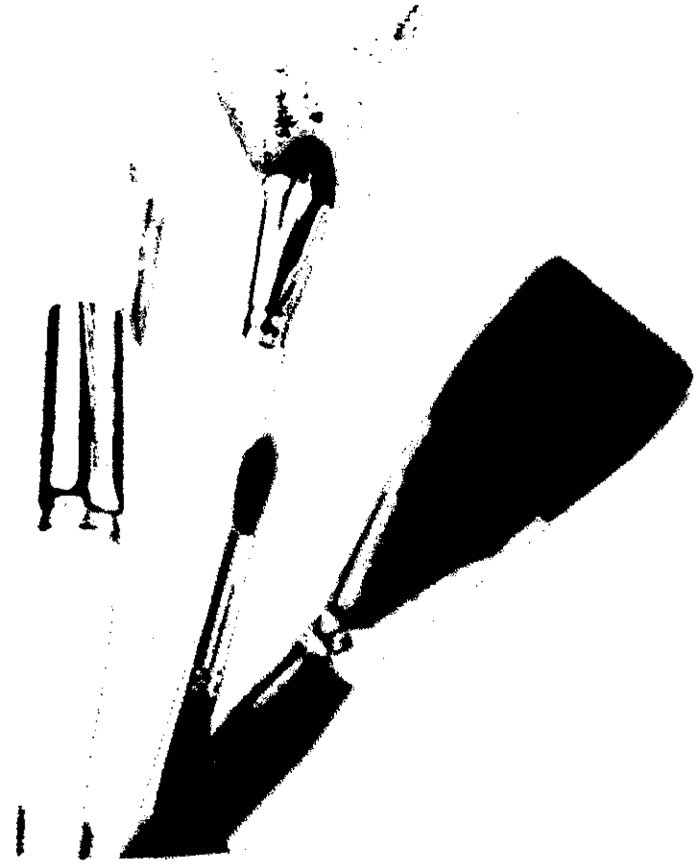


Creating Meaning Through Art

Teacher as Choice Maker

Judith W. Simpson
Boston University

Jean M. Delaney
Southwest Missouri State University

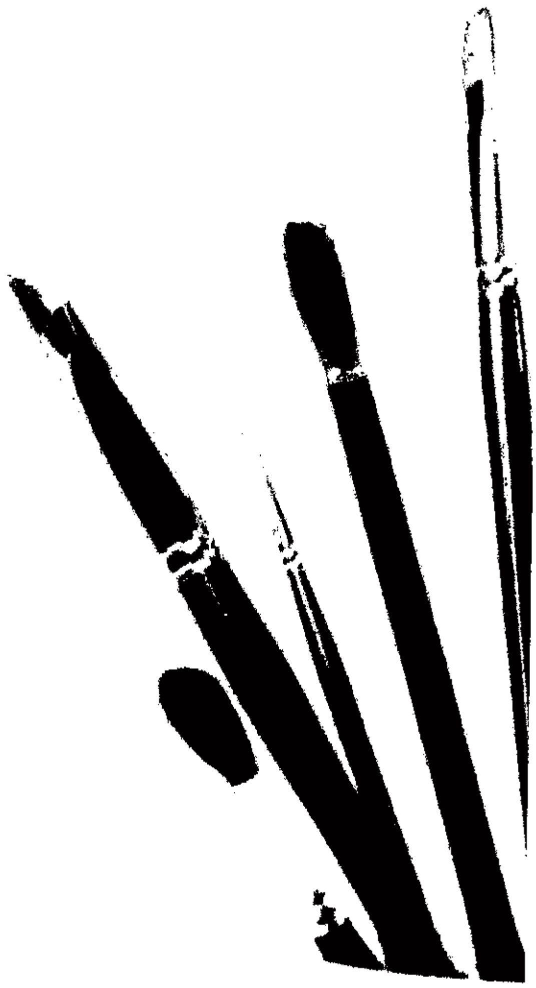
Karen Lee Carroll
Maryland Institute, College of Art

Cheryl M. Hamilton
Wichita State University

Sandra I. Kay
Monroe-Woodbury Central Schools

Marianne S. Kerlavage
Millersville University of Pennsylvania

Janet L. Olson
Boston University



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CHAPTER 7

Shaping Elegant Problems for Visual Thinking

Sandra I. Kay
Teachers College, Columbia University

Guiding Questions

- Who are the learners in my classroom?
- What forms of thinking are meaningful in art?
- How do I design the learning experience to fit my learners?
- What are the characteristics of an elegant problem and how do they guide curriculum design?

You will always remember certain art studio assignments. If you are an artist, most likely the first assigned problem that comes to mind is one that presented you with a challenge and evoked a solution that pleased you. When some people are asked to recall an art lesson or experience, they quickly respond with the memory of a catastrophe that convinced them to go no further. Unfortunately, for many, this event occurs around fifth grade. Without confidence in their own art-making abilities, and with little opportunity to further their appreciation of art, many individuals think of art as a subject only for artists.

Who Are the Learners in My Classroom?

The role of appreciators of artistic creativity has received too little attention in art education practice. This lack of attention is found in all creative endeavors. According to Stein (1984), the creative process requires more than the individual. He describes this process as a transactional relationship between creative individuals and the public. He uses the term **contricipation** to describe the two major roles in the creative process: contribution and participation. Participators include intermediaries such as parents, teachers, or gallery owners that facilitate the success of the creative person. But there is also the audience:

> If the audience does not appreciate creativity and the creative person, then society's creativity will diminish markedly. . . . Composers could compose great music but no one would listen. Painters could paint magnificent paintings but no one would look at them, let alone buy them. Writers would write superb novels but no one would read them. (Stein, 1984, p. 31)

The participant in the creative process must be able to appreciate how a problem is selected and formed, how it is worked out and tested, and how the results and solution are communicated to others.

The concept of contricipation is important to the structure and design of the assignments you choose for your students. Shaping problems that provide effective memories for both the contributor and the participant requires careful consideration. An elegant problem provides an opportunity for many excellent responses or solutions from a variety of problem solvers.

Lesson Scenario

The following fourth-grade lesson scenario provides a context for the discussion on shaping elegant problems for visual thinking. A clay unit had been introduced weeks ago, with all three assignments and the agenda on the blackboard:

> Problem 1: Netsuke or miniatures; techniques: wedging and forming; A. demonstration: dinosaur/bird; B. work time
>
> Problem 2: ornament, jewelry, or glaze tile; techniques: slip and scoring (addition and subtraction); A. demonstration of each; B. work time
>
> Problem 3: container (other than ashtray); techniques: planning and patternmaking; A. demonstration: mug; B. work time

Never having experienced clay, these fourth graders had learned the basics of wedging, sculpting, and additive/subtractive surface decorations with the previous two assignments. We had worked up to the long-term lesson that we were about to begin.

Several of the 30 students brought in their sketches to preempt time spent on planning and increase time with clay. One young sculptor accompanied her sketches with the necessary pattern pieces cut from newspaper. Attentively quiet, the class anticipated the 5–10-minute discussion/demonstration that preceded individual work time. Building a slab-constructed mug using a rectangular pattern was demonstrated. Five precut patterns were available for interested students, but handles required individual designs. Options of slab and sculpted coil handles were displayed and demonstrated. Then, those with advanced preparation were asked to hold up their sketches for everyone to see. Designs ranged from candy jars with lids to a clay house.

One student pointed to John's sketch, exclaiming that his was not a container. Moving closer to the disagreement brewing, I noticed John's drawing was of an old man sitting by a tree with an engaged fishing pole. With pride in often being correct, Danny adamantly reminded the class that a container had to hold something. John's sketch was of a sculpture, not a container.

John rarely spoke and often appeared aloof during class discussions. Approaching gently, I queried him: "John, this does look like a drawing for a sculpture. Is it?" John nodded. With sincerity, I asked, "How is a sculpture a container?" This fourth grader explained, "If a sculpture contains a feeling or a memory, then it is also a container. Isn't it?" Everyone, including Danny, understood.

A shiver reached my spine as I realized that John had managed to expose his fourth-grade classmates to a level of thought embodied in advanced philosophical discourse (Langer, 1953a). Word of this interpretation spread throughout the grade levels. Discussions were overheard by classroom teachers in hallways throughout the school. Other sketches for sculptures appeared in subsequent classes. The topic even reached the teachers' room, where I was questioned regarding my teaching strategy for such a difficult concept. I credited John.

Several weeks later, during a visit from John's mother, I learned that his inspiration to stretch the problem definition came from his need to fill a void from the recent loss of his grandfather. Working through the grief of losing his soulmate, John spent every free moment at capturing the memories. John's mother had come in to personally thank me for being so flexible about altering or making an exception to the assignment. I explained that the problem was good enough to not require revision if exceptionally advanced thought was applied, as her son had demonstrated.

Modestly, her discussion continued around John's profoundly high IQ and his interest in advanced mathematics and science. Although capable as a young child, John had never held a particular interest for art. However, since the class discussion had occurred, he had accepted his parents' standing offer to go to art museums. Hours during the past two weekends had been spent looking at sculptures, particularly the funerary statues in the Egyptian wing. Believing that a scientist must be cultured, his parents were profoundly pleased with this change in attitude—thus the personal visit of thanks.

Although the lesson remained monumental for John through high school, his response had altered my perception of the potential range of capabilities at the fourth-grade level. Particularly for students at the high end of conceptual development, opportunities to discover abilities requisite to advanced understanding of art must be made available to students prior to Lowenfeld's recommendation of age 11.

Affective Dimension of Learning

Designing problems that provide meaningful encounters in art for all students must begin at a point just beyond the student's current level of ability and experience. However, the range of abilities and degrees of art experiences within a given class may be extreme. Naturally, most art teachers try to provide a challenge that is meaningful to the artistically creative child. Art education practice often mirrors the curriculum design that guides most studio coursework. The assumption that all children enjoy expressing themselves through visual art experiences may be questioned upon encountering a child with severe emotional difficulties or a child who excels in problems that require correct responses. These situations occur more frequently at the elementary levels, where students cannot opt out of art classes.

These potential appreciators and consumers of art, rather than the future producers, are the most challenging to reach. In developing creative, open-ended lessons for these students, teachers may find some of the lessons beyond the students' realm of understanding. The subsequent feelings of anxiety or alienation produce either disruptive behavior or disinterest (disengagement). No doubt, these negative feelings affect learning.

The affective dimension of learning is described in Csikszentmihalyi's "flow construct" of intrinsic motivation (1982). He suggests that when activity is at an appropriate level of difficulty for a child's current level of skill, learning and advancement are internally motivated (see Figure 7.1). Therefore, when a challenging task or understanding is mastered, a sense of pleasure as well as new knowledge is gained by the individual.

This flow state is that familiar experience of total absorption that occurs during creative activity when there is no sense of time and all that matters is before you. Csikszentmihalyi sees the flow construct as containing important implications for understanding the dynamics of growth. The level of challenge in a task must provide and maintain this flow state. To provide the intrinsic pleasure of learning in the flow channel, the challenge cannot be greater than the child's current skill level or the learner may feel too anxious about his or her ability to succeed. This feeling occurs when the task is too high on the task difficulty axis for the child. In contrast, if the learner's skill level has developed beyond the demands of the task, the child's motivation will drop below the flow channel into the realm of boredom. Either way, the benefits of the learning experience are lessened. Thus, the curriculum challenge is to provide the opportunity for each child to maintain the balance necessary to preserve the intrinsic pleasure of learning that occurs within his or her flow channel.

The clay container lesson exemplifies an appropriate width for the channel crossing. Designed to address the need for a low level of task difficulty by providing the mug pattern as an answer to the challenge of creating a container, the assignment forced a small step forward by requiring choices to be made regarding technique and design of

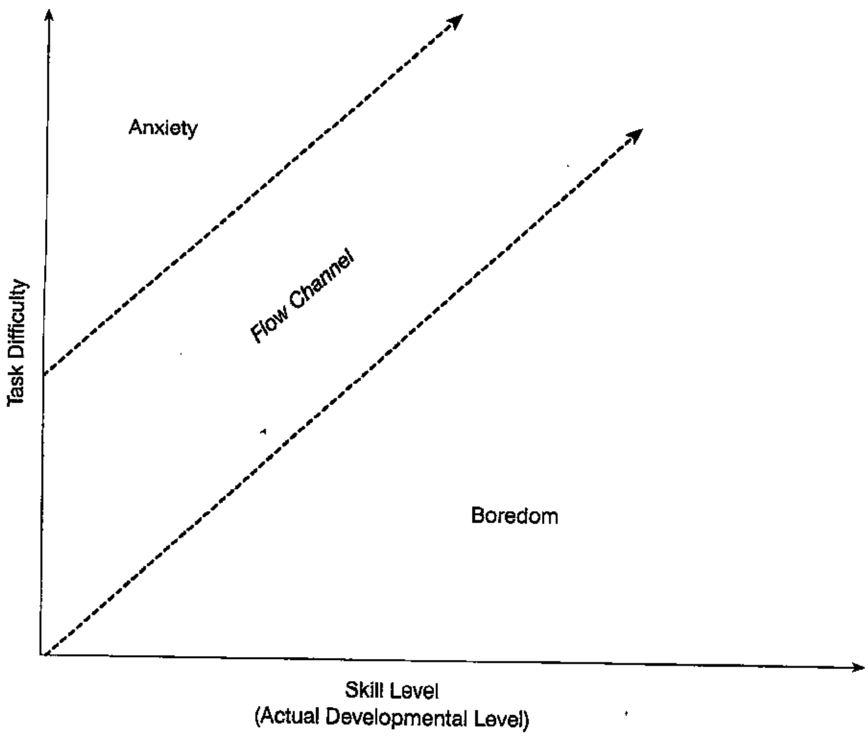

Figure 7.1
Flow Diagram of Motivational Theory

Adapted from Csikszentmihalyi, M., & Csikszentmihalyi, I. S. (Eds.). (1988). *Optimal experience: Psychological studies of flow in consciousness*. New York: Cambridge University Press.

the mug handle. For some students, this was the optimal level of challenge at this time in their development. John took a very high road, making an unexpected leap. The adequacy of the design of the problem was demonstrated in this flexibility.

Social Dimensions of Learning

The developmental approach to learning in art, as described by Lowenfeld (1947), provides a ballpark in which to begin planning appropriate problems. But the huge variation in individual expressive capability within each stage, and apparent in any given classroom, requires further understanding. Vygotsky (1978) provided a theory of intellectual development that explains various mechanisms affecting individual approaches to problem solving. Abstract thought requires advanced intellectual development, or higher-level thinking skills. One way of developing abstract thought (whether verbal or visual) is by creating imaginary situations (Vygotsky, 1978). Children create imaginary situations through play and art. Therefore, learning in art occurs in relation to cognitive development.

Vygotsky believed that cognitive development originated from social interaction, which progressively led to the internalization of knowledge. He felt that all higher mental processes (such as visual thinking) begin as social processes whereby a particular behavior is first demonstrated and then requested by another individual (e.g., teacher) before it becomes internalized. Thus, cognitive development goes from other-regulation to self-regulation of behavior. This theoretical framework appears to support the value Lowenfeld (1947) originally placed on imitation. From this viewpoint, Vygotsky (1978) felt "that the only 'good learning' is that which is in advance of development" (p. 89).

As introduced earlier, based on this belief, assignments must be just beyond the child's current level of problem-solving skill. Research has demonstrated that the capability to learn under a teacher's guidance varies tremendously in children with equal levels of mental development. This area of fluctuation is described as the "zone of proximal development" (ZPD) and is defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86).

Theoretically, the zone of proximal development within each child varies in relationship to his or her intellectual ability (Csikszentmihalyi, 1982; Kanevsky, 1992). Supporting this theory, one can cite John's response to the clay container problem and his high IQ score. However, the static scores on IQ tests are not of interest in Vygotsky's dynamic assessment approach. Vygotsky was interested in presenting a set of tasks that were taught, then assessing how quickly the learner took ownership of the learning. In Vygotskian terms, it was John's behavior, when presented with the assignment, that demonstrated advanced intellectual ability. The zone of proximal development concept is clearly depicted by the contagious spread of the idea that a sculpture is a container because it holds feelings or memories.

This type of performance assessment is particularly relevant to classroom instruction. Presenting a problem and monitoring how quickly and conceptually advanced the students' solutions are informs student assessment procedures. If the shape of the problem is too complex or too simple for a particular student, as Csikszentmihalyi's "flow construct" indicates, the quality of the solution could be affected by reduced intrinsic motivation. Many context-specific factors must be considered when designing the elegant problem for your curriculum purposes. Knowing the various shapes that problems can take will help define the menu of choices to consider.

The cultural context. A good comedian knows how to read an audience. A good art educator must do the same. An incident in one of my graduate classes exemplifies the importance of knowing your audience. In telling their teaching stories as an introduction to this course, my students provided a brief description of their encounters. One woman began by describing her first year in a very rural school district where logging is the major industry. The population was economically poor and interested only in sports, and she taught K–12 classes in a room with very few supplies. She said that had she not left for her current position as a middle school art teacher in a less rural area, she would have left teaching.

Another member of the class jumped in by stating that she had just finished her first year in a school district like the one just described. But this teacher had found the experience exhilarating. Although the community was poor, the people were industrious with their time, and their meager leisure activities involved outdoor events (e.g., hunting and fishing). She found the natural environment spectacular, a view shared by most other community members. Inspired by the surrounding beauty, the teacher began the year with a drawing unit on landscapes. The Hudson River School and other American painters (e.g., Remington, Sargent, Wyeth) were introduced. All of her classes spent September outside recording acute observations of seasonal changes in their world through drawing. This led to storytelling and narrative drawings (see Chapter 5, "Encouraging Visual Storytelling"). Enthralled by the ability to capture important events such as football games, log rolling competitions, and so on, this teacher found her students carrying sketchbooks to every community event. The community embraced her and art by providing donations of wood for carving sculptures, assisting her with a unit on papermaking, and demonstrating traditional crafts such as quilting and lacemaking.

The capstone of this story came when these two beginning teachers identified their school districts—both had taught in the same place! The successful teacher had designed her curriculum to match the audience. Few of us teach in such a homogeneous community, but the lesson is clear. Community-based art education is a concept worthy of attention (see London, 1994).

Cognitive Dimensions of Learning

Although the expressive qualities of art making are often discussed, attention to thinking skills in art education also has an extensive history (Dorn, 1994). Arnheim (1969) suggests that the imagination necessary to engage in artistic problem solving requires abstract thought. If we are to systematically develop abstract thought in our students, we must understand the cognitive processes associated with thinking in art. A theoretical framework that provides a more comprehensive understanding of the complexity of the learning process can be found in the research on individual differences in cognitive development.

The approach that a learner takes to an assignment involves the use of problem-solving strategies, which are integral to the study of thinking. Two main factors influence the problem-solving strategies used in any situation: the nature of the problem and the nature or experience of the problem solver. The dimensions of the learner's experience precede discussion of the nature or forms of problems.

The role of expertise. Individuals respond to problems differently. The way individuals initially perceive a given situation or problem is affected by prior experience. This prior experience directs the response. In an art studio curriculum, we provide a problem or assignment and expect individual interpretations to emerge. Cognitive scientists, seeking to identify the necessary elements of critical and creative thought, focus on the level of **expertise** of the problem solver. Studies on expertise may prove quite valuable to art educators seeking explanations for the differences observed between the behaviors of the artistically talented and those of other learners in the classroom.

Newell and Simon (1972) use the term "problem space" to describe the internal response to a stimulus situation. The problem space defined by an individual in a particular situation affects the formulation of the problem. The initial perception of a problem or the problem space seems to differ depending on the level of expertise acquired. De Groot (1965) found that expert chess players perceived the board positions in terms of broad arrangements or patterns, whereas the novice players did not. Research in physics yielded a similar difference between expert and novice scientists, which was described as a difference between "deep and surface structures" to a problem (Chi, Feltovich, & Glaser, 1981). Experts in physics identify problems as similar if they perceive the principles used to solve the problems as similar. This is a similarity in "deep structure." Novices, on the other hand, perceive similarities that are related to "surface structure," such as comparing the same terms or objects used in two problems.

The age difference between expert and novice problem solvers in the previous studies led Schoenfeld and Herrmann (1982) to conduct a study in which students of the same age participated in a mathematical problem-solving experiment. The experimental group received training in problem solving, while the control group did not. The result from this analysis was compared with the responses from expert mathematicians. Students, after participating in the problem-solving training, had more responses of a deep structural nature that corresponded with the responses of experts. These results offer more direct evidence of a relationship between problem perception and expertise. Although as art educators in K–12 classrooms we will most likely not often encounter a student with highly developed expertise as an artist, it is important to know as much as possible about the destination if we are to help direct those aimed for such a goal.

Characteristics of a learning moment. Whole classes can become absorbed in a moment of learning. Have you ever observed an entire class so totally absorbed that you could literally hear a pin drop? Have you ever watched a child play a computer game for hours? These symptoms describe the behavior of engagement during the flow experience described earlier. Spending time observing his own children hooked on Nintendo, a reflective educator proposed that the attraction was based on sound teaching theory put into practice (Moscati, 1993). His analysis of the activity highlights characteristics of any good learning moment:

- Learning occurs in a personal and individual way, which includes options for personally controlled pace (accelerated or remedial), the amount of repetition, and degree of challenge.
- Assessments are frequent, with a focus on progress without failure or cynicism. (Mistakes are opportunities to continue learning, and learning occurs without humiliation.)
- Learning allows for the reinforcement of personal integrity.
- Learning contains elements of surprise, adventure, excitement, and humor.
- Learning is outcome based and assumes that everyone will register the highest levels of achievement.

- A good learning moment generates its own enthusiasm for personal learning, instilling a sense of self-challenge, desire for greater challenges, and a sense of self-satisfaction (even triumph) upon completion.
- The activity allows practice and cooperative learning in groups.
- A good learning moment assumes that effort is all that is necessary to learn what is needed.

Empowering the learner to take ownership of his or her own learning requires attending to the affective and social dimensions of learning. An educator who has experienced the phenomenon of engaging an entire class at a level that reaches the silence necessary to hear that proverbial pin drop becomes hooked on the magic of teaching. More of us could capture memories of such moments through reflective writing and written self-evaluations. Recognizing the merit in such activities, one principal coaxed teachers into record keeping by asking them to keep reflective teaching journals and using the technique as an official evaluation tool (Goffman, 1995). Focusing on successful strategies, these journals add fuel to the fire necessary for the creative energies required in teaching.

As with any art form, the art of teaching is complex and multifaceted. With so much to learn, one can feel quite overwhelmed at times. In developing any new skill, this spiraling learning process toward the goal of developing expertise as a teacher involves practice and critique. Beyond the student teaching experience, most evaluations of your classroom practice will come from you. Too often, self-evaluation begins by addressing the disappointments. The one question that seems to surprise my student teachers and novices trying to analyze a less-than-successful lesson is "What went well?" or "What did you do right?" Yet, it is the answers to these questions that help one identify and define the necessary ingredients to repeat the formula for more successful teaching moments. As the ceramicist records the ingredients of an experimental glaze formula for later analysis, knowing what part of the lesson works well informs future directions.

What Forms of Thinking Are Meaningful in Art?

Many art educators view their role as one of introducing students to the way artists think—they present artistic problems and then cultivate artistic behaviors. Traditionally, the knowledge of how artists think has been gleaned from exposure to art history, criticism, and the teachers' personal experiences with making meaning in an art form. Although not extensive, research on the creative thought processes of artists offers further insight for the art educator (Carroll, 1994; Kay, n.d.; Pariser, 1985). Knowledge of the nature of expertise in the field can enhance the learning of a novice or assist the nonartist's appreciation of the complexity of thought involved in producing ideas in art. Although we accept the practice of studying studio techniques from experts, art educators do not necessarily study the expert thought processes of eminent artists.

Unlike children's engagement with art as they explore through trial and error, the visual language (Goodman, 1968) spoken by the artist must be mastered to eloquently guide the perception of its viewers. To achieve this mastery, the artist must have a working knowledge of the perceptual schema (pattern) in which information is transferred to the mind. A simple example would be using the knowledge that grayed colors recede to provide depth to a painted surface. With every decision, the artist selects information that the viewer attends (Arnheim, 1974; Goodman, 1968; Kaufman, 1966; Winner, 1982). This selection process becomes deliberate and calculated, with organizational rules used or discarded with meticulous care.

What Is Visual Thinking?

Most people would say that visual thinking is thinking in images, seeing in the mind's eye. Some people like to think with numbers; many like to think with words. Artists, it is believed, think with images. The word *imagination* is defined as "the act or power of forming a mental image of something not present to the senses or never before wholly perceived in reality" (*Webster's Ninth New Collegiate Dictionary*). One can form a mental image using pictures/figures, words, or numbers. As art educators, we seek to encourage and develop the imaginations of our students. So, if we are talking about visual thinking as thinking in images, the topic is important to prospective art educators. But this is only the simplified answer.

Arnheim (1969) coined the term **visual thinking,** defining it as visual perception (p. 14). Like visual perception, visual thinking is far more complex than the ability to think with images. As educators engaged with developing visual symbol systems and their role in an individual's imagination, it is important that you have a bit more than a cursory notion of visual thinking. In this chapter I will take a closer look at what has been said about visual thinking and perception, their roles in creative thought, and the potential role of the arts in developing productive and inventive thought. To do so will involve reviewing some of the ideas in art, psychology, communication, and science.

The Role of Perception in Thinking

Perception involves information obtained through the senses. The visual arts have informed the world of science on the nature of perception throughout history. Scientists acknowledge artists by using their work as exemplars to define or support perceptual theory (see Bateson, 1979; Gibson, 1960). Three different perceptual theories contribute to the description of visual perception (see Kay, 1990, for a review), but each offers various reasons for individual differences in the way information is perceived. A rose may be a rose, but your perception of that flower will be different from another viewer's perception, especially if the rose is red and the other viewer is color blind. In addition, more subtle differences occur: one viewer may note the velvety texture; another may be inspired by the form of the rose.

Beyond physical differences in perception, cultural and psychological factors affect perception. For example, in many African cultures size in pictorial representations is relative to importance, not distance. Contrarily, in an image of two people with one larger than the other, your perception would most likely be that one was farther away, not less important. It is critical to know that this is not the interpretation of all cultures, especially in a multicultural classroom. Another example can be found in perceived space as it significantly differs between Western and Eastern cultures. Hall (1966) describes one example: "In the West, man perceives the objects but not the spaces between. In Japan, the spaces are perceived, and revered as the ma, or intervening interval" (p. 70). Many cultural variations are documented in the literature of cultural anthropology.

Perception can be affected by both cognitive and affective characteristics of the learner. If one is taught to attend to the perception of textures, one will be aware of subtle variations (a necessary skill in microbiology). The tendency of an individual to select perceptual clues or make choices about what to attend to (such as the form rather than the color of the rose) brings affective characteristics into the picture (Kaufman, 1966). Personality, values, and interests are believed to play a part in the selective perception of each individual. This may be far more difficult for psychologists to prove scientifically than it is to accept as an anecdotal observation by a thoughtful art educator. As exemplified in a contour line drawing assignment of a shoe (see Figure 7.2), four variations depict different sensory emphases beyond capturing the form with line. Of these four upper elementary students, one noted the colors (Figure 7.2a), one emphasized textures (Figure 7.2b), another focused on form (Figure 7.2c), and the fourth indicated sensitivity to the light source (Figure 7.2d). Now look at two studies by a sixth-grade student (Figure 7.2e–f). Compare these with the integrated work of a study by an eleventh-grade student (Figure 7.2g).

Once perceived, memory, past experiences, and our thoughts and feelings begin to work on the mental images initially stored. Research has shown that the mental images we store in our minds are different from the idiosyncratic perception of information from the senses. Empirical evidence supports the belief that mental images reflect the way information is organized in long-term memory as analyzed representations. The organizational principles of long-term memory are now generally accepted as influencing perception and mental imagery. In other words, memory and thought act upon our perceptions to produce images in our minds. Three types of imagery theories offer different explanations for the apparent pictorial and spatial qualities of mental images (see Finke, 1985, for a comprehensive review). All three support the belief that mental imagery fundamentally resembles perception.

From this background knowledge, several major points are worthy of consideration when designing learning in art. First, the act of perceiving sensory information is a complex process. For most species, perception is a tool of survival. Yet the biological, cultural, and personal characteristics of an individual appear to affect his or her visual perception, creating the potential for large individual differences to occur at perhaps the most basic level—the reception of information obtained through the senses. This is important to the art educator seeking to develop visual perception. In fact, the art room is an excellent laboratory for observing perceptual difficulties that affect learning. Detecting perceptual difficulties, informing the special education staff, and providing compensation strategies are important contributions provided by the sensitive art educator.

Second, research has attempted to specify the relationship between sensory perception and the phenomenon of mental imagery. Although the exact nature of the relationship is not clear, imagery researchers agree that the relationship is strong. The notion that perception plays a role in intelligence was established less than a century ago (El Koussy, 1935; Spearman, 1927). Prior to the popularization of a theory of multiple intelligences (Gardner, 1983), the study of intelligence addressed thinking in images with descriptors such as spatial ability, visualization, figural information, and nonverbal thought.

In fact, the distinction between abstract reasoning using words and abstract reasoning involving figures was so clearly delineated that some intelligence tests were designed to measure them separately. IQ tests such as the Cognitive Abilities Test (COGAT) provide subscores for verbal (facility with words), quantitative (facility with numbers), and nonverbal (facility with figures or images) reasoning power. The differences among scores on the three subtests can be as great as 50 points. Proportionately higher scores on the nonverbal subtest appear to be characteristic of many artistically able students, although a formal study of this potential relationship would be an important contribution to the field.

Figure 7.2
Samples of contour line drawings: shoe assignment. Upper elementary students (a–f; fourth through sixth grade) focused on different sensory emphases as compared with an eleventh grader's solution (g; in pencil).

Collection of the author.

Who Thinks Visually?

Several studies of the biographies of eminent scientists and mathematicians (e.g., Nobel laureates) reveal an intimate relationship with the arts (Root-Bernstein, 1989). The imaginative ability of these scientists occurs in artistic accomplishments as well as in their scientific endeavors. Note the following:

> Copernicus was a painter who also translated poetry. Galileo had intended to be an artist as a teenager, and wrote poetry throughout his life. Newton, too, painted and wrote poetry. . . . We've heard that Louis Pasteur was a gifted painter as a youth. (Root-Bernstein, 1989, p. 317)

Believing that there is a relationship between engaging in an art form and making creative contributions to a scientific field, Root-Bernstein (1989) is compiling a list that already includes several hundred eminent scientists with artistic proclivities.

A visual-spatial strategy (often referred to as nonverbal thought) may be necessary to capture the essence of the whole form to define a problem. Research (Ferguson, 1978) involved with the inventiveness of the scientific process has cited this type of strategy as necessary to creative endeavors in that field:

> As the scientific component of knowledge in technology has increased markedly in the 19th and 20th centuries, the tendency has been to lose sight of the crucial part played by nonverbal knowledge in making the "big" decisions of form, arrangement, and texture that determine the parameters within which a system will operate. (p. 46)
>
> This intellectual component of technology, which is nonliterary and nonscientific, has been generally unnoticed because its origins lie in art and not in science. (p. 64)

Art educators aware of the importance of nonverbal, or visual, thinking in scientific endeavors can make the kinds of connections necessary to engage scientifically oriented students in art by shaping the problems (assignments) to develop visual thinking strategies. More important, understanding the role of visual thinking outside the realm of art assists art educators in making real-life connections between the nonartist and the tools of thought developed through engagement in art.

Why Is Visual Thinking Important?

Cognitive psychologists describe three different ways we mentally represent and process information: linguistically, numerically, and visually, or spatially. Sternberg (1986) suggests that a thorough conceptual understanding is demonstrated when an idea can be represented in words, numbers, and images. The mental representation of information through images describes a major component of visual thinking (Arnheim, 1969), spatial ability (Smith, 1964), and spatial thinking (Dixon, 1983; Olson, 1992). Some empirical evidence supports the theory of a visual-spatial thinking strategy that is inherently different from the strategies used with verbal information (Kay, 1989).

Thinking with images has been cited as the most effective strategy for critical thinking skills associated with certain reasoning and insight problems (Sternberg, 1986). However, thinking with images is more often associated with the problem-solving strategies used in creative thought (Arnheim, 1969; Perkins, 1981). So, visual thinking can be used for both critical and creative thought.

Research in critical and creative thought has potential for influencing the perceived importance of an education in art. Information processing research began as an attempt to reproduce human thought processes in inanimate objects—namely, computer technology. In an attempt to reproduce thinking and **creativity**, scientists are seeking to identify the nature of human thought processes. The most important discovery in scientific research on seeking to develop creative thought in machines is that affective characteristics (personality, emotions, and other very human attributes) influence these thought processes. From the knowledge gained in the field of artificial intelligence, educators can learn more about facilitating the development of thought processes in their students.

Problem-Solving Theory: What Shapes Do Problems Take?

Some theories on problem solving concentrate on creative problem solving, while others address critical thought. Each theory categorizes problems into different types. Each type of problem requires a different problem-solving approach. For example, when shown a slide during an art history exam and asked to identify the artist acknowledged for that painting, the art history instructor is seeking one specific answer. This problem is called a closed, or well-defined, problem because it is clearly stated and requires a specific answer. On the other hand, if an art history instructor requires a final project that demonstrates thorough understanding of any pertinent topic of your choice, you are faced with an open-ended, or ill-defined, problem. Deciding what you will choose to study and what form the product will take (e.g., term paper, video, slide presentation) offers opportunities to formulate your own problem.

Theoretically, problems are often categorized in terms of placement on an imagined continuum. On one extreme of this continuum lie closed problems, with open problems located on the opposite end (Reitman, 1964; Sternberg, 1982). Closed problems are clearly formulated and require specific solutions (e.g., the task of copying a drawing). Open problems are structured to accommodate multiple perspectives, are not as clearly formulated as closed problems, and require working toward discovering the problem situation prior to pursuing a solution (e.g., an advanced independent study course in sculpture). The thought process (or cognitive skill) associated with the approach to an open problem is described as **problem finding.**

More specifically, problem finding involves the formulation of a problem prior to the actions taken to solve the problem (Kay, 1989). In this circumstance, the solution to the problem is directed by the choices made by the individual in his or her chosen definition of the problem. In their seminal work, Getzels and Csikszentmihalyi (1976) described the difference between **problem solving** and problem finding in creative thought as the difference between presented and discovered problems. A presented problem requires following routine steps using a particular method to arrive at a known solution. On the opposite end of the scale, discovered problems do not have specific requirements, so the problem solver must identify the problem and choose methods to arrive at solutions that satisfy the situation.

Wakefield (1992) has classified four different types of thinking skills involved in problem solving and problem finding by combining the types of problems with the types of solutions required. He presents a fourfold classification "based on the degree of constraint imposed on problems and their solutions" (p. 27). He explains that logical thinking is required when constraints are given to the problem and the solution. If asked to produce a value scale employing 10 gradations of grey, logical thinking is employed. Divergent thinking occurs when a closed problem (e.g., draw something in each of the 12 circles provided) has few rules or constraints on the solution. Creative thinking occurs when the freedom of the problem and the solution are not constrained. Optimal freedom of problem choice is the context in which an artist discovers and engages with ideas in the studio. When an open-ended problem is presented to an individual (e.g., a class assignment or commission), the position moves toward the closed end of the problem-solving continuum.

Problem finding or defining is a common element in most of the theories that propose steps to creative thought. Creativity is an interesting topic, with varying perspectives within and across disciplines. The three broad categories of creativity research (the three Ps of creativity) involve personality, product, and (thought) processes. The studies considered classic in this body of literature that directly relate to artists focus on the creative personality (Ghiselin, 1952; Koestler, 1964). Since a teacher cannot direct personality traits, it is the processes involved in creative action that hold the greatest potential for educational research and translation to classroom practice.

The Thought Processes of Artists

Most of the research on creativity that enlists the expertise of the artist takes the form of personal accounts and retrospective reports (Ghiselin, 1952; Koestler, 1964; Roe, 1975). Scientists argue that this type of data is subjective and inaccurate. Although some empirical research exists on the artistic productivity of children, only a few studies enlist the cooperation of artists as participants in research on the creative process, and of these few, most focused on personality rather than process. Here I give a brief review of studies less likely to be found in the art education literature.

Roe (1946, 1975) conducted a study on personality traits and the effects of alcohol on the creative process with 20 male artists. She categorized into four groups the descriptions given on the way a new painting was developed and noted a tendency for the creative process to differ among and within individuals, implying the lack of one consistent "process." Beittel and Burkhardt (1963) studied personality attributes of 47 college juniors majoring in art education and noted three approach strategies to drawing: academic, spontaneous, and divergent. These authors reported that their findings support a distinction between problem discovery and problem solving.

Possibly the first empirical study seeking to identify the process behind the creative thought rather than the creative personality of artists was done by Patrick (1937) when she observed 50 professional artists and 50 nonartists (as a control) sketch pictures based on a poem they were given. A detailed analysis of the process, enlisting verbal feedback, formed the core of the research procedure. This study reported two important results. First, she found no difference between the two groups in the amount of time they spent on the tasks (quantitative differences) but major differences in the quality of the results. Second, the problem-solving processes for both groups were described as periods of unorganized and organized thought (p. 67).

The thought processes described by Getzels and Csikszentmihalyi (1964, 1976) as problem finding and problem solving appear similar to those described by Patrick as unorganized and organized. In their original work (1964), the sample consisted of 179 sophomore and junior college art students with three fields of specialization: fine art, applied arts, and art education. Both male and female subjects were included in this core population. Because of the variations in performance among the groups, the problem-finding process was thoroughly examined in only male fine art students (N = 31).

Getzels and Csikszentmihalyi (1976) realized the potential in observing the discovered problem situation (open ended) in that it is closely related to the artistic process. A problem offering 27 objects for possible use in a still-life drawing was individually presented to 31 male art students. The instructions stated that the task was untimed, although the participants were encouraged to complete their work in "an hour or so" (p. 85). Although a discovered problem situation was presented, behavioral differences in the approach implied a crucial difference between those students seeking "to maximize the discovered nature of the task" and those who behaved as though they were in a "presented problem situation" (p. 90).

Questions arise when comparing the results of the Patrick study with this one. Although there were differences in qualities, Patrick did not find differences between the artists and the nonartists in the amount of time spent before engaging in the actual drawing or in the total amount of time spent on the entire task. Yet, in comparing creative and less creative college art students, Getzels and Csikszentmihalyi found major differences between the two in these problem-solving behaviors. Also, Patrick found that the artists did not change the essential structure of their work but only revised the surface structure. The art students identified as more creative in the Getzels and Csikszentmihalyi study were said to be more willing to change their entire product. Where Patrick found the nonartists to incorporate more objects into their sketches than the artists, the latter study found that those defined as more creative manipulated more of the still-life objects prior to initiating the drawing.

One possible reason for the discrepancy in the findings between these two studies is that the participants may be at different stages of their development. The thought processes of a second-year college art student are not likely to be at the most advanced level of expertise. The skills and behaviors of professional artists may differ considerably from those with less experience because their intense experience provides them with knowledge of what will fail, eliminating the need for extensive explorations.

The first possibility was examined in a study of the problem-solving and problem-finding behaviors of professional artists, semiprofessional artists, and nonartists (Kay, 1989). The purpose of the study was to explore the relationship between problem solving (the process of finding a solution to a stated problem) and problem finding (the process of formulating a problem prior to taking actions to solve the problem) in the manipulation of figural symbol systems by three groups of adults with varying degrees of expertise in art. (The possibility of qualitative differences in the approaches taken by these groups was supported in the literature on experts versus novices discussed earlier in this chapter.)

Sixty participants were selected, representing three independent groups. Of the 20 in each group, 10 were male and 10 were female. Twenty adult visual artists—10 sculptors and 10 painters—who regularly exhibit their work in museums or galleries and earn their living solely through the production of art made up the group of professional artists. The group of semiprofessionals consisted of individuals who had formal art training beyond high school, produced ideas in art, exhibited in galleries, but did not earn their living producing ideas in art. The nonartists were graduate students in education and psychology, had no formal art training since high school, and reported that they did not produce ideas in art under any circumstances.

These participants were given a series of tasks to complete. The entire process was videotaped and played back for the participants so their observations, thoughts, and responses could be audiotaped in an interview. The procedure, data analysis, and complete results are published elsewhere (Kay, 1989, 1991). The empirical study began with an examination of the proficiency variables highlighted in the earlier research by Patrick and/or Getzels and Csikszentmihalyi.

Like Getzels and Csikszentmihalyi's (1976) more creative art students, the professional artists were expected to take longer, pause more, and design more transformations than the semiprofessional artists, who would, in turn, outperform the nonartists in the same manner. This was not the case. The significant differences between the groups existed between the semiprofessional artists and the other two groups. The semiprofessionals behaved in the same manner as the art students involved in the Getzels and Csikszentmihalyi study. However, based on these initial variables, the professional artists did not differ from the nonartists. Patrick's (1937) study of creative thought in artists and nonartists supports the results of this study in that she found no quantitative differences between these two groups in the overall time spent on the drawing task.

The **qualitative** differences between Patrick's artists and nonartists were replicated through the process variables identified and analyzed using the videotaped recordings. In fact, the two-stage process of problem solving sketched by Patrick as unorganized and organized thought and later redrawn by Getzels and Csikszentmihalyi as the Problem Formulation Stage and Problem Solution Stage was found in these open-ended tasks that did not involve drawing.

The differences in the problem-finding behaviors of the three groups were analyzed. A strategy of considering many perspectives of various alternatives characterized the behavior patterns of the artists. For example, the artists would describe a decision that might involve the analysis of several variables (e.g., wrong color, right shape, good angle, "but then needs a contrasting form emerging from the right of the piece"). In contrast, the nonartist usually reported a focus on only one option, such as color, and ignored other dimensions. The nonartists were quite different from the other two groups in their approach to problem finding in that they employed fewer dimensions and viewed fewer perspectives. This implies a more narrow approach to problem defining. The strategy employed by the two groups of artists may be described as a visual-spatial thought process. Rather than directing a limited amount of information toward a goal that is sequentially determined or decided, a process of simultaneously addressing a large quantity of information is depicted.

The professional and semiprofessional artists differed because the semiprofessional artists handled many more game pieces, explored the materials, paused more, and made more changes in position or types of pieces than the professional artists. Like the expert chess masters studied by de Groot, greater depth and breadth of experience may provide a less likely chance for unsuccessful attempts or changes because of knowledge of what would fail. It is likely that the professional artists have more opportunities than semiprofessional artists to manipulate figural information and to make and learn from mistakes.

Another phenomenon not described in the expert/novice or creativity literature also appears to be reflected here. Based on the observations and interviews, the professional artists who participated in the study exhibited a behavior that I labeled a "personal aesthetic preference." The result of an artist's personal aesthetic preference forms the work or oeuvre that makes a Monet a Monet or a Dali a Dali. The artist's personal aesthetic framework seems to form an organizing principle for the professional artists' perceptual information gathering and consequent thought processes. This **aesthetic** appears to guide the search for specific information, providing a selective criterion within which one explores (Campbell, 1960). This personal aesthetic preference behaves like the engineering of a fine bridge, offering tensile strength to the pursuit of an idea. As in steel structures, this tensile strength supports the endeavor, yet it bends or flexes in response to the forces that act upon it. There are references in the literature to aesthetic characteristics of creative thought that help to shape a correct solution (Campbell, 1960; Meier, 1939; Perkins, 1981; Stein, 1974), but the idea of an aesthetic preference that guides the perception of new experiences has not been previously suggested. Obviously, more research is needed to understand the nature of expertise in the arts as well as generically.

But the results from the factor analyses of this study offer scientific evidence to support the idea that the thought processes involved in problem solving are different from those involved in problem finding. Although this may seem obvious to individuals more comfortable with directing their own learning than with figuring out the correct answer in a given situation, scientific verification of these perceptions is necessary for acceptance as a scientific truth. If the ability to ask questions or determine the problem to be solved is different from the ability to provide answers, major curricular revisions are necessary at every level of our educational system.

Developmental Issues Regarding Expertise

One cannot apply the research on adults to the behaviors of children. But as we learn more about the advanced levels of thought that an expert engages for his or her problem-solving processes, we may better understand the behaviors of children with advanced achievement in art. This talent may influence the approach an individual takes to your assignments. If the parameters of the assignment allow a student to pursue his or her own agenda (whether or not the student is aware of this agenda), the product is often more advanced than required. For example, given the homework problem of capturing a light source on a familiar object, a high school student chose a pencil sharpener—an object that metaphorically reflects light in addition to the concrete solution. With the student working solely in pencil, the pencil sharpener maintains his drawing tools and drawing illuminates his life. What he did not realize at the time was that the thematic underpinnings of all his work had to do with the way light responded to metal surfaces (Kay, n.d.).

I was particularly impressed by the efforts of one young lady's immersion in a landscape assignment. As an academically talented fifth grader, she managed her schedule to free extra time for the drawing during a span of several weeks. She spent several hours a day intensely recording her observation, and I watched as an image of the concrete stairs that led through the grass to the playground carefully emerged. When asked for the source of her inspiration, she said that the drawing was of her childhood—for her, the concrete stairs led either to the playground or back to the school. They led to freedom or to rules. The grass was always free. As each blade of grass was drawn, she could ponder the details of her life.

This ability to animate the physical environment with a perceptual metaphor is called physiognomic perception (Stein, 1984) and is found in creative individuals during the creative process. Metaphors and analogies are at the core of many creative thinking strategies (Gordon, 1961).

Some artistically talented artists are persistent in their need to address or "own" their own problems. At the high school level, the student may have learned how to negotiate the learning environment to suit personal needs (e.g., getting an extension on a due date). Young children with a serious attraction to art may have well-developed habits or work conditions prior to conforming to the timetable of school. It is an unforgettable experience to observe a 5-year-old prepare his work space at home by adjusting the light sources in the room, eliminating extraneous noises by closing windows, and searching for the correct fine-line marker to execute the task he set for himself and then spend several hours engaged in drawing without interruption.

Children with an aptitude or gift in art often demonstrate this ability before entering school. This precocity, a rapid developmental process, and high motivational levels are characteristics of the artistically talented (Hurwitz & Day, 1991). Some students are well on their way to defining and exploring their own problems prior to entering first grade (see Figure 7.3). In fact, a retrospective study of the talent development of sculptors reports the feeling that elementary art classes impeded their artistic development (Bloom, 1985). Although rare, examples of this high degree of precocity provide thoughtful art educators the additional challenge of designing problems that permit problem interpretation to encompass the young artist's personal agenda (also see Color Plates 7.1–7.4).

Figure 7.3
"Magnificent 7" contour sketch by Carson Rutter, age 5
Used with permission.

THEORY INTO PRACTICE

How Do I Design the Learning Experience to Fit My Learners?

Problem Exemplars

A look at some assignments that pose open-ended problem-solving situations with a record of appealing to or arousing enthusiasm from a wide audience of learners will ground the discussion on elegant problems.

Example 1

Real situations in an art class involve abbreviated periods, field trips, or assemblies that pose extra challenge to delivering meaningful art education to students. Utilizing a 20-minute period of time to create a teaching moment can be viewed as a frustration to a traditional curriculum or as a challenge to engage the students in a visual thinking exercise. The scissor "transformations" in Figure 7.4 are products of an assignment that asks the learners to examine a scissor with their imaginations. Transforming the ordinary into the extraordinary by elaborating on the contour of real scissors requires few tools or preparation but calls for visual thinking. Inspired by the challenge, many students will continue working on the idea at home and return the next day with the calibre of products exhibited here.

Example 2

Sometimes, the elementary art teacher finds that the day belongs to a field trip or special school performance and is assigned the role of chaperon. One way to engage students in artistic behaviors under these conditions is to provide training in aesthetic inquiry. The performance card shown in Figure 7.5 was originally

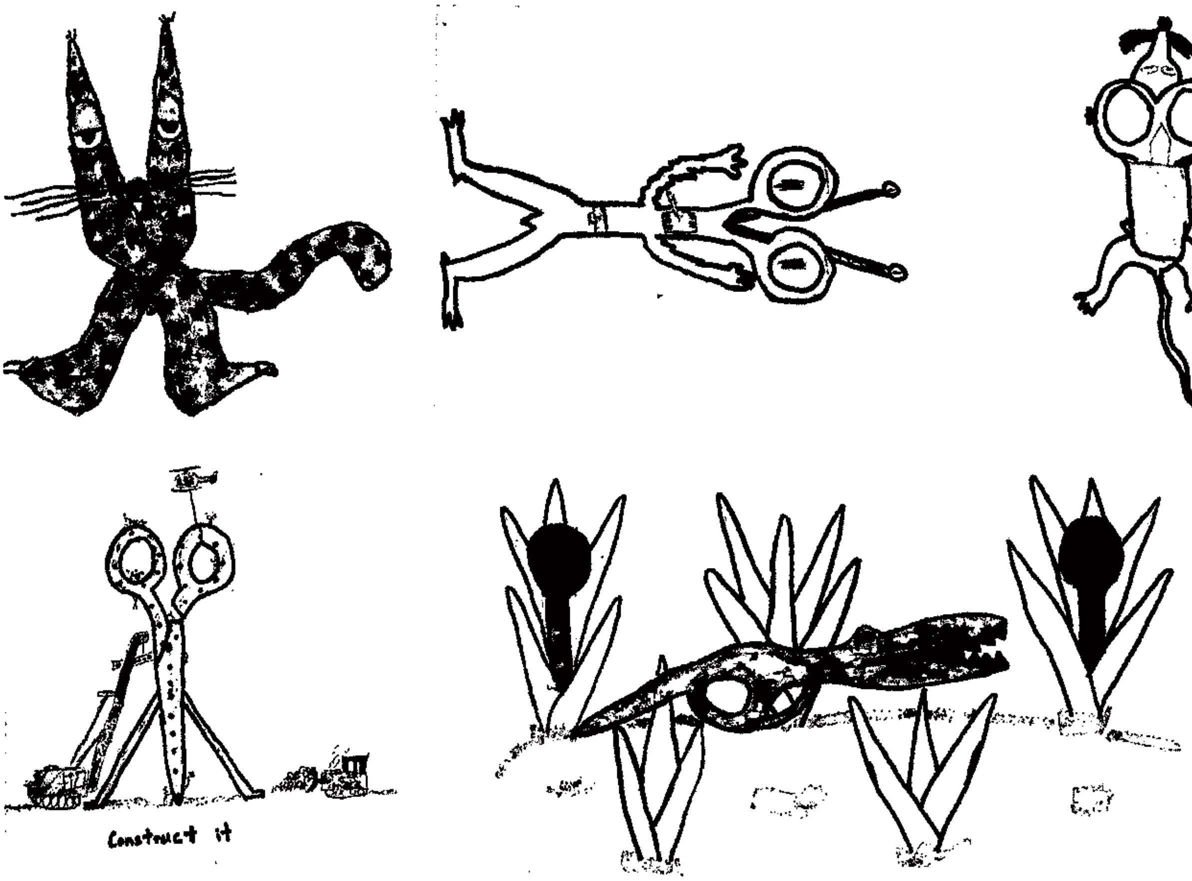

Figure 7.4
Scissor "transformations" (watercolor pencil) by upper elementary students
Collection of the author.

designed to engage the imagination of my students during performances attended during classtime with the students. Special programs in music, dance, and theater were often brought to the students by the parent organizations. But without some type of debriefing, discussion, or reaction, the students did not practice attending to (Greene, 1992) or did not develop language to describe their perceptions of these exposures. The usefulness of this tool to also broaden the viewing experience for visual artwork became apparent shortly after the first use. Subsequently, these cards have been used by high school and college undergraduate students as gesso (preparation) to the art criticism process.

Example 3

Drawing is a product of visual thinking. (So is sculpting, and too few art educators tackle the complexities of designing exposures with three-dimensional visual thinking. But drawing is a necessary skill and one deserving ample attention.) I would question any art curriculum that did not include a unit on drawing from observation. My preference at the elementary level was to begin the year with this unit starting with a still-life assignment. This provided a baseline (a perfor-

Performance Card: Never leave home without it.

Justin Paterno

Whistler's Mother

1. • Looks like: an old grandma knitting
6. • Feels like: a old woman drying to cover up
7. • Sounds like: crickety crack – crickety crack
4. • Moves like: a ~~snail~~ slug
5. • Tastes like: The smell
2. • Smells like: cinnimon buns cookin in the oven
3. • Reminds me of: a gloomy day

Figure 7.5
Performance card sample completed on "Whistler's Mother"
Collection of the author.

mance assessment) to record the current level of achievement in observation, hand–eye coordination, and visual thinking/designing levels. By designing a still life with a large variety of complex and simple objects, and assigning the students the opportunity to choose what part they wanted to tackle and what lens they would put on their mind's eye (close-up, telephoto, panoramic, microscopic), an appropriate match between challenge and ability could be reached by all. This strategy is useful for all ages, from first grade to adults.

However, the objects employed in a still life deserve attention to attracting intrinsic motivation. Drawing the traditional still-life objects (glass bottles, fruit bowls, etc.) is an exercise for sophisticated and serious art students. To engage students in grades one to six, I found toys and play objects to be much more inspirational. Students with a fear of drawing could choose parts of a familiar object and concentrate on the skill of drawing. The close-ups of a bicycle shown in Figure 7.6 demonstrate the attempts by nonartists to address what they considered attemptable.

Example 4

Vygotsky's zone of proximal development is easily observed as third graders attend to the exhibited work of sixth graders. In fact, it was the pleading of young students that led to a building-block assignment that has engaged a range of students, from first graders to juniors in high school. Building a structure and then capturing it in a drawing is surprisingly enticing. Enough colored wooden building blocks can be inexpensively purchased to suit a class with five or six blocks per student. Other than the sound of a structure collapsing periodically,

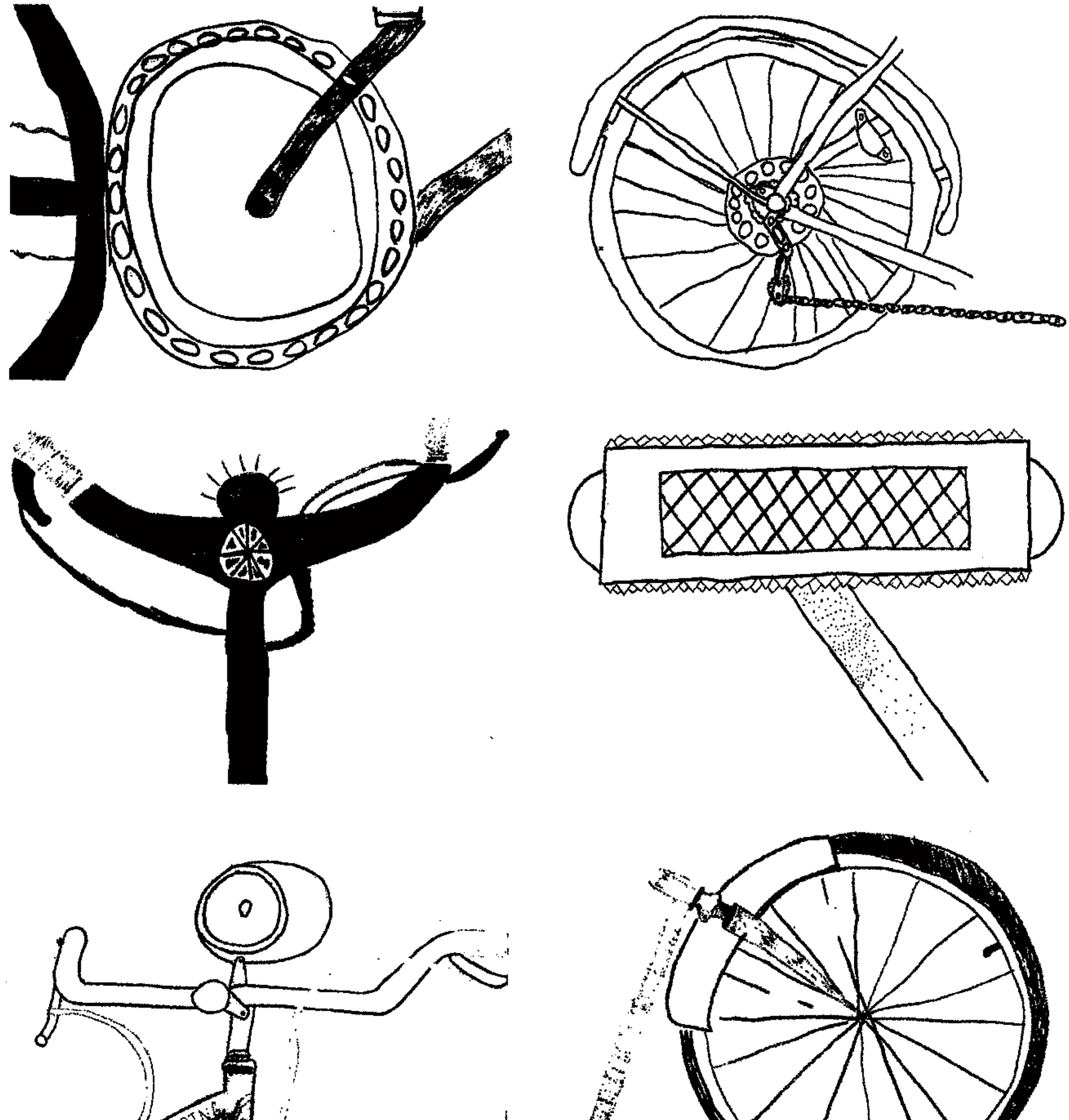

Figure 7.6
These close-up drawings of bicycle parts are first attempts by nonartists, grades four to six.
Collection of the author.

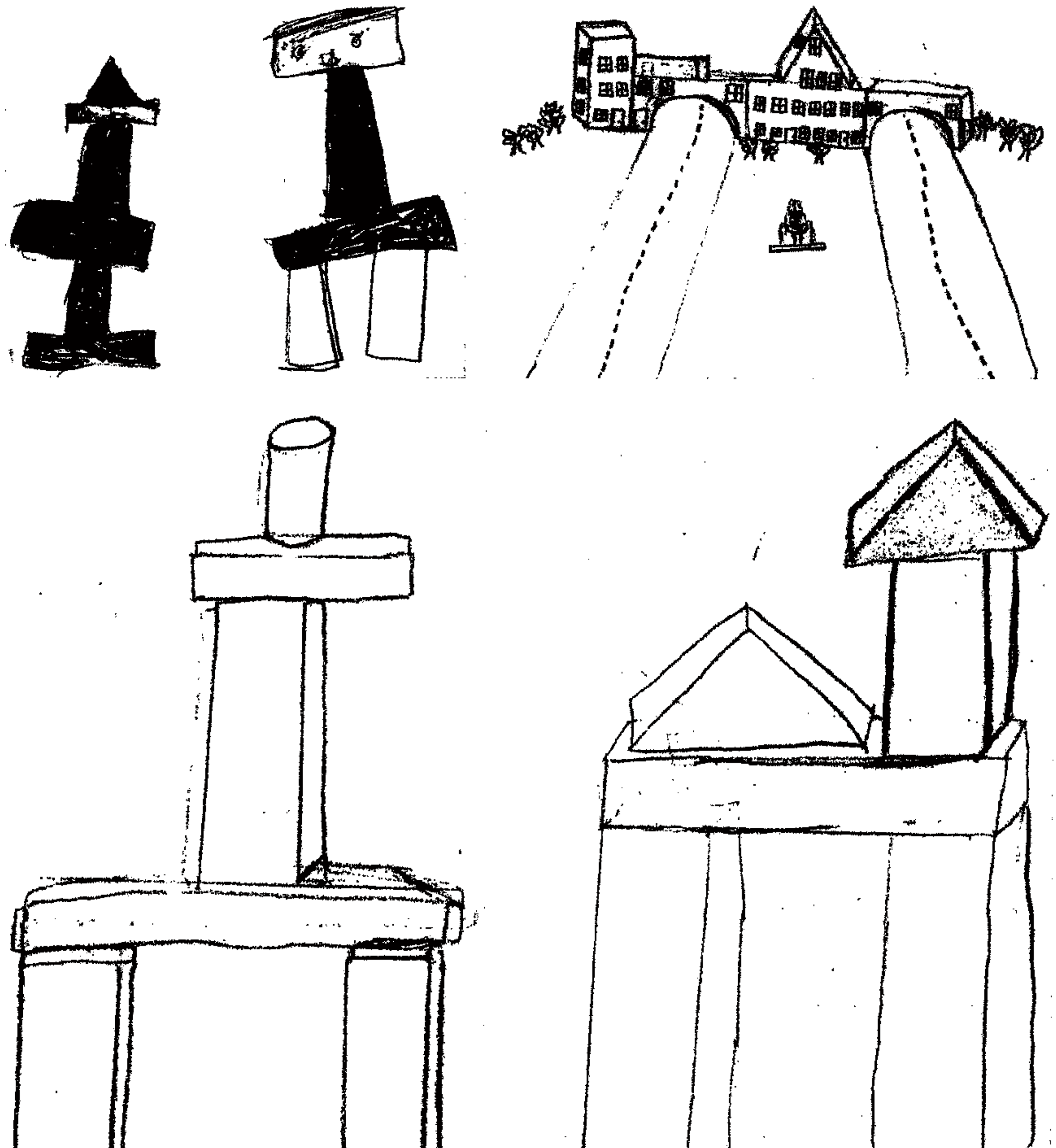

Figure 7.7
Range of ability is depicted in samples of one third-grade class on building-block drawings.
Collection of the author.

this problem allowed one to hear the proverbial pin drop.* Third-grade students challenged by the desire to reproduce three dimensions explored perspective drawing, calling for assistance when required. The range of student capabilities within a single class is evident in the third-grade samples in Figure 7.7.

* I am not a proponent of silent learning, but a principal I once knew couldn't decide whether the level of noise was a good determinant of learning—especially when some assignments required more sound than others. He often came into my room during these quiet moments to drop a pin, which disturbed those who had not noticed him before.

What Are the Characteristics of an Elegant Problem and How Do They Guide Curriculum Design?

From the examples presented in the "Theory into Practice" section and the discussion on thinking that precedes it, one can see a pattern or set of characteristics that distinguishes a problem as elegant. If a problem has the **flexibility** of problem space to engage audiences from elementary to postsecondary levels, there is an elegance to the design. Within those age ranges in the audience, the problem must also address varying abilities and engagement levels. Therefore, an elegant problem lends itself to many kinds of solutions by many types of problem solvers. In addition, the problem or assignment must provide the opportunity for **fluency** of responses. An elegant problem provides the opportunity for many choices of responses and solutions. With length and width variability, variations in depth are earmarked by the ability to **elaborate** or provide **original** solutions to the problem. Producing the environment for novel and inventive solutions characterizes a well-composed problem. If the assignment encourages flexibility, fluency, elaboration, and originality of responses, it has met the four characteristics often used to define **creative thought.** By designing a problem that encourages these behaviors, creative teaching elicits creative thought.

Another characteristic of elegant problems deserves highlighting: an elegant problem is worth solving. The issue of quality or value discriminates an elegant problem from others. Some problems are more important than others. The elegant problem allows for technical and intellectual growth as it elicits creative solutions from each individual. To do so, the problem must remain responsive to the various levels of expertise found in a student population. The growth necessary for a developing artist is different than the growth of a nonartist. Knowing more about the thoughts and behaviors of other artists broadens artists' and art educators' understanding of issues that engage artists' thought. (Although I have known a first-grade artist striving to capture movement or action in his own drawings to devour the techniques portrayed in Leonardo da Vinci's notebook, most first graders are interested in learning ways to show movement in their drawings and are willing to learn from "experts" in sixth grade.)

Some art educators feel that the issues and techniques presented to a first grader need not differ greatly from those presented to a twelfth grader except in amount and size of chunks. Whether this matches your personal philosophy of teaching, nonartists (those not interested in becoming artists) can grasp the challenge presented to develop visual thinking more easily than they can understand how the elements or principles of design will enhance their careers. The fact that these individuals may someday sit on town planning boards and make aesthetic decisions about our built environment may be too distant to come into clear focus, but it is a probability. Ownership of artistic knowing is important for everyone. Visual thinking is a skill that has universal application.

Finally, an elegant problem elicits elegant solutions. Knowing when an elegant solution has been reached is an interesting phenomenon. The criterion an individual uses to evaluate whether the novel solution is correct is an aesthetic criterion. According to Stein (1984), creative work in all fields employs this evaluation process:

> The experimental finding, the engineered apparatus, the portrait, the abstract painting, have a feeling about it that it "works." It is well designed. Everything fits just right. It is pleasing and satisfying. (p. 21)

Exposure to this qualitative type of decision-making process is an important contribution the arts have to offer both the expert and nonexpert. The transfer of this tool of thought to other situations or disciplines may be key to creative productivity.

Summary

This chapter focused on four questions radiating from the choice to shape elegant problems for visual thinking. The major points are highlighted in the following list:

~ Who are the learners in my classroom?

The learners in your classroom are contributors and appreciators in the creative process. Both need to understand the process of making art—the former to continue developing expertise, the latter to develop skills as collectors, museum-goers, or supporters of the artistic process. To facilitate optimum growth in these learners, instruction is designed to address the affective, cognitive, and social (including cultural) dimensions of learning.

~ What forms of thinking are meaningful in art?

Visual thinking as a product of **cognition** is described as important to many creative individuals in scientific as well as artistic domains. Understanding the roles visual thinking may take in creative and critical thought provides educators with increased knowledge for guiding their learners to develop advanced thinking skills, when presented with any of the four types of problem situations.

~ How do I design the learning experience to fit my learners?

Meaningful learning experiences are made within the constraints of the conditions we face. The conditions of the learning environment include the physical qualities of time and space, as well as the psychological qualities of the learners you are addressing. Exercises in visual thinking (e.g., scissors transformations) or translating emotional response to verbal thought (e.g., performance card) provide guided instruction that can be used as references for deeper investigations in the future. Seizing the moment and tailoring lessons to fit the student variations that compose very different classes with the same course title are skills observed in excellent teachers.

~ What are the characteristics of an elegant problem and how do they guide curriculum design?

Creative teaching elicits creative thought. By designing problems that invite flexibility, fluency, elaboration, and originality of responses, you engage learners in the creative thought process. For a problem to be considered elegant, it also must be worth solving. The test for determining whether a problem is elegant is in the problem generated. If the problem elicits elegant solutions (aesthetically meaningful) to a large percentage of students and does so consistently over time, it merits the label "elegant."

Advantages and Challenges of Making This Choice

There are many advantages to this approach for the educator as well as the learner. By changing the question from "What am I going to teach them tomorrow?" to "What do my students know and need to know to develop visual thinking strategies?" one alters the conversation about the art curriculum to language that other educators understand. Like the nonartists in the classroom, other teachers and administrators are not well enough acquainted with art to recognize the thought processes essential to all critical and creative thought. Most important, the dialogue in the classroom becomes more inclusive by acknowledging and valuing the role of the appreciator of art. Widening an understanding of what problem an artist tackled and possible reasons for the solution adds to the power of appreciation for some people.

Another advantage to this approach is in one's ability to reflect the higher-level thinking skills called for in this wave of educational reform. Focusing on shaping classroom problems or assignments to develop skills in visual thinking broadens the conceptual framework to include and address the skills necessary for creative thought. By developing problems that provide a "flow" experience for both the artist and the nonartist, all students are engaged in their optimal level of learning. Activities that incite personal meaning-making last as memories. Visual thinking is a skill necessary to the home decorator, doctor, lawyer, and plumber.

The challenges to this approach to creating meaning are plentiful. An understanding of cognitive psychology (especially perception), science, and special education becomes essential. Looking at learning in this way requires considerable thought and reflection before and after the experience. The educator interested in this pursuit must realize that the goal is far higher and will take longer—but the road to expertise as a teacher does not have many shortcuts.

Action Plan for Instructional Decision Making

To go from arranging lesson plans and assignments to choosing problems that promote thinking alters one's frame of reference considerably. In any new task, making small steps toward the goal is better than making no steps. As the saying goes, the longest journey begins with the first step.

- *Review* a lesson or unit that went fairly well.
- *Analyze* why it went well. Were all the students engaged in their learning? If not, who wasn't? Was the lesson below or above the "flow" channel of that individual? If the lesson provided a choice of variations from closed to open problems (the cognitive dimension), did it also provide an appropriate width for the affective channel (allowing students to twist and distort the problem to meet their own personal agendas)?
- Adding to the first run of a lesson design is often easier than beginning anew. After analyzing student responses, *take a new look* at your assignment. Does it meet all the characteristics of an elegant problem? Discussion with colleagues often invites new ideas and perspectives.
- Once a degree of comfort is reached in designing lessons, *map out* your plans for the entire year (it's only 40 weeks at best). What thinking skills do your students have, and what do they need the most? These questions are congruent with the curriculum plan in hand (district, state, or cooperating teacher). Choosing to shape problems that promote visual thinking does not necessarily negate what was done before. It may, however, alter how one does what is done.
- Once the year is mapped out (in units, exposure to materials and techniques, or design education), *imagine* a problem you could become excited about investigating that would address the former constraints. This procedure is called curriculum mapping and is often used to seek commonalities between subjects so that interdisciplinary units of study can be designed.
- *Brainstorm* many problems for an assignment.
- *Look* at the potential of each assignment by brainstorming possible solutions. Which is wider? longer? deeper than the rest? Choose the most exciting option, try it, and consider the results. (Good choices lead to good results. If the results are unsatisfactory, reanalyze your process.)

Discussion Questions

1. In discussing the meaning of art with friends and family who are not involved in art, what are their perceptions of what you do?
2. What role does thinking play in the communication of feelings/emotions?
3. How is designing curriculum like designing a work?

Suggested Activities

1. If you do not already do so, write out your studio assignments (accurately and in detail, as they were delivered) in your sketchbook. Apply your thinking in the ways described for elegant problems and solutions.

2. When you observe teaching situations, take note (literally and figuratively) of the assignment/problem posed to the students. If necessary, rewrite it to better fit the elegant problem recommendations.
3. Look at your own work with a fresh eye. What problems inspired your preferred solutions? Keep a record of these potentially elegant problems.

ANNOTATED RESOURCES

Creativity and Imagination

Egan, K. (1992). *Imagination in teaching and learning: The middle school years.* Chicago, IL: University of Chicago Press.
In this book, written in a user-friendly style, Egan discusses why imagination is important to education and the characteristics of students ages 8–15. A framework and examples are provided.

Greene, M. (1995). *Releasing the imagination: Essays on education, the arts, and social change.* San Francisco, CA: Jossey-Bass.
This book provides the thoughtful educator with ideas for using our imaginations to construct our lives and the lives of our students toward a cultivated community. By the "mother of aesthetic education," it is a poignant piece to use in setting goals as a teacher.

Stein, M. I. (1984). *Making the point: Anecdotes, poems & illustrations for the creative process.* Amagansett, NY: Mews Press.
Gleaning from his scholarly publications, the author has provided an entertaining and informative outline in this brief introduction to the creative process.

Curriculum Planning

Roukes, N. (1988). *Design synectics.* Worcester, MA: Davis Press.
Written in lesson plan format, this book provides practical applications of the author's interpretation of synectic thinking skills. Well written and illustrated, it is a useful planning tool. (See also Art synectics *by same author.)*

Expertise

This is a relatively new area of research, so little is translated from educational research into plain language. The best way to learn more about expertise in art is to go to primary resources: any autobiography, or publications with quotes from artists such as those in retrospective exhibits.

Bloom, B. S. (Ed.). (1985). *Developing talent in young people.* New York: Ballantine.
The findings of a study of talented sculptors, pianists, Olympic swimmers, tennis players, and mathematicians are described in a clear, easily readable manner. Based on interviews with family and talented individuals, the conclusions are dramatic.

John-Steiner, V. (1985). *Notebooks of the mind: Explorations of thinking.* Albuquerque, NM: University of New Mexico Press.
This book provides a look into creative minds, with many quotes and reflections from these individuals.

Curriculum Planning

Rodari, F. (1991). *A weekend with Picasso*. New York: Rizzoli International.
Excellent reproductions and insightful information accompany this children's book written in the first person.

Motivation

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper Collins.

Perception and the Senses

Ackerman, D. (1990). *A natural history of the senses*. New York: Random House.
This is an enticing history and story about the senses and their fictional and nonfictional roles in society. It is filled with real-life applications of the perceptual skills developed in aesthetic education.

Bateson, G. (1979). *Mind in nature*. Glasgow, Great Britain: William Collins Sons.
Received as a gift from one of the artists I interviewed for my research, this book provided a translation of much of the empirical research on perception in which I had been totally immersed. It is a gentle transition of meaning from science to art that enlightens the reader to the power of perception.

Curriculum Planning

London, P. (1994). *Step outside: Community-based art education*. Portsmouth, NH: Heinemann.
Attending to the child's environment, London gracefully guides the reader through several elegant solutions to the problem posed of developing visual perceptual skills.

Ruef, K. (1992). *The private eye: Looking/thinking by analogy*. Seattle: The Private Eye Project.
Directed at developing scientific observation skills in students, this curriculum guide provides invitations to develop artistic and creative skills in most of the lessons. Interesting art lessons can be derived as one also encounters concepts in the arts that transfer to other subject areas.

Thinking and Problem Solving

Eisner, E. W. (1994). *Cognition and curriculum reconsidered* (2nd ed.). New York: Teachers College Press.
Looking at the relationships among sensation, cognition, and representation, Eisner discusses choices of art educators. This is a book I wish I had read early in my teaching (and research) career.

Sternberg, R. J. (1986). *Intelligence applied*. Orlando, FL: Harcourt Brace Jovanovich.

With practice problems and self-tests scattered throughout, this book presents and applies Sternberg's theory of intelligence in a comprehensible style. Although only one theory is covered in depth, it is a sound foundation for understanding all others. It has been well received by teachers seeking more information on the topic.

Curriculum Planning

Battin, M. P., Fisher, J., Moore, R., & Silvers, A. (1989). *Puzzles about art: An aesthetics casebook.* New York: St. Martin's Press.
The format of this book provides readers with open-ended problems dealing with aesthetic inquiry. It is useful as an advanced high school text but can be filtered to adapt some of the problems to elementary-level experiences.

Visual/Spatial Thinking

Dixon, J. P. (1983). *The spatial child.* Springfield, IL: Charles C. Thomas.
This is an excellent book on a learning style and thinking strategies that are underrepresented in educational research. Highly recommended for all art educators.

Curriculum Planning

McKim, R. H. (1980). *Experiences in visual thinking* (2nd ed.). Belmont, CA.: Wadsworth.
Complete with an index of strategies, this book provides options for a variety of experiences in visual thinking exercises. Designed for the teacher as choice maker.

Key Terms

Aesthetic From the Greek word meaning "of sense perception, artistic"; appreciative of, responsive to, or zealous about the beautiful

Cognition The act or process of knowing, including both awareness and judgment

Contricipation A new word combining the activities of two major roles involved in the creative process—contribution and participation (Stein, 1984, p. 31)

Creative thought (creativity) A process in which the individual finds, defines, or discovers an idea or problem not predetermined by the situation or task (Kay, 1989, p. 10)

Elaboration Something planned or carried out with great care and worked out in detail. This is one of four major cognitive strategies often associated with creativity; it is a characteristic of the result of the creative process.

Expertise The skill or knowledge representing mastery of a particular subject

Flexibility Characterized by a readiness to adapt to new, different, or changing requirements. This is one of four major cognitive strategies often associated with creativity; it is a characteristic of the result of the creative process.

Fluency Smooth and rapid effortlessness, flowing from one idea to another. This is one of four major cognitive strategies often associated with creativity; it is a characteristic of the result of the creative process.

Originality Freshness of idea, design, or style; the result of independent thought or constructive imagination. This is one of four major cognitive strategies often associated with creativity; it is a characteristic of the result of the creative process.

Perception Information obtained through the senses; observation; quick, acute, and intuitive cognition

Problem finding Defining or formulating a problem by an individual prior to the actions taken to solve the problem (Kay, 1989, p. 10)

Problem solving The process of finding a solution to a stated problem. Convergent problem-solving tasks require the identification of one correct response; divergent problem-solving tasks require the formation of a quantity of solutions to a problem (e.g., generating a list of uses for an object) (Kay, 1989, p. 10).

Qualitative Of, relating to, or involving quality or kind; often contrasted with *quantitative*, which measures or expresses quantities or amount

Visual thinking Perception; mental representation and ordering of information using images or figures