it was logical it was black and white. Visual it was all different bright colors all at once. Musical, there were stripes I think." Her project, along with five other projects made by girls in the two groups, contains a grid of the types of intelligences, along with simple visual representations of each intelligence.

Perhaps the girls were more concerned to show that they had learned the new vocabulary than to show the images in their minds? Perhaps they were influenced by my not having mentioned 3-d models? Unfortunately, without interviews with the participants we will never know.
8.5 Gallery

Figure 8.1 Adrian

Figure 8.2 Brooke

Figure 8.3 Christine

Figure 8.4 David

Figure 8.5 Erin

Figure 8.6 Evelyn G
Figure 8.7 Evelyn T

Figure 8.8 Graham

Figure 8.9 Ian

Figure 8.10 Jaime

Figure 8.11 Jenny

Figure 8.12 Joey
Figure 8.13 Joy

Figure 8.14 Justin

Figure 8.15 Katie

Figure 8.16 Lecia

Figure 8.17 Sean

Figure 8.18 Shari
Figure 8.19 Taylor

Figure 8.20 Whet
Exercise 9: Creative Thinking

9.1 Overview

This exercise is an exact repeat of the second exercise. When planning this study, I thought it would be best to use the same script twice, once early in the sequence and once late in the sequence, so that I could compare the students’ understanding of how their minds work. I placed this exercise in the second position so that the students would already be familiar with the process before doing it the first time. The repeat could have been placed last, but I chose the ninth position because I wanted to leave the students with something new at the end of the series.

9.2 Transcript of Guided Visualization with Pat's Class

Creative Thinking

Listen carefully. Remember when we did the second one I said that there was something a little weird about it, because we'd be doing it twice? This is the ninth one, and this is the one that's the same as the second one. What I'm going to ask you to think about a little bit is, before we start, I want you to think about creativity. Some of you had a hard time thinking about this last time when we did this; I want you to think about it again. I'm going to be asking you during this visualization to think of a time when you came up with a particularly creative solution to something. Something that you, or somebody else, noticed was particularly creative. Do you want to talk about creativity before we start? Can people think of things? [Several students mention Odyssey of the Mind.] Something that went beyond ordinary, predictable. [Several students come in late.] For those of you who got here late, this is the one that's the repeat of the second one. It's really a chance for you to look at creative thinking. Put every idea you ever had before we started this series out of your head. I'd also really like you to just open up your mind and see what happens in it. Don't come into this one expecting to see the same stuff that you saw before; I'd be disappointed if you did.

Sit in a comfortable position. Close your eyes and... This is hard in a crowded room, but try to imagine that you are all alone in a very dark place. Begin to breathe slowly, and very quietly. Breathe out... and in... and out... and in... As you breathe in, feel the
oxygen travel through your body to each muscle; as you breathe out, let each muscle release any tension inside it. Continue to breathe quietly, in... and out..., not thinking about anything except your breath.

Now keep on breathing quietly and slowly, keep your eyes closed. Imagine that inside your brain the darkness is changing to light. It might get brighter slowly, the way a day gets brighter before the sun comes up, or it might switch on suddenly. Notice what color the light is. Does it have a sound? Your mind is not exactly like anyone else’s in the whole world. You think about things in your very own way. Take a minute of clock time, equal to all the time you need, to think about what is unique to you about your thinking. Remember a time that you had an idea that you or someone else noticed was special. How did your mind think about it? [Pause.] Now let yourself notice the light coming through your eyelids. When you feel ready, quietly open your eyes.

There are two questions this time. What did you notice is special about your mind? Does something special happen inside it when you are feeling especially imaginative or creative?

Adrian: At first you just told me I was in a deep dark place, I thought of being inside the earth. And then when you said in your mind, I kept on thinking inside the earth, but that’s what came to me. (R: That your mind and the earth were somehow the same?)

Shari: When you said a dark place, I imagined that I was sitting, I was lying on the ground, and I got up because there were little tiny lights flickering, but they were like the stars and you could see constellations, but they were flickering on and off, then slowly streaks of color came up, till it went into the ground and started turning, turning, then suddenly they became smoke and turned to something brown.

David: What happened with me was, when you said a dark place, I just looked around and it was all black. After you said it started to get light I saw these handles started glowing, then the whole place turned blue, and I heard blue, blue, blue, blue.

Jonathan: I was in a cave. Then this vampire came and then an angel came and she let me pick a door... [Segue to his grandfather and baseball fantasies.]

Joy: It was totally black, then there were these stars up on two lights in the ceiling, and as it got brighter they were flickering real fast, so they were dim and as they slowed down they got brighter, and I found myself in this weird place. I was small, about this
big, and I was in this wire basket thing with clear junk on the top, which had black little things, and the bigger spots were the little star things.

R: Before I call on anyone else, I'm going to remind you what the questions are...

Whet: When you said that dark place, I came in this room and there was only some light because the door was open, I was standing there and couldn't see anything, and then I pulled the switch, it just lighted up really quick.

Erin: I noticed a bright little ball, it was real dark, then when you said when it starts to get lighter, this light just flashed on.

Christine: When you said a dark place, I was in a space shuttle, it was totally pitch dark. There weren't any stars. When you said it was getting light, the sun was getting brighter and brighter.

R: When I asked you during the later part of it, when I asked you to take a minute to notice what was unique about your thinking, did anything come up for you? Anybody? (Joey: My thinking is awesome.) Joey, what is particularly awesome about your thinking?

David: Well, everything was going around in my mind, I don't even know what it was 'cause I didn't hear you, everything was just popping on and off. It was just little shapes, like squares, triangles, numbers.

Jaime: It was really different from last time. It was dark and there were these lamps, I had seen them in my mind last time, and I knew there were these lamps, they started shining darkness instead of light. It was strange because it was getting blacker, until I found out these lamps weren't working, so I changed the lamps, actually I tried to change the lamps, I couldn't, then these lights started flickering and I was wondering what [he makes little squeaky sounds], it turned out there was a computer that had put in different things, printing out things, not in words, it had printed out pictures.

Shannon: I went into the dark place, and when you said light, I just came outside.

R: OK, so let's do a quick show of hands. All of you were in dark places, right? Raise your hands if you were in a dark place... Keep your hand up if lights came on in some way. OK, that's one hundred percent, now keep your hand up if you also noticed something about your thinking while you were in that place. If you noticed something new about your thinking, keep your hand
up. You didn’t? OK, well then, I want to do something. Everybody close your eyes again. We’re going to go back through that part of the exercise again; this time we’re going to focus on it a little bit better, so let’s all go back into that dark place.

Let’s all breathe together for a minute. In and out..., in and out... This time as you breathe out, let all the light that’s in your eyes go back out, let your mind just fill up with darkness. Now in that dark place, let yourself think about your mind. Let a thought come through your mind, and look at the shape of it, look at the shape of the thought, and the size of it. Let some more ideas go through your mind, look at them. Notice whether they have sounds or shapes or smells or textures, notice how they travel, notice that they connect with other ideas, how those connections might work. Notice where they go to... Take another minute to let those ideas travel around in your mind; notice what’s special about how they do that. Now go ahead and let a little light trickle in through your eyelids. OK, everybody? Ready? Did you think of anything this time about… [Chorus of "Yes, yes!"] Raise your hand if you came up with something new. Gosh, well, that worked a little better, didn’t it?

Jenny: Birds are flying around holding these numbers

Joy: Each idea was a different shape of wire. One might be a coiled circle, one might be a coiled triangle, they are all different colors, a soft golden, a light golden, soft gold tint.

Adrian: There were these little checkered things, they were going around and the checkers were flashing, the checker things were two-dimensional or three-dimensional, this place was full of them, and then they were on these big skyscrapers and the skyscrapers were made out of ideas, and these special trucks with oval wheels were zooming around with the ideas on them.

Whet: My ideas were all circles and they had pictures, and like these big globs of glue balls. They looked like that, part of it came off when they went together.

Erin: All these little different-color letters going around, and they would come together and make words.

R: Guys, as you’re waiting for other people to give their answers you might start planning out which of the materials you know that I have (because I have them every week) you’re going to use, and which tools you’re going to need, how you’re going to get it all together very, very fast. If you’ll be quiet enough about it, you can come and start getting your stuff together.
Christine: My ideas are in this little room, and there's this huge folder that has all these ideas in it, the ideas were on pieces of paper, they formed a tornado, the tornado went all the way up to Vermont.

Joey: ...little streamlined blobs of light, they just moved around.

Jaime: Pictures came into these flying saucers, and fly out, I couldn't open one, but it came into this machine that went into the main part of my brain, and that was a thought. It was really neat because they weren't words, they were pictures.

9.3 Transcript of Guided Visualization with Betsy's Class

Creative Thinking

(Dandridge: What was the thing last week?)

(R: It was an idea that a man named Gardner had, called multiple intelligences, about ways that your mind might work, might include all the different kinds of ways that we've had, plus a few more. He includes kinesthetic intelligence, where you can control how your body works with your mind, it includes personal intelligences, which is how you relate with other people and with yourself, it includes linguistic intelligence, which is how you use words, and logical-mathematical, which includes numbers and concepts in an organized kind of way, how you use spatial intelligence, that's visual stuff plus things about how you perceive that space is organized, musical, all the different things that have sensory input. His idea is that each of us has all of those different ways of the mind functioning, each of us uses different ones of those to varying degrees, that we don't necessarily all have all of those things to the same degree.)

This is one which is a rerun on number two. Remember I told you, back toward the beginning, that one of them was a little different from the others and that we were going to have it twice. This is about creative thinking and it's a very open-ended one, trying to get you to think about how your mind works and how you perceive that your mind works. What I want to see with this one is how your thinking has changed over the last month about how you think, whether you still think in the same ways about how you think, or whether that's changed a little bit. It's not telling you anything about how other people think that you think, it's basically just trying to give you a chance to share how you think you think. [Off-topic question.]
OK, so this one here, I'm going to need to turn out the lights, so those of you who are working [students from the first group], try to work in the semi-dark, and those of you who are fidgeting, try to put down the materials that you're fidgeting with so that we can begin. [Discussion of whether people are fidgeting or "just playing around," whether they work better when they're fidgeting, and where the tools should be put.]

Try to sit very comfortably. Close your eyes and—this is hard in a crowded room—I want you to try to imagine that you are all alone in a dark place. Begin to breathe slowly and very quietly. Breathe out... and in... and out... and in... This time as you breathe in, feel the oxygen travel through your body to each muscle; as you breathe out, let each muscle release any tension inside it. Continue to breathe quietly, in... and out..., in... and out..., not thinking about anything except your breath. Now keep on breathing quietly and slowly, keep your eyes closed. Imagine that inside your brain the darkness is changing to light. It might get brighter slowly, the way a day gets brighter before the sun comes up, or it might switch on suddenly. Notice what color the light is. Does it have a sound? Your mind is not exactly like anyone else's in the whole world. You think about things in your very own way. Take a minute of clock time, equal to all the time you need, to think about what is unique to you about your thinking. Remember a time that you had an idea that you or someone else noticed was special. How did your mind think about it? [Pause.] Notice the way ideas move around in your mind, the way they connect to other ones, notice whether they have a shape or a sound. [Pause.] Now let yourself notice the light coming through your eyelids. When you feel ready, quietly open your eyes.

R: Dandridge, you look like that was a pretty strange experience. Was it?

Dandridge: Not real strange, just you wouldn't think of a person like me being in a dungeon like that. (R: Were there ideas in there?) Not really, it was like I was in a dungeon, and it was dark and pretty wet; then when it got light, it didn't flash, it got light suddenly, it went gradually but suddenly, "zzzzzzzzzzzzzhh," like that, not like "tch!"

R: How about thoughts, guys, did any of you notice something special about your mind, something about what happens when you are really thinking?

Ian: Mine were like these little balls of molecules, little tubes connecting them all together, it was weird... There were little red balls being connected by black tubes.
Evelyn G: Last time I had bubbles and this time it was rain, it got put together in a puddle.

Katie: The way I thought, I was under water, and a fish came and told me and then when you said the light slowly got brighter, I was going up to the surface to sea turtle islands.

Brooke: I heard this pretty weird sound, when you said the colors [unclear] and then when the light came on, I was in this cave there was this humming, there was also water dripping everywhere, when the water hit the ground, out came the [inaudible].

Lecia: I was inside my brain, I was a light, and every time I got an idea, a light bulb would screw into me.

R: Ooohhh, Jaime [he stayed late to finish up], that's gorgeous. [Students start to look, ask questions.] Jaime has flying saucers in his mind. Every time he has ideas they shoot off, with little pictures on them.

Jaime: This is the main computer, they fly out of this and it sends them to that. This is a wrecked one, though. The idea crashed. [Discussion of failed toothpicks and accidental fuzz in his 3-d intentions and of a pencil as the central computer. Then Jaime leaves.]

Evelyn T: Mine was in a closet, it was kind of like little, I don't know quite what they were they just hanged over me, I was in a closet, it was in an old dark mansion-like thing, it was real dark, and then when the light came on I had gotten out through a wall and it was out in the desert.

R: How about ideas, did you have any ideas in there? Does everybody want to take a minute, everybody saw darkness, right? How many of you had light that came on in some way, you had one state and then you had a second state? How many of you got any kind of a fix on your creative ideas or on the way your mind works? Did you have any sense during the visualization of how your mind works? [Lecia and Evelyn did; the others did not.]

I'm going to give you another minute, get yourself back in a dark place, close your eyes. Breathe in... and out... and in... and out. Let an idea go through your mind, notice whether it has a shape or a sound or a color or a texture. Let another idea come through your mind. Let a whole bunch of ideas crowd through your mind. See whether they connect with each other; if they do, notice what the connections look like. If you have an especially creative idea, try to notice how that's different. Open up your eyes.
[Lots of excited talk, overlapping.]

Brooke: …the idea came in the form of a palm tree, then I made a beach because I made a whole lot of palm trees… (R: Do you know the book Harold and the Purple Crayon? When he makes a dragon and then his hand shakes and he makes an ocean?)

R (to everyone): This is the same assignment that I gave you the second time. I want you to make a model of how you think now that your mind works.

9.4 Discussion of Results

The same script, Creative Thinking, was used in the second and ninth visualizations so that I could compare the students’ understanding of how their minds work. I anticipated that more students would create three-dimensional responses the second time around, given that they would have a greater understanding of the concepts explored in the exercise, but I turned out to be wrong. Students created significantly fewer multi-dimensional responses in the ninth exercise than in the second—fifth overall in the later exercise versus third in the earlier one. Both girls and boys made fewer three-dimensional projects on only one occasion each, although their use of relief was quite high in the ninth exercise. Materials use showed roughly the same gap as dimensionality: students used their greatest number of materials in the second exercise, and during the ninth they used the fourth-greatest number. Color use was similar in the two exercises.

If the students had been interviewed individually after the session and asked to describe what they had made and why they made it, it might have been possible to track growth in their understanding. Although the tape recorder was left on throughout each activity, students were not asked to speak directly into the tape recorder about their projects; thus mostly what can be heard once the work period begins is a hubbub of students looking for materials and making arrangements to take turns with tools. The conversation during this exercise with Jaime about his work is unique among the twenty transcripts. There appears to be no measure that can be retroactively applied to this study that will reveal each student’s true understanding. Knowing what I now know about teaching, I’m guessing that the novelty of the first few exercises may have influenced the results far more than any other factor.
Graph 9.1  Use of Three-dimensions and Relief (Creative Thinking Exercises)

Graph 9.2  Dimensionality, Colors and Materials (Creative Thinking Exercises)

With Pat’s class I did not mention models or three-dimensional projects; with Betsy’s class I said, "I want you to make a model of how you think now that your mind works." The students in Betsy’s class did produce substantially more three-dimensional work, but the difference falls completely within the normal range of the difference between the groups.

Brooke, who made two complete 3-d projects in the work period for this exercise, said that "the idea came in the form of a palm tree, then I made a beach because I made a whole lot of palm trees." One of her projects illustrated this.

Adrian gave interesting verbal responses twice during the discussion. Early in the discussion he said, "At first you just told me I was in a deep dark place, I thought of being inside the earth. And then when you said in your mind, I kept on thinking inside the earth, but that’s what came to me." About the ideas in his mind, Adrian said, "There were these little checkered things, they were going around and the checkers were flashing, the checker things were two-dimensional or three-dimensional, this place was full
of them, and then they were on these big skyscrapers and the skyscrapers were made out of ideas, and these special trucks with oval wheels were zooming around with the ideas on them.” His three-dimensional project was a model of one of these.

Several students made eloquent verbal responses, with less exciting visual products, to one portion of the visualization. David said, ”What happened with me was, when you said a dark place, I just looked around and it was all black. After you said it started to get light I saw these handles started glowing, then the whole place turned blue, and I heard blue, blue, blue, blue.” Shari explained, ”When you said a dark place, I imagined that I was sitting, I was lying on the ground, and I got up because there were little tiny lights flickering, but they were like the stars and you could see constellations, but they were flickering on and off, then slowly streaks of color came up, till it went into the ground and started turning, turning, then suddenly they became smoke and turned to something brown.”

In response to a later portion of the visualization, Joey made a clear acetate project after describing his ideas as ”little streamlined blobs of light, they just moved around.” Jaime’s project illustrated his statement: ”Pictures came into these flying saucers, and fly out, I couldn’t open one, but it came into this machine that went into the main part of my brain, it was really neat because they weren’t words, they were pictures.”

In general, projects illustrated the visions described by the students, either of the way in which they perceived the light (no light bulbs this time, interestingly enough) or of the way they perceived their ideas.
9.5 Gallery

Figure 9.1 Adrian

Figure 9.2 Brooke (A)

Figure 9.3 Brooke (B)

Figure 9.4 Christine

Figure 9.5 Colleen

Figure 9.6 Dandridge
Figure 9.7 David
Figure 9.8 Erin
Figure 9.9 Evelyn G
Figure 9.10 Evelyn T
Figure 9.11 Graham
Figure 9.12 Ian
Figure 9.13 Jamie

Figure 9.14 Jenny

Figure 9.15 Joey

Figure 9.16 Jonathan

Figure 9.17 Joy

Figure 9.18 Justin
Exercise 10: Creative Responses to the Environment

10.1 Overview

This is the final visualization in the series. Because of my concerns about the ways in which schools, even very good ones, fail to support students in developing their spatial intelligence, I wondered what ideas my students would have about how schools should be. Originally I planned a final visualization in which I would ask the students to imagine that they were living and learning in ways that would be totally supportive of learning to think about spatial issues, with a request that they describe their school and their life. However, influenced by Bruner (1973, 1979) and by Feldman (1987), I recognized that my choice of vocabulary would have a profound influence on the results. Familiar terms were apt to create literal interpretations, and I wanted the children to create and share unique visions. I changed the wording of the final visualization, moving as far as possible from the words "school," "education," and "teacher."

This exercise placed students in an (imaginary) unfamiliar environment and on their return asked them how they would help others who were going to go to that same unfamiliar environment. Because each student dreamed up his or her own environment and because I deliberately did not mention school, students were free to consider what might best help another to learn.

10.2 Transcript of Guided Visualization with Pat's Class

Creative Responses to the Environment

R: Today is the last one. Everybody get comfortable. I want to talk about what a couple of words mean, before we start this one. What does "environment" mean?

David: A home or a place.

Joy: Bugs have to live in a certain environment, animals have to live in a certain environment. People live in this climate, you can't live very easily in a desert or at the North Pole.
R: You can also have a built environment, like this building is a built environment. It's anything that is surrounding you, anything you are living inside of. I wanted to make sure we all knew what that word meant. The other word is "creative." "Creative" is a big word today. (Joey: No, it's not.) "Creative" is the word of the day. [Interruption to deal with a student who is playing with scissors.] What does "creative" mean? (Joey: Well, I'm creative.) I don't want a personal definition, I want a regular definition. What does "creative" mean?

Joy: When you create something that is really interesting to other people.

Adrian: You open your mind and make things.

R: That's a nice definition.

Erin: When we make something and no one's ever thought of it.

R: So it's a new putting together of something, a new invention of something. A unique way of formulating something, and causing it to get created. [Another interruption to deal with a student's restlessness.] Last time we did the repeated one, and we were basically looking at how our own minds work, again. This time we're going to be thinking about what might help other people learn to think in creative ways; that'll be toward the end of it.

Sit in a comfortable position. Close your eyes... and notice which parts of your body are a bit tense. Begin to breathe slowly, out... and in... and out... and in... As you breathe in, feel the oxygen travel through your body to each tense muscle; as you breathe out, let each muscle release that tension. Continue to breathe quietly, in... and out..., not thinking about anything except your breath.

Each of you is an amazingly intelligent and creative person. Your mind is capable of responding in fresh and unique ways to all sorts of input from your environment. You have each learned to process information in ways which are unique to you, and you probably don't do it quite the same way as anyone else. Today you are going to travel to an imaginary place of your very own, where you will learn a special way to use your brain. When you come back, you will invent a new way to help other people learn.

Keep breathing in and out, and as you breathe out, imagine yourself very tiny, floating out on your breath. Your breath carries you away from your body, swirling up into the air. You float a long way. You can hear voices, speaking a language you can't quite understand, and you smell things you don't recognize. You look around and try to make sense of the unfamiliar sights.
Gradually you discover that you can control where and how you move. As you explore the environment, you begin to notice that everything makes more sense than you originally thought it did. You find that you are able to organize clues from your environment, and you gradually recognize familiar spaces. Spend a minute of clock time noticing the ways you organize the information which you are taking in. The information is the things that you’re seeing or smelling or touching, all the different information you’re taking in. Spend a minute noticing the ways you organize that information. [Pause.] You are able to understand where you are, and you find a path to return to your body. You travel back slowly, enjoying your surroundings.

Your creative mind knows it is possible to help other people find their way in the future. Take a moment to let your mind come up with some solutions. [Pause.]

In a moment I will begin to count to ten. You will join me in counting after I reach six. You will feel relaxed and eager to share your experience. One... two... three... four... five... six... (With students: Seven... eight... nine... ten.)

R: For the discussion questions today, rather than describe the environment, which I’m sure was awesome, I would like you to tell me how you made sense of it. What happened for you that made it possible to understand what that environment really consisted of?

Joy: Color. [ Interruption.] It was a little tiny room, and I could see that there weren’t walls there, there was another green switch, one was red, and it had different colors, I couldn’t quite make out what the figures were, one was blue, and so on, and then I walked into one of them and they said that one was math, and that one was divided into four things. (R: OK, by looking at colors you were able to make sense.)

Christine: My sense was sight. See, I traveled to Japan somehow, and I saw all these weird buildings and they had Japanese writing on them, that’s how I found out it was Japan. (R: So, signs helped you. Did anyone else find that signs helped them? Jenny, Shannon.)

Whet: I was traveling, I came out on this clear flying carpet, I went over this place and I was in the Saharan Desert and I went over the Sphinx and all the pyramids, and I saw these landmarks and I knew what they were. (R: So landmarks helped you.)

Jonathan: [Talks about his grandfather.]
David: First when my breath came out, I came out of my mouth and started and my breath started to go up, I was in a tornado, it took me somewhere, and it was just black all around, I heard all these weird noises. I couldn't see anything, just noises. (R: When it began to make sense, what was it that changed?) Well, the noises started to sound like regular American words. (R: So words finally helped you when they became recognizable words.)

Adrian: I'm not exactly sure what helped me. I went to this place, and there were all these little silver things that flew around, and they were all round and they were the only thing that was on this whole thing. There wasn't any ground or anything, but I was somehow walking on something and there were all these silver things that were flying around. (R: Did it ever begin to make sense? Were you ever able to organize it? How did you find your way back?) Well, I think they were little spaceships. I got in one of them and I zoomed back into my mouth. (R: So you basically did it by getting into—) …one of the things. (R: So you did it by finding a new way to travel?) Yeah.

Erin: When you said come out your breath, I came out and I was in this cloud, floating around. I went to this real dark place. There was a sign on the door, and it said drink, and I went in and there was all this like Dr. Pepper and everything around. I took that... (R: OK, so you got a magic potion that got you back.)

Shari: What happened was that I went on a little hike. When I found this big grandfather clock in the middle of the trail—strange, isn't it?—so I stepped right in it and then suddenly I appeared in this different place. I was this big. And I walked around and I heard this sound [she mews] and then suddenly I ran into this sign that was this big, that's this far off the ground. I'm in cat land. And I went walking along and suddenly I find a shovel or something that was shining, and I dug into the ground, I finally found myself in a tunnel. And inside the tunnel, I found— [Shrieks of protest from other students; R says, "Is this a movie or something?"] And suddenly I sprouted wings that were this big on my little tiny body, and I started flying, and I flew into my ear, and suddenly my wings went like that.

Jaime: What was the question again? (R: The first question was, how did you make sense of the unfamiliar environment, how were you able to organize the information that was coming in so that you could make sense of it.) I'm not sure. (R: What ultimately helped you find your way back?) Mental contact.

R: The other question, if somebody else had to be in that environment that you were in, how could you help them ahead of time? If you knew that they were going to go to that environment, how could you help them find their way around?
Jaime: I could have them contact the [inaudible].

Adrian: If they could get there, I would just tell them to walk around on it and whenever they needed to get back, just get in one of those things and program to whoever was next.

David: When all those sounds went in, it told me what it was and it just stuck in my brain, and I couldn’t talk at all. So I couldn’t help. I couldn’t speak it. (R: Would it help then if you let them know that if they just kept an open mind the sounds would start to make sense?) Yeah, but that wouldn’t happen. For some reason, I’m just all to myself, for some reason. Just stuck in my brain, I couldn’t say anything. (R: So everything that you learned was like a private language that you couldn’t communicate to anybody else to help them learn from.)

Graham: I’d make a map.

Joey: Well, if they were smart, they’d keep an open mind, then a thought from my mind would go to theirs, but they’d still be mine, you see.

Joy: I’d take a piece of cardboard and lay out, draw, just different ones, so that way if they wanted to go to the one [unclear]. (R: You’d give them a pattern.) It’s just this long hall with just these sections, huge.

Jaime: If I could, I would just give them a contact with them. (R: So you would send nonverbal signals to them, through your mind directly to their mind, the whole time?) Yeah.

Christine: I’d type them a letter that said when you get in you have to turn right, go to someplace, then you’d go straight. (R: So you’d give them written word instructions.)

Whet: I’d tell them about the landmarks. (R: Would you tell them about the landmarks or would you find a way to show them those landmarks?) Let’s see, I’d tell them what the landmarks were and what they looked like.

Shari: There was some sort of power that I didn’t know about. Something happened when I went to the wizard. And he gave me this potion, you drop a drop of potion on the ground and suddenly Mittens appeared. (R: But I’m not asking you what happened
to you, I'm asking you what you could share with somebody else who was going to go through that experience that would help them.) Climb up the first sign that they saw, and you'd tell them a big such and so place.

Shannon: I'd go with them. (R: By going with them, what would change that experience for them? As you went with them...) I'd tell them what [inaudible].

Jaime: I wouldn't have to know that they would be there, 'cause when they went there, I would know they were there.

Jonathan: I wouldn't tell at all.

R: What I'm really asking you is how you go about teaching somebody else about something that you've already experienced that's not real simple to just explain. Some of the answers I've heard make a lot of sense to me. When you make a decision to share information with somebody else, to help them learn it more easily... When Graham said he'd make a map, that made a lot of sense to me. If someone else is visually oriented and if you're visually oriented, and they're going to be going into unknown territory, a map is a good way of letting them know what's going to happen. So are written instructions like Christine's, so are descriptions of landmarks like Whet's. There's got to be some way that you can find that's going to help share that information. So, yes, Jonathan, it is an option to make a decision not to share, but what I'm asking everybody to do is to think if you were going to share, what those critical pieces are to share, for dealing with that particular kind of information that that environment is going to have. There are going to be different ways to share for different kinds of places.

I want you, for your project today, to find some way to show, in a way that would teach other people about that environment you were in, to show the things that need to be taught ahead of time. Not the whole environment, I'm not asking you to depict the whole environment. Make an assumption that someone else is going to go to that place, and show them the critical piece that they need to know for how to cope with that. Whatever the thing is, go ahead and do it.

Jaime: I'm going to put a circle. When you get close it's going to look like it's going around and around.
10.3 Transcript of Guided Visualization with Betsy's Class

Creative Responses to the Environment

Last time we were looking at how we use our very own mind in creative and unique ways. This time we're also going to be thinking about what might help someone else learn to think in creative ways.

Sit comfortably. Close your eyes. Notice which parts of your body are a bit tense. Begin to breathe slowly, out... and in... and out... and in... As you breathe in, feel the oxygen travel through your body to each tense muscle as you breathe out, let each muscle release that tension. Continue to breathe quietly, in... and out..., not thinking about anything except your breath.

Each of you is an amazingly intelligent and creative person. Your mind is capable of responding in fresh and unique ways to all sorts of input from your environment. You have each learned to process information in ways which are unique to you, and you probably don't do it quite the same way as anyone else. Today you are going to travel to an imaginary place of your very own, where you will learn a special way to use your brain. When you come back, you will invent a new way to help other people learn.

Keep breathing in and out, and this time as you breathe out, imagine yourself very tiny, floating out on your breath. Your breath carries you away from your body, swirling up into the air. You float a long way. You hear voices, speaking a language you can't quite understand, and smell things you don't recognize. You look around and try to make sense of the unfamiliar sights. Gradually you discover that you can control where and how you move. As you explore the environment, you begin to notice that everything makes more sense than you originally thought it did. You find that you are able to organize clues from your environment, and you gradually recognize familiar spaces. Spend a minute of clock time noticing the ways you organize the information which you are taking in. [Pause.] You organize all the visual information, everything you can touch or smell. You are able to understand now where you are, and you find a path to return to your body. You travel back slowly, enjoying your surroundings. Your creative mind knows it is possible to help other people find their way in the future. Take a moment to let your mind come up with some solutions. [Pause.] You're going to be finding a way to communicate ahead of time to someone else who's going to be in the same unfamiliar place, what it is they'll be experiencing, before they get there.

In a moment I will count to ten. You will join me in counting after I reach six. You will feel relaxed and eager to share your experience. One... two... three... four... five... six... (With students: Seven... eight... nine... ten.)
R: I have two questions today, and neither one of them is going to directly ask you to describe where you were. I'm going to ask you to do two other things with it. You're going to probably end up telling me a little bit about where you were, in order to answer the questions, but you're not going to go on and on. The first question is, how did you make sense of the unfamiliar environment?

Katie: The environment I was in was like ten square feet of desert and ten square feet of jungle. They were just all around me. I went to the place that I liked best, where I felt most comfortable, and then I knew my way. (R: Were you like in a grid, when you said ten square feet of desert and ten square feet of jungle?) A checkerboard. (R: So sort of a 3-d checkerboard.)

Ian: I was up inside a cloud and there were these trees. The trees were made out of clouds, and I could warp to different places.

Evelyn G: I was inside a tree and I was on a little tame Frisbee, and the way I found my way around was I told the Frisbee, I said "Hmm, I want a drink," and I went and took it, or something like that. (R: So you were able to communicate with your transportation.)

Lecia: I went into the ground with my breath and there was an underground city, but nobody had eyes, they just had noses. Nobody could see and it was always summer. It was just strange, they communicated by smell, they had the usual nose and then they had noses where their eyes would be.

R: How did you learn to find your way around in that difficult situation? (Dandridge, to Lecia: They always smelled their way around, right?) Were you able to smell your way around also?

Lecia: Yeah. Well, I could smell when I wanted to go somewhere, I could smell the smell of the place where I wanted to go.

Brooke: Mine was strange because when I got there, you said I was small, so, I was inside of a regular size peach, and I just knew that it was regular size. Something was eating it, they didn't stop; when I looked what was eating, it was a monster. I knew where to go because I was inside the Loch Ness monster and there were rooms inside of it. There was one that said like the moon room, and I fell in moon pies there and then jungle tropics. (R: When did you get on top of how to get from one place to another inside this space?) Well, because I saw those doors. (R: Because you had doors with signs on them?) Yeah.

R: Who else had things that helped them in any way?
Justin: I thought I was in a hall made out of clouds. Then, I was walking along, this mouse met me, he told me I was in a mouse hole, and the walls were lined with cotton. (R: So, was he a guide for you?) Right.

R: Who else had something interesting like that?

Colleen: I was in the rain forest, I was walking through there, it was really warm and humid, I saw a [hornet?]. I got on it and I fell asleep, and when I woke up I was home. (R: So you never did learn to find your way around, you simply dreamed yourself back to where you had started.)

Evelyn T: I went up in a cloud. Inside it was a little teeny one, and there were like these little things about this big [she gestures] that just pointed. You'd say something, like I'd say I wanted something to drink, I'd just say it to myself, in my mind, those things just pointed where it would be.

Katie: Mine was in different environments, and like in the desert there was a snake telling me how to get to a different place. (R: So you had helpers that were different in the different places?) Yeah, and they looked different too.

Dandridge: I was inside a mouth. When I wanted to get out, you know I always wanted to get out, finally I came to [he opens his mouth] right there, and I saw my teeth. There was little button, or this little thing on the tongue or whatever I was one, and I pushed it, it turned out to turn into signs, like a jackpot, you know. So I hit the thing and it turned out it said to get out you go through the crack on the edge here, and then you walk around like that.

Evelyn G: The Frisbee, when I was in different places, there was a little leaf at each foot inside the tree, was split and it walked and it could talk when it told me, see, when I came out of a place, or when I'm about to go out, it told me a quick way to go and I told my Frisbee.

R: The second question today is quicker. If somebody else had to go to that same environment you've been in, and you wanted to help them and make it possible for them to find their way through that environment without ever having to feel lost, what would be your most helpful way to communicate about that environment to them? Now, there were people in the other class who gave written directions, people in the other class who gave maps. [Rumblings of surprise.] Let's say I was about to go to that environment, Dandridge, that you were in. Let's say I was going to be stuck inside that mouth, and you want to help me out, and you want to tell me before I go there— [Interruption.] If I'm going to go into that mouth, and you don't want me to have to get
stuck in that mouth, and you don't want me to have to learn everything for myself, but you want to make it a little bit easier for me, you want to let me to experience that mouth, but you also want to let me know ahead of time what would help me find my way out of there, what would be the thing that you could do that would be the most helpful to me? Would it be the most helpful to tell me about that one place to push? Would it be the most helpful to... (Dandridge: That one place, probably.) Well, each of you is going to have something different, because you were in a different sort of place, so you may be telling me something to look for, or you may be showing me something to look for, or you may be telling me something to listen for, or to smell for. It could be as simple as just needing to communicate that what one needs to do is to sniff. What I want you to do going around is tell me what the thing is, in that last time I paused during the visualization, if anything came up for you then that you knew would make it simpler for somebody else. How could you help other people to find their way around?

Katie: Go to the place that you feel drawn to, and when you get in that place you go to the animal you feel comfortable with. (R: And they'll help you. So you would give a verbal clue?)

Evelyn T: I would tell them, watch out and listen for these little things that squeaked and pointed where you go, when you think.

Ian: I tell them to just think where you want to go and you'll go there. And then if you want to get out, a trap door opens on you and you fall into a go-cart, and you start to ride down.

Evelyn G: You have to find the leaf, it was the yellow leaf. (R: Would you show them that yellow leaf, would you give them, make them a yellow leaf and say look for this, it will help you?) Yeah.

Lecia: I would tell them to go wherever you get a nose from and tell them to take out their eyes and put in a nose. (R: You would seriously recommend to them that they go ahead after a bigger nose?) I would just tell them to smell your way around with your nose.

Brooke: What I would probably do is I would [inaudible].

Colleen: I would probably tell them to, if they feel they’re getting really lost in the jungle, take a nap.

Justin: I don't know the way through it myself, I'd try the mouse. (R: You would tell them, "You will need a guide.") Exactly.
R: For the project today (you have sixteen minutes before the science fair starts), what I'd like you to do is make something that you could give someone else that would be a help to them.

Dandridge: I want to make a tongue. I wish I had dreamed a big tongue, that the teeth opened up and made the tongue stick out.

### 10.4 Discussion of Results

![Graph 10.1](Use of Three-dimensions and Relief (Creative Responses to the Environment))

![Graph 10.2](Dimensionality, Colors and Materials (Creative Responses to the Environment))

As it happens, this tenth and final exercise was also the tenth-ranking exercise for three-dimensionality, tenth-ranking for the number of materials used by each student, and tenth-ranking for the number of colors used by each student. Yet the projects are truly interesting to look at because of the wide range of strategies put forth by the students, and the verbal responses are unusually varied and interesting as well. Visual responses to the exercise included providing help in the form of a key, making a map, being a leader, acquiring a new nose (sensory device) for an environment with unusual qualities, and employing quite a bit
of faith, magic, trust, and waiting. Verbal responses to this visualization are vivid and descriptive. (If you have not done so, I strongly recommend reading them all.)

This exercise placed students in an (imaginary) unfamiliar environment and on their return asked them how they would help others who were going to go to that same unfamiliar environment. Because each student dreamed up his or her own environment and because I deliberately did not mention school, students were free to consider what might best help another person to learn.

There are substantial gender differences in the strategies presented by the students. Four girls—no boys—produced written directions. Five boys—no girls—created tools or devices, including a communication button, spaceships, a word unscrambler, a key, and a transport sled. One boy had a mouse as a living guide, and two girls had imaginary creatures as living guides. Two girls and one boy produced maps with detailed landscapes, including landmarks, and one boy created a three-dimensional map. One girl made a nose, and one boy made a mind-to-mind direct communication system. One boy said, "I wouldn't tell at all," and made an illustration of two people standing separately. One girl suggested that taking a nap would help—perhaps a reflection of the guided visualization process itself. Many of the remaining students illustrated a scene from their experience, incorporating clues they felt would be helpful.
10.5 Gallery

Figure 10.1 Adrian

Figure 10.2 Brooke

Figure 10.3 Christine

Figure 10.4 Colleen

Figure 10.5 Dandridge

Figure 10.6 David
Figure 10.7 Erin

Figure 10.8 Evelyn G

Figure 10.9 Evelyn T

Figure 10.10 Graham

Figure 10.11 Ian

Figure 10.12 Jaime
Figure 10.19 Lecia

Figure 10.20 Sean

Figure 10.21 Shannon

Figure 10.22 Shari

Figure 10.23 Taylor

Figure 10.24 Whet
APPENDIX

DESCRIPTION OF THE STUDY GROUPS

I conducted each exercise with two groups of students at Community School in Roanoke, Virginia. Although each group consisted of a mix of nine- and ten-year-old boys and girls, the two groups had distinct personalities, as is evident in the transcripts of the discussions following the guided visualizations.

Each forty-five-minute session began with a settling-down period, moved on to the guided visualization and then to a discussion period, and concluded in a fifteen- or twenty-minute period during which each child tried to find a (usually visual) way of expressing the experience he or she had had during the visualization.

I always worked with "Pat's class" first, immediately after lunch. The students tended to come in rather restless and overexcited, and after the exercise they frequently wanted to stay past their forty-five minutes to finish their projects. There was generally a lot of friction among certain members of the group. Although participating in the study was optional, Pat actively encouraged her students to participate, and everyone in her group came unless absent from school.

"Betsy's class" came immediately after the other group left. Because the students in this group had to leave early on several occasions, they sometimes had as little as thirty minutes for the visualization and project time combined. They reaped the benefit of its being my second time through each exercise but paid the penalty of having to work amid the mess left behind by the other group. Several of the students in Betsy's class elected not to participate in the study; thus it seems safe to assume that each of the students who did participate actively wanted to.

Ideally, the space in which to conduct the visualizations would have been soft, comfortable, and easily darkened. In fact, we did these in a small, hard-surfaced room usually used for art and science classes. The worktables and stools were crowded, and moving them around (and moving around them) was difficult. The attempt to make the space work both for relaxing and for efficiently making projects led to frequent interruptions at the beginning of many of the exercises.
### PARTICIPANTS FROM PAT'S CLASS

<table>
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<th>Name</th>
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<th>Girl/Boy</th>
<th>Visualizations</th>
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<td>Christine</td>
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### PARTICIPANTS FROM BETSY'S CLASS

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MATERIALS AND TOOLS AVAILABLE TO THE CHILDREN

The materials and tools were generally available in a central location in the room in which I conducted the guided visualizations. I had previously checked with the teacher in whose room we were working about the availability of other materials, and on several occasions children did use certain of these.

One surprise in the course of the sessions was that the boxes intended for storing materials and for keeping projects organized were often used by students as art supplies.

There was a tremendous amount of interest in the hot glue gun. None of the students had previous experience with the glue gun, and many used it not only as a means of rapid connection for three-dimensional constructions, but also as a source of heat for melting crayons and bending plastic toothpicks and as a means of producing fine clear filament.

There was one accident with the glue gun in the course of the sessions, and although the child who was burned was in considerable pain, neither he nor his classmates lost interest in continuing to use it. (Fortunately, in spite of emergency medical attention, his parents were not upset and he chose to continue to participate in the sessions.)

There were no accidents with any other tools.

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</tr>
<tr>
<td>Cutting boards</td>
<td>Elmer’s glue</td>
<td>Watercolors</td>
</tr>
<tr>
<td>Scissors</td>
<td>Rubber cement</td>
<td>Crayons</td>
</tr>
<tr>
<td>Art knives</td>
<td></td>
<td>Pencils</td>
</tr>
<tr>
<td>Wire cutters</td>
<td></td>
<td>Colored pencils</td>
</tr>
<tr>
<td>Pliers</td>
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<tr>
<td>Saw</td>
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</tr>
</tbody>
</table>
Sheet materials:
Peeled matboard
Colored matboard
Railroad board
Colored fade-proof construction paper
Cast coat paper
Foam core
Origami paper
Bulk print paper
Clear Mylar, lightweight and heavyweight
Wax paper
Balsa wood in sheets
Sandpaper

Linear materials:
Stiff wire
Thin copper wire
Plastic coated wire in various colors
Pipe cleaners in various colors
Yarn
Clear fishing line
String (of various types and weights)
Toothpicks (of natural wood and several varieties of colored plastic)
Straws
Balsa wood
Wood dowels

Materials in the room:
Cardboard tubes
Colored glass
Fake fur
Cotton balls
Colored foil
Glitter
Fabric (including a variety of woven and knit textures)

Shoeboxes and large flat boxes
PERMISSION LETTER

April 19, 1989

Dear Parents,

As you are probably aware, I am working on my Master’s Degree in Architecture this year at Virginia Tech. I want to borrow your children for part of my thesis work.

Starting this Monday, April 24, I'll be working with 7 to 11 year old Community school students on a series of design projects based on guided visualizations. They would miss silent reading time twice a week, so this may necessitate extra reading at home, but it should be a fine opportunity to do some extra art. I will be able to return their projects late in the fall.

In order to use your child in my study, I need your permission. Please return the form below.

I appreciate your help.

Rebekah Rice

______________________________________,

My child, _____________________________, has permission to participate in the study being conducted by Rebekah Rice at Community School. I understand that my child’s art will be photographed and may be published.

Signed, ________________________________, date______________
GALLERY

In the Gallery, each child has a page of his or her own, with the pages arranged alphabetically by first name. Measurements and a brief description of each piece are given. All measurements are height x width (x vertical rise if the piece is three-dimensional).

If a child was absent for a particular session, his or her page indicates "not present." In a small number of cases, "missing piece" indicates that, although the child was present, for some reason the child’s project was not left in the collection boxes for photographing and recording. For example, on four occasions Jonathan, whose grandfather died during the time this project took place, felt a need to take his art home immediately.
4" cylinder, 7" tall, of clear plastic filled with cogs made of elaborately bent, coiled, or twisted pipe cleaners (red, green, yellow), coated wire (yellow, orange, black), and plastic toothpicks (yellow, green, red, orange). D3 M5 C11

7" x 6" black matboard base with hot-glued 7" x 3" twisted green wire forming the word "hello." D3 M3 C2

6" triangular form of twisted pipe cleaners (red, yellow, white, blue), coated wire (orange and white), filigree of hot glue, and two small red foil figures. D3 M4 C7

1-1/2" x 20" tube made of clear plastic and hot glue with five 24" (pieced together) red pipe cleaners sliding freely as a group inside. Attached red wire and white handmade nametag. D3.5(movable) M5 C3

10-1/2" x 7-1/4" cardboard base covered with green construction paper; attached (vertically) with hot glue, a 10" turquoise pipe-cleaner stem and a blue and pink construction-paper flower. D3.5(movable) M5 C4

3" x 3" silver foil base with hot-glued brown pipe cleaners 6" high supporting one figure (drawn in pencil on stiff white paper and carefully cut out) on each of the two tips. D3 M5 C3

6" x 10" green origami paper with circle of heavy silver wire outlining silver foil circle; scattered small gold, green, and red foil triangles hot-glued on. D2 M5 C5

2" cylinder, 8" high, of clear plastic with numerous orange/white origami paper bits, decorated with tiny pencil drawings, glued facing mostly in but some facing out. D3 M4 C4

3" triangular base of black cast-coat, with 2" high box made of red/white matboard (red inside, white outside) and covered on all five sides with small squares of black cast-coat arranged as a checkerboard. D3 M3 C3

3" x 4" red metallic paper with two gold metallic paper forms glued on. D2 M3 C2
Adrian 1

Adrian 2

Adrian 3

Adrian 4

Adrian 5

Adrian 6
BROOKE

1. 5" x 3" x 4" twisted copper wires with attached white cardboard cut-out figure with red and green felt-tip and pencil drawings and separate cut-out paper symbols.  D3 M5 C5

2. 7" x 6" x 4" 3-d construction of construction paper (red, green, purple, light blue), rubber cement, origami paper, and hot-glued white foam-core center curl. Signature in black felt-tip.  D3 M6 C6

3. 1" x 2" x 4" twisted orange and white wire figure holding black pipe-cleaner segment in one hand and white cardboard panel with green felt-tip self-portrait (?) in the other hand.  D3 M4 C5

4. 7" x 11" x 5" off-white shoebox with green construction-paper background, green wire person, and larger white wire and cotton four-legged animal with puddles of hot glue at feet.  D3 M5 C3

5. Not present.

6. 17" x 8" x 6" brownish cardboard base and white cardboard vertical side, with glued-on cutouts of construction-paper shoes (orange, green), pink construction-paper numbers, white X symbols, and pencil and purple felt-tip writing and drawing.  D3 M5 C8

7. 17" x 7" x 5" blue-gray matboard with folded brown construction-paper stairs and balsa-wood supports.  D3 M4 C3

8. 8" x 6" x 10" cream peeled matboard base with glued vertical piece of the same material, with felt-tip writing and drawings (black, yellow, orange, pink, lime).  D3 M4 C6

9. Two projects. The first uses an off-white 7" x 11" x 1" shoebox lid as a base for a 5" red coated wire stand to support a yellow origami paper fish.  D3 M4 C3 The second project is a 14" x 14" cut and folded paper base with two 6" palm trees made of brown pipe cleaners and green origami paper, with blue felt-tip drawings and glitter writing. The transcript indicates that the second project is the response.  D3 M5 C5

10. 10" x 7" white paper with written instructions in turquoise and magenta felt-tip.  D2 M2 C3
Brooke 8

Brooke 9A

Brooke 9B

Brooke 10
CHRISTINE

1  9" x 12" white paper with black felt-tip drawing of boat trip in red bloodstream, with green toothpick and "Blood Falls" sign glued flat to paper, off to the side of map through body to brain. D2 M4 C4

2  Approx. 12" x 12" x 3". Three green/white origami paper airplanes with slips of paper inside with pencil messages on them, loosely attached to wire loop. D3 M4 C3

3  9" x 11" peeled cream matboard with pencil drawing in two labeled halves. D2 M2 C2

4  9" x 12" white stiff paper with felt-tip drawing (brown, yellow, black, red) of rabbit with family album. D2 M2 C5

5  8" x 11" white paper with felt-tip drawing (brown, black, red, blue, three shades of green), self-portrait in meadow with multicolored flower and butterfly. D2 M2 C8

6  9" x 12" white stiff paper with felt-tip drawing (brown, purple, green, yellow, red, black) of size-distorted classmates. D2 M2 C7

7  9" x 12" white stiff paper with dividing line between felt-tip drawing and writing (black, red, purple, green, yellow). D2 M2 C8

8  9" x 12" white stiff paper with felt-tip writing (red, orange, yellow, green, blue) in squares, with little diagram at the side. D2 M2 C6

9  9" x 12" white stiff paper with felt-tip drawing (black, red, orange, blue) labeled "Idea Tornado." D2 M3 C5

10  8" x 10" white paper with written directions in purple felt-tip and pencil. D2 M3 C3
Christine 7

Christine 8

Christine 9

Christine 10
COLLEEN

1 12” x 14” white paper with felt-tip portrait of herself riding on a pencil (yellow, brown, black, red) and hot-glued colored glass bits (amber, yellow, blue, red), intentional glue loops, and scrunched-up green origami paper. D2.5(relief) M5 C10

2 18” x 13” white foam-core with felt-tip self-portrait (red, orange, blue, tan) with glued-on clumps of shiny red and silver paper on head. Words ("Art is neat") are coming out of mouth. Signature in black felt-tip. D2.5(relief) M4 C8

3 9” x 12” white paper with felt-tip self-portrait in the Olympics (black, orange, yellow, green, blue, red). D2 M2 C7

4 5” x 24” peeled matboard, black felt-tip comic strip of experience. D2 M2 C2

5 9” x 12” white foam-core base with felt-tip drawing (black, red, turquoise, yellow), gold and red glitter, several 1-2” vertical columns supporting colored plastic wings, a large piece of balsa wood colored with crayons. D3 M7 C8

6 12” x 15” vanilla matboard with felt-tip drawing (blue, green, yellow, orange, brown, red, black, purple). D2 M2 C9

7 9” x 24” off-white cardboard. One half has a faint crayon drawing on clear plastic with glued-on coiled pink and yellow pipe cleaners; the other half is covered with white cardboard with written felt-tip words (red, purple, blue). D2.5(relief) M5 C7

8 (Missing piece.)

9 9” x 11-1/4” white stiff paper with glued-on pipe-cleaner letters (pink, brown, yellow) and red and green toothpicks. (Unsigned.) D2.5(relief) M3 C6

10 9” x 12” white stiff paper with felt-tip drawing (brown, black, green, flesh, red, purple) of falling asleep in a hammock and dreaming of home. D2 M2 C7
DANDRIDGE

1 Not present.

2 11-1/2" x 10" black matboard base with hot-glued spirals and squiggles of plastic coated wire and of pipe cleaner up to 3” high. **D3 M4 C8**

3 Two twisted wire figures, one of blue pipe cleaner, one of white coated wire. Each is flattish, about 1" wide and 4” tall. **D3 M2 C2**

4 (Missing piece.)

5 11-1/2" x 11-1/2" gray matboard square with a 3” square of green drawing paper and glued-on 3-d spirals of a variety of kinds and colors of green paper. (Unfinished.) **D3 M4 C6**

6 8-1/2” x 11” gray cardboard base with three figures, each of two colors of pipe cleaner (green and red, blue and black, yellow and lavender) and each constructed differently, standing 4”, 6”, and 8” tall. **D3 M3 C7**

7 11” x 8-1/2” lined notebook paper with math problems written on it, glued to cardboard of the same size, with a white pencil (pink eraser) hot-glued to the page at a writing angle in the middle of the last problem solution. **D3 M5 C5**

8 Not present.

9 8” x 5” x 3” white shoebox with top glued down, a 1” square hole cut into it, and a 2” pipe-cleaner figure deep inside the dark inside. **D3 M3 C2**

10 8-1/2” x 12” white drawing paper with pencil illustration of a person standing on a tongue looking out at teeth, made with slots between them and a moving band of paper sliding to the left. **D2.5 (movable) M3 C2**
Dandridge 10
DAVID

1  Not present.

2  5" x 5" clear acetate window with brown cardboard crossbars and image of brown and green felt-tip tree on green construction paper.  D2 M5 C5

3  12" x 9" white drawing paper with similar felt-tip drawings (green, black, and brown) on each side. The person on the side marked "real body" is saying "ouch I fell"; on the side marked "kinesthetic body" the stick figure is saying "WEEEE!" D2.5(reversible) M2 C4

4  9" x 11" white railroad board with black felt-tip drawing (person riding on a cat?).  D2 M2 C2

5  5" x 11" white matboard base with 7" tall green pipe-cleaner figure with a green construction-paper head smelling a yellow and brown construction-paper flower (large brown construction-paper bubble attached to head says "this stinks").  D2 M4 C6

6  12" x 9" white railroad-board base with sitting figures of cut and folded origami paper (green and peach) rising 1" off the base.  D3 M3 C3

7  Not present.

8  10" x 5" x 6", cream peeled matboard base and vertical background with green crayon tree. A pyramid of blue-striped white straws stands near the front.  D3 M4 C4

9  8" x 9" cream peeled matboard with black felt-tip drawing and large glued-on coil of yellow pipe cleaners.  D2.5(relief) M4 C3

10 9" x 12" black construction paper with white chalk illustration and one tiny figure in pencil.  D2 M3 C3
1. 9" x 12" white drawing paper with red felt-tip stream, yellow pipe-cleaner boat 2" x 1/2" x 1/2", and yellow and black pipe-cleaner brain 2" x 1" x 1". **D2.5(relief) M4 C4**

2. 7" x 9" white railroad board with multicolored plastic toothpicks (yellow, orange, red, green, blue) rubber-cemented on the board and through a 1-1/2" hoop of twisted blue and green pipe cleaners set up with hot glue. **D2.5(relief) M4 C**

3. 9" x 16" peeled matboard with penciled lines and writing and two nearly identical glued-on basketball hoops made of black pipe cleaner and white cardboard with drawn-on nets. **D3 M5 C8**

4. 6" x 6-1/2" white foam-core with yellow felt-tip sun and blue clouds, with three black pipe-cleaner figures glued down flat with hot glue, labeled "mom," "Chris," and "Dad." **D2.5(relief) M3 C4**

5. 9" x 12" green drawing paper with lime-green pipe-cleaner figure and a long row of yellow or green stems, all glued flat, with red felt-tip flowers. **D2.5(relief) M3 C5**

6. 8" x 8-1/2" peeled cream matboard with felt-tip drawings of people, each a different color (purple, orange, blue, green, red, black), each labeled, and most with a head decoration of matching glued-on pipe cleaner. **D2.5(relief) M4 C7**

7. 9" x 11-1/2" white railroad board divided in half, with felt-tip drawings and writing (brown, black, yellow, blue, green). The side labeled "picture" also contains a turquoise mass of pipe cleaner. **D2.5(relief) M4 C7**

8. 5-1/2" x 11" gray cardboard with felt-tip words and drawings (red, orange, yellow, turquoise, blue). **D2 M2 C6**

9. 9" x 11-1/2" white railroad board, with red and black felt-tip words and with glued-on pipe cleaners forming a yellow sun, a red C, and a turquoise N. **D2.5(relief) M4 C6**

10. 10-1/2" x 8" white paper with directions written in felt-tip (red, blue, green). **D2 M2 C4**
Erin 1

Erin 2

Erin 3

Erin 4

Erin 5

Erin 6
Erin 7

Erin 8

Erin 9

Erin 10
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Tags</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9” x 14” black matboard base, heavy loop of coated wires (black, red, white) wires rising to 2”, hot-glued circles of pipe-cleaner pieces (yellow, lavender, red, green). D3 M4 C8</td>
<td>D3 M4 C8</td>
</tr>
<tr>
<td>2</td>
<td>8” x 11” cardboard covered with a white paper background, with a collage of green foil and blue and turquoise tissue, topped with a felt-tip drawing on white paper of a tree and a light bulb (red, black, green, yellow). D2 M7 C8</td>
<td>D2 M7 C8</td>
</tr>
<tr>
<td>3</td>
<td>9” x 12” white paper base with hot glue and twisted pipe cleaners forming yellow and black figure (3”), white and black ball (2”), and red goal (4”). D3 M3 C5</td>
<td>D3 M3 C5</td>
</tr>
<tr>
<td>4</td>
<td>9” x 12” light blue paper base glued to cardboard, hot glue, and twisted black and white pipe cleaners forming 3” object. D3 M5 C3</td>
<td>D3 M5 C3</td>
</tr>
<tr>
<td>5</td>
<td>Delicate creature with 3” long and 2” high body made of foil-covered cardboard (red, gold, green), with a 5” wingspan of transparent plastic with gold glitter glued to it. D3 M5 C5</td>
<td>D3 M5 C5</td>
</tr>
<tr>
<td>6</td>
<td>9” x 12” magenta construction paper with five pairs of origami paper socks (black, pink, aqua, lime, pale yellow), drawn onto with felt-tip (blue, green, red, orange) for details and patterns, glued on and labeled with comments ranging from &quot;wierd&quot; to &quot;boring.&quot; Two-d except for vertically folded and glued signature. D2.5(relief) M4 C10</td>
<td>D2.5(relief) M4 C10</td>
</tr>
<tr>
<td>7</td>
<td>7” x 9” brown cardboard with red and blue felt-tip drawing, with 10” x 5” blue-gray cardboard glued overlapping on top with writing and numbers (red, blue, silver). A strip of dark blue matboard is glued at the seam between the two base pieces, emphasizing the division. D2 M7 C6</td>
<td>D2 M7 C6</td>
</tr>
<tr>
<td>8</td>
<td>11” x 10” light blue construction paper with glued-on origami paper (black, white, aqua, pink, yellow, lighter blue) and white plastic straws, and black and brown felt-tip writing. D2.5(relief) M5 C10</td>
<td>D2.5(relief) M5 C10</td>
</tr>
<tr>
<td>9</td>
<td>9” x 11” white cardboard with glue, glitter, and puddles of hot glue and dark melted crayon. D2.5(relief) M5 C3</td>
<td>D2.5(relief) M5 C3</td>
</tr>
<tr>
<td>10</td>
<td>12” x 5” x 2” cream peeled matboard, cut out, with hot-glued and wrapped pipe-cleaner extensions, borders, and decorations (black, brown, turquoise, yellow, pink). D3 M4 C6</td>
<td>D3 M4 C6</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Reference</td>
</tr>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>1</td>
<td>17” x 20” white cardboard base with brown and blue drawings, yellow and white twisted wire pathway (slightly 3-d), 3” tall sail made of twisted yellow and black pipe cleaners, 4” long boat of twisted green and black pipe cleaners, dark yellow figure standing on boat.</td>
<td>D3 M5 C9</td>
</tr>
<tr>
<td>2</td>
<td>12” x 16” cardboard covered with sections of red construction paper. Yellow-arrow-tipped toothpicks, hot glue, and light blue and green origami paper pieces with drawn patterns resembling lines of writing. Signature and drawings are in dark brown felt-tip.</td>
<td>D2.5(relief) M6 C5</td>
</tr>
<tr>
<td>3</td>
<td>7” x 15” white cardboard base, sectioned in two, with identical yellow pipe-cleaner figures, 3” high, with green pipe-cleaner ski poles and black skis. The left side is labeled “imaginary body” and has two sets of skis in black felt-tip with arrows indicating motion.</td>
<td>D3 M3 C5</td>
</tr>
<tr>
<td>4</td>
<td>8” x 11” brown cardboard base with balsa-wood table, 2-1/2”x 6”x 2-1/2”. A white and black pipe-cleaner cat, a construction-paper and copper-wire teapot, and a yellow pipe-cleaner teacup are on the table, and a yellow pipe-cleaner figure is on a brown construction-paper chair.</td>
<td>D3 M7 C7</td>
</tr>
<tr>
<td>5</td>
<td>9” x 10” cardboard covered with light green origami paper is decorated with glue and multicolored glitter. A 2” yellow pipe-cleaner figure is standing, smelling a slightly taller flower (green stem with pink, turquoise, and yellow petals) with large and small red and gold glitter flakes attached.</td>
<td>D3 M5 C9</td>
</tr>
<tr>
<td>6</td>
<td>9” x 12” cream cardboard base, with a 5” tall brown pipe-cleaner rack of origami paper shirts (folded and then cut; they are each two-sided) organized by color (pale blue, red, yellow).</td>
<td>D3 M3 C5</td>
</tr>
<tr>
<td>7</td>
<td>(Missing piece.)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9” x 12” white cardboard with five blue felt-tip drawings of labeled intelligences, each bounded by a different color pipe-cleaner border (yellow, turquoise, orange, red, lavender).</td>
<td>D2.5(relief) M4 C7</td>
</tr>
</tbody>
</table>
9" x 12" white cardboard with a wide pile of stacked-up rings of yellow and pink pipe cleaners (1"+) and six smaller black pipe-cleaner rings. **D2.5 (relief) M3 C4**

10" x 12" white cardboard base with drawn orange foot outline, two pipe-cleaner balls (yellow and black), and a 10" high orange origami paper leg. **D3 M5 C5**
GRAHAM

1 3" x 3" x 4" blue/white origami balloon with one side cut off and replaced by clear plastic supported by twisting and crisscrossing black coated wires and glued into place. Inside is a figure made of black pipe cleaner. **D3 M5 C4**

2 9" x 12" x 5" stiff white paper base with four yellow-arrow-tipped toothpicks glued upright with hot glue, the word "ideas" penciled in, and a white and yellow pipe-cleaner figure leaning against the uprights with feet wired through holes in the base. **D3 M5 C6**

3 (Missing piece.)

4 1/2" x 6" x 1/2" red plastic arrow pointing out from white cotton cylinder glued to itself. **D3 M3 C2**

5 5" x 15" white matboard with yellow felt-tip brain, an eye made of clear plastic with black paper iris and black pipe-cleaner outline, and a blue plastic arrow indicating direction of input from a small glued-on shape. **D3 M7 C4**

6 Not present.

7 Not present.

8 4" x 9" x 8" black and white matboard folded into four columns, one panel set down 1/2" below top. Supports for top are black pipe-cleaner bundles poked through holes in columns and hot-glued. **D3 M3 C3**

9 4" x 4" white cardboard with red, orange, and blue pipe-cleaner loops and a frame of stacked wooden toothpicks. **D3 M4 C5**

10 12" x 12" x 4" 3-d map of bent pipe cleaners (two red, two black, two green, two yellow) forming a twisty loop. **D3 M1 C4**
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>16” x 2-1/2” wine matboard with brain made of brown and tan yarn piled 1” high in a 4” x 4” area and a black pipe-cleaner boat with a white sail attached with tape. D3 M4 C5</td>
</tr>
<tr>
<td>2</td>
<td>10” x 5-1/2” black matboard base supporting a vertical white cardboard sign to 6” high. Turquoise, pink, brown, and black yarn, hot glue, two toothpick arrows as the post. Red and blue metallic paper glued to penciled grid on sign. D3 M7 C9</td>
</tr>
<tr>
<td>3</td>
<td>7-1/2” x 3-1/2” brown cardboard base with pencil markings, 3” high at top of two pipe-cleaner figures (one black, one white and yellow), one supported above the other by three red pipe-cleaner supports. D3 M4 C5</td>
</tr>
<tr>
<td>4</td>
<td>Half a shoebox, 12” x 3” x 5”. Black fake-fur animal and white pipe-cleaner figure. D3 M4 C3</td>
</tr>
<tr>
<td>5</td>
<td>7-1/2” square cardboard covered with striped fake fur. Yellow pipe-cleaner figure with two layered brown cardboard wings to 2-1/2” tall. D3 M5 C3</td>
</tr>
<tr>
<td>6</td>
<td>3” x 4” white railroad-board base. 4-1/2” tall figures of twisted pipe cleaners (lavender, yellow, red, brown) and hot glue. D3 M3 C5</td>
</tr>
<tr>
<td>7</td>
<td>Cut-down shoebox, 7-1/2” x 2-3/4” x 5”. Bush-shaped cut-out scraps of box used for two hot-glued attachments, one labeled with green felt-tip, one drawn on with two shades of green crayons; white pipe cleaners and black coated wire form two sides of “tower.” D3 M6 C7</td>
</tr>
<tr>
<td>8</td>
<td>14” x 5-1/2” tan cardboard with overlapping cream matboard. Felt-tip drawing (green, black, red) and 2” tall lavender and red yarn pile. D3 M4 C7</td>
</tr>
<tr>
<td>9</td>
<td>10” x 7” white railroad board, torn black origami paper, rubber cement, green coated wire, and pipe cleaners (turquoise, green, yellow, black) bursting out in a loose arrangement. D3 M6 C7</td>
</tr>
<tr>
<td>10</td>
<td>8” x 2-1/2” x 5-1/2” tall. Cutout of cream peeled matboard, white cotton attached with rubber cement, pipe cleaners (black, white, red, green, yellow, turquoise, blue) attached with hot glue. D3 M5 C8</td>
</tr>
</tbody>
</table>
JAIME

1  9-1/2" x 2" x 3" balsa-wood box with yellow and red pipe-cleaner stripes, clear acetate, tape, and eight green pipe-cleaner figures (one holding white paper with writing on it, three holding different types of yellow toothpicks).  D3 M10 C9

2  7" x 9" cardboard base with 3-1/2" to 4-1/2" white paper towers, yellow and black pipe-cleaner figures holding black coated wire weapons or implements, hot-glued.  D3 M5 C4

3  7" x 3" x 1/2" clear acetate with cream cardboard and pink origami paper figures on each side (glued back to back), one figure wrapped with coated wire (yellow, gray, black, red).  D3 M5 C7

4  11-1/2" x 9" stiff paper with pencil and red and black felt-tip drawing with names and light bulbs in heads (wiggly lines between the figures' heads).  D2 M3 C4

5  15-1/2" x 8" peeled cream matboard base with orange railroad-board structures up to 5" tall and two pipe-cleaner squiggles (red, turquoise, orange).  D3 M4 C5

6  11-1/2" x 9" light cream cardboard with glued-on white paper cutouts of people felt-tipped in grids (lime, yellow, orange, brown) and penciled commentary.  D2 M5 C6

7  10" x 10" orange origami paper with brown, black, and orange crayon drawing on white side of paper.  D2 M2 C4

8  13" x 11" clear acetate with hot glue, pipe cleaners (lavender, lime, red), and blue/white origami paper box.  D3 M4 C4

9  10" x 11-1/4" black matboard with hot glue, plastic toothpicks (red, orange, yellow, green, blue, white), gold metallic paper, white drawing paper, black and brown felt-tip and a glued-on pencil stub.  D2.5(relief) M7 C12

10  9-1/2" x 20" white drawing paper with ink and felt-tip (red, orange, yellow) spiral.  D2 M3 C4
JENNY

1 25” x 20” red construction paper with pencil drawing of the inside of her body, with a small 3-d black and white cast-coat paper boat. **D2.5(relief) M4C3**

2 20” x 18” gray matboard with felt-tip drawing (blue, brown, red, black) of a person and a (black, yellow, red) bird. The bird is speaking ("Do what I tell you"), and the black words are contained in a cartoon bubble outlined with a black wire loop hot-glued in place. **D2.5(relief) M4 C7**

3 9” x 12” white matboard (yellow on reverse) with felt-tip drawing of swimming scene (water is covered with clear plastic to make it shiny) with swimmer drawn on one side of a midpoint dividing line, and nothing but water on the other. (Unfinished.) **D2 M4 C5**

4 8” x 11” white stiff paper with brown and black felt-tip drawing of forest scene. **D2 M2 C3**

5 9” x 12” light blue construction paper with felt-tip drawing (purple, blue, orange, brown) and green pipe-cleaner leaves and stems glued in place for flowers in the drawing. **D2.5(relief) M4 C6**

6 Not present.

7 8” x 11” brownish cardboard with green crayon drawing and glued-on balsa wood for tree trunks. The drawing is divided with a red line into two halves, one with labels on each component but otherwise indistinguishable. **D2.5(relief) M4 C4**

8 9” x 9” black construction paper with darker black felt-tip drawing of five doors with keyholes and keys. The edge of each door is defined, four with white toothpicks and one by copper wire wrapped in crisscrossing black coated wire. **D2.5(relief) M6 C5**

9 9” x 12” brown construction paper with blue felt-tip drawing and glued-on pipe-cleaner arch shapes (lavender, turquoise, yellow, black). **D2.5(relief) M4 C6**

10 20” x 20” vanilla matboard with green and black felt-tip map and two black pipe cleaners glued on. **D2.5(relief) M4 C3**
6" x 3" x 1-1/2" cream peeled matboard "boat" covered with clear acetate, with red pipe-cleaner figures inside. **D3M4C3**

(Missing piece.)

9" x 9" x 1" lightweight white cardboard with a black line drawn up the center. Folded-up edges support two strands of fishing line on one side of the line and two black pipe cleaners on the other. **D3 M5 C4**

3" x 8" cardboard with attached red and white pipe-cleaner figure. Black felt-tip signature. **D2.5(relief) M3 C4**

3" x 8" cardboard with vertically attached (hot-glued) 4" blue pipe-cleaner frame filled with clear acetate and also hot-glued vertical corrugated cardboard line. **D3M5C2**

12" x 14" blue matboard with six attached parallel lines: a white straw, a red pipe cleaner, aluminum wire, copper wire, red coated wire, and fishing line. **D2.5(relief) M8 C7**

12" x 12" x 3". Brown corrugated cardboard base with four linear red pipe cleaners on one face and seven vertically attached wiggly pipe cleaners (blue, green, yellow, brown) and three orange coated wires sticking up on the other face. **D3 M4 C6**

8" x 2" x 1" slider made of orange and white pipe cleaners along two brown pipe cleaners forming a long loop. **D3.5(movable) M1 C3**

5" x 4-1/2" x 1/2" pouch made of clear acetate and hot glue. **D3 M2 C1**

6-1/2" x 5" black matboard pierced by bent blue-striped white straw, white chalk drawing. **D3 M3 C3**
JONATHAN

1  5-1/2" x 9-1/2" x 3-1/2" white shoebox with front side removed, completely lined with blue origami paper, balsa-wood boat, hot glue.  **D3 M4 C3**

2  (Missing piece.  Jonathan made a pack of baseball cards and decided to take them home and add them to his collection.)

3  12" x 9" drawing paper with pencil.  **D2 M2 C2**

4  (Missing piece.)

5  Not present.

6  (Missing piece.)

7  10" x 8" brown cardboard with black and red crayon drawing that does not appear to be a response to the visualization.  (Unsigned.)  **D2 M2 C3**

8  (Missing piece.)

9  11-1/2" x 8-3/4" light cardboard with blue and red toothpicks, hot glue, and one small cardboard triangle.  **D2.5(relief) M4 C3**

10  8-1/2" x 12" white drawing paper with red and orange felt-tip and pencil drawings.  **D2 M3 C4**
JOY

1  15" x 20", cream peeled matboard with scattered plastic toothpicks (green, blue, red, yellow). Clear cellophane pocket and orange and brown coated wire figure.  D3 M5 C8

2  4" x 4" blue origami paper base supporting an 8" tall clear plastic tube (taped) with pipe cleaners (green, brown, yellow, white, red) and plastic arrows (white, yellow, blue, red, orange) erupting from the top.  D3 M5 C11

3  6" x 11" pink paper with pencil and felt-tip writing, covered with clear plastic, attached to shiny paper panel framed by blue and red pipe cleaners.  D2.5(relief) M5 C5

4  9-1/2" x 6-1/2" fake-fur bunny, mounted on foam-core, holding 6" pipe-cleaner key (red, with black and white stripes, attached to arm with yellow pipe cleaner).  D3 M4 C5

5  8-1/2" x 9" brown cardboard base covered with clear plastic. Four 2" tall pipe-cleaner flowers (green stems, red or yellow tops) are attached with hot glue. A 7" white pipe cleaner supports a two-sided blue/purple figure horizontally above.  D3 M5 C7

6  8-1/4 x 8-3/4" clear contact paper covers two-sided rotating (around lavender pipe-cleaner band with white handles) rows of blue and pink paper people cutouts. Black felt-tip labels for each row on the white side of silver metallic paper.  D3.5(movable) M5 C5

7  10" x 11" brown cardboard base with 5-1/2" tall partition of heavy gray cardboard. "Joy's Room" is written in ink on one side, with red metallic origami paper floor, balsa-wood bed, yellow felt rug. Other side has scribbled words and numbers in ink.  D3 M7 C5

8  8" x 5" off-white shoebox lid with ten coiled pipe cleaners (lime, pink, yellow, orange, turquoise, red, lavender, white, brown, black) arrayed in a tight grid with a color-coded key written in matching felt-tip.  D2.5(relief) M3 C11

9  8" x 5" shoebox lid, lined with gold metallic paper, scattered toothpicks (red, orange, green, blue, white), six stacked coiled pipe cleaners (pink, red, turquoise, black).  D3 M5 C10
16” x 6” white matboard with felt-tip drawing and writing (red, black, yellow, blue, purple, green, orange, brown) forming a scorecard or game board. **D2 M2 C9**

Joy 1

Joy 2 (Detail)

Joy 2

Joy 3

Joy 4

Joy 5
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4” x 3” x 3” wire (copper, plus gray, white, and red coated wire) network, with small white paper and orange wire figure hanging inside by a loop. D3 M4 C6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>9” x 10” black matboard with single glued spot of foil paper. D2 M3 C2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(Missing piece.)</td>
<td>D2 M3 C2</td>
</tr>
<tr>
<td>4</td>
<td>2” x 7” x 4” tan fake-fur animal, two-sided, with white cotton-ball tail. D3 M3 C2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>11” x 5” x 1” white matboard base with scrunched-up purple origami paper ball. D3 M3 C2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>7” x 8” white foam-core with felt-tip drawing and writing (blue, brown, yellow, green, orange). D2 M2 C6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8” x 9” clear plastic cut with irregular outline and black felt-tip drawings. D2 M2 C2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>5” x 7” x 3” free-form black coated wire sculpture with attached orange coated wire figure, copper wire coil, black pipe-cleaner object, blue toothpicks, and foil shape attached with crayon-tinted hot glue. D3 M7 C6</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>4” x 6” blue matboard base with bits of green construction paper and foil attached in a slightly 3-dimensional way. D2.5(relief) M4 C3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3” x 5” x 3” tan toilet paper roll covered with white cotton balls, with small black pipe-cleaner animal inside the tube. D3 M4 C3</td>
<td></td>
</tr>
</tbody>
</table>
KATIE

1. 12" x 12" white foam-core with small felt-tip drawing (yellow and red) and attached 1" high pieces of scrunched-up bright pieces of tissue paper (turquoise, blue, red, orange, yellow) and plastic toothpicks (green, orange, yellow).
   
   D2.5(relief) M4 C11

2. 4" x 4" x 1" blue tissue circle with folded and sectioned black cast-coat circle attached. Trees ranging from a 1/2" seedling to a 4" mature tree are felt-tipped (brown and green) onto graduated pieces of white railroad board and radiate out from the center. Large black question mark is felt-tipped in center.
   
   D3 M5 C6

3. 5" x 5" piece of lined notebook paper written on in pencil and black marker and covered with clear acetate.
   
   D2 M5 C3

4. 4-1/2" x 3" base of brown construction paper supporting four arches of green pipe cleaners (6" high at center) with attached green leaves, yellow toothpick, and glitter.
   
   D3 M6 C5

5. 10" x 10" aqua origami paper with glitter sun and green metallic paper butterfly with pipe-cleaner outlines and details (black, yellow, orange, pink, red, turquoise), toothpicks (yellow, red, green), and glitter details.
   
   D2.5(relief) M6 C10

6. 12" x 12" white foam-core base with light color pencil squiggles, 12" x 2" foam-core strip hot-glued along top edge has three holes for clear fishing line, each suspending a different article of colored paper clothing (magenta, yellow, pink).
   
   D3 M6 C4

7. Not present.

8. 7" x 10" curved clear acetate shape surrounding white railroad-board cluster of handmade file folders that open out to 11" x 9". The math folder opens to show rectangles of white paper with black felt-tip operations written on them.
   
   D2.5(movable) M5 C3

9. 7-1/2" x 4-1/2" x 4-1/2" made of white shoebox and lid glued together at right angles and lined with a sheet of black construction paper that has been curved into place. Glitter is glued into place to create the design.
   
   D3 M4 C3
10" x 10" peach origami paper is decorated with orange felt-tip dots and large squiggles of hot glue. A dark blue crayon is melted onto the paper with an attached blue construction-paper face. **D2.5(relief) M6 C4**
LECIA

1. 10" x 10" x 1" white paper with flat purple construction-paper blob and six strands of coated wire (yellow, orange, red, black) twisted together and hot-glued in three spots. D2.5(relief) M4 C6

2. 7" x 5" stiff whitish paper cut into the shape of a head with black felt-tip details including brain. Yellow pipe-cleaner figure sideways inside brain area. D3 M4 C3

3. 9" x 12" white paper with soccer game depicted in yellow and red pipe-cleaner figures, all glued flat to the paper, with two black pipe-cleaner balls and a black pipe-cleaner goal, with a series of balls and arrows drawn in pencil. D2.5(relief) M4 C5

4. 9" x 11" stiff white paper with drawing in pencil and brown and black felt-tip. D2 M3 C4

5. 12" x 14" peeled cream matboard with butterfly, flower, and connecting wires using pipe cleaners (yellow, pink, lavender), green plastic toothpicks, metallic paper, black coated wires, black felt-tip, and hot glue. D2.5(relief) M7 C6

6. 6" x 11" white foam-core with five pieces of fake fur ranked from dark to light. D2.5(relief) M3 C6

7. 9" x 9" white cardboard with clear plastic over it and pipe cleaners (black, red, pink) forming words and outlines. D2.5(relief) M4 C4

8. 12" x 12" cream peeled matboard with a carefully drawn orange crayon grid, 9 columns x 10 columns, with squares filled in with orange or red crayon or with blue crayon discs or with single or clustered crayon letters. D2 M3 C5

9. 12" x 12" cream peeled matboard with black felt-tip words and brown drawing, and a small circle of white paper with multicolored glitter on it. D2 M5 C4

10. 3" x 5" x 5" container of light cardboard, labeled "extra nose" in purple crayon, with a red and black pipe-cleaner nose deep down inside. D3 M3 C4

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SEAN

1  4-1/2" x 1-1/2" x 1-1/2" tube of red, white, and black pipe cleaners carefully woven together. A small paper figure on a paper boat is positioned inside at the midpoint.  D3 M2 C4

2  2-1/2" x 3-1/2" x 1/2" tangled plastic coated orange and red wires, wrapped around a light bulb made of yellow and black construction paper with pencil markings.  D3 M4 C5

3  9" x 12" white drawing paper with pencil illustration.  D2 M2 C2

4  8-1/2" x 14" white copy paper with felt-tip drawing (green, brown, yellow, red, blue).  D2 M2 C6

5  5" x 5-1/2" x 3". White foam-core base with attached cotton balls and white pipe-cleaner figure.  D3 M4 C1

6  3" x 4" white foam-core base with three vertically attached pipe-cleaner figures, 3" pink, 2" dark blue, and 1-1/2" turquoise.  D3 M3 C4

7  7" x 9-3/4" pencil drawing (picture of castle in mind of person) on the whitish back of orange origami paper.  D2 M2 C2

8  10" x 10" cream peeled matboard base divided into four squares with pencil lines. The squares contain:
   ▪ a torn shape of black cardboard;
   ▪ a 2-1/2" x 2" x 1" tangle of orange and black plastic coated wires;
   ▪ a 3" x 2" x 1" tangle of red, orange, turquoise, and yellow pipe cleaners; and
   ▪ a 4" x 3-1/2" x 1-1/2" twist of heavy aluminum wire.  D3 M7 C10

9  Not present.

10  2-3/4" x 1-3/4" key made of silver paper glued to white cardboard base.  D2 M3 C1
| 1 | 9" x 12" white construction paper with red felt-tip blood river and small bundle (boat?) of black scrunched-up pipe cleaners. D2.5(relief) M4C3 |
| 2 | 9" x 18" white construction paper with unevenly torn upper edge. Four cut-out pictures of toy animals (gray, red, yellow) from magazines are scattered on the page, each with a carefully folded printed recipe (black on white or black on pink) attached. D2 M4C7 |
| 3 | Two separate panels, each 10" x 4", of red origami paper, one covered with clear plastic and the other not. The back of the covered one has a felt-tip self-portrait. The other is still plain. (Unfinished.) D2 M4C2 |
| 4 | (Missing piece.) |
| 5 | 9" x 6" cardboard rectangle with blue origami paper cut to similar size and glued on. White and black pipe-cleaner figure is attached 2-3" above. D3 M4 C3 |
| 6 | 9" x 7" yellow drawing paper divided into vertical sections with pencil lines. Each column contains pencil, crayon, and felt-tip drawings (yellow, black, brown, red, blue) of people, separated by hair color. D2 M4 C7 |
| 7 | 9-1/2" x 12" x 6-1/2". The base is yellow railroad board used gray-green side up, with one half containing small rectangles of white paper with pencil scribbles, the other half with black felt-tip math problems. The partition between the sides is made of blue and white matboard hot-glued into a vertical position. D3 M6 C6 |
| 8 | 10" x 20" drawing of a map showing a "scince tunle" and spelling, math, and "o.m." tunnels, executed in pencil on two glued-together squares of slightly different shades of orange origami paper. D2 M3 C3 |
| 9 | 9" x 12" pink drawing paper with yellow coated wire hooked into a circle and rubber-cemented into place. A small squiggle of orange wire is hooked onto the circle. D2.5(relief) M3 C3 |
| 10 | 12" x 8-1/2" white drawing paper with maroon felt-tip written instructions. D2 M2 C2 |
Shannon 9

Shannon 10

To Anna:
When you go to one hole to the right and then go to the left, then be sure to go to the
hunk. You see and there go through the hole. You will be there.
SHARI

1  Not present.

2  12” x 18” drawing on white paper with felt-tip pens (black, green, brown) and glued-on sphere of twisted pipe cleaners (red, yellow, black), a red plastic arrow, and a wire loop. Drawing shows horse and rider, tree, and an underground scene. D2.5(relief) M5 C9

3  Roughly cut 4” x 4” black cardboard square with layer of gold foil paper, pencil drawing on tracing paper, top layer of clear plastic. D2.5(relief) M6 C3

4  7” x 12” x 5” off-white shoebox with white cotton bunny, freshly picked real buttercups, balsa-wood and black felt-tip sign, and 3-d figure of black pipe cleaners and brown origami paper. D3 M7 C7

5  10” x 10” orange origami paper with two red and black felt-tip figures dressed in cut-out blue origami paper. (Unsigned.) D2 M3 C4

6  16” x 16” formed of two black matboards, joined side to side, with pink cut-out figures with pencil faces and blue figures without drawings. Forming a T with this is a smaller piece of blacker cast-coat with pipe-cleaner grid (yellow, white, lavender). D2.5(relief) M5 C8

7  17” x 22” cream peeled matboard, covered on the left half with a green paper rectangle with a blue paper river. The whole piece is covered with plastic, and on the right side are black felt-tip drawings and writing on the plastic. D2 M6 C4

8  9” x 12” x 2” blue construction paper with ten folded pipe cleaners (lime, pink, yellow, orange, turquoise, red, lavender, white, brown, black) built up in a stack with hot glue, plus polka dots of hot glue with melted crayons of various colors including gold. D3 M4 C12

9  9” x 11” black felt-tip drawing on thin white cardboard with red and brown felt-tip highlights and glued-on glitter, balsa wood, lavender pipe-cleaner pieces, and plastic toothpicks (red, orange, yellow, green, blue, white). D2.5(relief) M7 C13

10  8” x 18” white paper with map drawn on both sides in blue felt-tip. D2.5(reversible) M2 C2
TAYLOR

1  5" x 2" x 2" simple white and red pipe-cleaner cylinder.  D3 M1 C2

2  4" x 3-1/4" x 3-1/2" tall. Two black matboard rectangles separated by vertical white plastic toothpick spears, containing a clump of red yarn.  D3 M4 C3

3  Not present.

4  7" x 1" x 1" curved black pipe-cleaner cylinder.  D3 M1 C1

5  4-3/4" x 7-1/2" x 6" cardboard base with brown fake fur hot-glued to it, with a black pipe-cleaner figure soaring above.  D3 M4 C2

6  6" x 4" light cardboard base with five cut-out stiff white paper figures hot-glued at base, Elmer's glue to glue heads on.  D3 M4 C1

7  2" x 2-1/4" cream peeled matboard base with 4-1/4" tall peeled matboard "4" cutout attached with hot glue.  D3 M3 C1

8  5-1/4" x 4-1/4" cream peeled matboard base with 4" high bent pipe cleaners (yellow, blue, pink, black, turquoise, lavender, red) and red yarn.  D3 M4 C9

9  4" tall brown pipe-cleaner figure, wooden toothpick sword, balsa-wood shield, gold metallic paper armor, hot-glue attachments.  D3 M5 C4

10 2-1/2" x 2-1/2" light cardboard base with 8" white straw and 4-1/4" black pipe cleaner supporting arm for fishing line and white paper airplane.  D3 M6 C3
WHET

1  7” x 11” x 1” shoebox lid fully lined with orange-red matboard. Contains red construction paper, balsa-wood boat, red pipe-cleaner figure, purple construction-paper brain wrapped in clear plastic. **D3 M7 C7**

2  7” x 11” x 1” shoebox lid fully lined with red poster board, hot-glue decorations, yellow coated wire, and red plastic toothpicks. **D2.5(relief) M5 C4**

3  10” x 10” red origami paper with two drawn black figures. One labeled "kinesthetic" is embellished with white chalk and coded "shivers." **D2 M3 C3**

4  (Missing piece.)

5  Two were produced, first an off-white 7” x 11” x 1” shoebox lid with pieces of colored paper (light blue, white, green) forming a landscape collage, second a 2” x 3” x 3” structure of pipe cleaners supporting three arrow-tipped toothpicks. He stated that the second had nothing to do with the assignment, he just wanted to make it, and he stressed that he would want it back. Only the first has been scored. **D2 M3 C4**

6  6” x 10” x 1” off-white shoebox lid with glued-in cut-out figures made of origami paper (yellow, turquoise, blue, white) with visible pencil outlines. **D2 M4 C6**

7  5” x 9” x 1” off-white shoebox lid with origami paper collage of light blue sky, brown tree trunks, and torn and slightly crumpled green and white leaves. **D2.5(relief) M3 C5**

8  7” x 11” x 1” off-white shoebox lid with balsa wood, red coated wire, and notebook paper torn and drawn on. **D3 M6 C4**

9  6” x 10” x 1” off-white shoebox lid with black and brown felt-tip drawings on pale blue and pale green origami paper collage. **D2 M4 C5**

10  7” x 11” x 5” off-white shoebox with pencil drawings and writing on orange origami paper. **D2 M5 C3**
BIBLIOGRAPHY


Of particular interest is "Growth," a look at the normal development of artistic skills in children.


“A tree is a confusing sight, and so is a bicycle, or a crowd of people in motion. Sensory perception, therefore, cannot limit itself to simply recording the images that hit the receptor organs. Perception must look for structure. In fact, perception is the discovery of structure. Structure tells us what the components of things are and by what sort of order they interact. A painting or sculpture is the result of such an inquiry into structure. It is a clarified, intensified, expressive counterpart of the artist's perception.... Even more important for our present purpose is the fact that all perception is symbolic. Since all structural qualities are generalities, we perceive individual appearances as kinds of things, kinds of behavior. The individual percept stands symbolically for a whole category of things." (p. 253)


"In considering how to design an education appropriate for women, suppose we were to begin by simply asking: What does a woman know? Traditional courses do not begin there. They begin not with the student's knowledge but with the teacher's knowledge." (p. 198)


This collection of twenty-seven articles on cognition, development, and education, although out of date, is still helpful in thinking about what issues are important in cognition. As Jeremy M. Anglin writes in the Introduction (p. xxiii), "Bruner's view of man as an information processor, thinker, and creator emphasizes both the rationality and the dignity of which human beings are capable."

From "Education as a Social Invention" (p. 472): "What comes out of this picture...is a view of human beings who have developed three parallel systems for processing information and for representing it—one through manipulation and action, one through perceptual organization and imagery, and one through symbolic apparatus. It is not that these are stages in any sense; they are rather emphases in development. You must get the perceptual field organized around your own person as center before you can impose other, less egocentric axes upon it, for example. In the end, the mature organism seems to have gone through a process of elaborating three systems of skills that correspond to the three major tool systems to which he must link himself for full expression of his capacities—tools for the hand, for the distance receptors, and for the process of reflection."

From "Readiness for Learning" (p. 417): "As David Page, one of the most experienced teachers of elementary mathematics has commented, 'In teaching from kindergarten to graduate school, I have been amazed at the intellectual similarity of human beings at all ages, although children are perhaps more spontaneous, creative, and energetic than adults. As far as I am concerned, young children learn almost anything faster than adults do if it can be given to them in terms they understand.'"


The essays in this collection, most of them written before 1962, address issues that are still being tested, explored, and thought about in new ways.
From "Conditions of Creativity" (p. 18): "An act that produces effective surprise—this I shall take as the hallmark of a creative enterprise. The content of the surprise can be as various as the enterprises in which men are engaged. It may express itself in one's dealing with children, in making love, in carrying on a business, in formulating physical theory, in painting a picture. I could not care less about the person's intention, whether or not he intended to create.... What is curious about effective surprise is that it need not be rare or infrequent or bizarre and is often none of these things. Effective surprises...seem rather to have the quality of obviousness about them when they occur, producing a shock of recognition following which there is no longer astonishment. It is like this with great formulas, as in that for the conservation of energy...."

From "The Act of Discovery" (p. 82): "First, I should be clear about what the act of discovery entails.... I shall operate on the assumption that discovery, whether by a schoolboy going it on his own or by a scientist cultivating the growing edge of his field, is in its essence a matter of rearranging or transforming evidence in such a way that one is enabled to go beyond the evidence so reassembled to new insights."


Articles written by various developmental psychologists explore such issues as gender, the development of planning skills, and new ways of looking at children's ability to put themselves into another's role (variations on Piaget's three mountains).


A wonderful book. First, Duckworth makes Piagetian concepts interesting, intelligible, and personal. Second, she succeeds in sharing her thoughts about approaches to teaching in appropriate ways.

"An...important ingredient of ultimate artistic attainment crystallizes during the years from five to seven when the child is able for the first time to produce works that in themselves exhibit internal organization and coherence. I have questioned whether the child is fully aware of what he is doing, whether he can be considered in control of this production. Yet even if this tendency to produce a balanced and composed work is in part the result of unconscious processes, ones only partially visible to the child, or of a failed attempt to produce a perfectly symmetrical work, its significance cannot be overemphasized. For even as the scribbling and exploring of earliest life serve as models for the experimentation that is the lifeblood of mature artistry, so too the vision of a balanced graphic symbol constitutes an unequivocally central aspect of any aesthetic achievement.

"It may be useful in this connection to recall the notion of a U-shaped curve in development—the view that some
important aspects of artistry emerge early in the life of the child, only to 'go underground' during a period of middle childhood. Certainly the burden of the evidence that we have reviewed concerning drawing in middle childhood indicates that some of the magical aspects of early drawing—free exploration, the sense of form unwedded to specific content, the willingness to flaunt conventional practices—disappear from the works of most children....

"Be assured, the period of middle childhood is scarcely a time of stagnation in the arts. Or, more accurately, it need not be such. It is then that the child develops particular technical skills; it is then that he is susceptible to (and eager for) training; it is then that he becomes able to plan his work with some thoroughness and accuracy; it is then that he can intentionally place in his own work those features of the aesthetic that figure crucially in later production—such as telltale details, subtle variation of color, and expressiveness of line. And perhaps most crucially, it is at this time that the child undertakes to solve problems within the graphic realm—problems of a visual-spatial nature (such as rendering accurate perspective) and problems too of a personal or emotional nature (such as sorting out his feelings about an individual, a situation, or an ideology)." (p. 261)


"To my own way of thinking, Kosslyn has the stronger line of argument within the empirical cognitive sciences [than Pylyshyn]. If one is trying to model the way the mind works, and a certain line of modeling consistently produces rich and revealing results, then it is folly to dismiss that line just because of some theoretical objections—which would be very hard to disprove. (Indeed, in my own view, further research might well reveal several imagery systems, analogous to the one described for the visual system, but capturing and transforming other kinds of information, such as linguistic, musical, or tactile.)" (pp 335-336)


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Wonderful puzzles about arrangements, shapes, arithmetic, reasoning, routines, and words. The introduction is a concise and neatly phrased thinking about the nature of sudden creative leaps of thought. A lovely little book.


A fascinating look at how a distinguished scientist uses her ability to project herself inside genetic material.

"What is it in an individual scientist's [McClintock's] relation to nature that facilitates the kind of seeing that eventually leads to productive discourse?... Her answer is simple. Over and over again, she tells us one must have the time to look, the patience to 'hear what the material has to say to you,' the openness to 'let it come to you.' Above all, one must have 'a feeling for the organism.' One must understand 'how it grows, understand its parts, understand when something is going wrong with it.'" (pp. 197-198)

"A deep reverence for nature, a capacity for union with that which is to be known—these reflect a different image of science from that of a purely rational enterprise. Yet the two images have coexisted throughout history. We are familiar with the idea that a form of mysticism—a commitment to the unity of experience, the oneness of nature, the fundamental mystery underlying the laws of nature—plays an essential role in the process of scientific discovery. Einstein called it 'cosmic religiosity.' In turn, the experience of creative insight reinforces these commitments, fostering a sense of the limitations of the scientific method, and an appreciation of other ways of knowing. In all of this, McClintock is no exception." (p. 201)

"[McClintock] has always had an 'exceedingly strong feeling' for the oneness of things: 'Basically, everything is one. There is no way in which you draw a line between things. What we [normally] do is to make these subdivisions, but they're not real. Our educational system is full of subdivisions that are artificial, that shouldn't be there.'" (p. 204)

An excellent, fairly technical book by a Harvard researcher of mental imagery.


A well-written and comprehensive book, subtitled "Creating and Using Images in the Brain." Kosslyn sums up all the spatial research of the 1970s, including his own, and presents the information in a particularly accessible way.


"Creativity is apparently not one of the specialized areas of the brain. The notion that creativity is exclusively the function of the right hemisphere comes from making a false dichotomy between logic and creativity, or equating creativity with emotion. Creativity is a way of thinking, not a specific skill." (p. 346)


"A deeper goal of the teaching of creativity, and of art, is to offer a starting-point, a vocabulary of the spirit, tools for climbing through the changing terrain of the mind. The dilemmas of our lives are dealt with by looking not just at the problems but with them, around them, inside and outside of them, and beyond them." (p. 8)

"Joseph Chilton Pearce, in his book _The Magical Child_, speaks about a certain point in childhood, especially between the ages of seven and eleven, where virtually any suggestion can be adopted and utilized by the child, if it is given without doubt or ambiguity." (p. 8)


This book was a resource for me in my earliest use of guided visualizations with my Odyssey of the Mind teams. Murdock provided inspiration and a wonderful tool.


This classic is referred to both directly and indirectly in much of the more recent work done by psychologists everywhere. I’d recommend reading Duckworth first and then going back to Piaget and Inhelder’s less accessible book for details.


Probably the best education book that I’ve seen on issues related to the right/left brain, showing what changes can be achieved in public schools with a bit of sensitivity. Excellent bibliography.
VITA

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EDUCATION and AWARDS

2003  Master of Architecture, Virginia Polytechnic Institute and State University, Blacksburg, VA

2002-2003  Eisenhower Fellow (Secondary School Math, Science and Technology), Union College, Schenectady, NY

2001-2002  Sadowsky Fellow (Ceramic Sculpture), Skidmore College, Saratoga Springs, NY

1985  Bachelor of Architecture, cum laude, Virginia Polytechnic Institute and State University, Blacksburg, VA

Fifth year project: Design for a crafts school.

EXPERIENCE

2002-present  Assessment and Instructional Materials Specialist, Association for the Cooperative Advancement of Science and Education (ACASE), Saratoga Springs, NY. Design materials that support teaching and learning in math, science, and technology (e.g. "Sun & Shadows"); provide staff development to teachers.


1998-2000  Founding Director, Quaker Arts Camp, Baltimore Yearly Meeting. Developed successful arts based summer camp.

1985-present  Designer, building and site design for small to mid size business and residential projects.

1985-present  Odyssey of the Mind Coach, Judge, and Consultant Trainer for coaches and judges.

1989-1995  Visiting Scientist and Enrichment Teacher for 4th through 6th grade students. Group projects for students included local architecture surveys, and designing and building scale models of boats and castles based on classics.

1986-1988  Art Teacher, Community School, Roanoke, VA.

1975-1976  VISTA Volunteer, Preschool Director, Anthony Escuelita, Anthony, NM