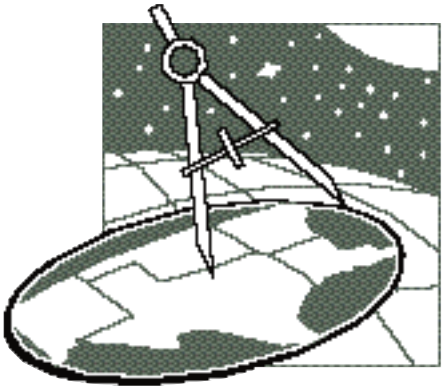
Eisenhower Southwest Consortium for the Improvement of Mathematics and Science Teaching



Classroom Compass

Fall 1998 • Volume 4, Number 2

HIGHLIGHTS

The Rhythm of Mathematics

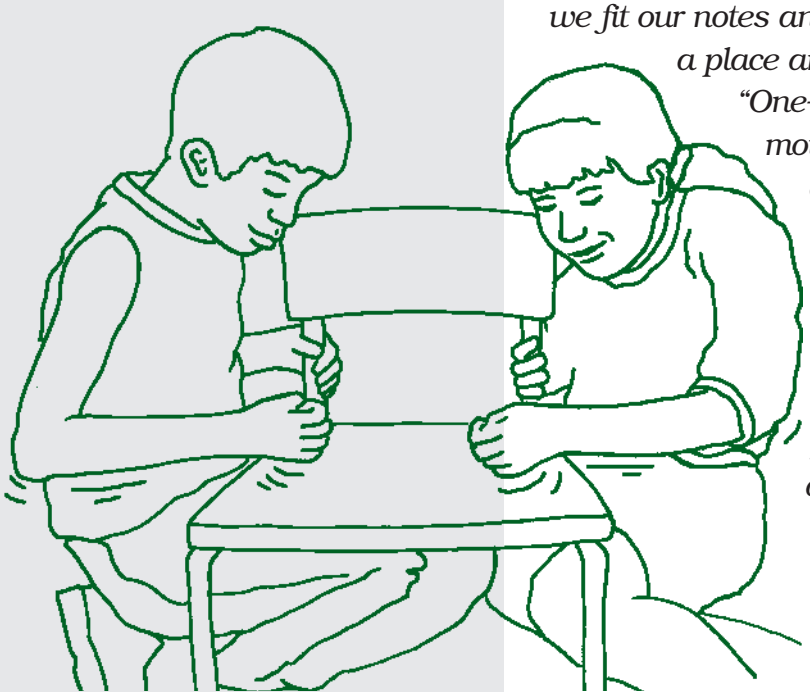
Two subject areas that might appear to be impervious to integration are mathematics—viewed as abstract and cold by many—and dance and music—usually perceived as emotional. The work of several New Mexico schools shows that these two areas have much to offer each other. Mathematics and music share a concern with numbers and patterns of change. In music and dance these patterns are called rhythm.

We enter the room silently, quietly flexing our fingers—readying ourselves to create rhythms with our hands upon classroom chairs.

"The music created from the patterning of our hands tapping the chairs in sync takes us to a mathematic realm as we fit our notes and time into an artistic form. We are lifted to a place and time with a oneness of music and math.

"One-eighth time takes us to a fast movement, a flurry of fingers, a creation of a rhythm above all we have done. We slow down to one-half time, easing our fingers to a slower time frame, artistically drumming fractions.

"How do we attain this? Very easily and simply—we kneel upon the floor in front of plastic chairs. We, ourselves, are the expensive instruments.



Cris Marie Alton, teacher of ten, eleven, and twelve year olds at Alvord Elementary School, a collaboration of the Santa Fe Public Schools and the College of Santa Fe, New Mexico

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Standards

The Standards of the National Council of Teachers of Mathematics emphasizes that patterns are of recurring importance to mathematics. The following is excerpted from the NCTM's *Curriculum and Evaluation Standards for School Mathematics.* Reston, VA: NCTM.

Grades K-4: Standard 13: Patterns and Relations

p. 60 Patterns are everywhere. Children who are encouraged to look for patterns and to express them mathematically begin to understand how mathematics applies to the world in which they live. Identifying and working with a wide variety of patterns helps children to develop the ability to classify and organize information. Relating patterns in numbers, geometry, and measurement helps them understand connections among mathematical topics. Such connections foster the kind of mathematical thinking that serves as a foundation for the more abstract ideas studied in later grades.

From the earliest grades, the curriculum should give students opportunities to focus on regularities in events, shapes, designs, and sets of numbers. Children should begin to see that regularity is the essence of mathematics. The idea of a functional relationship can be intuitively developed through observations of regularity and work with generalizable patterns.

Physical materials and pictorial displays should be used to help children recognize and create patterns and relationships. Observing varied representations of the same pattern helps children identify its properties. The use of letters and other symbols in generalizing descriptions of these properties prepares children to use variables in the future. This experience builds readiness for a generalized view of mathematics and a later study of algebra....

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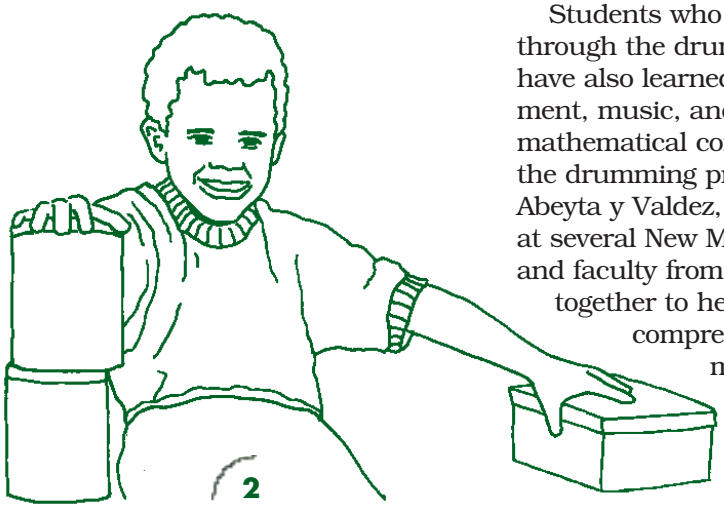
The Rhythm of Mathematics, *continued from page 1*

Each year the students at the Alvord Elementary School repeat this scene. Before their families and friends they drum and leap and twirl. The hall is packed since from year to year community members look forward to receiving their invitations to the Alvord performance. The students have also been looking forward to this day with the combination of excitement and fear that all performers feel. They know that, however they do, their efforts will be acknowledged, rewarded, and remembered by the community in which they live.

The Performance

The performance begins with two drum captains beating their hands on chairs. The simple rhythm they produce guides the performers into the room. Each child, dressed like his neighbors, takes his place behind a chair. Soon all of the children have joined in the rhythm set by the captains as they methodically strike the chairs in front of them. This sound does not last long; soon it moves to ever more complex rhythms. By the end of the hour, the intricate beating has brought the audience to its feet as the whole room joins in stomping and clapping to the performers' sounds.

All semester the students have worked toward this night. Finally, they have put themselves and their abilities on public display and their peers and parents have shown them that their performance and understanding is valued. After the drumming, performers and parents gather to talk over the stimulating evening. In the excitement, only a few remember how much more the students have learned from their percussive work.



The Results of the Class

Alvord and several other New Mexican schools introduce rhythmic, athletic, and high energy movement and music to 8 to 12 year olds. While the children and their families obviously enjoy both the performance and the work that goes into it, the program has even deeper intentions. The teachers know that few if any of their students will become professional musicians or dancers. They do hope that all of them will become life-long learners who search for excellence in all their activities. The drumming program nourishes thoughtful habits of mind and helps the children build contacts between the rhythms they produce and basic knowledge and understanding they need in everyday life.

Through the drumming program, the students realize that performance is a way to share learning. They learn to define and work toward goals consistent with their individual abilities and to cooperate with others in reaching shared goals. As a result of such shared work, they come to see how the work of each person depends on the work of others.

Students who have been through the drumming experience have also learned to link movement, music, and rhythm to basic mathematical concepts. As part of the drumming program, Valdez Abeyta y Valdez, a music teacher at several New Mexico schools, and faculty from Alvord work together to help all children comprehend the mathematics that underlies the world we experience every day. In this

program teachers are often as much learners as students. Even those teachers who have been through a drumming exercise many times learn new things each year.

While dance and music motivate most students through exciting action, the excitement these disciplines generate can also help them understand more abstract concepts. They learn to work out mathematical meaning in new and concrete ways. From a natural and intuitive understanding of how his or her own body works, a student can develop an awareness of the working of mathematics in the physical world. (See art standard on page 8.)

For example, clapping two half beats in the place of one whole beat can help children begin to understand the meaning of fractions. Learning to beat half time, quarter time, and eighth time, children can feel fractions in their own bones as they also begin to work with the larger mathematical theme of patterns and their changes. (See standards beginning on page 2.)

The idea of patterns will surface again as the students put together steps, sounds, and movements to create their performance. This early attempt at choreography can also move them into more mathematics, since an interested teacher can help students compare the shapes they make with their bodies and space during dance to similar geometric shapes.

In using rhythm to teach mathematics Alvord is part of a long tradition. Western culture has recognized the connection between music and mathematics since the time of the ancient Greeks. The Pythagoreans (of the famous theorem regarding the square of the hypotenuse of a right triangle) used harmony and rhythm as a basis for their mathematical ideas. Music teachers have long expressed the notion that learning music improves mathematical abilities and scientists recently established experimentally that the link exists.

The Mozart Effect

During the 1990s researchers at University of California at Irvine led by Gordon Shaw, a physicist, and Frances Rauscher, a cellist and a psychologist, studied the relation between music and intelligence. In one study they divided three and four year olds into three groups. One group received piano lessons, another private computer lessons, and a third either studied singing or had no special lessons at all. After six months, the group studying piano was the only one to show a significant increase in spatial-temporal reasoning; in fact, these children scored 34 percent higher than did the next group. (Spatial-temporal reasoning is required for certain higher brain functions and is employed in chess, mathematics, engineering, and composing music. It enables the thinker to put mental images into many different forms without having to use a concrete model of any of the forms.) This increase in spatial-temporal reasoning has been dubbed the "Mozart Effect."

Musical intelligence follows the same sequences as spatial-temporal reasoning, so learning music is like a warm-up exercise for these other reasoning abilities. Researchers believe that music calls on abilities that increase student capacity to learn in other areas. Musical learning, for example, helps students develop such mental skills as concentration, symbol recognition, and memory. Some researchers go so far as to say that musical activity repatterns neurons to improve cortical functioning. Staging an actual performance also teaches students the value of cooperation and collaboration.

Musical training appears to function on several levels. First, musical activities call on the entire body: the muscles of the arms and hands, those that control breathing and the voice, the coordination of movements. At the same time, music can lead students through a series of victories that give them a sense of the necessary sequences of learning and pacing. They find out how it feels to accomplish their own learning goals and develop sought-after self-esteem through actually learning difficult material. Their pictures of themselves as learners become more realistic and each student develops a better idea of how she or he learns.

Multiple Intelligences

The work of Howard Gardner, of Project Zero at Harvard University, has shown that each of us has a mixture of different ways of learning. In his first book, *Frames of Mind* (1985), Gardner identified seven "intelligences"; recently, he has added an eighth intelligence. These intelligences include the musical and the bodily-kinesthetic, as well as the logical-mathematical. Gardner points out that people are born with all intelligences but usually only one or two are fully developed in any individual.

While he has identified individual "intelligences," Gardner emphasizes that actual intelligence is inseparable since each intelligence involves the others. Once a learner has identified the way she learns best, it is important that she not try to learn only in that one way. If a teacher helps a student identify her most natural way to learn and, as a result, that student begins to say, for example, "I am a visual learner and that is the only way I learn, " the student and the teacher will have missed

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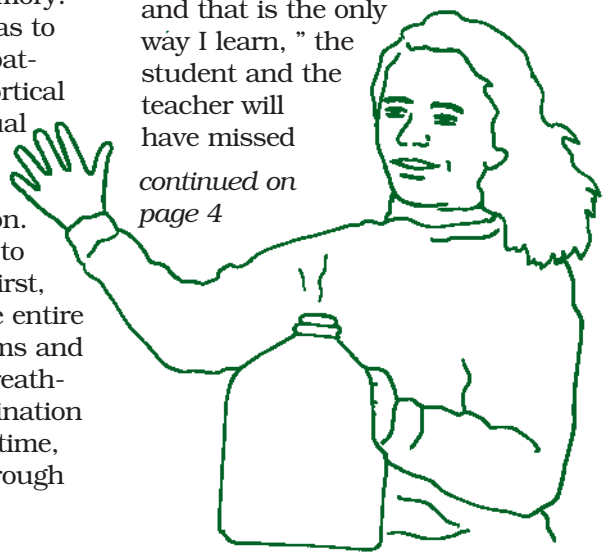

The Rhythm of Mathematics, *continued from page 3*

one of the important meanings of Gardner's work: Each of us needs to work on learning in ways that are not our most immediate and natural way in order to become more complete human beings. The visual or the logical learner cannot rely on her most comfortable intelligence. If she is to become a strong learner, she must turn to other ways of learning. The ideal school gives all students experiences of learning in many different intelligences.

In the Alvord music classroom two intelligences—musical and bodily-kinesthetic—are used to open understanding of other domains. Students who are more comfortable in these two worlds can use their natural understandings and abilities to access other areas of knowledge. In addition, students whose strengths are in other intelligences can learn more about the physical and rhythmic aspects of their own lives.

Bodily-kinesthetic intelligence is awakened by movement. (See dance standards on page 8.) Those with well-developed kinesthetic intelligences typically can control their body motions skillfully to reach certain goals and can do both fine and gross motor work with finesse. Dancers and athletes have developed this intelligence, and so have artisans, surgeons, mechanics, and instrumentalists. Many musicians and others have long noted the close relation between movement and music. Young people, especially, frequently find it impossible to listen to music without moving. These two intelligences seem made to go together in education.

Cultural Attitudes toward Musical and Kinesthetic Abilities

U.S. culture tends to treat musical and kinesthetic abilities as innate, much as we have long assumed that mathematical ability is innate. Working from the assumption that musical ability cannot be taught, schools often suppose that most students have no musical interests or abilities. In contrast to some other intelligences, such as the linguistic and the logical-mathematical, musical intelligence is not highly valued by our education system. It is usually assumed that only those with special interest or aptitudes in the discipline should study music intensively and for the long term. The bodily-kinesthetic intelligence is also channeled onto the athletic field in the U. S. public school system.

Except for those children with special interests in chorus, band, or the school orchestra, music education essentially ends with the elementary grades in the United States. While being in the band or chorus may be a competitive goal in many schools, its popularity does not translate into broad music training for all students—just as most students do not receive the kinesthetic training that student athletes receive. Since they are assumed to have natural talent, even musically "gifted" students often receive no training in formal processing and understanding of music; instead they only practice and perform. As school budgets shrink, music programs (along with art and other "peripheral" subjects) decrease and what money is available for music will be concentrated on perfecting the performances of the few who are considered expert. Even some elementary schools have cut back so severely on music that young children only have an hour or two a month on the subject, taught by a roving teacher.

Other cultures have different assumptions about musical and kinesthetic abilities and how they should be nurtured. Many cultures see their musical heritage as something each child should understand and be able to perform at some level. Dancing, drumming, and other performances are part of the life of the entire group rather than the domain of a few talented experts. In a few U.S. schools, including Alvord, this approach is also the norm. Alvord faculty also uses music to introduce students to the wide range of cultures in the world and in their own community.

Cultural Knowledge

Movements and music can be used as ancillaries to words and to help make meaning clearer for those who do not speak or do not understand English. Since music and movement do not have to be presented verbally, students with language differences can participate in class work with fewer frustrations.

In addition, music and dance can be part of a cultural learning experience. Alvord students can express interest in their own culture and in other cultures through the drumming they learn and the performances they present. They can weave together sounds and rhythms from the Middle Eastern, African, Native American, Japanese, Flamenco, and other musical traditions.

The teacher can show students that fundamental concepts of mathematics remain the same no matter how they are expressed. The relations between half notes, quarter notes, and whole notes are the same in different musical traditions, no matter how different the notes may sound from each other. In exploring these similarities and differences, children can become aware of the constants of mathematics the sameness of human cultures and of their differences.

Other Benefits for Students

Cooperating on expressing the emotions of dance and practicing together to get movement and rhythm correct can teach children to work together just as well as

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Making Mathematics Move

Fear keeps many teachers from trying to teach mathematics through music or rhythm. Teachers often think they don't know enough about the relationships between these subjects. The relationship is not that mysterious and help does exist (for a start, see the resources section on p. 10). Moreover, showing students how an adult goes about learning a new subject may well be one of the most important lessons a teacher can pass along. Admitting to students that we don't know something can be a daunting task for teachers, but the lessons learned from this experience can stay with students for a lifetime.

People can come up with other objections to tackling a project like this: Supplies are bound to be expensive. The project will take up too much valuable class time. Who can help me with this complicated stuff? None of these problems is insurmountable.

Overcoming Initial Difficulties

Expensive equipment for music and dance is a luxury not a necessity. Students can explore rhythm and movement with objects lying around the classroom and at home. The class at Alvord uses the seats and backs of the plastic chairs that fill classrooms throughout the United States. Pots, discarded plastic bottles, and odd pieces of metal also make resonating sounds, as do the children's own arms, legs, and chests. Mention the popular dance group Stomp—they use all kinds of found objects in their performances—and the students will probably be able to name and find some of the objects the group uses. If a school feels that it must have percussion instruments, simple and inexpensive hand drums are adequate.

A teacher who feels "rhythmically challenged" might want to invest in one more piece of equipment: a simple metronome or, even, a clock that ticks. A metronome makes any beat steadier as the class grows in its understanding of rhythm.

Time for this project is flexible, it can take a few days or a semester. If the class is truly interdisciplinary, this investigation can be a wiser use of time than having separate music, mathematics, and science classes. A school could integrate the topic vertically so students increase their learning in each year, rather than having one teacher devote a large block of time to the exploration during one year.

Students may be the greatest resource the teacher has for this project. Many students probably already have some kind of musical training. They can explain concepts to the class or show the others how a rhythm works on the instruments they play.

Other teachers and people from the community can also be helpful in integrating this material into the classroom. The teacher might consider inviting the band instructor, cast from local dance productions, drummers in local bands, choir masters from area churches, and similar experts to help with these classes.

Exploring Rhythm

Most students have an intuitive understanding of music and rhythm. The teacher's goal is to help them use that understanding to form a bridge to unfamiliar material in mathematics. Start with something they already understand—clapping their own hands. Young children are used to clapping in the classroom. Often teachers clap for attention; some classes regularly applaud those who have reached some milestone in life or done well on an assignment.

Begin by clapping with and for the children in a very simple pattern like four equal and fast beats. Ask the students if they can repeat this pattern. Then vary the beat (two fast and two normal or an easily recognized rhythmic pattern from popular music). Ask the students to complete the pattern of a rhythm they all know.

The goal at this stage is to enjoy and explore the rhythm for its own sake. Eventually, the students will need to consider certain basic questions, even though they may not know the answer when the questions are first posed:

- What is the difference between clapping like this (fast beats the equivalent of half notes) and clapping like this (steady beats the equivalent of whole notes)?
- Can you see the relationship of the fast beats to the slower beats?

The students will see that a whole note includes two half notes or four quarter notes, but understanding of that concept should not be rushed. At this stage the ideas of patterns, change, and repetition are the important concepts to consider.

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Building Patterns

Now the students can begin writing their own version of musical notation. Like any system of notation, this version helps make music concrete and preserves it for future use. The students will use this notation system to present their own rhythmic ideas to each other and to people from outside their classroom.

As an introduction, use objects to stand in for specific beats. Something the students are already familiar with is best, for example, Cuisenaire rods. Colored strips of paper, beans of different colors and shapes, or buttons are other possibilities. (For simplicity's sake the rest of this activity will be written as if Cuisenaire rods are being used.)

Assign values to the colors. (For example, red Cuisenaire rods could be designated as quarter notes, white rods as eighth notes, purples as half notes, and browns as whole notes; these values will be followed in the rest of this activity.) Since the rods of one color indicate a specific beat length, the color helps the students control the frequency and speed of beats.

The students lay out the rods on a piece of chart paper or on a large sheet of butcher paper with grids marked on it. The rods are arranged to make a pattern—say, two reds, one purple and a brown—and this pattern is repeated several times. The children then "read" the patterns by clapping or beating their instruments—in the above example, two quarter beats, followed by a half beat and a whole.

It helps to keep the rhythm steady if the students say the color word as they clap or beat. When tapping out quarter notes, for example, they say "red" with each beat. Point out that using this system will make it possible to write out any rhythm the students can think of.

On their own some students will notice that clapping two reds (quarter notes) equals the time for clapping one purple (half note). See if these students can discuss their observations with the class. Help all the students realize that the reds must be clapped twice as fast as the purple. Show the students that two purple rods make one brown rod. Clap the beat for them. Have them clap the beats with partners and talk about how many of any one beat it takes to make a whole beat. Have confident students demonstrate to the rest of the class that four beats of the red rods equal one beat of the brown and that changes can be made in the patterns. (See mathematics standards on page 8.)

Testing Patterns

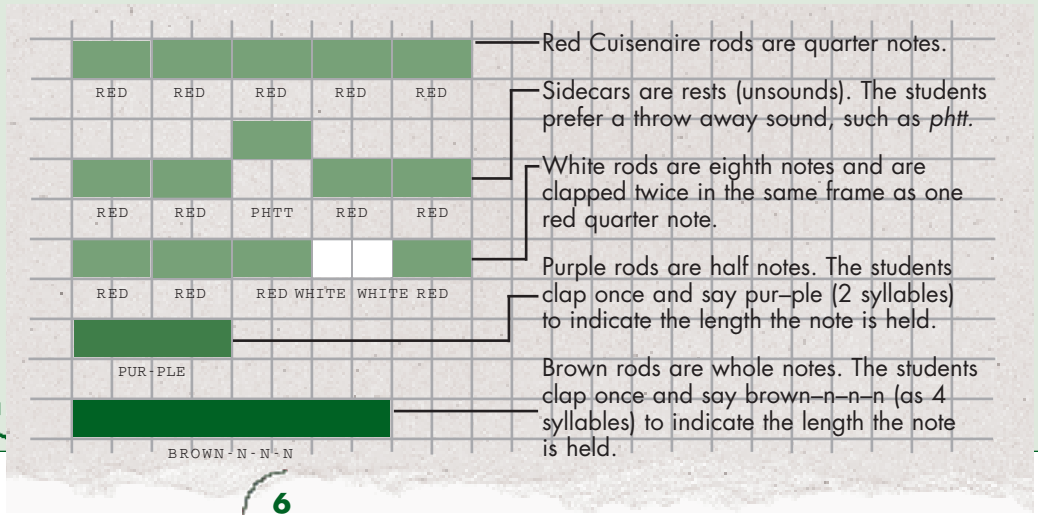
Now the students develop their own rhythms, write them in the new notation system, and test to see if they can move rhythms out of their own minds to the understanding of others. Give them an assignment: For example, each small group or pair of students is to develop a rhythm using four red rods and four whites (whites should be used in pairs at this stage). The working groups draw their rhythmic pattern on graph paper and then clap it for themselves.

When the members of the small groups have agreed that they understand their own pattern, they ask others in the class to clap it also. In this way, each group tests to see if the notation they have used is understandable to others. (They can tape their clapping to see if the other students match it when they reproduce the pattern.)

Now the students rearrange their rhythms—without increasing or decreasing the numbers of counters. After they have rearranged their patterns they clap the new rhythm. How many ways can the eight rods be rearranged? Can they clap out each rearrangement? Can they write it out so others can clap it?

The teacher can begin to compare the relationship between whole, eighth, and quarter notes and fractions. Help them to see how quarter notes and half notes, for example, make up whole notes. How many changes can you make to get a whole note? What would happen if you had an extra half note?

The class and the teacher need to work at a pace that is comfortable to them. If the teacher thinks it is possible, the class might work on this project over an entire



semester. Eventually, the students will work out their understandings of the relations among the notes, of how to indicate these relations on paper, and of transferring the notations from paper to practice.

Eventually, the teacher will have to introduce the concept of rests: Explain that sometimes in a piece of music no noise or sound is needed but the beat has to go on. This place in the music where there is no sound is called a rest. Rests are useful for varying the beat. (This concept may be conveyed best by playing a few selections and asking the students to indicate where the rests are.) As a group the class needs to work out a way to indicate rests. For example, they may want to use a nonsense sound to indicate a rest and to put it above the line rather than on the line with the other rods. (At Alvord they use "phtt" as their sound indicator and put the appropriate rods above the line.) To understand each other's notations, the whole class will have to agree on the same system.

Preparing for Performance

The students are now ready to put their learning into practice by preparing for a public performance. Performance will be both a celebration and an assessment of their learning. They will need to continue their rod exercises as warm-up exercises for their performance and as a method for explaining the rhythms they have imagined to each other. They will also begin experimenting with different materials and rhythms from many sources. What kinds of sounds can they make from abandoned tires or blocks of wood? How can these differences be incorporated into their performance? What effect would they have on the finished product?

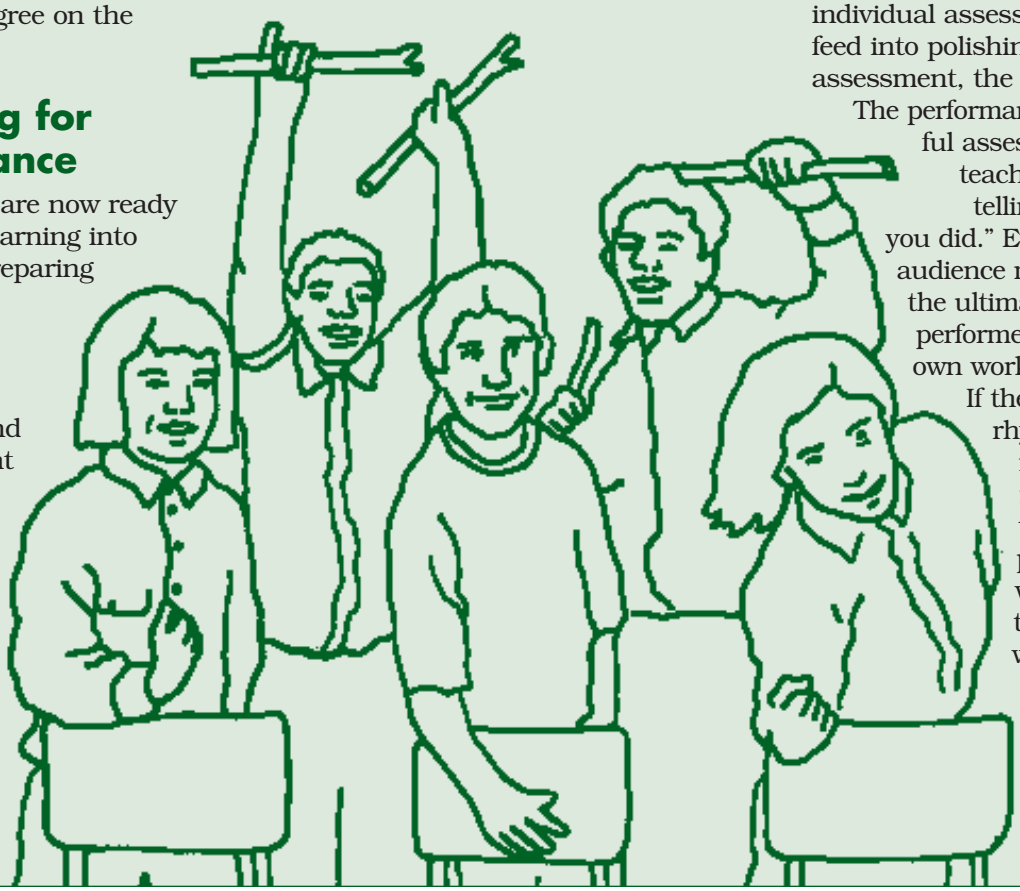
The teacher could introduce the students to rhythms from other sources. Other cultures emphasize different rhythmical structures and patterns. Do the students find these more difficult to beat out than those they have written on their own? Students can discuss folk dances with their parents and others in the community, and guests might visit the class to discuss their musical traditions. Recorded music and videos might also be useful in bringing rhythms of other cultures to the attention of the students. The teacher can use these discussions to show that the mathematics behind the music remains the same across cultures.

The teacher can also present rhythms that occur in nature: crickets' chirps, frog calls, raindrops. How will the children interpret these sounds with their instruments? Can they see any relations between these sounds and the rhythms that form human music? Is the mathematical structure behind these rhythms the same as the structure in others they have studied?

The students now narrow their search to a rhythm or series of rhythms they feel comfortable with and begin describing it in their notation system and beating it out in the classroom. Soon they add movements to the sounds and put them together into a beginning choreography.

In private conferences with students and work groups the teacher can ensure that the mathematical concepts are clear in their minds. Ask them to explain the patterns they see in their rhythms. Probing the use of terms like "whole note" and "quarter beat" will show the level of mathematical understanding each child has reached. These individual assessments can then feed into polishing the public assessment, the final performance.

The performance can be a powerful assessment piece. The teacher is not alone in telling children "how you did." Even the reactions of audience members will not be the ultimate assessment. The performers can judge their own work as they present it. If the relations between rhythm and mathematics have been made clear to the students, the performance itself will further embed their memories with knowledge of mathematics as well as the joy of performance.



Standards, *continued from page 2*

p. 61 Pattern recognition involves many concepts, such as color and shape identification, direction, orientation, size, and number relationships. Children should use all these properties in identifying, extending, and creating patterns. Identifying the "cores" of patterns helps children become aware of the structures. For example, in some patterns the core repeats, whereas in others, the core grows.

Grades 5-8: Standard B:
Patterns and Functions

p. 98 One of the central themes of mathematics is the study of patterns and functions. This study requires students to recognize, describe, and generalize patterns and build mathematical models to predict the behavior of real-world phenomena that exhibit the observed pattern....Exploring patterns helps students develop mathematical power and instills in them an appreciation for the beauty of mathematics.

The study of patterns in grades 5-8 builds on students' experiences in K-4 but shifts emphasis to an exploration of functions. However, work with patterns continues to be informal and relatively unburdened by symbolism. Students have opportunities to generalize and describe patterns and functions in many ways and to explore the relationships among them....

During the middle years, the study of patterns and functions should focus on the analysis, representation, and generalization of functional relationships. These topics should first be explored as informal investigations.

Students should be encouraged to observe and describe all sorts of patterns in the world around them: plowed fields, haystacks, architecture, paintings, leaves on trees, spirals on pineapples, and so on....

p. 99 Looking for patterns in simple situations can lead to a method of counting generalizable in other situations....

Arts

Consortium of National Arts Education Associations (1994). *National Standards for Arts Education: What Every Young American Should Know and Be Able to Do in the Arts.* Reston, VA: Music Educators National Conference.

General Statements

p. 98 **The Benefits of Arts Education.** Arts education benefits the *student* because it cultivates the whole child, gradually building many kinds of literacy while developing intuition, reasoning, imagination, and dexterity into unique forms of expression and communication. This process requires not merely an active mind but a trained one. An education in the arts benefits *society* because students of the arts gain powerful tools for understanding human experiences both past and present. They learn to respect the often very different ways others have of thinking, working, and expressing themselves. They learn to make decisions in situations where there are no standard answers. By studying the arts, students stimulate their natural creativity and learn to develop it to meet the needs of a complex and competitive society. And, as study and competence in the arts reinforce one [another], the joy of learning becomes real, tangible, and powerful.

The Arts and Other Core Subjects. The Standards address competence in the arts disciplines first of all. But that competence provides a firm foundation for connecting arts-related concepts and facts across the art forms and from them to the sciences and humanities. For example, the intellectual methods of the arts are precisely those used to transform scientific disciplines and discoveries into everyday technology.

Dance

p. 98 Children in grades K-4 love to move and learn through engagement of the whole self. They need to become literate in the language of dance in order to use this natural facility as a means of communication and self-expression, and as a way of responding to the expression of others....Students learn basic movement and choreographic skills in musical/rhythmic contexts.... The skills and knowledge acquired allow them to begin working independently and with a partner in creating and performing dances.

Experiences in perceiving and responding to dance expand students' vocabularies, enhance their listening and viewing skills, and enable them to think critically.... They investigate questions such as "What is it? How does it work? Why is it important?" ....Students learn to compare works in terms of the elements of space, time, and force/energy and to experience the similarities and differences between dance and other disciplines.

Through dance education, students can also come to an understanding of their own culture and to begin to respect dance as part of the heritage of many cultures....

p. 39 Students in grades 5-8 develop a sense of themselves in relation to others and in relation to the world. As a result, they are ready to respond more thoughtfully to dance, to perceive details of style and choreographic structure, and to reflect upon what is communicated.

p. 55 High school students need to continue to dance and create dances in order to develop more highly their ability to communicate in a way that is different from the written or spoken word, or even from other visual or auditory symbol systems. They also need to respect their bodies and to understand that dance is the product of intentional and intelligent physical

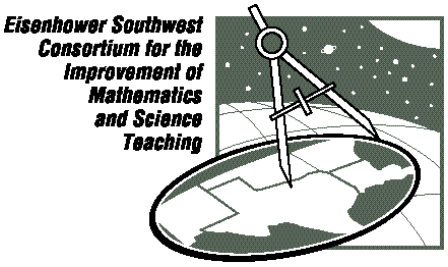
actions....Because dance involves abstract images, students can develop higher order thinking skills through perceiving, analyzing, and making discriminating judgments about dance.

Music

p. 42 The period represented by grades 5-8 is especially critical in students' musical development.... Composing and improvising provide students with unique insight into the form and structure of music and at the same time help them to develop their creativity. Broad experience with a variety of music is necessary if students are to make informed musical judgments. Similarly, this breadth of background enables them to begin to understand the connections and relationships between music and other disciplines.

p. 59
Through singing, playing instruments, and composing, students can express themselves creatively, while a knowledge of notation and performance traditions enables them to learn new music independently throughout their lives. Skills in analysis, evaluation, and synthesis are important because they enable students to recognize and pursue excellence in their musical experiences and to understand and enrich their environment.

SCIMAST



Eisenhower SCIMAST supports mathematics and science education in Arkansas, Louisiana, New Mexico, Oklahoma, and Texas with a combination of training, technical assistance, networking, and information resources. The project is funded by the U.S. Department of Education's National Eisenhower Program and works in partnership with the Eisenhower National Clearinghouse (ENC), a national resource center for increasing the availability and quality of information about instructional resources for science and mathematics educators. In cooperation with SCIMAST, the Louisiana Environmental Educational Information Center (LEERIC) is a state access center for ENC.

The SCIMAST resource center, located in Austin, is open to visitors Monday through Friday, 8:00 A.M. to 5:00 P.M. The center houses a multimedia collection of science and mathematics instructional materials for grades K–12. It is located at the Southwest Educational Development Laboratory, on the fourth floor of 211 East Seventh Street, Austin, Texas 78701. A toll-free number, 1-800-201-7435, provides callers with information and assistance concerning instructional materials for mathematics and science classrooms.

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The Rhythm of Mathematics, *continued from page 4*

working in cooperative learning groups can. Intrapersonal and interpersonal skills can both be improved in a performance. Many dance and music teachers emphasize team building as one of the major benefits of studying their disciplines and one that is as realizable as the team spirit of a school team.

Tying music and dance to another, more traditional, subject helps students see that their abilities have relevance to academic subjects. Children who are unmotivated in other classes can often blossom into hard workers once they have found their niches in music.

Since all students, including special education and gifted and talented students, are in the program, Alvord has offered the students an experience that knits the school together. The sense of unity fostered by the drumming is not artificial or fleeting. It comes out of real learning in an authentic setting. The unity extends throughout the community and between different generations since drumming experiences live on in the students' future learnings and in the memories of their parents and other community members.

Resources and Opportunities

Classroom connections of music and mathematics do not yet have an extensive bibliography, but some resources do exist.

National Dance Institute

The National Dance Institute (NDI) sponsored the initial work in dance, music, and mathematics at the Alvord School. The NDI has had a permanent program in New Mexico since 1995. Besides supporting programs in individual schools, the NDI offers summer dance camp, Saturday programs, and scholarships to spend a summer working in New York City. The NDI office in Santa Fe can be reached by calling (505) 983-7646. For background on the NDI's founder Jacques d' Amboise and his work with schools throughout the country, go to <http://kennedy-center.org/honors/1995/jacdam.html>.

The Southeast Center for Education in the Arts

The Southeast Center for Education in the Arts is headquartered in Chattanooga, Tennessee. Try their web page <http://www.utc.edu/SCEA/index.htm> for information on their institutes for school teams interested in discipline-based music and theater education. Educators in Louisiana would have access to this resource.

The Community Discovered Project

The Community Discovered Project is located in Nebraska and works to promote curricula that integrate arts and technology with core subjects. The project involves nine Nebraska school districts, but other educators can learn much from their web site <http://communitydisc.wst.esu3.k12.ne.us/HTML/info/abs.html>. The Community Discovered Project offers professional development, integrated curriculum strategies, computer-based education, and strategies for other kinds of instruction and assessment.

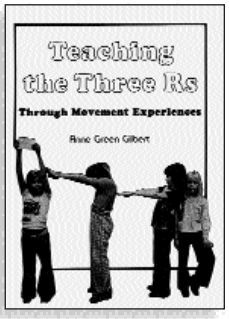
Timelines and Rhythms

Technical Education Resource Centers (TERC) has a two-week unit for second graders that is called "Timelines and Rhythms." In the rhythms part of the unit the students record rhythms on paper so others may follow the patterns. Eventually, they use standard musical notation to compose a two-part rhythm. <http://terc.edu/byterc/invest2unit.html>. Or you can get more information by writing to TERC at 2067 Massachusetts Ave., Cambridge MA 002140 or calling (617) 547-0430.

ArtsEdge

ArtsEdge is a project of the Kennedy Center for the Performing Arts and the National Endowment for the Arts with support from the U.S. Department of Education. While most of its emphasis is on helping students understand performances by arts professionals, some curriculum units that involve students in both dance and mathematics can be found in the "Curriculum Studio" at <http://artsedge.kennedy-center.org/cs.html>. Click on "Curriculum Showcase."

Teaching the Three R's through Movement

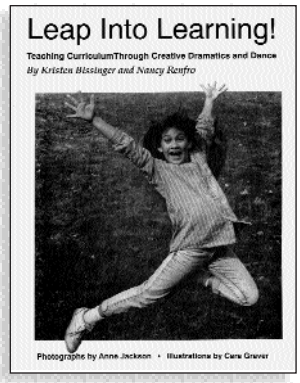


Anne Green Gilbert runs the Summer Dance Institute for Teachers in Seattle, Washington. Gilbert is also the author of *Teaching the Three R's through Movement.* A teacher connected with the institute, Helen Landalf, has written *Moving the Earth: Teaching Earth Science through Movement.* For information on the institute's summer professional development programs or on the publications of its staff members, try <http://www.creativedance.org/training.html> or write to Creative Dance Center 12577 Densmore Avenue North Seattle WA 98133. The phone number is (206) 363-7281.

ArtsEdNet

The ArtsEdNet is sponsored by the Getty Education Institute for the Arts of the J. Paul Getty Trust. While its focus is mainly on the visual arts, the ArtsEdNet does have lesson plans and curriculum ideas. Their page is worth keeping up with: <http://www.artsednet.getty.edu/ArtsEdNet/Resources/index.html>

Leap into Learning



Kristen Bissinger and Nancy Renfro (1990). *Leap into Learning: Teaching Curriculum through Creative Dramatics and Dance.* Austin, TX: Nancy Renfro Studios [P.O. Box 164226, Austin TX 78716]. This text discusses some basic elements of dance and movement with basic teaching suggestions (such as teaching a cue for stopping movement early in the learning process). Photographs and line drawings illustrate the curriculum class plans, which are divided into subjects and start with activities suitable for elementary school children and go on into high school subjects. Some mathematics activities include "Add and subtract with us," "Rhythmic multiplication," and "Negative numbers."