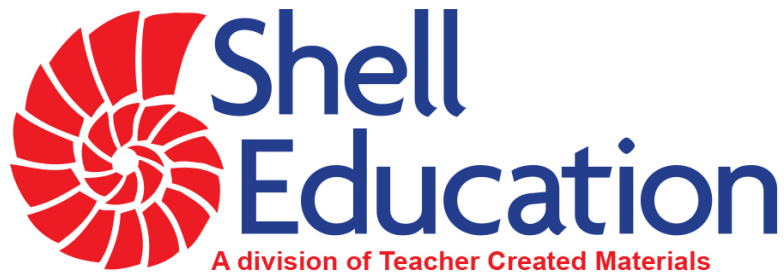


Sample Pages from



Thanks for checking us out. Please call us at 800-858-7339 with questions or feedback or to order this product. You can also order this product online at **www.tcmpub.com/shell-education**.

For correlations to state standards, please visit
www.tcmpub.com/teachers/correlations

To Create a World ⁱⁿ which
Children love to Learn!

800-858-7339 • www.tcmpub.com/shell-education

SECOND EDITION

INTEGRATING THE ARTS IN MATHEMATICS

30 Strategies to Create
Dynamic Lessons

Linda Dacey
Lisa Donovan

Table of Contents

Preface	4
Introduction	5
The Importance of Arts Integration.....	5
Arts and the Standards	10
How to Use This Book	12
How This Book Is Organized.....	12
Correlation to the Standards	21
Storytelling	23
Understanding Storytelling.....	25
Strategies for Storytelling	26
Personification.....	28
Scenarios	37
Story Box Tales	46
The Untold Story.....	50
Points of Entry.....	56
Drama	61
Understanding Drama	63
Strategies for Drama.....	64
Mantle of the Expert.....	66
Teacher in Role	73
Tableaux	79
Enacting Scenes.....	86
Monologue.....	95
Poetry	103
Understanding Poetry	105
Strategies for Poetry	106
Poems for Two Voices.....	108
Poetry Collections.....	115
Found Poetry	122
Structured Poems	126
“I Am From” Poems	134

Music	141
Understanding Music.....	143
Strategies for Music	144
Experimentation	146
Songwriting	152
Scoring	161
Call-and-Response	166
Chants.....	171
Visual Arts	177
Understanding Visual Arts	179
Strategies for Visual Arts.....	180
Visual Narrative	182
Visual Patterns	187
Representation.....	195
Visual Observation	204
Mixed Media	211
Creative Movement	217
Understanding Creative Movement ..	219
Strategies for Creative Movement....	220
Choreography in the Classroom.....	221
Introducing the Strategies	223
Answer Me in Movement.....	235
Movement Strings.....	239
Progressions.....	243
Interpretation.....	251
Choreographic Structure.....	258
References Cited	275
Digital Resources	283

Preface

Welcome to the second edition of the Integrating the Arts series! Now more than ever educators are experiencing what the arts have always accomplished: instructional approaches for social-emotional learning and culturally responsive teaching that value students' funds of knowledge and lived experiences.

This series of books was launched initially to share more widely the success of arts integration in transforming classrooms and to foreground effective and easy-to-implement ideas. Since the first editions were published, educators have reached out telling us their stories and experiences using these strategies with their students.

We're so grateful for the feedback we received from educators about the first edition of this series. We loved hearing how you could flip through the books with your colleagues at planning time and choose a lesson to implement that afternoon or the next day. The practical aspect of the books was a highlight of the feedback. We learned that the lessons were versatile and worked with a wide variety of topics and learning targets. You'll find this continues to be a focus in our latest work, where we offer even more learning experiences for your classroom.

.....

"The arts help children develop creative problem-solving skills, motor skills, language skills, social skills, decision-making skills, risk-taking skills, and inventiveness."

—Sharuna Segaren
(2019, para. 20)

.....

Here's what you'll find new and different in the second edition:

- inclusion of diverse perspectives and culturally responsive strategies that invite students to tap into their individual ideas and lived experiences
- a variety of student examples
- carefully selected ideas for mentor texts of multiple genres and modalities
- suggestions for the inclusion of primary sources
- several new strategies to bring to your classroom
- call-out boxes to highlight key insights and ideas
- resources for finding texts that bring diverse voices to your classroom
- a new structure in the movement chapter that provides additional details for classroom implementation
- a focus on the elements and key vocabulary of each art form
- updated standards

Dig in and enjoy! Let the power and novelty of the arts bolster deep engagement with your content areas. We hope you create, experiment, and explore the artistic strategies alongside students, curating your own portfolio of creative work.

Music

Understanding Music

Music has played a significant role in every culture since the beginning of time. Now with recent technology, our favorite tunes are readily available, and music has become even more prevalent in our lives. Dr. Howard Gardner (2011) has identified musical intelligence as one form of intelligence. His theory of multiple intelligence suggests that students learn in different ways, and for some students, connecting with rhythm, beat, and melody provides access to learning. And as any adult who has introduced a cleanup song knows, music can motivate children and help them make transitions from one activity to another. Recently, attention has been given to the benefits of music in academic performance. It has been suggested that early music training develops language skills, spatial relations, and memory (Perret and Fox 2006).

Music and mathematics have long been linked. After all, it was the famous mathematician Pythagoras who first noted that the pitch of a string was directly related to its length. “Mathematics is also universal, crosses cultural, historical, and intellectual boundaries, and is reflected in music. The interconnectedness of math and music pulsates with a rhythm and harmony of its own” (Garland and Kahn 1995).

In the following strategies, students explore mathematical ideas alongside the basic elements of music. Students engage in singing, playing, and composing music as well as using everyday objects as nontraditional instruments. The focus is on deepening mathematical knowledge while experiencing the joy of creating music together in ways that all students can participate. Along the way, students develop a deeper understanding of and skills in creating music. No previous musical training is needed for you or students.

Exploring mathematical ideas through music engages and motivates students. As they identify, apply, and generalize ideas to real-world situations, mathematics becomes meaningful and purposeful. Abstract ideas are connected to

concrete models, and students’ representational fluency deepens. The more avenues we provide for students to experience mathematics, the more likely we are to connect with the variable ways in which they learn.

“Every musical experience that we offer our students affects their brains, bodies and feelings. In short, it changes their minds permanently.”

—Claudia Cornett (2007, 463)

Elements of Music

The most basic accepted definition of *music* is “organized/intentional sound and silence.”

According to Jacobsen (1992) and Estrella (2019), the basic elements of music from a Western perspective include the following:

- **Pitch:** Highness and lowness on a musical scale
- **Harmony:** Notes of different pitches played at the same time
- **Melody:** How notes are put together in a sequence
- **Dynamics:** Loudness and quietness of composition (musical piece) and transitions between the two
- **Rhythm:** How time is controlled in music (beat, meter, tempo)
- **Timbre/tone color:** The sound quality of a note
- **Texture:** The number of layers in a composition (musical piece)

Music (cont.)

Strategies for Music

Experimentation

The sound of musical instruments changes depending on different variables. In this strategy, students experiment with a variety of variables that affect the quality of sound in a rain stick (material, angle of rain stick, length of the tube, number of nails or placement of foil, and so on).

Experimentation is essential to problem solving. It involves students identifying variables, making predictions, collecting and analyzing data, drawing conclusions, and communicating results. A post on classroom experiments from the Science Education Resource Center (2018) states, “If the result of an experiment is surprising yet convincing, students are in position to build ownership of the new idea and use it to scaffold learning” (para. 1). As a result, this active approach to learning allows students to revise their thinking and deepen their conceptual understanding.

Songwriting

When students sing, a deep connection is created with the melody, rhythm, and lyrics of the song. Further, creating and making music supports academic achievement (Deasy 2002). Although students have opportunities to sing in school, far less attention is given to their ability to create their own songs. This strategy invites students to become songwriters, and as they do, become more familiar with the importance of tone, rhythm, and beat. Students can begin on an intuitive level or simplify the task, for example, by creating new lyrics for a song they already know. As songs can help us remember things, these adaptations can help students retain important mathematical information. Also, writing lyrics prompts students to discuss, synthesize, and categorize curricular concepts. Students can explore rhythms on a drum or experiment with notes on a keyboard. As their musical knowledge expands, they can create original melodies as well as score their compositions.

Scoring

When music is composed, it needs to be scored so that others can perform it. Scoring is the communication of the sounds that are to be made and the timing of those sounds. Scoring music can be done in nontraditional ways so that all learners are able to participate; for example, students can record a word in writing, such as *clap*, or draw a hand to indicate when such a sound is to be made. Such scoring techniques encourage students to construct the symbols and their meanings. Traditional scoring also can be considered, allowing students to experiment with the common language of musicians. “Musical elements such as steady beat, rhythm, tempo, volume, melody, and harmony possess inherent mathematical concepts such as spatial properties, sequencing, counting, patterning, and one-to-one correspondence” (Geist and Geist 2008).

Call-and-Response

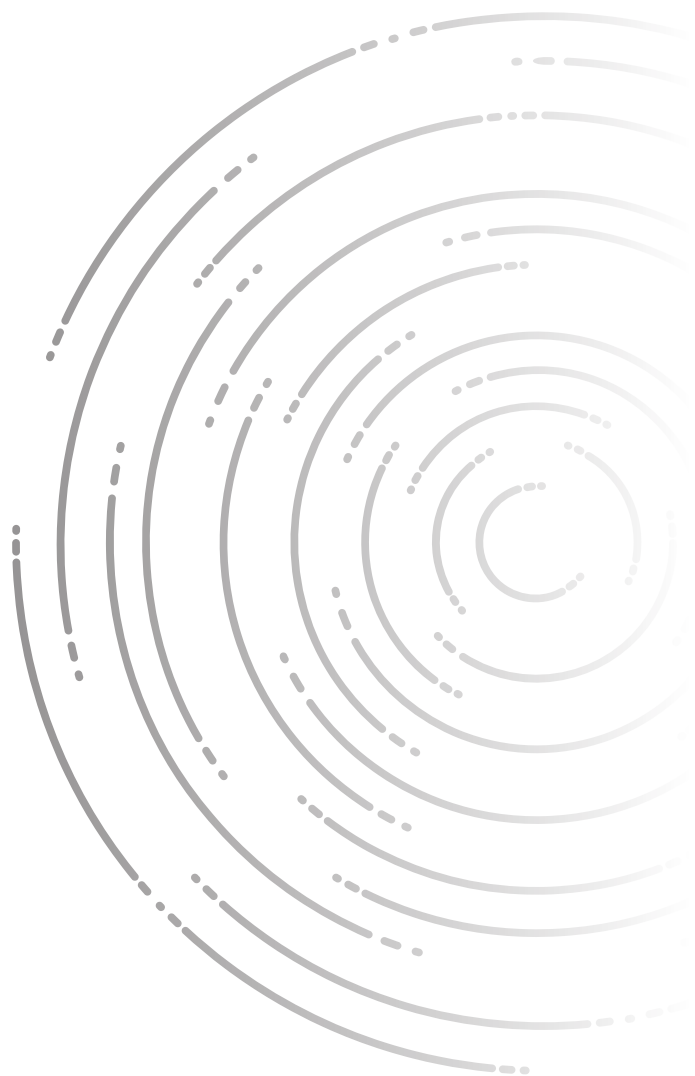
Used for centuries around the world, call-and-response is a musical pattern of phrases exchanged between musicians. There is a conversational pattern with the second musician (the “response”) responding to the first musician (the “call”). This pattern has rich cultural roots in African, African American, Indian classical, and Cuban traditions, among others. In the United States, such songs are most familiar as sea chanteys and maritime work songs.

The cadences and rhythmic patterns involve learners and support memory. This strategy supports full participation as students pose and answer questions in an engaging way to review information, reinforce skills, and expand ideas (Plessinger 2012).

Music (cont.)

Chants

Chants involve the rhythmic repetition of sounds or words. They can be sung or spoken. They can be a component of spiritual practices or heard on a football field. By combining different dynamics (ranging from soft to loud), pitch (variations from high to low), and different notes (length of duration), students can create engaging sound effects that help them learn and remember ideas. According to Sonja Dunn (1999), “A chant is a rhythmic group recitation” (para. 7). Chants can be used in a variety of ways. They can be created with catchy rhythms that make the associated words easy to learn and remember. When this form of chant is emphasized, students retain important mathematical information. Chants also can be constructed by layering phrases on top of another that are then spoken or sung simultaneously. In this format, the use of differing rhythms and pitch creates interest and suggests relationships among the chosen phrases and thus the content being considered.



Songwriting

Model Lesson: Adaptation

Overview

Students express mathematical knowledge by writing new lyrics to familiar songs. The result is sometimes called a *piggyback song* as it is built or rides on a song that already exists. Adapted songs can be simple (one verse) or involve several verses separated by a repeating chorus. In such cases, the chorus can represent central ideas worth repeating, and the verses can be constructed to expand ideas, consider different examples, or suggest a sequence. In this strategy, students explore an adapted song and then create their own.

Materials

- ▶ *Song Exemplars* (pages 157–158)
- ▶ *Lyric Brainstorming Guide* (page 159)
- ▶ *Chorus and Verses* (page 160)
- ▶ *Elements of Music* (page 143)

Standards

Grades K–2

- ▶ Represents and compares whole-number relationships
- ▶ Demonstrates how a specific music concept (melody) is used for a specific purpose
- ▶ Demonstrates and explains reasons for personal choices of musical ideas

Grades 3–5

- ▶ Understands the correct order of operations for performing arithmetic computations
- ▶ Demonstrates and explains how responses to music are informed by the structure and elements of music like melody
- ▶ Describes the connection between personally created music and expressive intent

Grades 6–8

- ▶ Represents a situation using verbal descriptions, tables, graphs, and equations
- ▶ Demonstrates and explains how responses to music are informed by the structure and elements of music, such as melody

Grades 9–12

- ▶ Interprets functions that arise in applications in terms of the context
- ▶ Demonstrates and explains how responses to music are informed by the structure and elements of music, such as melody

Songwriting (cont.)

Preparation

Decide how you will group students as they plan for their song adaptations. Identify the mathematical theme of the song on which you would like the groups to focus. Refer to the *Song Exemplar* for your grade level to familiarize yourself with these models. Consider having a rhyming dictionary handy for students to consult, if appropriate. Additional suggestions are provided in the Specific Grade-Level Ideas.

Procedure

1. Tell students they are going to adapt a song to incorporate the facts and ideas they have learned. Sing or have students sing the *Song Exemplar* for your grade level as a model.
2. Distribute the *Lyric Brainstorming Guide*. As a class, brainstorm key ideas and descriptive phrases or instructions that students may like to include in their lyrics related to the content you have selected. Have students record this information using the *Lyric Brainstorming Guide*.
3. Have students go back through the list and regroup their ideas into categories, recording their thinking on the *Lyric Brainstorming Guide*. This categorization can help organize the lyrics. During this process, encourage students to decide which lyrics are most relevant and which may be too tangential to include.
4. Ask students to brainstorm familiar songs that might be used for the melody. These can include childhood songs, holiday songs, songs they have heard on the radio or online, or advertising jingles. Brainstorm songs that everyone in the class knows, keeping in mind students who may have different traditions and consequently may not be as familiar with some of the songs. You might learn or review a common melody with the whole class such as “If You’re Happy and You Know It Clap Your Hands,” “This Land Is Your Land,” or “Itsy Bitsy Spider.” The songs will take on new meaning once the words have been changed.
5. Focus on some of the key terms and brainstorm rhyming words, having students record them on the *Lyric Brainstorming Guide*. However, remind students that not all lines have to rhyme and that sometimes it is repeated words and rhythm that make a song work.
6. Introduce the terms *chorus* and *verse*. Ask students to think about the structure of the song “Old MacDonald Had a Farm.” Explain that the lines about the different animals are verses and the repeated phrase “Old MacDonald had a farm, E-I-E-I-O” is the chorus. Ask students to identify what core idea(s) might be included in a chorus so that it is repeated throughout the song.
7. Have the class try a few different melodies until they find one that fits the content in both mood and rhythm of the words. Choose a few lines from the *Lyric Brainstorming Guide* that might work and try them with each melody to identify the right fit. Encourage students to use the same structure that the song uses in terms of rhythm and number of syllables. In some cases, they might elongate a syllable or adjust their singing of syllables to make the rhythm work.
8. At this point, students can work in small groups to complete their adaptation. If they are including a chorus and two verses in their adaptation, distribute *Chorus and Verses* and have them complete it. They can then refer to it as they sing their song. As students work, use the Planning Questions to support their thinking.

Songwriting *(cont.)*

9. Provide time for groups to share and discuss their songs. Debrief, using the Discussion Questions.

"Teachers harness the mnemonic power of music by teaching students how to put curricular information into songs, raps, and chants. Learning how to write original songs that transform content information builds student confidence and grows creative thinking."

—Claudia Cornett (2007)

Planning Questions

- ▶ What melody will you work with?
- ▶ Are there mathematical ideas that you could include?
- ▶ When might you use this math in a real-world situation?
- ▶ Does it make sense to keep some of the lines from the original song?
- ▶ Have you checked to make sure your new lyrics match the structure of the original song?
- ▶ Is there a word you could add (or take away) to make the rhythm work better?

Discussion Questions

- ▶ How did you decide which mathematical idea to focus on?
- ▶ How did you decide on the song you would "piggy back?"
- ▶ What artistic choices did you make in writing the lyrics?
- ▶ What did you learn about songwriting?
- ▶ What was easiest/most challenging about writing your song?
- ▶ What did you learn from listening to the songs your classmates wrote?

Songwriting *(cont.)*

Specific Grade-Level Ideas

Grades K–2

As a class, brainstorm ideas to create lyrics and adapt a song that students know well. Work with students to learn the song and sing it together. Topics may include counting songs, shapes, or addition and subtraction. Share the Grades K–2 *Song Exemplar* with students as a model. Students can use their hands to demonstrate the changes in number as they sing, and the song can continue to higher place values with the trading theme of the song.

Grades 3–5

Have students create a song to help them remember rules such as the order of operations. Such a song may only contain one verse and a chorus. Note that students often use a mnemonic device to remember this order, such as **Please Excuse My Dear Aunt Sally** (**p**arentheses, **e**xponents, **m**ultiply and **d**ivide, **a**dd, and **s**ubtract). Unfortunately, the result is that they may conclude incorrectly. For example, they may think that they must multiply before they divide and add before they subtract. Consider the adaptation of “Jingle Bells” in the Grades 3–5 *Song Exemplar*. It emphasizes the left-to-right component of the convention; for example, you add or subtract in the order the operations occur from left to right. You can teach students this song as a way to remind them of this important fact. Then, students can create other songs for vocabulary or procedures they need to remember. When students help write the song, they synthesize and express their knowledge through the creation of lyrics.

Students also can explore conceptual ideas. For example, students can create an adaptation that focuses on what to do with remainders, something that many students find challenging. Students can begin with a stanza that provides an example of when the remainder can be divided into fractional parts. Students can then create other verses that describe a situation in which remainders are omitted or one in which they are rounded up to the next whole number. Remind students that they can create a chorus to sing after each verse.

Songwriting *(cont.)*

Specific Grade-Level Ideas *(cont.)*

Grades 6–8

Students can explore ideas for lyrics and song melodies to be used. They can find and download popular songs and lyrics from the internet. Listening to them and seeing the words may help them replace the words and identify the patterns of the rhythm.

For the Grades 6–8 *Song Exemplar*, have students use gestures to indicate the directions of the slope as uphill (from left to right), downhill (from right to left), horizontal, or vertical.

Grades 9–12

Invite students to focus on a variety of functions such as trigonometric, direct, inverse, and exponential. Have students explain the functions as well as their applications in the real world. At this level, you also can invite students to create harmonies for their songs.

Song Exemplars

Grades K–2

Sung to “She’ll Be Coming ‘Round the Mountain”

She’ll be trading her 10 ones when she has ‘em
She’ll be trading her 10 ones when she has ‘em
She’ll be trading her 10 ones
She’ll be trading her 10 ones
She’ll be trading her 10 ones for 1 ten

Grades 3–5

Sung to “Jingle Bells” (Starting
with *Dashing through the snow* . . .)

We must all agree
On the order to compute
Otherwise you see
We might pay too much loot
Follow the same rule
Working left to right
What fun it is to use this tool
An equation done just right

Chorus

Oh, left to right, left to right
Whatever you first see
Powers and parentheses
In the order that they be
Left to right, left to right
Multiply, divide
Left to right, add, subtract
We do it all in stride.

Song Exemplars *(cont.)*

Grades 6–8

Sung to “Three Blind Mice”

(Chorus)

Rise over run

Rise over run

What is the slope?

What is the slope?

(Verse 1)

With negative slope

It goes downhill

Like a bank account

After paying bills

Take the change in y

Over the change in x

To find the slope

(Verse 2)

With positive slope

It goes uphill

Like the water’s height

In a glass you fill

Take the change in y

Over the change in x

To find the slope

(Verse 3)

Horizontal lines

Have a zero slope

With vertical lines

Its undefined slope

Take the change in y

Over the change in x

To find the slope

Grades 9–12

Pythagorean Theorem

(sung to “London Bridge is Falling Down”)

Pythagoras found a helpful rule,

Helpful rule, helpful rule

Relationship among the sides

Of right triangles.

Off three sides you make a square,

Make a square, make a square

Hypotenuse square tells the sum

That’s all you need.

Square of A plus square of B,

Square of A, square of B

These together give you square of C

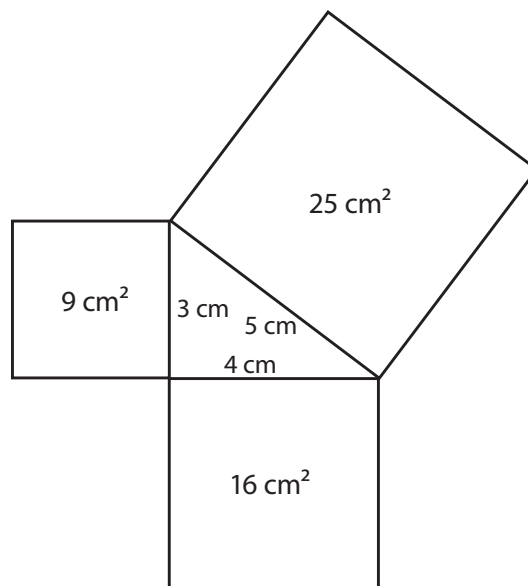
Missing lengths discovered.

Algebra and your fine mind,

Your fine mind, your fine mind

Gets the answer every time

Pythagorean theorem.



Name: _____ Date: _____

Lyric Brainstorming Guide

Directions: Use the chart to help you plan your song lyrics.

Math Concept:	
Key Ideas to Include:	Descriptive Phrases to Include:
Categories:	Potential Rhymes (optional):

Name: _____ Date: _____

Chorus and Verses

Directions: Use the chart to help plan your song structure.

Title of Song

--

Chorus

--

Verse 1

--

Verse 2

--