CHAPTER 9

Creativity II

Teaching for Creative Growth

I know that it is possible to teach children to think creatively. . . . I have seen children who had seemed previously to be "non-thinkers" learn to think creatively, and I have seen them continue for years thereafter to think creatively.

E. PAUL TORRANCE (1995, P. 269)

Students find training in creative strategies to be enjoyable and it does improve students' abilities to use specific strategies taught. . . . Teachers should be aware that transfer will likely not occur unless they take time to assist students with seeing and practicing other applications.

SCOTT L. HUNSAKER (2005, P. 292)

CAN CREATIVITY BE TAUGHT?

Can creativity be taught or are you born with it? The answer is *yes* and *yes.* Some people are born with a special combination of creative genius and intelligence that, activated by high motivation and a sense of destiny, leads them to dream their dreams and implement their creations that make the world a better place. The names Leonardo da Vinci, Wolfgang Mozart, Marie Curie, Thomas Edison, Albert Einstein, George Washington Carver, and Georgia O'Keeffe come to mind. No amount of creativity training can elevate an average person to such lofty creativeness. Recall from Chapter 8 that Taylor (1959) referred to this high creativeness as the *genius level* of creativity and Csikszentmihalyi (1996) classified those with it as the "big C" creative people.

At the same time, it is absolutely true that everyone's personal creativity can be improved. In the case of gifted and talented children, efforts to strengthen their creative abilities—and get them to use the abilities they were born with—can have visibly dramatic effects, as evidenced, for example, in the marvelous products and performances in the Future Problem Solving and

Odyssey of the Mind programs. Furthermore, these programs have proven effective, based on multiple outcomes, including divergent thinking tests, problem-solving applications, surveys, and affective measures (Meador, Fishkin, & Hoover, 1999; as cited in Hunsaker, 2005).

Many teachers already are creativity conscious and integrate creativity exercises into class work, perhaps daily. For example, some teachers arrange independent projects in language arts, science, or art areas. Such projects help students develop such creative problem-solving attitudes and skills as independence, problem defining, information gathering, idea generating, evaluating, decision-making, and communication, along with valuable technical skills.

Some teachers give divergent thinking exercises, either as a classroom brainstorming activity or by asking students individually to write their ideas. Divergent thinking problems may or may not be tied to the subject matter at hand. For example, teachers might ask students to think of unusual uses for ping pong balls or for the math balance scales; improvements for bicycles or better ways to evacuate the building in case of fire; or clever ways to make the school burglarproof or to keep the hallways clean. Some ask "What would happen if . . . ?" questions: What would have happened if gasoline engines were never invented? if nobody went to school? if Jefferson had not arranged the Louisiana purchase? if we didn't have any fingers? if nobody could spell or write a correct sentence? Many workbooks are filled with divergent thinking and other creativity exercises and activities. Some favorites are *Hearthstone Traveler* (Stanish, 1988), *Mindglow* (Stanish, 1986), *Hippogriff Feathers* (Stanish, 1981), *I Believe in Unicorns* (Stanish, 1999), *Sunflowering* (Stanish, 1977), *Teaching Is Listening* (Gordon & Poze, 1972a), *Strange and Familiar* (Gordon & Poze, 1972b), *Making It Strange* (Gordon, 1974), and *New Directions in Creativity* (Renzulli, Callahan, Smith, Renzulli, & Ford, 2000).

Further, as we will see in Chapter 11, teachers interested in character and values education can use "What would happen if . . . ?" questions, brainstorming, and other creativity thinking techniques taught in this chapter to help students understand character and values and make commitments to productive, not self-destructive, principles. "What would happen if everyone were always rude to everyone else?" "How many ways can we think of to make a new student feel welcome?" (Davis, 2003a, 2003c).

Some teachers review biographical information about creative people, such as the training, lifestyles, attitudes, and thinking habits of Edison, Einstein, Curie, or Picasso. They might ask students to research the life of a creative person and even might design and create a learning center that explains the person's thinking style, personality, struggles, and accomplishments. On parents' night, students might dress as famous creative characters and explain "what it's like being me" (Betts & Kercher, 1999). The goal of the biographical approach is to help students better understand creativity and creative people and, possibly, to motivate them to acquire some of the attitudes and technical talents they have learned about.

Specific training in divergent thinking is effective. Pyryt (1999; as cited in Hunsaker, 2005), in a meta-analysis of 25 studies, concluded that students' improved performance in divergent thinking tasks was directly correlated with the number of training sessions in which they participated. He further found that direct teacher instruction was more effective than student self-directed study.

GOALS OF CREATIVITY TRAINING

The strategies just described are logical efforts to "teach creativity." However, creativity training might be better structured if we itemize the main goals and objectives of such training and then review ways to achieve each objective (see, e.g., Davis, 1987, 1989a, 2003b, 2004). The list is brief and uncomplicated:

- raising creativity consciousness, teaching creative attitudes, and strengthening creative personality traits;
- improving students' understanding of creativity;
- strengthening creative abilities through exercise;
- teaching creative thinking techniques;
- involving students in creative activities; and
- fostering academic creativity.

Our recommendation is that a sensible creativity training effort should include *all* of these objectives and their corresponding activities. By a remarkable coincidence, a sensible order of objectives and their related learning activities exactly matches the order in which these topics are presented.

CREATIVITY CONSCIOUSNESS, CREATIVE ATTITUDES, AND CREATIVE PERSONALITY TRAITS

Increasing creativity consciousness and creative attitudes is the single most important component of teaching for creative growth. Creative attitudes are taught in every creative thinking course and program, and for good reason. To think creatively, a person must be consciously aware of creativity. He or she must value creative thinking; appreciate novel and far-fetched ideas; be open-minded and receptive to the zany ideas of others; be mentally set to produce creative ideas; and be willing to take creative risks, make mistakes, and even fail. Sternberg (2000a), in fact, argued that high creativity stems from conscious decisions—for example, to redefine problems, overcome obstacles, do what you love to do, and believe in yourself.

In Torrance's (1995) list of 20 suggestions for fostering creativity in school experiences, about half dealt with raising creativity consciousness and altering attitudes, such as "Teach children to value their creative thinking," "Develop tolerance of new ideas," and "Develop constructive criticism, not just criticism" (p. 44). In Piirto's (2004) list of 13 suggestions, almost all did—for example, "Do your own creative work" and "Set a creative tone."

Many students are capable of creative achievements. However, they do not think about creativity or appreciate the importance of creativity for their personal growth—for developing their talents and potential, for coping successfully with their world, and for simply getting more out of life. Students also should become more aware of the importance of creative innovation in the history of civilization and for solving society's present and future problems. Indeed, without creative innovation and creative people, we still would be living in caves during our short and sick lives, digging roots and clubbing rodents for lunch.

Strengthening Creative Personality Traits

Creative personality traits are tied closely to creative attitudes and awarenesses. We normally do not speak of "teaching personality traits." However, teachers can reward and encourage the (positive) kinds of traits and behaviors that relate to creative thinking—confidence, independence, enthusiasm, adventurousness, a willingness to take risks, curiosity, playfulness, humor, time alone for thinking, interest in complexity, perceptiveness, and artistic and other aesthetic interests. Cropley and Urban (2000) suggested these important attitudes and personality traits that may be strengthened in the classroom: autonomy, ego strength, positive self-concepts, preference for complexity, tolerance for ambiguity, and acceptance of all (even contradictory) aspects of one's own self.

Regarding "contradictory" aspects of the self, Barron (1969) and others noted long ago that creative persons assimilate traits traditionally associated with the opposite sex. More recently, Cropley and Urban (2000) reported this "integration of opposites": stereotypically masculine traits of autonomy, self-confidence, and toughness with stereotypically feminine traits of sensitivity, intuition, and responsibility. Even with brilliant, natural potential, though, would a Hell's Angel pursue a career in ballet?

Teachers can also foster creativity by encouraging students to learn independently, by not judging student ideas harshly, tolerating "sensible" errors, encouraging flexible thinking, promoting self-evaluation, encouraging fantasy and imagination, helping students cope with frustration and failure, accepting students as they are, helping students resist peer pressure to conform, rewarding courage as much as rewarding being right, and being aware that a child's "difficult" behavior could be a manifestation of creativity (Cropley & Urban, 2000; Fleith, 2000; Rejskind, 2000).

Teachers also may take a direct approach: Help students understand each creative attitude and trait and why it is essential for creativeness.

Creative Atmosphere

Creative attitudes and awareness relate closely to the notion of a creative atmosphere, an environment where creativity is encouraged and rewarded. Carl

Rogers (1962) called it *psychological safety,* a prerequisite for creative thinking. In brainstorming it is called *deferred judgment*—the noncritical, nonevaluative, and receptive atmosphere where fresh and even wild ideas may be safely proposed.

When a teacher refers to the "different" child as a *creative thinker,* the students are less likely to refer to that child as weird and the student is more likely to be appreciated rather than shunned.

It is an ancient and honored principle of psychology that rewarded behavior will persist and become stronger, while punished or ignored behavior will disappear. A creative atmosphere rewards creative thinking and helps it become habitual.

Blocks to Creativity

Creative attitudes and predispositions may be aided when teachers raise students' awareness of blocks and barriers to creative thinking, which may be categorized as *perceptual, cultural,* and *emotional* (Davis, 1999, 2004; Simberg, 1964). With *perceptual blocks,* we become accustomed to perceiving things in familiar ways, and it simply is difficult to view them in a new and creative way. Here is an illustration of a perceptual block: Given the letter stream BTAENNLEATNTEARS, cross out 10 letters to find a meaningful word. (See footnote if you give up.*)

Cultural blocks, as with perceptual blocks, result from learning and habit. With cultural blocks, we have the creativity-squelching effects of traditions, conformity pressures, and social expectations, which—along with "fear of being different"—will nip creativeness in its proverbial bud.

Conformity pressures and social expectations can take the form of idea squelchers. The list that follows contains some favorites, condensed from a longer list by Warren (1974; Davis, 2004). Think about your efforts in installing an innovative G/T program as you read these:

> It won't work.
>
> It's not in the budget.
>
> We've never done it before.
>
> We're not ready for it yet.
>
> What will parents think?
>
> We're too small for that.
>
> We have too many projects now.
>
> Somebody would have suggested it before if it were any good.
>
> We can't do it under the regulations.
>
> It's not in the curriculum.
>
> It will mean more work.

Such idea squelchers are the products of unreceptive, inflexible, and uncreative attitudes.

It is true, of course, that the human processes of socialization, education, and even healthy peer relations necessarily require a good measure of conformity. *However, children and adults should realize that there is a time for conformity and a time for creativity.*

Emotional blocks are the insecurities and anxieties that interfere with creative thinking. Here we find temporary states, such as job anxieties, school pressures, emotional problems, or health concerns. We also have more permanent emotional blocks, such as a chronic fear of making mistakes or failing, fear of being different, fear of not being different enough, fear of rejection, fear of supervisors, timidity, and other persistent anxieties.

Some of us need a whack on the side of the head to jostle us out of our uncreative attitudes (see Box 9.1).

Fortunately, a heightened creativity consciousness and creative attitudes are a natural outgrowth of most types of classroom creativity exercises and activities. As we noted in Chapter 2, the main differences between people who *have* creative abilities and those who *use* their creative potential lie in attitudes, awareness, and related creative personality traits that predispose people to think and behave in creative ways. Sternberg (1990) itemized tips that encourage students to develop creative habits and traits—and to use them (see Box 9.2).

*The solution is BANANA. What did you cross out?

BOX 9.1

A Whack on the Side of the Head

One popular book on stimulating creativity, written for corporate readers, is entitled *A Whack on the Side of the Head* (von Oech, 1983). The entire book focused on removing 10 mental blocks. As his book title suggests, it can take a whack on the side of the head to jolt us out of our anticreative attitudes.

The first mental block, *The Right Answer*, is the well-learned assumption that there is one right answer. But this is not so. We should look for the second right answer, the third right answer, and more. A later right answer probably will be more creative than the first.

Von Oech's second block, *That's Not Logical*, is based on the common assumption that logical thinking is better than illogical thinking. However, illogical thinking stimulates the imaginative play and new perspectives that can generate creative ideas.

A third block to creative thinking is *Follow the Rules*. Instead of following the rules, said von Oech, we should play the revolutionary and challenge rules. He recommended holding "rule-inspecting and rule-discarding" sessions.

Pressure to *Be Practical* is his fourth block. Instead, we should ask creativity-stimulating "What if?" questions and encourage "what-iffing" in others.

Avoid Ambiguity is the fifth block. In fact, a period of ambiguity is an integral part of creative problem solving. Such ambiguity inspires imaginative solutions.

Von Oech's sixth block is *To Err Is Wrong*. While a fear of making mistakes inhibits trying new things, creative innovation necessarily requires making errors and even failing. Thomas Watson, founder of IBM, claimed, "The way to succeed is to double your failure rate" (von Oech, 1983, p. 93).

The seventh block is the notion that *Play Is Frivolous*. Countless creative innovations and scientific discoveries have been born by playing with ideas; and childlike thinking, humor, and playing with ideas are common traits of creative people.

Block number eight is *That's Not My Area*. This block is an excuse for not even trying to solve a problem. Further, many innovations are born by adapting ideas from outside a field.

Don't Be Foolish, block nine, is another cultural barrier. Said von Oech, you occasionally should play the fool, and you certainly should be aware of when you or others are putting down a creative "fool."

Finally, the 10th block is the self-squelcher: *I'm Not Creative*. If you seriously believe this, you will be correct.

Do you need an occasional whack on the side of the head?

UNDERSTANDING THE TOPIC OF CREATIVITY

Any creativity training will have more impact and make a more lasting impression if students are helped to understand the topic of creativity. There is a large body of information that contributes to this understanding (see Cropley & Urban, 2000; Davis, 2004; or Treffinger, Sortore, & Cross, 1993, for an overview). Some main topics that could comprise lessons "about creativity" are the following:

the importance of creativity to self and society;

characteristics of creative people;

the nature of creative ideas as modifications, combinations, and analogical relationships;

BOX 9.2

Tips for Strengthening Creativity

- **Know when to be creative and when to conform.** For example, be creative in artistic and research projects; do not be creative on multiple-choice exams or by violating normal school requirements.
- **Find out what you are best at.** Experiment and explore; take risks and challenge yourself. You might discover new talents.
- **Be motivated from inside yourself, not from the outside.** Work to please yourself; do things that interest you. Seek satisfaction in a job well done.
- **Do not let personal problems stop your thinking and your work.** Accept that everyone sometimes has problems, and try to take them in stride. Work can take your mind off problems.
- **Do not take on more—or less—than you can handle.** Find the balance that allows you to do a thorough job, but without accomplishing less than you could.
- **Be persistent.** Do not let frustration, boredom, or fear of failure stop your creative work. Finish what you start—but also know when to quit if you hit a dead end.
- **Make your environment more creative.** Do your parents, teachers, and friends support your creative efforts? Does your room inspire creative thinking? Can you change your environment to make it more creative?

Source: Information based on Sternberg (1990).

the nature of the creative process—stages, changed perceptions, modifying, combining, analogical thinking;

creative abilities;

theories and definitions of creativity;

tests of creativity and the rationale underlying them;

creative thinking techniques; and

barriers to creative thinking, including von Oech's 10 blocks.

As we noted previously, biographies of well-known creative people provide a useful way to teach students about desirable creative characteristics, attitudes, habits, and lifestyles.

Students also can learn principles of creative thinking such as the following:

- Creativity will help you live a more interesting, successful, and enjoyable life.
- Creative people are not rigid; they look at things from different points of view.
- Creative people are aware of pressures to conform—to be like everybody else.
- Creative people are not nonconformers all of the time.
- Creative thinking includes taking risks and making mistakes—and the more creative the idea is, the greater is the risk of mistakes and failure.
- Creative people play with ideas, consider lots of possibilities, use techniques, think analogically, evaluate their ideas, and get their ideas into action.
- Creative people use, and don't waste, their talents.

STRENGTHENING CREATIVE ABILITIES

In Chapter 8 we itemized abilities that logically underlie creativity. It is a common and reasonable strategy to try to strengthen creative abilities through practice and exercise, the same way we strengthen skills of reading, math, typing, solving chemistry problems, and shooting baskets.

We will look again at some of those abilities, noting strategies, exercises, or materials that aim at strengthening each ability. Note that most activities not only exercise creative abilities, but also implicitly raise creativity consciousness and bend attitudes in a creative direction.

Note also that there is a thin-to-nonexistent line between creative abilities and many thinking skills. Bloom's (1974) classic higher-order thinking skills of *analysis, synthesis,* and *evaluation* were listed in Chapter 8 as creative abilities. Other "thinking skills" such as *critical thinking, reasoning, planning,* and *organizing* are, obviously, essential to creative problem solving. Thinking skills are discussed in Chapter 10.

FLUENCY, FLEXIBILITY, ORIGINALITY, ELABORATION Many types of questions and problems will exercise these traditional creative abilities. Students can do the exercises as a class, perhaps following brainstorming rules, or else individually. One of the most involving methods is to divide students into problem-solving teams. All teams work on the same problem and then report all or their best ideas to the entire class. Students often are surprised at the different problem interpretations, approaches, and ideas from the other groups. The surprising differences encourage them to risk putting forth their own creative ideas.

Some useful types of exercises for stimulating fluency, flexibility, originality, and elaboration follow:

1. With "What would happen if . . . ?" exercises, students list consequences for unlikely events. The events may be imaginary or potentially real. What would happen
   - if each person had an eye in the back of his or her head?
   - if we did not have books?
   - if the British had won the Revolutionary War?
   - if the only musical instruments were drums?
   - if there were no gravity in this room?
   - if people with blond hair were not allowed in hotels or restaurants and could not vote?
   - if the earth shifted and your town became the north pole?
   - if Edison had become a plumber and we had no light bulbs?
   - if no one ever smiled?
   - if everyone were a litterbug?
   - if we had no bricks or wood to build homes?
   - if we had no automobiles, TV, video games, peanut butter, bicycles, football?
2. Thinking of *product improvements* is another type of open-ended question. Students may be asked to think of improvements for any product or process—pencils, desks, classrooms, skateboards, pianos, school lunches, soda pop, kitchen sinks, the school (or city) bus system, popcorn, bathtubs, computers, bicycles, jogging shoes, and so on.
3. Thinking of *unusual uses* for common objects is probably the single oldest creativity test item; it also makes a good exercise. How might we use discarded rubber tires? a coat hanger? empty plastic gallon milk containers? plastic grocery bags? a wooden stick? a sheet of paper? leftover and wasted cafeteria food?
4. Posing *problems and paradoxes* is intrinsically interesting and challenging. A problem may require a solution, or a puzzling situation may require a logical explanation. The problem may be realistic or fanciful. For example, How can bicycle thefts be eliminated? How can the lunch menu be improved? What can we buy for parents for Christmas or Hanukah for 20 dollars? How can the school (family) electricity bill be reduced? How can our health be improved? What can be done for Mr. Smith, a former night watchman who is 55 years old, out of work, with no special skills? How could we remove a stubborn elephant from the living room? How can the Three Bears prevent burglaries?

   Here are some examples of problems requiring explanations: The principal suddenly cancels recess. Why? The grass behind billboards in pastures is often lush. Why? Ten paintings were discovered missing from the art gallery, but there was no sign of a break-in. How could they have disappeared?
5. With *design problems,* students can design an ideal school, an airplane for hauling nervous kangaroos, a better lawnmower, more functional clothes, safer ways to travel, a more efficient

way to serve lunch in the cafeteria, new sandwiches or other treats for McDonald's, a better mousetrap, and so on.

Looking more specifically at each ability, *fluency* can be exercised by having students list things that are, for example, round, square, sweet, sour, blue, white, made of metal, made of wood, long and slender, short and stubby, smell good, taste bad, or have sharp edges. Some *flexibility* exercises ask students to look at things from different perspectives: How does this room look to a tidy housekeeper? a hungry mouse? an alien from outer space? How does a highway look to a tire? a crow? a lost pilot? *Elaboration* exercises require the learner to build upon a basic idea—for example, developing the dog-walking or cat-petting machine in detail (measurements, materials, costs) or elaborating and embellishing a short story, drawing, invention, class outing or field trip, or creative dramatics people machine.

SENSITIVITY TO PROBLEMS Exercises aimed at strengthening problem sensitivity should have the learners find problems, detect difficulties, or identify missing information. Therefore, one type of exercise is having students *ask questions* about an ambiguous situation or even a common object. For example, what questions could you ask about clouds, Mexico, Mickey Mouse, a computer, the moon, or the school lunch program? Another type of problem sensitivity exercise would begin with "What don't we know about . . . ?" or "What is wrong with . . . ?"

PROBLEM DEFINING *Problem defining* is a complex ability. Relevant exercises would evolve around the following activities:

Identifying the "real" problem. What really needs attention (fixing)? What are we really trying to do?

Detecting missing information. What's missing here? What else do we need to know?

Identify important aspects of a problem. What's relevant? Essential? What should we focus on? What can we ignore?

Clarifying and simplifying the problem. Checkout service at a discount store is very slow. What needs to be done?

Identifying subproblems. What problems are related to the main problem? What problems will follow from each solution?

Proposing alternative problem definitions. This exercise asks questions such as those posed in the "In what ways might we . . . ?" tactic of the CPS model (Chapter 8).

Defining the problem more broadly to open up new solution possibilities. What is it, generally, that we wish to accomplish? What is a broader view of this problem?

VISUALIZATION AND IMAGINATION *Visualization* and *imagination* are, obviously, central creative abilities (e.g., Daniels-McGhee & Davis, 1994; Piirto, 2004). Three books filled with imagination-stimulating exercises are *Put Your Mother on the Ceiling* (DeMille, 1973), *Scamper* (Eberle, 1995), and *200 Ways of Using Imagery in the Classroom* (Bagley and Hess, 1984). All ask students to relax, shut their eyes, and visualize some colorful narration—for example, "Now put a light bulb in each hand. . . . Hold your hands straight out to the side. . . . Pretend that your light bulbs are jet engines. . . . Run down the street for a takeoff. . . ." (Eberle, 1995).

Another exercise guaranteed to elicit visualization is a creative writing activity suggested by Helman and Larson (1980): "Cut out headlines from a newspaper dealing with unusual stories and have the kids make up the stories." The familiar grocery store rags provide an endless supply of candidate headlines. Among the winners are these mirth-inspiring entries: "Angry Dad Sells Bratty Kids," "Baby Born Talking Gives Dad Winning Lottery Numbers," "Lightning Bolt Zaps Coffin—And Corpse Comes Back To Life!" "Titanic Survivor Afloat for 80 Years," "Teacher Picks Up Hitchhiking Ghost," and "Woman Weds Two-Headed Man—And Gets Sued for Bigamy!"

ANALOGICAL THINKING As we will see in the next section, analogical thinking is not just a cognitive ability, but it is also the single most common and important creative thinking technique used—consciously or unconsciously—by creatively productive people (Davis, 2004; Gordon, 1961). Many activities for exercising analogical thinking appear in workbooks by Gordon (1974), Gordon and Poze (1972a,

1972b), and Stanish (1977, 1986, 1988). A teacher or G/T coordinator also can make up his or her own activities, with the format of such questions as "How is a hamburger like a good day at school?" "What animal is like a bass fiddle and why?" "What kind of weather (animal, fish, vegetable, car, book, fish, sport, magazine, etc.) is like you?" and, perhaps, "What color is sadness?" or "How can noise be seen?" In the next section we will see the *direct analogy method,* which involves finding ideas by asking how nature has solved similar problems—for example, "How do animals, birds, and plants keep warm in winter?" "What could have given a cave dweller the idea for a spear? and What do you think was the connection?"

RESISTING PREMATURE CLOSURE Most children and adults are guilty of grabbing the first idea that presents itself. However, considering many ideas and deferring judgment are two of the most basic principles of creative problem solving, principles that students should thoroughly understand. Brainstorming, with heavy emphasis on the rationale behind deferring judgment, should help with this pivotal ability (or attitude).

Other Creativity Exercises

There are many types of creativity and problem-solving exercises that may be used to strengthen creative abilities. Some are relatively simple, divergent thinking exercises; others ask for more complex aesthetic products for, or solutions to, difficult invention or design problems.

A workbook by Stanish (1988), *Hearthstone Traveler,* includes instruction and exercises in these areas: poetry writing (cinquains, diamanté), creative writing, humor, analogical thinking, values, recognizing patterns in nature, idea-finding techniques, the CPS model, idea evaluation, and more. Consider the cinquain writing strategy:

> Select a title word (for example, *merry-go-round*).
>
> Brainstorm words (or phrases) associated with the title (for example, *wild horses, beasts, children, music, mirrors, ticket to ride*).
>
> Brainstorm a second list of "-ing" words descriptive of the title (for example, *smiling, laughing, playing, circling, spinning, galloping, running*).
>
> Brainstorm a third list of feeling words also ending in "-ing" (for example, *exciting, wondering, thrilling, mastering, owning the world, riding high*).
>
> Write the title on one line, two associated words on the second line, three "-ing" words on the third line, four feeling "-ing" words on the fourth line, and another word associated with the title on the fifth line.

Here is one result:

> Merry-go-round
>
> Music, wild horses
>
> Galloping, playing, laughing
>
> Thrilling, wondering, mastering, owning the world
>
> Ticket to ride.

Said Stanish, such cinquain may be used to write about oneself, to capture the essence of a reading assignment or an important person one has studied, or as the conclusion to a unit of study. Try it. Some of Stanish's (1988) other exercises include the following:

> In what ways is our circulatory system like a tree?
>
> Investigate the use of spirals in computer art, Van Gogh paintings, the human face, the horns of animals, floral patterns, religious temples.
>
> If I were a hawk, in what ways might I assert an opinion?
>
> Something that few people know about me is. . . .
>
> Create a humorous drawing that merges two meanings of a word (for example, *horn, school, bark, sock, punch*).
>
> What kind of sound would an exclamation point (question mark, dollar sign) make?
>
> Invent a Rube Goldberg machine, with at least five steps, to time your suntan (walk your dog, tickle an armadillo's stomach).

PERSONAL CREATIVE THINKING TECHNIQUES

Personal creative thinking techniques are methods that are developed and used, consciously and unconsciously, by every creative person, regardless of the subject or content of his or her creations. This topic lies at the core of central questions such as "Where do ideas come from?" and "What is the nature of the internal creative process?" (Davis, 1981a).

Most personal techniques are *analogical* in nature. That is, the innovator based the idea for the creation on a news event, an historical event, or an earlier book, movie, melody, art or architecture style, invention, scientific discovery, business idea, some other previous innovation, or some phenomenon in nature. Indeed, whenever we hear the phrase "was inspired by . . ." or "was based upon . . .," we can be sure that a deliberate or accidental analogical technique was used by the innovator.

An important point is that every single one of the standard techniques described in the next section originated as a personal creative thinking technique—a method that some creative person used in his or her day-to-day high-level creative thinking. The standard techniques are unconscious methods made conscious, knowable, and teachable.

To present the flavor of personal creative-thinking techniques, let's look at a few examples. In science, Einstein used what he called "mental experiments." In his most noted example, he once imagined himself to be a tiny being riding through space on a ray of light, which helped him develop his general theory of relativity.

In art we find recurrent subjects and styles with every famous painter, reflecting their personal creative thinking techniques. Picasso, for example, is known for his African, harlequin, blue, and pink (rose) periods, during which his paintings were inspired by particular themes. He also deliberately disassembled faces and other elements and put them back together in more original arrangements. Paul Gauguin painted South Pacific natives in his unique style, time and again. Edgar Degas is noted for his graceful ballerinas. Renoir's trademark is his soft pastel, female subjects and still lifes. Georges Seurat used a "dot" style (pointillism), often with water and sailboats as subjects.

Seurat's most famous painting, *Sunday Afternoon on the Isle of La Grande Jatte,* inspired the Broadway musical *Sunday Afternoon in the Park with George.* Andrew Lloyd Weber's *Cats* was based on T. S. Eliot's *Old Possum's Book of Practical Cats.*

Even Leonardo da Vinci reportedly wandered Italian streets, sketchbook in hand, looking for interesting faces for his painting *The Last Supper.* Throughout art history, ideas for paintings have been taken from mythology, the Bible, or historical events.

All of Franz Liszt's *Hungarian Rhapsodies* were drawn from the folk tunes of Hungarian gypsies. Tchaikovsky, too, developed folk tunes into symphonies. Aaron Copland's marvelous *Appalachian Spring* was based on the folk tune *Simple Gifts.* Even the ever-popular *Star Spangled Banner* came from an English drinking song.

Cartoonists continually use deliberate analogical thinking to find ideas. For example, after the first Gulf War, Saddam Hussein was portrayed as the powerless Wizard of Oz behind the curtain—"I am Saddam the great and powerful!"

Former columnist–humorist Art Buchwald also used deliberate analogical thinking—borrowing ideas and concepts from one area and using them to make a humorous political comment in another. For one column, he borrowed ideas from TV soap operas and used them to discuss a new "Seamy, Steamy Tale of Power and Greed—The Budget of the United States Government":

> I couldn't put it down. I kept turning the pages to see what government programs would be cut next. It's more frightening than *Rosemary's Baby.*
>
> You mean it's a thriller?
>
> It's more of a whodunit. Or, specifically, who's doing it to whom. It's about money and power, the struggle for survival, death and taxes and man's fate in a world he never made.
>
> Any sex?
>
> The military chapters are very sexy, particularly the love scenes between the President of the United States and the new weapons that the Pentagon has seduced him into buying.

You mean the President is in bed with the military-industrial complex?

All through the book! Some of the scenes are so hot that Tip O'Neill has threatened to ban the book in Boston. . . .

Toward the end of the 16th century, Holinshed's *Chronicles,* a history book, was published. William Shakespeare used it extensively as a source of ideas for *Macbeth, Henry IV, Henry V, Henry VI, Richard II,* and other plays. He drew from Plutarch's *Lives* to write *Antony and Cleopatra* and *Coriolanus. Troilus and Cressida* came from various accounts of the story of Troy.

Contemporary novelists and screenwriters continue to draw ideas analogically from identifiable sources. For example, Japan's attack on Pearl Harbor during World War II inspired the films *From Here to Eternity, Tora, Tora Tora!* and *Pearl Harbor.* In an interview, the screenwriter of *High Noon* confessed that the inspiration for his award-winning suspense western came from the intimidation of writers and actors in Hollywood, by organized crime, in the 1950s.

The *Star Wars* series was based partly on an effective personal creative thinking technique used by George Lucas. While writing the script for *Star Wars,* Lucas read books on mythology. Said Lucas in a *Time* magazine interview, "I wanted *Star Wars* to have an epic quality, and so I went back to the epics." Thus, in the movie we find a young man who must prove his manhood to himself and to his father; who rescues a princess in distress; who has an older and wiser mentor (actually, two—Ben Kenobi and Yoda); and who battles with a villain, Darth Vader. Some western movies have been built deliberately around the same principles.

Professional comedians also use personal creative thinking techniques, both for their unique type of humor and for their original delivery. Comedian Don Rickles insults people, using the same insults again and again ("Shut up, dummy; you're makin' a fool of yourself!"). Rodney Dangerfield's "I don't get no respect" theme makes him one of America's most successful comedians. He continually puts himself down: "When I was born, the doctor told my mother, 'I did everything I could, but he's gonna be okay.' " "I couldn't play hide-and-seek 'cause nobody wanted to find me!" "I remember when I called this girl for a date. She said, 'Sure, come on over, nobody's home.' So I went over an' nobody was home!" "Last week I went to a psychiatrist. He said 'I think you're crazy.' I said I wanted another opinion, so he said, 'Okay, I think you're ugly, too!' " The list of creations and innovations produced via personal creative thinking techniques, usually analogical in nature, could be endless. At the same time, we should not lose sight of unexplainable creative genius and inspiration. Consider the marvelous *Harry Potter* books and movies. Although Ernest Hemingway drew ideas from his travels and World War II, he also said, "The stuff comes alive and turns crazy on ya."

Developing Personal Creative Thinking Techniques

There are several ways students may be encouraged to develop personal creative thinking techniques. First, students should understand how even extraordinarily creative people have "found" ideas. This demystifies creativity and helps convince students that they also can legitimately build upon existing ideas without feeling "uncreative." After all, if William Shakespeare, Franz Liszt, George Lucas, and Art Buchwald can borrow plots, tunes, and ideas, so can they.

Second, some recurrent personal creative thinking techniques may be teachable. For example, some techniques include these strategies:

1. Deliberately using analogical and metaphorical thinking. For example, in aesthetic creations students can find ideas by looking at what others have done and where their ideas came from. Students can learn to ask these questions: What else is like this? What has worked for others? What could I adapt from similar problems or situations? Does history, the Bible, or other literature suggest ideas? What would professionals do (Davis, 2004)?

2. Modifying, combining, and improving present ideas.

3. Starting with the goal—perhaps an ideal or perfect solution, such as having the problem solve itself—and working backward to deduce what is required to reach that goal.

4. Asking yourself how the problem might be solved 50, 100, or 200 years in the future.

Because personal creative thinking techniques develop (1) in the course of doing creative things or (2) from instruction by people who use and understand such techniques, G/T students should become involved in such inherently creative activities as art, photography, creative writing, acting, journalism, independent research, or other activities requiring creative thinking and problem solving.

Mentorships may be especially good, because they involve many hours of direct, personal work with a creative professional. Field trips lead to exposure to experts, to creative ideas, and to sophisticated elaborations and embellishments of ideas.

Visitors also can teach personal creative thinking techniques. For example, school districts in some states contract with a different visiting artist or writer each school year. In this way children have a close view of the creative processes of a variety of artists during their school years. University and industry researchers and other creative professionals also may be invited to share their experiences related to creative discoveries and creative thinking.

STANDARD CREATIVE THINKING TECHNIQUES

Several well-known methods for producing new ideas and new idea combinations are taught in most university and professional creativity training courses. These strategies also may be taught to middle and high school students and to gifted and talented elementary students. One lively workbook, *Imagination Express* (Davis & DiPego, 1973), incorporates standard creative thinking techniques into a fantasy story about a Saturday subway ride from Kansas City to Pittsburgh, to Dublin, to Tokyo, to Santa Monica, and back. It also teaches good creative attitudes and awarenesses.

The techniques of brainstorming, attribute listing, the CPS model, and others are taught, for example, in the workbooks by Stanish (1977, 1981, 1988, 1996, 1997, 1999, 2001; Eberle & Stanish, 1980, 1996) in a form that is comprehensible to young learners.

It is worth repeating that every standard creative thinking technique began as a personal technique that some creative person explained and thus made conscious and teachable.

Brainstorming

Alex Osborn, cofounder of the New York advertising agency Batten, Barton, Dursten, and Osborn and founder in 1954 of the Creative Education Foundation, identified the conditions and listed the rules for brainstorming. The main principle is *deferred judgment:* Idea evaluation is postponed until later. Deferred judgment implicitly creates a receptive, creative atmosphere—an appreciation for novel ideas and a predisposition to find them. Osborn (1963) noted, simply enough, that any type of criticism or evaluation interferes with thinking of imaginative ideas: You cannot do both at once. And the purpose of any brainstorming session is to generate a long list of possible problem solutions.

Brainstorming may be used in the classroom for (1) teaching brainstorming as an effective creative thinking technique, (2) practicing creative thinking (and thus strengthening attitudes and abilities), and, perhaps, (3) solving some pressing school problem, such as high absenteeism, messy school grounds, drug problems, traffic problems, bicycle thefts, raising money, selling play tickets, and so on.

Osborn's four ground rules are simple:

1. ***Criticism is ruled out.*** This is deferred judgment, which contributes to the creative atmosphere that is essential for uninhibited imaginations to work.
2. ***Freewheeling is welcomed.*** The wilder an idea is, the better it is. Seemingly preposterous ideas can lead to imaginative, yet workable, solutions.
3. ***Quantity is wanted.*** This principle reflects the purpose of the session: to produce a long list of ideas, thus increasing the likelihood of finding good solutions to the problem.
4. ***Combination and improvement are sought.*** This lengthens the idea list. Actually, during the session, students should be encouraged to spontaneously "hitchhike" on each other's ideas, with one idea inspiring the next.

Variations on brainstorming include *reverse brainstorming,* in which new viewpoints are found by turning the problem around. For example, consider these questions: How can we *increase* vandalism?

How can we *increase* the electric bill? How can we *stifle* creativity? How can we *decrease* morale? Reverse brainstorming quickly points out what currently is being done incorrectly and implicitly suggests solutions. With *stop-and-go* brainstorming, short (about 10-minute) periods of brainstorming are interspersed with short periods of evaluation. This helps keep the group on target, selecting the apparently most profitable directions. In the *Phillips 66* technique, small groups of six brainstorm for 6 minutes, after which a member of each group reports either the best ideas or all ideas to the larger group.

Nominal brainstorming groups (Katzenbach, 1998; as cited in Isaksen & Gaulin, 2005) may not be groups at all and are probably inappropriately named. They are groups in name only and can be very small groups with common goals or even "groups" of one (hardly a group). They follow the guidelines for brainstorming, with individuals writing their ideas and sharing them afterward. In brainstorming, nominal groups generated more ideas than some real groups that were not facilitated by a leader (Isaksen & Gaulin, 2005), although not as many ideas as some real groups that were facilitated by trained leaders. In the same study, the brainwriting variation of brainstorming groups generated the most ideas, compared with other kinds of brainstorming groups. In brainwriting, the participants write their ideas down and share them with others during the sessions so that they can build on one another's ideas.

It is worthwhile to try to run a classroom brainstorming session. The teacher begins by discussing creativity and creative ideas, which leads to the subject of brainstorming as one method that stimulates creative thinking. The four brainstorming rules are discussed, and a problem selected, such as "How can we raise money for new playground equipment?" or "How can we turn the classroom into a foreign planet?" A volunteer scribe lists ideas on the blackboard. The teacher–leader's role is to ask, "Anyone else have an idea?" Or the leader might specifically ask quieter students whether they have ideas they wish to contribute. If a serious problem (for example, messy hallways) is the focus, the leader can give the group 48 hours' advance notice of the problem. Gifted and talented students can also learn to organize and lead brainstorming sessions.

Whereas teachers and gifted students can learn to lead brainstorming sessions of all varieties, they can do that better with training. When brainstorming groups were led by trained facilitators, groups produced more ideas and were more likely to overcome the typical barriers to successful brainstorming, such as applying judgement inappropriately or giving up in the group (Hunsaker, 2005). Isaksen and Gaulin (2005) remind us also that brainstorming is only a part of the creative process.

IDEA EVALUATION Listing wild ideas does not represent the complete problem-solving process. Therefore, a brainstorming session can be followed by an idea evaluation session. Idea evaluation would be most important if the class intended to present the school principal (or the mayor) with some blue-ribbon solutions to a real current problem. The group can brainstorm evaluation criteria such as the following: Will it work? Can the school afford it? Will the community (parents, principal, mayor) go for it? Is adequate time available? Are materials available? As we saw in the previous chapter, the most relevant criteria would be listed across the top of an *evaluation matrix*, the specific ideas itemized in rows down the left column. Table 9.1 shows one evaluation matrix that was constructed to evaluate ideas brainstormed for the problem "How can we build school spirit?" The total scores are a guide to ideas that students may wish to pursue.

The use of objective criteria

1. helps evaluate the ideas in a mostly unbiased manner;
2. helps students learn to evaluate as part of the overall creative problem-solving process;
3. teaches an effective evaluation technique, one that is used in both the CPS model and Future Problem Solving;
4. requires students to consider many components and views of the problem;
5. often helps the group explore its values relative to the problem at hand (what criteria are truly relevant?);
6. prevents idea evaluation from becoming a personal attack on specific children; and
7. helps children understand that thinking of "silly" and "far-fetched" ideas truly can lead to good, practical solutions to problems.

TABLE 9.1 Example of Evaluation Matrix

IDEAS	CRITERIA						
	Cost	Effect on Teachers	Educational Effects	School Spirit Effect	Effect on Students	Effect on Community	Totals
Buy class sweatshirts	+3	+2	+1	+3	+3	+3	15
Establish school baseball team	−2	+2	0	+2	+2	+2	6
Start interclass competition	0	0	+1	+3	+2	0	6
Get new school building	−3	+3	+2	+3	+3	−2	6
Get rid of troublemakers	−3	0	−3	+1	−3	−3	−11

POSITIVE EFFECTS
+3 = Excellent
+2 = Good
+1 = Fair
0 = Not Applicable

NEGATIVE EFFECTS
−1 = Slightly Negative
−2 = Somewhat Negative
−3 = Very Negative

Evaluation sessions may follow the use of any of the creative thinking techniques in this section.

Attribute Listing

Robert Crawford (1978), designer of *attribute listing*, argued, "Each time we take a step we do it by changing an attribute or a quality of something, or else by applying that same quality or attribute to some other thing." Attribute listing thus is both a *theory* of the creative process and a practical creative thinking *technique*. According to Crawford's definition, there are two forms of attribute listing: (1) *attribute modifying* and (2) *attribute transferring*. Either strategy may be used individually or in a group.

ATTRIBUTE MODIFYING The problem solver lists main attributes (characteristics, dimensions, parts) of a problem object, then thinks of ways to improve each attribute. For example, a group of students might invent new types of candy bars or breakfast cereals by first writing important attributes (size, shape, flavor, ingredients, color, texture, packaging, nutritional value, name, intended market, and so on) on the blackboard, and then listing specific ideas under each main attribute. Particularly good combinations are picked out of the lists of ideas. Not-so-good, but nevertheless entertaining, ideas—the 2-pound "Popeye's Delight" candy bar containing spinach and steroids and created for muscle-builders—will keep enthusiasm high. In university design engineering courses the attribute modifying strategy is called the *substitution method* of design.

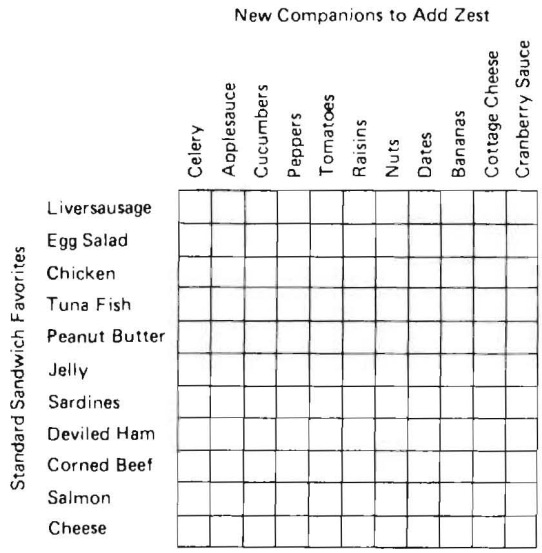
The attribute listing technique is simple, and it works—whether used for inventing breakfast cereals, writing short story plots, or solving any other problem in which attributes can be identified. For example, the problem of "dirty hallways" might be attacked by the listing of such attributes as student habits, student awareness, available trash containers, disciplinary consequences, and/or other aspects of the problem. Students would *list* specific ideas for improving each *attribute*.

ATTRIBUTE TRANSFERRING This is a pure case of analogical thinking—transferring ideas from one context to another. We noted earlier how deliberate analogical thinking is used by creative persons in many aesthetic and scientific areas. As one classroom application, ideas for a creative and memorable parents' night or open house might be found by borrowing ideas from a carnival or circus, Disneyland, *E.T.*, the "Wild West," a funeral parlor, McDonald's, or a *Star Wars* or *Harry Potter* movie.

Morphological Synthesis

The *morphological synthesis* technique is a simple extension of the attribute listing procedure (Allen, 1962; Davis, 2004). Specific ideas for one attribute or

A sixth grade Milwaukee class used the morphological synthesis method to generate 121 zany ideas for creative sandwiches. Can you find a tasty combination? A revolting one? If you add a third dimension, with five types of bread, how many total ideas would you have?



Ratings of Various Spreads

Flavor	Choices 1st	2nd	3rd	4th	5th
Super Goober (Peanut Butter/Cranberry)	17	2	1	0	4
Charlies Aunt (Tuna and Applesauce)	3	16	2	2	1
Irish Eyes are Smiling (Corn Beef and Cottage Cheese)	0	0	16	2	6
Cackleberry Whiz (Hard Boiled Eggs/Cheese Whiz)	1	3	2	14	4
Hawaiian Eye (Cream Cheese and Pineapple)	3	3	3	6	9

FIGURE 9.1 A Morphological Sandwich. *Source:* From *Creativity Is Forever*, 4th ed., by G. A. Davis (Dubuque, IA: Kendall/Hunt). Used with permission.

dimension of a problem are listed along one axis of a matrix; ideas for a second attribute are listed along the other axis. Plenty of idea combinations are found in the cells of the matrix. One sixth-grade class invented new sandwich ideas with the morphological synthesis technique (Figure 9.1). With a third dimension (type of bread) you would have a cube with three-way combinations in each cell. Davis (2003a, 2003c) used morphological synthesis to generate hundreds of exercises for teaching values and moral thinking.

The method may be used with a half-dozen dimensions by listing ideas in columns. The columns may be cut into strips that can slide up or down, to create hundreds or even thousands of combinations made by reading horizontally.

Idea Checklists

Sometimes, one can find a *checklist* that suggests solutions for your problem. For example, the *Yellow Pages* are often used as a checklist for problems like "Who can fix my TV?" or "Where can I get a haircut?" High school counselors have used the *Yellow Pages* for career counseling ideas. Examining a gift

store catalogue—or browsing through a gift store, clothing store, book store, cheese-and-sausage store, or gourmet kitchen/food shop, which often can be done on the Internet—is also using an idea checklist.

Some idea checklists have been designed especially for creative problem solving. The most popular of these is Alex Osborn's (1963) *73 Idea-Spurring Questions.*

The checklist technique sometimes is called the *SCAMPER* method: *S*ubstitute, *C*ombine, *A*dopt, *M*odify-*M*agnify-*M*inify, *P*ut to other uses, *E*liminate, *R*everse-*R*earrange.

Synectics Methods

Synectics comes from the Greek word *synecticos,* means the joining together of apparently unrelated elements. It was his work with creative-thinking groups that led William J. J. Gordon, originator of the synectics methods, to identify strategies that creative people use unconsciously. He made these strategies conscious and teachable in a form for adults (Gordon, 1961; Gordon and Poze, 1980) and for children (Gordon, 1974; Gordon and Poze, 1972a, 1972b; see also Stanish, 1977, 1986, 1988).

DIRECT ANALOGY With this method, the person is asked to think of ways that similar problems are solved in nature by animals, birds, flowers, weeds, bugs, worms, lizards, and so on. For example, ideas for conserving energy could be found by asking how animals keep warm in winter.

In a creativity workshop for the elderly, many expressed concern for their personal safety. With a synectics approach, the problem became, "How do animals, plants, and birds protect themselves, and how can these ideas help the elderly?" The list included spray cans of skunk scent, slip-on fangs and claws (mildly poisonous), a compressed air can that screams, an electronic transmitter that secretly "yells" for police assistance, traveling only in groups, camouflage, or disguises (for example, wearing a police uniform), and others.

PERSONAL ANALOGY Imagine you are a piece of candy sitting quietly with your candy friends on the shelf of the local drugstore. A little boy walks in, places a nickel on the counter and points at you. How do you feel? What are your thoughts? Describe your experiences for the next 15 minutes. The purpose of such exercises is to give elementary students practice with the *personal analogy* creative thinking technique. With this strategy, new perspectives are found by becoming part of the problem, usually a problem object. What would you be like if you were a highly efficient can opener? A captivating short story? A truly exciting and valuable educational learning experience for children?

FANTASY ANALOGY Problem solvers think of fantastic, far-fetched, and perhaps ideal solutions that can lead to creative, yet practical, ideas. Gordon sees *fantasy analogy* as a type of Freudian wish fulfillment. For example, we can ask how to make the problem solve itself: How can we make the hallways keep themselves clean? How can we get parents to want to attend open house? How can we get the school board to want to give us a new instructional materials center? Some years ago, design engineers probably asked, "How can we make refrigerators defrost themselves? ovens clean themselves? automobile brakes adjust themselves?" This was employing fantasy analogy.

SYMBOLIC ANALOGY A fourth synectics technique is called *symbolic analogy;* other names are *compressed conflict* and *book titles.* Your dictionary will call it an *oxymoron.* The strategy is to think of a two-word phrase or "book title" that seems self-contradictory, such as "careful haste" or "gentle toughness." The compressed conflict would be related to a particular problem and would stimulate ideas. For example, the phrase "careful haste" might be used by educators or firefighters to stimulate ideas for quickly and safely evacuating a large school building. "Gentle toughness" might stimulate ideas for designing automobile tires, durable fabrics, or long-distance bicycles.

An exercise from a synectics workbook, *Teaching Is Listening,* by Gordon and Poze (1972a), includes a direct analogy, personal analogy, and symbolic analogy:

1. What animal typifies your concept of freedom? (Direct analogy)
2. Put yourself in the place of the animal you have chosen. Be the thing! Describe what makes you feel and act with so much freedom. (Personal analogy)

3. Sum up your description of the animal you chose by listing the "free" and "unfree" parts of your animal life.

   Free: _____

   _____

   Unfree: _____

   _____

4. Express each of these parts of your life in a single word. Put together these two words and refine them into a poetic, compressed conflict phrase.

   _____ _____

   _____ _____

   _____ _____

5. Circle the phrase you like best. Write a new essay about freedom. Use any material you may have developed in this exercise.

Synectics methods can be used in the classroom either as creativity exercises or as material for lessons in techniques of creative thinking.

As a final note on creativity techniques, a five-volume series of activity books for students at different grade levels (K–8) uses brainstorming and other "forced relationship" techniques to improve students' "ideational fluency and originality . . . [and] the ability to speculate and imagine" (Renzulli et al., 2000, p. 2). As with virtually all creativity training efforts, the activities will also strengthen creativity consciousness and other creative attitudes. As a sample activity, students are given an improbable situation and asked for consequences: "What would happen if there were no such thing as darkness or night?" (p. 2). Follow-up activities include asking students for improbable situations for which classmates can think of consequences. The activities are intended to elicit humor and playfulness—legitimate parts of creativity. (For further information, visit www.creativelearningpress.com.)

Implementation Charting

Implementation charting helps gifted children see implementation as a realistic next step in creative thinking, following the generation of ideas and the selection of one or more workable solutions. With implementation charting, students prepare a chart specifying both the *persons responsible* for implementing components of the idea(s) and a *completion deadline.* For example, if the best idea for increasing school spirit were to sell school sweatshirts, then an implementation chart such as the one in Table 9.2 might be suitable.

TABLE 9.2 Implementation Chart for Selling School Sweatshirts

Activity	Person Responsible	Time for Implementation
1. Ask permission for project	Ron	March 10
2. Design sweatshirt	Lateisha, Ruth	March 15–20
3. Approve design	Student Council	March 22
4. Review possible sweatshirt sellers	Ana, John	March 15–20
5. Make recommendation to Student Council	Student Council	March 22
6. Order sweatshirts	Ana, John	March 24
7. Organize student sales campaign	Tomas, Maria & Allan	March 22–31
a. Posters	Bob, Andy	March 25
b. Article in school newspaper	Alice	March 25–31
c. Article in community newspaper	Allan	March 28
8. Actual beginning of sales	Tomas, Maria & Allan	April 10
9. Student Sweatshirt Day	Ron, Lateisha & Ruth	April 12
10. Evaluation of success of project	Original Brainstorming Group	April 20

Note that there is more than one role of *evaluation* in creative problem solving. In the present example, the initial ideas were evaluated in an evaluation matrix (Table 9.1). After one or more ideas are selected and the project implemented, a later evaluation can determine whether the project was successful and whether it should be continued.

INVOLVING STUDENTS IN CREATIVE ACTIVITIES

The most logically sound answer to the question "How can we teach creativity?" is this: Involve students in activities that intrinsically require creative thinking and problem solving. It is virtually assured that creative attitudes, abilities, and skills will be strengthened in the course of this creative involvement. It is no accident that Renzulli's Type III Enrichment (Renzulli and Reis, 1997; see Chapter 7) focuses on developing creativity via individual or small group projects and investigations of real problems. Appendix 7.1 lists topics in art, science, literature, and so on, that will stimulate creative thinking and problem solving. We particularly recommend the Future Problem Solving and Odyssey of the Mind programs, which were designed to teach creativity through involvement with real problems and projects.

The G/T teacher-coordinator should be continually alert for opportunities to exercise creative thinking and problem solving in content areas. Available opportunities also might be expanded. Are music, science, and art programs adequate? Are students encouraged to become involved in scientific and aesthetic activities? Are community resources and mentors being used to good advantage?

A KNOWLEDGE BASE As a consideration, on the one hand—and contrary to some strong opinions—it *is* possible to think creatively "in the abstract." One does not need a great fund of specialized knowledge to brainstorm ideas for improving local traffic conditions, making parents' night more exciting, or making Wanda the guinea pig a little happier. Many such problems were posed, and solutions suggested, earlier. On the other hand, one does need a good knowledge base for making creative contributions in a specialized area, which happens with independent research projects and with real-world creative innovations, for which the inspiration grows out of education and experience. Although there is considerable research that supports effectiveness of teaching creative thinking strategies or increased divergent thinking, Hunsaker (2005) reminds us that the missing piece is that there is nothing in the creative thinking research which assures us that students transfer their skills to their world outside the classroom.

CREATIVE TEACHING AND LEARNING

Torrance (1977) stated that "people fundamentally prefer to learn in creative ways." These ways include exploring, manipulating, questioning, experimenting, risking, testing, and modifying ideas. Said Torrance, learning creatively takes place during the processes of sensing problems, deficiencies, or gaps in information; formulating hypotheses or guesses about a problem; testing, revising, and retesting the hypotheses; and then communicating the results. He explained that problems arouse tension, thus motivating the learner to ask questions, make guesses, and test the adequacy of the guesses, correcting errors and modifying conclusions if necessary.

Some recommendations for creative teaching, partly from Torrance (1995), include the following:

Maintain high teacher enthusiasm.

Accept individual differences—for example, in preferred ways of learning, learning rates, faults, and so forth.

Permit the curriculum to be different for different students.

Communicate that the teacher is "for" rather than "against" the child.

Encourage and permit self-initiated projects.

Support students against peer conformity pressures.

Allow or encourage a child to achieve success in an area and in a way possible for him or her.

Do not be blinded by intelligence test scores; they do not tell the whole story.

Do not let pressure for evaluation get the upper hand.

Encourage divergent ideas; too many "right" ideas are stifling.

Teach how to test each idea systematically.

Create necessities for creative thinking.

Create "thorns in the flesh."

Encourage the habit of working out the full implication of ideas.

Try to be "adventurous of spirit."

Do not be afraid to wander off the teaching schedule and try something different.

Torrance (1981a, 1981c, 1995; see also Millar, 1995; Hébert et al., 2002) summarized some signs that creative learning is taking place, which partly represent benefits of creative teaching and learning. These include improved motivation, alertness, curiosity, concentration, and achievement; a charged atmosphere "tingling with excitement"; the combining of activities that cut across curriculum areas; improved communication of ideas and feelings; a boldness in ideas, drawings, stories, and so on; improved self-confidence; improved creative growth and creative expression; a reduction in unproductive behavior, behavior problems, hostility, vandalism, and apathy; and an increase in enthusiasm about school, learning and improved career aspirations.

Piirto (2004) recommends 13 practical guidelines for how parents and teachers can enhance creativity both at home and at school:

1. Provide a private place for creative work to be done.
2. Provide materials (e.g., musical instruments, sketchbooks).
3. Encourage and display the child's creative work, but avoid overly evaluating it.
4. Do your own creative work, and let the child see you doing it.
5. Set a creative tone.
6. Value the creative work of others.
7. Incorporate creativity values into your family mythology.
8. Avoid emphasizing sex-role stereotypes.
9. Provide private lessons and special classes.
10. If hardship comes into your life, use it positively to teach the child expression through metaphor.
11. Emphasize that talent is only a small part of creative production, and that discipline and practice are important.
12. Allow the child to be "odd"; avoid emphasizing socialization at the expense of creative expression.
13. Use humor, and get creativity training.

Fostering Academic Creativity

Chapters 8 and 9 have provided quantities of information on the creative personality, the creative process, and creative thinking and problem-solving techniques. Teaching students to apply these techniques to their real world is surely the lifetime goal, but within the classroom it is important for children to learn to apply these techniques to their academic subjects such as math, science, history and English (Carlson, 2002; Meador & Granada, 2002; Smutney, 2002; Torrance & Goff, 1990).

An example given by Torrance and Goff (1990) makes it clear. Children can be asked to memorize the date Columbus discovered America, or they can be asked how history would have been different if Columbus had landed in California. Which question is more engaging?

Shallcross (1981) created exercises that could be integrated into specific subject matter. As some examples, consider the following:

1. Sculpt something, using leaves, rocks, paste, and a paper bag (art).
2. List ways to get children to enjoy brushing their teeth (health).
3. Invent a one-step "meal-in-one" (home arts).
4. Plan a mystery or soap opera series, using the morphological synthesis approach (language arts; described in next section).
5. Think of new ways to measure time, water, air, or height (math).
6. Have someone strike three notes on a piano. Use them as the basis for a melody (music).

7. Invent stretching exercises for joggers (physical education).
8. Brainstorm ways that endangered species might be preserved (science).
9. Brainstorm ways that different cultures could learn to understand each other better (social studies).

Are you thinking that there isn't enough time? But wasn't that listed as an idea squelcher earlier in the chapter?

Creativity training and creative teaching can make a difference for gifted, normal, and even troubled students. And yes, indeed, creative teaching does take more time.

Summary

Creative thinking can be measurably increased. Many teachers incorporate creativity training activities into their classrooms.

Goals of creativity training include increasing creativity consciousness and creative attitudes and personality traits, helping students understand creativity, strengthening creative abilities, teaching creativity techniques, involving students in creative activities, and fostering academic creativity.

Creativity consciousness and creative attitudes include an awareness of creativity, valuing creativity, a predisposition to think creatively, a willingness to make mistakes, and others. A teacher can reinforce creative personality traits (e.g., confidence, curiosity, risk taking, playfulness, artistic interests); promote independent learning, self-evaluation, and fantasy and imagination; help students cope with failure and with peer pressure to conform; establish a creative atmosphere; and raise awareness of blocks to creative thinking.

Creative persons accept personality traits stereotypically associated with the opposite sex, such as autonomy, confidence, and toughness (masculine), along with sensitivity, intuition, and responsibility (feminine).

Helping students understand creativity can involve lessons on the importance of creativity, characteristics of creative people, creative abilities, theories of creativity, creativity tests, creativity techniques, blocks and barriers to creativity, and important principles of creativity.

Many types of exercises exist for strengthening creative abilities such as fluency, flexibility, originality, sensitivity to problems, problem defining, visualization, analogical thinking, and others. Stanish's workbooks include simple and complex (e.g., poetry writing, inventing) exercises.

Personal creativity techniques—usually analogical—are used by every creatively productive person. Examples of these techniques were cited from science, art, music, political cartooning, political satire, theater, moviemaking, and comedy.

Teachers may help students to develop personal creativity techniques, by explaining the techniques used by others, teaching such problem-solving strategies as looking for analogically related solutions, working backward from an ideal goal, encouraging involvement in creative activities, and arranging for instruction from creative professionals who use such techniques.

Standard creative thinking techniques are commonly taught in creativity courses and workshops.

Brainstorming is based on deferred judgment. Variations include reverse brainstorming, stop-and-go brainstorming, the Phillips 66 procedure, nominal brainstorming groups, and brainwriting. Brainstorming groups led by trained leaders performed better.

Students may be taught idea evaluation with an evaluation matrix.

The attribute listing technique takes two forms, modifying important problem attributes and transferring attributes from one situation to another, which is analogical thinking.

Morphological synthesis, an extension of attribute listing, is a matrix approach to generating ideas.

Osborn's "73 Idea-Spurring Questions" is an idea checklist designed for creative problem solving.

Four synectics methods include direct analogy—looking for ways that similar problems have been solved in nature; personal analogy, in which ideas are found by becoming a problem object or process; fantasy analogy, in which the thinker looks for far-fetched, perhaps ideal solutions to problems; and symbolic analogy, in which two-word conflicts are used to stimulate new perspectives.

Implementation charting includes assigning responsibilities and deadlines. Project success can be evaluated.

Involving students in creative activities—such as independent research projects, Future Problem Solving, and Odyssey of the Mind—is a sound way to develop creative skills, abilities, attitudes, and awarenesses.

A deep knowledge base is important for creative contributions in a specialized area, but not for classroom creativity exercises.

According to Torrance, creative teaching and learning includes exploring, questioning, experimenting, testing ideas, and other activities. Creative learning includes sensing a problem; formulating hypotheses or guesses; testing, revising and retesting the hypotheses; and communicating the results.

Some recommendations for creative teaching included maintaining high enthusiasm, accepting individual differences, encouraging self-initiated projects, looking beyond IQ scores, encouraging divergent thinking, creating necessities for creative thinking, providing resources for working out ideas, avoiding sex-role stereotypes, allowing children to be odd, and using humor.

Teaching children to apply creative thinking techniques is surely a lifetime goal, but within the classroom it is important for children to apply these techniques to their academic subjects. Shallcross suggested exercises that are tied to specific subject areas.

Creative learning can result in improved motivation, achievement, creativity, self-confidence, school attitudes, and others.