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Creative Thinking in Music

CREATIVITY AS CREATIVE THINKING

by Peter R. Webster

Creativity—its definition, evaluation, and place in the curriculum—is often misunderstood. Peter R. Webster clarifies the issue with a model for musical creativity that holds exciting implications for music educators.

There are few topics in music teaching and learning that are as fundamentally important as creativity. From the earliest works of Lowell Mason to the latest publications by MENC, thousands of words have been written about this subject. It has influenced the forming of philosophy, the writing of goals and objectives and the design of countless lesson plans. The *Music Educators Journal* alone has accounted for more than twenty articles since 1960. One bibliography of literature that deals with creativity in music education contains over a hundred annotated citations organized into theoretical, practical and empirical categories.¹

Much of this literature focuses on practice. Important monographs on creative teaching have been written, including books on traditional composition techniques as well as unusual approaches. Many of the major texts on teaching practice deal directly with creative strategies. For a listing of some of these materials, see the "Suggested Readings" sidebar.

In terms of student outcomes, approaches such as those of Carl Orff and Emile Jaques-Dalcroze stress certain kinds of creative activity. The Contemporary Music Project and Manhattanville Music Curriculum Project, two well-known efforts of the 1960s, contained detailed descriptions of creative strategies as a central focus of curriculum design. The Ann Arbor

Symposium III and the Suncoast Music Education Forum are examples of professional meetings that have dealt exclusively with this topic.²

Continued confusion

Although much of this work has been helpful in understanding the complexities of creativity and in helping to formulate practice, confusion continues about just what the word means. For instance, a ten-year-old child's Sunday piano recital might be termed a milestone of creativity by some, while others might view the same child's Orff improvisation during Monday's music class in the same terms. Some view the very presence of music in the schools as an example of educational commitment to creativity, while others gauge creativity solely by the products of these programs or by the awards they win. Some regard creativity as a term best reserved for geniuses, while others look to the spontaneous songs of the three year old or the daydreams of the adolescent.

Many questions about creativity continue to prevail. Is creativity product, or process, or both? Should it be considered primarily as something that takes place in composition? Can it be readily measured? Does it have anything to do with music aptitude? Isn't it the same as intelligence? Isn't it really only a "general music" activity? Can it be taught? There re-

mains little doubt about the importance of creativity in the music education profession, but little collective sense of what it is.

New thinking

Music educators and psychologists interested in artistic development have recently supplied answers to these and many other questions. Many of their studies are based, in part, on a more focused view of creativity—one that centers on the *mental processes* associated with creative production. One of the main problems we face is the word "creativity" itself. It has been used in so many different contexts that it has lost much of its meaning and power, especially in terms of music and children. In the educational context, it might be more prudent to use the term "creative thinking." There are a number of reasons for this.

By focusing on creative thinking, we place the emphasis on the process itself and on its role in music teaching and learning. We are challenged to seek answers to how the mind works with musical material to produce creative results.³ This approach demystifies creativeness, places it in context with other kinds of abilities and external influences, and—perhaps most important—makes our job as educators much clearer.

There are four characteristics of the recent literature on creative thinking that are worthy of consid-

eration: it shows (1) an emphasis on the role of musical imagination or musical imagery, (2) theoretical modeling of the creative process, (3) new approaches to the measurement of creative aptitude, and (4) systematic observation of creative behavior, often in natural settings. A fifth characteristic is now emerging: the use of computers and sound technology as tools for recording and stimulating creative thought. Each of these characteristics has important implications for practice and each helps in its own way to clarify what we really mean by the term "creativity."

Musical imagination

The mind's ability to "think in sound" has been an important issue for musical achievement for some time. For example, the private trumpet teacher might encourage a student to "hear" a musical line internally before playing it to improve the quality of performance. A general music specialist can often encourage a sixth grade class to "remember" a musical passage during a listening lesson in order to compare the passage to an occurrence later. Conducting teachers encourage students to "imagine" the sound of a score before rehearsal.

This ability to internally imagine sound meaningfully is not only important for music achievement and *convergent* tasks (tasks designed to yield a single right answer), but is also critical for creative thinking ability and specifically for *divergent* tasks (tasks for which several answers are possible). What is of interest is the encouragement of imaginative, divergent thinking in the classroom, rehearsal hall and the private studio. Typical questions and statements that encourage this kind of thinking are:

"Imagine how the composer might have changed the ending to sound more tentative. How could this be done?"

"Think of what it would sound like without the strings—with just the tuba and piccolo playing together."

"Can you think of another accompaniment pattern for that melody? Play it for me."

"Clarinets, imagine what that fugue subject would sound like if it had been written a century later."

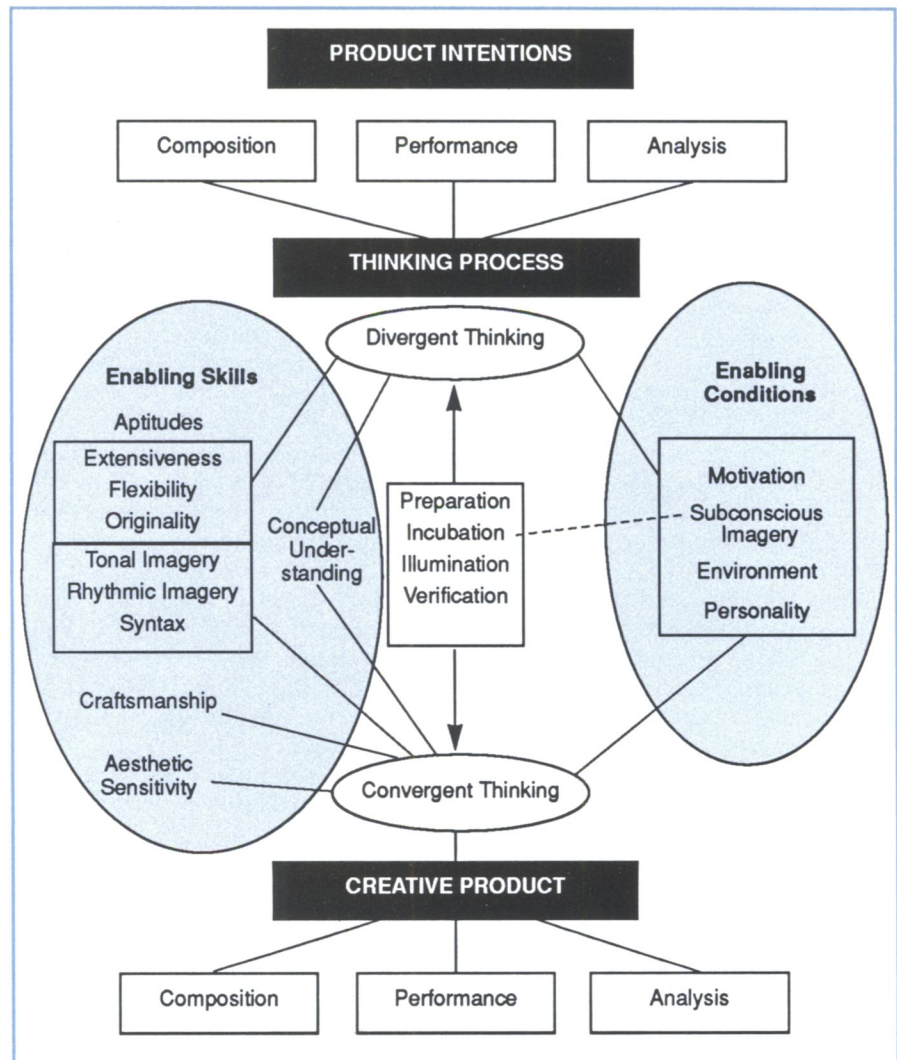


Figure 1. Model of creative thinking in music

It is this kind of imaginative problem solving with musical sound that plays such an important role in the creative process and that has captured the attention of many music professionals interested in the formal study of creativity. Ironically, it is precisely this kind of thinking that is so often not stressed by music teachers—often ignored in favor of factual or skill-oriented content. Factual information is, of course, critical for imaginative thinking, but we must provide students with opportunities for applying this conceptual understanding in creative tasks. It is equally ironic that mathematics or history teachers might be more effective in getting students to think imaginatively about their subjects than is the music teacher.

Model of the creative process

How does this imaginative thinking relate to the big picture? Figure 1 displays one view of the creative

thinking process. Such attempts at conceptual modeling are useful for teachers and researchers. They suggest relationships that imply possible teaching strategy and give direction to research. They can also generate a platform for debate in the profession—always a healthy sign. This model is designed to be representative of creative thinking by both children and adults, although certain aspects of the model might be qualitatively different at various stages of development.⁴

Product intention. Composition, performance/improvisation, and analysis (written and listening) can be considered at the outset of creative thinking as goals or "intentions" of the creator. At the same time, they represent the final product of creation. The product intentions of school-aged children are usually limited under our current educational system to performance/improvisation and listening, a fact that hopefully will change as

schools encourage more written composition and analysis. Each product intention results in subtle differences during the creative process, but the inner workings of the process are probably quite similar. An important point for music education is that creative thinking is part of the total curriculum effort and should not be viewed as just a classroom activity.

Enabling skills. With the intention established, the creator must rely on a set of skills that allow for the thinking process to occur. These skills form the basis of a musical intelligence and interact with the thinking process in a rich variety of ways.

First among these skills is the necessary collection of *musical aptitudes*. These are individual skills that are subject to influence by the environment during the early years of development and possibly into early adult life. They include such convergent thinking skills as the ability to recognize rhythmic and tonal patterns and musical syntax (sensitivity to musical whole). Certain divergent, imaginative skills are also critical, such as musical extensiveness (the amount of time invested in creative imaging), flexibility (the range of musical expression in terms of dynamics, tempo, and pitch), and originality (unusualness of expression). These musical aptitudes are largely innate, although they are subject to developmental improvement with training.

Another enabling skill is conceptual understanding: the *knowledge of facts* that comprise the substance of musical understanding. Furthermore, the possession of two more types of ability fall into this category: *craftsmanship* (the ability to apply factual knowledge in the service of a complex musical task) and *aesthetic sensitivity* (the ability to shape sound structures to capture the deepest levels of personal feeling—an ability that is demonstrated over the full length of a musical work).

Conceptual understanding, craftsmanship, and aesthetic sensitivity obviously grow with age and experience, but transfer of these abilities into the mosaic of creative thinking does not often occur naturally. This transfer might well be an important goal of formal music education.

Enabling conditions. In addition to the personal skills that drive the creative thinking process, there are a number of variables involved that are *not* musical. These influences vary greatly from person to person and mingle with musical skills in delicate and complicated ways.

One of these, *motivation*, comprises those drives (both external and internal) that help keep the creator on task. Another, *subconscious imagery*, is the presence of mental activity that occurs quite apart from the conscious mind and that may help to inform the creative process during times when the creator is occupied consciously with other concerns.

Another, *personality*, describes factors such as risk-taking, spontaneity, openness, perspicacity, sense of humor, and preference for complexity, that seem to exist in many creative persons and that may hold some significance for enabling the creative process. *Environment* is the host of characteristics that define the creator's working conditions and contribute to the creative process, including financial support, family conditions, musical instruments, acoustics, media, societal expectations, peer pressure and many others.

Thinking process in the central core. The center of the model in Figure 1 indicates movement, in stages, between divergent and convergent thinking. These stages involve time to play with ideas (preparation), time to have away from the tasks (incubation), and time to work in structured ways through the ideas (verification) after solutions have presented themselves (illumination). A very important implication for music teaching is that we must allow enough time for creative thinking to occur.

There are a number of important connections between this process and the enabling skills and conditions. Of the musical aptitudes, some (those of tonal and rhythmic imagery and musical syntax) are most clearly connected to convergent thinking. Tonal and rhythmic imagery concern the ability to perceive sound in relation to change and involve the representation of sound in memory. Musical syntax is the ability to shape musical expressions in a logical manner according to patterns of musical repe-

tion, contrast, and sequencing. In this sense, a grasp of syntax is closely related to aesthetic sensitivity and is an early indication of this skill before extensive formal training. The aptitudes of extensiveness, flexibility, and originality are clearly connected to divergent thinking. Conceptual understanding directly impacts both divergent and convergent thinking. (Divergent thinking requires the mind to survey its data banks for possible musical content, so the more that is in those banks, the better. It is impossible to expect individuals to think creatively if nothing is there with which to think creatively!) Craftsmanship and aesthetic sensitivity are also connected to convergent thinking because they require careful manipulation of musical material in sequential ways. Divergency is directly related to aesthetic sensitivity as well.

Another major implication shown in this model for music teaching is the idea that environments that encourage divergent thinking in music are just as important as environments that encourage convergency of thought. Are we doing enough in our rehearsals, private studios and classrooms to insure the very heart of this model?

Measures of creative aptitude

Only recently have attempts to actually measure creative aptitude in music begun. Much of this work has focused on young children, ages six to ten, and has sought to identify divergent and convergent thinking skills in music using musical tasks in game-like contexts. For example, a measure I developed uses an amplified voice, a round sponge ball with a piano, and a set of temple blocks to engage children in musical imagery.⁵ The tasks begin very simply and progress to higher levels of difficulty in terms of divergent thinking. There are no right or wrong answers to the tasks.

The first section of this evaluation procedure is designed to help the children become familiar with the instruments used and how they are arranged. The children explore the parameters of "high/low", "fast/slow", and "loud/soft" in this section and throughout the measure. The way they manipulate these parameters is, in turn, used



Telling a space story in the Measure of Creative Thinking in Music

as one of the bases for scoring. They are given tasks that involve images of rain in a water bucket, magical elevators, and the sounds of trucks.

The middle section asks the children to engage in more challenging activities with the instruments and to focus on the creation of music using each of the instruments singly. Children enter into a kind of musical question/answer dialogue with the mallet and temple blocks, and they create songs with the round ball on the piano and with the voice and the microphone. They use images that include the concept of "frog" music (accomplished by hopping and rolling the ball on the piano) and that of a robot singing in the shower (realized with the child's voice through the microphone).

In the last section of the procedure, the children are encouraged to use multiple instruments in tasks whose settings are less structured. They tell a space story in sounds, using drawings as a visual aid. The final task asks the children to create a composition that uses all the instruments and that has a beginning, a middle, and an end.

This measure, and others like it, yields scores for such factors as musical originality, extensiveness, and flexibility, as well as musical syntax. Measurement strategies are based on the careful analysis of video or audio tapes of children actually engaged in the activities. Objective criteria as well as rating scales are used: musical extensiveness, for example, is measured by

the time involved in the creative tasks, while evaluators rate originality by observing the manner in which pitch, tempo, and dynamics are manipulated.

Results based on administration

of the test to over three hundred children have been encouraging. Reliability and validity data seem to suggest that the children's responses follow consistent patterns and that the content of the tasks is appropriate. The tasks are not measuring the same skills as traditional musical aptitude tests (which measure tonal and rhythmic imagery), nor are they related with any statistical degree of significance to general intelligence. The scores on the tests do not seem to be grouped according to differences in gender, race, or socio-economic background.

Perhaps the most important point surrounding this work, however, is that what was once thought to be unapproachable and mysterious is now being studied. The actual tasks in these measures also serve as models for music teaching strategy as educators seek to engage children in imaginative thinking about music. (See figure 2.)

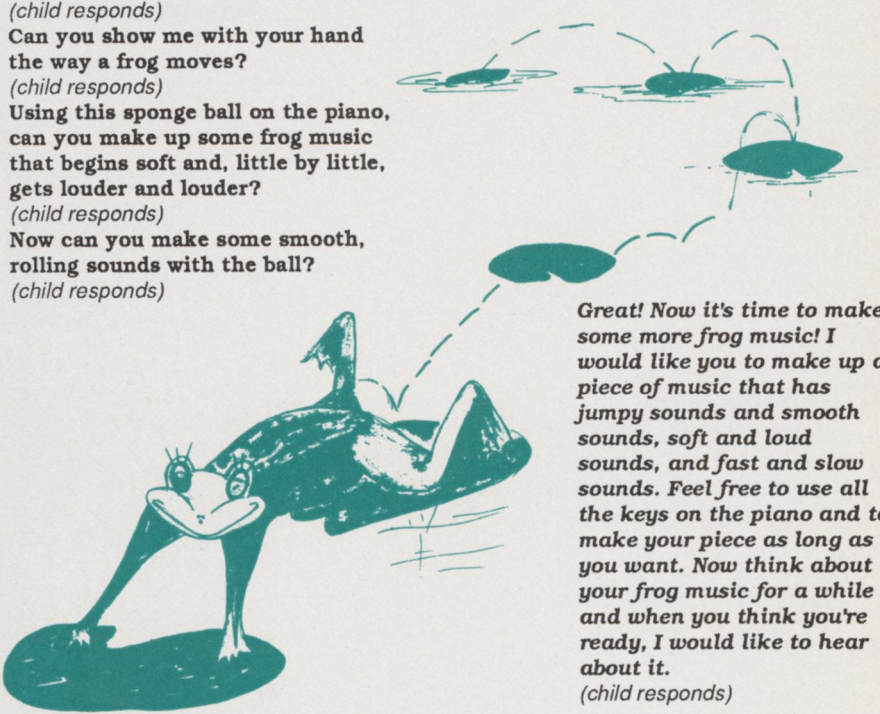
What is happening in this picture?
(child responds)

Can you show me with your hand the way a frog moves?
(child responds)

Using this sponge ball on the piano, can you make up some frog music that begins soft and, little by little, gets louder and louder?
(child responds)

Now can you make some smooth, rolling sounds with the ball?
(child responds)

Great! Now it's time to make some more frog music! I would like you to make up a piece of music that has jumpy sounds and smooth sounds, soft and loud sounds, and fast and slow sounds. Feel free to use all the keys on the piano and to make your piece as long as you want. Now think about your frog music for a while and when you think you're ready, I would like to hear about it.
(child responds)



The administrator should move to the rear and to the side of the child during performance so that the child will not be tempted to seek approval from the administrator for the various parts of the composition.

After this task is finished, proceed immediately to the concluding set of tasks by placing the first space picture on the piano music stand.

Figure 2. Administrator's instructions, illustration from Measure of Creative Thinking in Music

Observation

Some of the most interesting writing in recent times has come from studies that have systematically observed the products and processes of children's creative expression in music and have attempted to analyze what happens as children create. The aim is to provide a sense of how the mind represents sound at various stages in development and how the music educator might benefit from this knowledge. Strategies involve engaging children in either compositional, improvisatory, or quasi-improvisatory tasks; recording the results; and then studying the characteristics of the music the children produce. Unlike efforts that are designed to create a standardized measure as described above, these studies essentially describe content as it is happening.⁶

We already see some interesting trends. Until children are five or six, their rhythmic and melodic material is somewhat idiosyncratic, with no predictable pattern. It is not clear if this is because of motor coordination problems in the production of sounds or if it is a true representation of the children's inner hearing. After this age, both rhythmic and melodic structures seem to be more predictable. Between the ages of six and ten, changing or mixed meters occur, giving way to quite consistent patterns after age ten. Duple meter seems to be preferred by most older children.

After age five or six, consistent melodic and tonal characteristics also become more pronounced. The music of six- to ten-year-old children exhibits a gradual development of feeling for cadence structures and a growing awareness of tonal center within melodies. It seems clear that as children imitate the songs in their environment, their own music is influenced accordingly. After the age of ten, children become much more conscious of "correctness" of musical structure and tend to create music that is more organized in terms of rules, but not necessarily more original.

There appears to be a general rise in the use of both rhythmic and melodic motives from age five to eleven. Interest in the actual musical development of a melodic mo-

SUGGESTED READINGS

- Balkin, Alfred. "The Creative Music Classroom: Laboratory for Creativity in Life." *Music Educators Journal* 71, no. 5 (January 1985), 43-46. This article presents several practical suggestions for creative activities in teaching music. The author stresses that teachers move away from "yessing" (always expecting children to supply the one correct answer) and toward discovery learning. Encouraging children to make guesses about musical problems is stressed.
- Bennett, Stan. "Learning To Compose: Some Research, Some Suggestions." *Journal of Creative Behavior* 9, no. 3 (Summer 1975), 205-10. Bennett suggests approaches to teaching composition based upon his study of professional composers and his experiences as a composer. Having discovered that a germinal idea is often the first stage of composition and that this is often developed through improvisation, Bennett proposes an improvisational approach built on the immersion process by which language is acquired.
- Benson, Warren. *CMP 4: Creative Projects in Musicianship*. Washington, DC: Music Educators National Conference, 1967. This volume, the fourth in a series of MENC publications about the Contemporary Music Project (CMP), summarizes projects sponsored by CMP at two locations: Ithaca College and the Interlochen Arts Academy. The book describes each project briefly and concludes with some general observations about teaching "creative-process" courses in music.
- . "The Creative Child Could Be Any Child." *Music Educators Journal* 59, no. 8 (April 1973), 38-40. This article provides excellent tips on how to evaluate the products of students' creative thinking. Benson urges questions such as: "Did the piece interest us?" "Were there any obvious flaws?" "What would you do to correct the trouble spots?" He makes the point that each student should be encouraged to enjoy the pursuit of creativity and not just understand the procedures or rules for composition in creating a song.
- Burns, Mary. "Musical Creative Learning and Problem Solving." *The Creative Child and Adult Quarterly* 11, no. 4 (1986), 234-40. Burns presents a case for the need to include creative activities in the general music curriculum. The Kodály and Orff approaches are cited as appropriate avenues for this approach. A lesson plan is presented for the composition of a song based on the creation of a *haiku* poem. The lesson is quite specific as to the musical content of the creative process and to the steps taken in the classroom to make the lesson work smoothly.
- Cheyette, Irving. "Developing the Innate Musical Creativity of Children." *Journal of Creative Behavior* 11, no. 4 (Fall 1977), 256-60. This article gives some guidelines for teachers in developing creativity through a project that includes creating a story and the accompanying music. Cheyette argues that children must develop a background of enriched sensory images and presents ways to accomplish this. A list of teacher activities is provided.
- Cheyette, Irving, and Herbert Cheyette. *Teaching Music Creatively in the Elementary School*. New York: McGraw Hill, 1969. A textbook for potential teachers of music, this volume approaches the teaching of music from the assumption that the best way to learn music is to make music. In addition to chapters on developing an awareness of the musical elements, it also offers information on developing a classroom orchestra with informal instruments and on developing the innate creativity of children.
- Dennis, Brian. "Experimental Music in Schools." *International Society for Music Education Journal* 2 (1972), 20-21. The article puts forth the idea that we should think less about teaching the music of the past and consider music of today as an important part of the music we teach. Dennis argues for a better communication between composers of the present and their audiences. Children's performance of contemporary music by established composers is encouraged, and some examples are given.
- Feinberg, Saul. "Creative Problem-Solving and the Music Listening Experience." *Music Educators Journal* 61, no. 1 (September 1974) 53-59. Feinberg argues for a new approach

- to listening based on a model that stresses both a problem-solving approach and a knowledge-based approach. Ideas for music listening lessons are presented based on the general factors of fluency, flexibility, and elaboration of thought. The author also makes a connection between procedures for teaching listening and the overall creative process. The article also provides the underlying theme that such an approach is closely associated with aesthetic education goals.
- Galloway, Margaret. "Let's Make An Opera: A Happening with 120 Young Children." *Journal of Creative Behavior* 6, no. 1 (Winter 1972), 41-48. The article describes how the story "Peter Pan" was produced as an opera by students; it is an example of student creativity in original composition, dialogue writing, set making, and involvement in practically every other aspect of production.
- Hoenack, Peg. "Unleash Creativity—Let Them Improvise." *Music Educators Journal* 57, no. 9 (May 1971), 33-36. As a foundation for creativity, this article discusses several methods of improvisation in the music class using whatever instruments or rhythm accessories are available. Development of these skills in the early grades supports the art of composing and listening as a child learns to communicate with others.
- Holderried, Elizabeth Swist. "Creativity in My Classroom." *Music Educators Journal* 55, no. 7 (March 1969), 37-39. Holderried describes how Edgard Varèse's *Ionisation* and *Poème électronique* served as the stimulus for a creative project in her general music classes. Children suggested various approaches and were included in every phase of the project, which included performances of their works.
- Lasker, Henry. *Teaching Creative Music in Secondary Schools*. Boston: Allyn and Bacon, 1971. This book deals with techniques for acquainting children with the process of music composition, specifically for stimulating the ideas and climate for composition. There are many musical examples and suggestions.
- Marsh, Mary. *Explore and Discover Music: Creative Approaches to Music Education in Elementary, Middle, and Junior High Schools*. New York: Macmillan, 1970. This book is based on the premise that it is essential to find more creative ways of teaching music in order to develop the creative potential of each student. Marsh advocates a teaching process in which the teacher organizes activities so that the student discovers the concepts of music as he or she is involved in the activity. Specific teaching strategies and examples of how various students react to the activities of these strategies are given.
- Paynter, John. *Music in the Secondary School Curriculum—Trends and Development in the Classroom*. New York: Cambridge University Press, 1982. This book offers extensive information on establishing a music curriculum that centers on creative thinking skills. An excellent listing of contemporary scores and recordings is included, together with examples of course organization.
- Pogonowski, Lenore. "Bridging the Gap from the Podium to the General Music Class Using Concert Percussion." In *Music in the High School*, edited by Timothy Gerber and William O. Hughes, 55-63. Reston, VA: Music Educators National Conference, 1988. This article provides an approach for teaching music to high school general music students. It allows the student to be actively involved and socially interactive in the classroom by performing, composing, improvising, conducting, and evaluating music. Concert percussion instruments are used because of their accessibility and ease of use by those not able to read music. Specific strategies for implementation are included.
- Regelski, Thomas. "A Sound Approach to Sound Composition." *Music Educators Journal* 72, no. 9 (May 1986), 41-45. This article contains a rationale for including sound composition activities in a music curriculum and gives concrete suggestions as to the implementation of these activities. Models of action learning, activities approach, and problem-solving skills in music are also given.
- Ristad, Eloise. *A Soprano On Her Head: Right-Side-Up Reflections of Life and Other Performances*. Moab, Utah: Real People Press, 1982. This book challenges traditional music teaching with new insights for dealing with problems in music performance. Ristad suggests gaining control by letting go, achieving excellence by not trying, practicing through imagery, and learning by simple awareness.
- Schafer, R. Murray. *Creative Music Education*. New York: Schirmer Books, 1979. This book was originally published as five separate booklets: *The Composer in the Classroom*, *Ear Cleaning*, *The New Soundscape*, *When Words Sing*, and *The Rhinoceros in the Classroom*. The author, a Canadian composer, describes some dialogues that he has held with elementary, high school, and first-year university students. Examples of music lessons covering the topics of noise, silence, tone, timbre, and texture are included.
- Thackray, Rupert. *Creative Music in Education*. London: Novello and Company, 1965. This volume begins with a justification for creative activities in the schools: "The aim of this book is to suggest possible ways of approach for teachers and students at all levels from primary school to the college." Thackray includes sections on vocal improvisation, instrumental improvisation, and composition, and endorses the Orff approaches. The book contains a number of practical suggestions for engaging children in creative activities.
- Thompson, Keith P. "Vocal Improvisation for Elementary Students." *Music Educators Journal* 66, no. 5 (January 1980), 69-71. Thompson argues that creating music should be included in the general music curriculum because it allows the students to learn about aspects of music in a personal way. The act of creating music allows the students to exercise cognitive and affective decision-making processes. A three-stage process of creativity is proposed. Vocal improvisation is the recommended medium for exercising the creative process, and a series of activities using the author's creative process is given.
- Thoms, Hollis. "Encouraging the Musical Imagination Through Composition." *Music Educators Journal* 73, no. 5 (January 1987), 27-30. Thoms describes three projects involving high school-age students in the composition process: compositions centered on theme and variation form, musical setting of a poem, and a multimedia event with a focus on the musical concept of "line."
- Welwood, A. "Improvising with Found Sounds." *Music Educators Journal* 66, no. 5 (January 1980), 72-77. Welwood argues that composing and improvising should be as routine as writing an English composition or learning the multiplication tables. The goal of these activities in the classroom is not to master the art of composition but to become involved in the creative selection and arrangement of musical materials and to develop skills in self-evaluation along with constructive self-criticism. "Found" instruments are any ready-made objects that are capable of producing sound: they may be of materials such as glass, plastic, or paper. Many performance possibilities are available to an individual or an orchestra. This concept will expand the student's attitude toward twentieth-century music and the music of non-Western cultures.
- Wiggins, Jacqueline H. "Composition as a Teaching Tool." *Music Educators Journal* 75, no. 8 (April 1989), 35-38. Wiggins lists many benefits of compositional activities, including an increase in innate creative thinking in children, encouraging of pride in their musicianship, and the reinforcement of the meaning of musical concepts. Three lesson plans are presented, each devoted to either individual, small group, or large group instruction.
- Williams, Polly. "Musical Creativity: An Interdisciplinary Approach from Troy to Carthage from Vergil to Berlioz." *Creative Child and Adult Quarterly* 2, no. 3 (1977), 148-50. Williams provides curricular suggestions for the use of grand opera in developing various forms of musical creativity among a range of age groups. The author describes ways in which music and subjects such as literature, dance, history, psychology, and the visual arts may be linked through interdisciplinary studies built around opera. ☐


tive rises as children reach age eleven, but rhythmic development seems to remain relatively unchanged at all levels.

Much of this information is preliminary and more careful study is needed. What is most important for music education is the fact that there do appear to be patterns of thinking and behavior that can be studied. By asking children to solve musical problems with the goal of creating a musical product, we have an opportunity to learn more about the creative process while at the same time engaging children in tasks that are fundamental to music as art.


Technology: Its future role

Musical imagination, conceptual modeling, measurement, and observation are four keys to a better understanding of creative thinking in music. Each of these keys stands to gain immeasurably from technology. Much has been said about computers, electronic keyboards, software, and MIDI as teaching tools for convergent goals in music education. It is *not*, however, with this kind of education that such technology holds its greatest promise. It is rather with the encouragement and careful study of divergent, imaginative musical thinking.

Imagine a child seated at a music keyboard with a computer screen providing the score. This child composes a brief fragment of music by playing on the music keyboard. This fragment is displayed on the screen (in traditional notation or in other forms) and is played through speakers. The child continues to expand the fragment, working with many different timbres, additional voices, dynamics, and phrase patterns. At one point the child becomes frustrated and quits, saving the work in a file. The child returns later to the saved composition and continues work until a final version is ready to be shared with the teacher and the class. The child then prints a copy of the score and takes it home for the refrigerator door, and transfers the recording to cassette tape for the child's parents to hear. Throughout the entire process, the computer has saved every moment of the child's work and can "replay" the "electronic sketches" in exacting detail. Although this is of little interest to the



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child, it is of great interest to the teacher, who can use these electronic sketches to evaluate the student's progress. Indeed, Harvard University's "Project Zero" uses teacher review of similar "portfolios" of student work as a basis for evaluation. (See Lyle Davidson's article in this issue.)

Just a few years ago, such a scenario would have seemed financially and technologically out of the question. Not so today. With software and hardware to support multimedia applications, music work stations of this sort now exist in music labs in several schools. Similar projects will be easily designed by the teacher for performers and listeners as well. This technology will soon help us to expand our understanding of musical imagination, to challenge our concepts of the creative process, and to measure and observe creative thinking in ways never thought possible. The real question is, will we be able to take advantage of this power?

Providing the answers

Creative thinking, then, is a dynamic mental process that alternates between divergent (imaginative) and convergent (factual) thinking, moving in stages over time. It is enabled by internal musical skills and outside conditions and results in a final musical product which is new for the creator. Focusing on creative thinking is an important beginning to our under-

standing of creativity and may yield important answers to the questions raised at the beginning of this article.

A child's potential for creative thinking is not so complex that it cannot be measured and should be considered as part of an expanded view of traditional musical aptitude. It is not the same as general intelligence or musical achievement skill. Composition is not the only end product of the creative thinking process. Performances of precomposed music, improvisation, and careful listening and analysis all involve the creative thinking process. The rehearsal hall, private studio, and the classroom are all sites for such thinking. Creative thinking can be taught by providing children with chances to explore musical images and by applying them in problem solving tasks. Technology may play an important role in our teaching strategy.

In the final analysis, we are limited only by our own creative thinking as teachers. Exciting the imagination of our children about music is what it is all about. Facts and skills will not do it alone.

Notes

1. Peter R. Webster, "Creative Thinking in Music: Approaches to Research," in *Music Education in the United States: Contemporary Issues*, ed. Terry Gates (Tuscaloosa: University of Alabama Press, 1988), 66-81.
2. *Documentary Report of the Ann Arbor Symposium on the Applications of Psychology to the Teaching and Learning of Music: Session III* (Washington, DC: Music Educators National Conference, 1983); *Proceedings from the Suncoast Music Education Forum on Creativity* (Tampa, Florida: Department of Music, University of South Florida, in press).
3. This approach is in line with current work in music cognition and is part of a larger effort in the social and behavioral sciences, neurosciences, and computer science. For a general overview, see Howard Gardner, *The Mind's New Science* (New York: Basic Books, 1987).
4. For a fuller description of this model, see Peter R. Webster, "Conceptual Bases for Creative Thinking in Music," in *Music and Child Development*, ed. J. Craig Peery, Irene Peery, and Thomas Draper (New York: Springer-Verlag, 1987), 158-174.
5. Peter R. Webster, "Refinement of a Measure of Creative Thinking in Music," in *Applications of Research in Music Behavior*, ed. Clifford Madsen and Carol Prickett (Tuscaloosa: University of Alabama Press, 1987), 257-271.
6. For an excellent review of this literature, see John Kratus, "A Time Analysis of the Compositional Processes Used by Children Ages 7 to 11," *Journal of Research in Music Education* 37, no. 1 (Spring 1989), 5-20. ☐