

How to Use This Book

Choosing an Activity

You may want to select an activity as enrichment to support and align with the mathematical content you are currently teaching. Or you may want to choose an activity solely to shift instructional mode, to stimulate individual students, or to energize the classroom culture.

Aligning with content The teacher notes for each activity indicate how it can be connected to the primary curriculum and what mathematical topics it contains. Survey your course topics for the year and refer to the *Functional Melodies Activity/Topic Chart* on page xvii to find appropriate fits. It is also important to keep an open mind about ways to adapt the activities. For example, I have used very effective adaptations of Functional Composer with third-grade students. Don't rule out an activity if on face value it contains topics that are associated with a different mathematics level or not aligned with your course. Some suggestions for adapting the activities are provided in the teacher notes.

Shifting the instructional mode Students stay more engaged when the mode of instruction is varied. Since these activities stand alone with few prerequisites, it is possible to use them at any time. Between units and before and after school vacations are great junctures to use these activities. However, when concrete relevance of the activity to the course content is unclear, students can be resistant. If you use the activities out of context with the primary curriculum be aware of your students' sensibilities and provide adequate background preparation with the readings and discussion.

Instructional Format

Functional Melodies activities place you, the teacher, into the learning experience together with your students. Activities usually begin with you facilitating an exploration using the accompanying music CD and engaging the entire class with questions. The focus then oscillates between directed discussion by you and students working in pairs or groups to complete tasks or explorations on their worksheets. In some ways, it can be an advantage if you have no musical background! This authentically places you in the role of learner with the students. You can let go of your ego here—it is completely valid for a mathematics teacher to be ignorant of music theory. Consider it an opportunity to model the ethic of lifelong learning. It can be great to have your musical students be the ones to clarify any confusion that may result from lack of music knowledge within the class.

Student Materials

Worksheets Even though they work in pairs or groups for most of the activities, all students should record their own work on individual activity worksheets. The worksheets vary in style; some are graphs and charts while others contain problem sets that the students complete individually, possibly as homework. Make copies for each student from the blackline masters provided.

Resource pages Resource pages are a source of information for student groups. They contain summarized instructions of the goal of the activity and explain what students are expected to do, making them less dependent on direct instruction from you. In some cases, the resource pages contain necessary information such as vocabulary, definitions, charts, graphs, or diagrams. Each work group should have one resource page. The objective here is not merely to save paper. One sheet per group fosters interaction and interdependence among group members. Students will have to read the resource page together, or if one student reads it, he or she will inevitably be asked by the others to explain it. While I recommend that you use the resource pages, you can make available the information they contain in any way that fits your style. You might want to display one as an overhead, copy some material to the board, or give the information in a direct-instruction lecture format. Keep in mind that the resource pages are meant to create a comfort level for the students, to foster interaction between group members, and to reduce students' dependence on you.

Readings For most students, the idea that music and mathematics are closely related is a foreign concept. Thus there may be resistance or critical attitudes from students when relatively untraditional activities are presented. The *Functional Melodies* readings are designed to set the context for students and to enhance their readiness to engage in the activity. The readings are purposefully light and conversational to set an inviting and friendly tone. They are intended to inspire imagination and curiosity about the activity topic, to raise essential questions, to orient students to the concepts and issues presented in the activity, to introduce general background information for relevance, and to provide specific background knowledge necessary for the activity.

There are several ways to use each of the readings: Give a copy to each student a day or so prior to the activity to read for homework, ask a student to read it to the class or read it to the class yourself, or summarize the information in the reading and present it to students as a lecture or skit. No matter how you present the reading, discuss the ideas it contains either before the day of the activity or on that day.

Teacher Materials

Audio recordings Track numbers from the *Functional Melodies* CD are clearly indicated in the teacher notes for each activity. A CD player with a pause feature and ability to recall specific track numbers will make it easy to play the correct track. Some of the activities require you to repeat a particular track several times. You may also choose to use live performances by students (or yourself) if you wish.

Overhead transparencies Transparency masters are provided for Activities 8 and 9. For the activities with graphing exercises, you will find it helpful to make overhead transparencies of the activity worksheets. In Activity 11, you may want to make a transparency of the resource page.

Activity scripts The teacher notes for each activity contain a step-by-step script to guide you through the lesson. Included in these steps is the information essential for conducting the activity, such as questions for students and issues that may arise. Where the script suggests specific questions to pose to the class, the answers are noted in square brackets directly following the question. Other features presented in the activity script are discussion points and teaching tips.



Discussion points Discussion points indicate opportunities where you may wish to pause for discussion and elaborate on a relevant connection. They are interspersed throughout the activity scripts and indicated with the icon shown at left. A discussion point may be a series of questions or a presentation of interesting facts that relate to issues the activity raises at that point. Some cases warrant taking a significant digression from the activity to present examples from the primary curriculum that demonstrate the connection to music that the activity is exposing. However, discussion points are completely optional. All of the activities can proceed successfully if no discussion points are used.

Discussion points may contain interdisciplinary connections that are historical and cultural, special interest items, and specific connections to the primary mathematics curriculum. They may also provide educational opportunities for topics that vary from specified connections to the primary curriculum.

As you decide which discussion points to use, consider the following: your own background and comfort level; student background, skill/ability level, and maturity; time allocated for the lesson; overall curricular objectives; and tone of the classroom at any point in time. As you read through the activity script, become familiar with all the discussion points and tag those that you might use, but remain open to the possibility of using any of them. The first time you use an activity, it is difficult to predict what students will ask or what the classroom climate will be.



Teaching tips Teaching tips differ from discussion points in that they offer advice on issues of pedagogy and instructional strategy and do not contain material to be used directly with the students. Teaching tips are indicated in the activity script with the icon shown at left. They contain general pedagogical issues, insights into student issues with a particular aspect of an activity, background information on a topic that may assist you in conducting the activity, and my own anecdotal experience and advice.

Follow-up activities At the end of each activity, suggestions are provided that connect the ideas to the primary curriculum or allow for deeper study and extension projects.

Each activity of *Functional Melodies* is a starting point for a different music and mathematics connection. In writing this book I have barely scratched the surface. I hope that you and your students can uncover some new connections through research and your own creativity that will inspire and enrich your experience of mathematics. Good luck!

Activity/Topic Chart

Activity	Activity Mode	Mathematics Topics	Music Topics
1 Sound Shapes	Listening, sketching, discussing	Geometry, assorted vocabulary terms and concepts, mathematics as metaphor	Ear training, form and composition, melodic structure, rhythmic patterns
2 Measures of Time, Part I	Listening, creating models, singing, calculating	Measurement, addition of fractions, symbolic representation	Rhythmic notation measures, time values of notes, beats
3 Measures of Time, Part II	Listening (minimal), paper and pencil calculation, problem solving	Rates, unit conversions, dimensional analysis, operations on fractions	Rhythmic notation, tempo
4 The Multiples of Drummers	Interactive, listening, ensemble performance, calculating	Counting, multiples, least common multiples, factoring, exponents, ratio, patterns, problem solving	Beats, tempo, polyrhythms, phrasing, rhythm, accents, performance
5 Record-Producer Algebra	Interactive, listening, vocal performance, problem solving, manipulation of symbols	Counting, creating algebraic representations, solving equations	Beats, time, measures, pop/rock song arranging, vocal phrasing, rap vocal performance
6 Functional Composer, First Movement	Interactive, listening, identifying and calculating, graphing	Definition of a function, function notation, graphing transformations of functions, composite functions, order of operations, in/out tables	Musical notation, music composition and melodic structure, ear training, transposition, modes
7 Functional Composer, Second Movement	Interactive, listening, graphing, calculating	Graphing transformations of functions, periodic functions, in/out tables, function notation, domain, range	Melodic structure, patterns, intervals
8 Name That Function	Interactive, listening, singing, calculating	Function notation, transformations of functions, calculating function values, problem solving	Pitch, melody, ear training
9 Inside Out	Interactive, composing, drawing, tracing, listening, performing, graphing	Polar coordinate graphing, scaling of axes, angle measurement, angular velocity, mathematical interfaces	Musical notation, staffs, melodic contour, composition, imagery in music, instrumental performance
10 Scaling the Scale, Part I	Interactive, listening, calculating, problem solving	Ratio, operations on fractions, problem solving, the work of Pythagoras, physics of sound	Scales, intervals, pitch recognition, frequency of pitch, harmonic series, piano keyboard
11 Scaling the Scale, Part II	Calculating, problem solving	Geometric sequence, patterns, multiples, fraction multiplication, ratio, problem solving	Scale temperaments, chromatic tones, intervals, piano keyboard