# Chapter One: Music, Literacy, and Numeracy

Current brain research is helping us understand of how children learn. Neuroscience has allowed us to see the effect of music on the brain. Musical participation stimulates brain activity, involving the visual, auditory, and kinesthetic senses. The relationship between language and music has been recognized throughout history, particularly as words are expressed through melody and rhythm. Melody is built on the natural phrasing, rhythm, pitch, accent, syllabication, and rhyme of language. Music and math are linked through the natural proportions of rhythm and acoustics. Music notation, like the written word or numeral, is a symbolic representation of sound in time.

- What are the common elements in music, literacy, and numeracy?
- How can music promote literacy?
- How is the brain stimulated with musical activity?
- How does singing a lyric and chanting a nursery rhyme promote phonemic awareness?
- In what ways can singing and playing music help children develop language communication skills?
- How can phrasing, pitch, modulation, accent, and syllabication be taught through rhythm and melody?
- What is the relationship between music and mathematics?
- How can math concepts be strengthened through rhythmic activities?
- In what ways can music help with memorization?
- How can reading music symbols support the process of learning to read text?

Research is currently being conducted on the impact of music on learning. Studies indicate that the left and right brain functions used in processing music are similar to those functions used in processing language. (http://www.menc.org/information/advocate/brain.html). Much of the music we share with children is sung - vocal or choral music. The lyric of a song is poetry, using extensive rhyme, repetition, rhythm, melody, and form. Rhyme, rhythm, and repetition can provide us with helpful tools for short and long term memorization. The rhythm, accents, and metric patterns of the words flow along above the steady beat. The melody naturally flows up and down in pitch in imitation of speech and oral expression. The musical phrases follow the rules of oral conversation naturally punctuated with the rising tones of a question and the response of the answer ending with a period. The dynamics of sound relate to the volume of tones from soft to loud. Musical notation is symbolic, using notes, rests, and symbols that have meaning much like letters, words, and sentences in language. Written music reinforces the concepts of print with notes moving from left to right on the musical page along the musical timeline.

The steady pace is measured by the number of beats per minute ticking along on the metronome. Tempo refers to the speed or variation in the number of beats per minute. Rhythmic values are measured in fractions in relation to a time signature indicating note values. The musical staff is a timeline divided into equal measures of time. The science of sound involves the frequency of vibrations (Hz) per second. The mathematical formula found in the vibrations of tone is consistent. The fundamental low tone beats at a slower frequency, constantly doubling to create the overtone series. The mathematical mysteries of music have astounded researchers. The M.I.N.D. Institute is studying the impact of music on human intelligence - http://www.mindinstitute.net/index.html. Studies show that students with musical training

improve spatial reasoning which results in better problem solving and mathematics skills. The famous "Mozart Effect" study examined college students who showed short-term improvement of spatial-temporal reasoning after listing a a Mozart Sonata prior to taking a test.
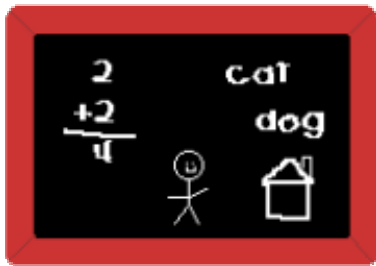
Literacy Standards

Early literacy standards emphasize phonological awareness and oral language development. The Early Reading First grants in No Child Left Behind examine how preschool age children acquire language, cognitive, and early reading skills. Oral language development involves learning expressive and receptive spoken language, including developing vocabulary. The use of the song lyric can be useful in helping children learning language and vocabulary. Early literacy also involved developing alphabet knowledge and letter recognition. Many publishers focus on learning letters and letter sounds through music. These programs also develop the child's print awareness using musical cues. One of the key components of early literacy is developing phonological awareness. Using songs, fingerplays, word games, nursery rhymes, jump rope rhymes, etc. can help children achieve phonological awareness. Early Reading First documents define phonological awareness as:

> (1) identifying and making oral rhymes;

> (2) identifying and working with syllables in spoken words through segmenting and blending;

> (3) identifying and working with "onsets" (all the sounds of a word that come before the first vowel) and "rimes" (the first vowel in a word and all the sounds that follow) in spoken syllables;

> (4) identifying and working with individual sounds in spoken words.

One of the best websites for finding materials to use in your classroom is "Songs For Teaching" - http://www.songsforteaching.com/. This site includes lyrics and audio song files for download. Featured are fingerplays, cheers, raps, chants, as well as songs on phonics, grammar, spelling, and phonemic awareness. This site also has counting songs, multicultural songs, action songs, etc. Coast Music Therapy - http://www.coastmusictherapy.com - includes many resources that are helpful for assisting students with learning disabilities with oral and written language development. Click on "Tips" for resources. Research includes studies of using music to assist learning and development. Their students examine music as a mnemonic device, music as an aesthetic to elicit attention, motivation, and positive mood, rhythm as a timekeeper for movement, and singing/chanting as a compensatory strategy for functional speech. Programs such as Zoo-phonics - http://www.zoo-phonics.com - combine music and the sound of the letter with kinesthetic signals and visual print recognition as a way to strengthen concepts of letter sounds

and learn phonics. See the appendices for lesson ideas and examples of nursery rhymes, fingerplays, jump-rope rhymes, etc.

The United States Department of Education has focused on developing early literacy skills. Free brochures are available on the web. The parent guide, "Put Reading First," includes suggestions on how to help the young child learn to read and provides us with definitions of terminology used in early reading.

- Put Reading First: Helping Your Child Learn to Read: A Parent Guide - Preschool Through Grade 3 - http://www.nifl.gov/partnershipforreading/publications/reading_first2.html
- Put Reading First: The Research Building Blocks for Teaching Children to Read, Kindergarten Through Grade 3 - http://www.nifl.gov/partnershipforreading/publications/reading_first1.html

If your child is just beginning to learn to read

At school you should see teachers...

- Teaching the sounds of language. The teacher provides opportunities for children to practice with the sounds that make up words. Children learn to put sounds together to make words and to break words into their separate sounds.
- Teaching the letters of the alphabet. Teachers help children learn to recognize letter names and shapes.
- Helping children learn and use new words.
- Reading to children every day. Teachers read with expression and talk with children about what they are reading.

At home you can help by...

- Practicing the sounds of language. Read books with rhymes. Teach your child rhymes, short poems, and songs. Play simple word games: How many words can you make up that sound like the word "bat"?
- Helping your child take spoken words apart and put them together. Help your child separate the sounds in words, listen for beginning and ending sounds, and put separate sounds together.
- Practicing the alphabet by pointing out letters wherever you see them and by reading alphabet books.

Definitions

Phoneme - A phoneme is the smallest part of spoken language that makes a difference in the meaning of words. English has about 41 phonemes. A few words, such as a or oh, have only one phoneme. Most words, however, have more than one phoneme: The word if has two phonemes (/i/ /f/); check has three phonemes (/ch/ /e/ /k/), and stop has four phonemes (/s/ /t/ /o/ /p/). Sometimes one phoneme is represented by more than one letter.

Grapheme - A grapheme is the smallest part of written language that represents a phoneme in the spelling of a word. A grapheme may be just one letter, such as b, d, f, p, s; or several letters, such as ch, sh, th, -ck, ea, -igh.

Phonics - Phonics is the understanding that there is a predictable relationship between phonemes (the sounds of spoken language) and graphemes (the letters and spellings that represent those sounds in written language).

Phonemic Awareness - Phonemic awareness is the ability to hear, identify, and manipulate the individual sounds--phonemes--in spoken words.

Phonological Awareness - Phonological awareness is a broad term that includes phonemic awareness. In addition to phonemes, phonological awareness activities can involve work with rhymes, words, syllables, and onsets and rimes.

Syllable - A syllable is a word part that contains a vowel or, in spoken language, a vowel sound (e-vent; news-pa-per; ver-y).

Onset and rime - Onsets and rimes are parts of spoken language that are smaller than syllables but larger than phonemes. An onset is the initial consonant(s) sound of a syllable (the onset of bag is b-; of swim, sw-). A rime is the part of a syllable that contains the vowel and all that follows it (the rime of bag is -ag; of swim, -im).

California Standards and Frameworks

Locate the English/Language Arts, Mathematics, and Music (Visual and Performing Arts) content standards and frameworks on the web. You may wish to save the file on your computer by right clicking or holding the button down on MAC and selecting "save target as" or "save link as" to save these standards on your own computer. Some will be Adobe Reader pdf files and others will be web html files.

California Curriculum and Instruction Website - http://www.cde.ca.gov/ci/

Additional Standards Resource Websites

- California Content Standards - S.C.O.R.E - http://www.score.k12.ca.us
- CTAP Searchable Standards - http://www.history.ctaponline.org/center/index.cfm?main=tools/standards.cfm-and-subj=2
- California Learning Resource Network (CLRN) - http://www.clrn.org/home/

California English and Language Arts Standards and Frameworks

What should your students know and be able to do in...

- *Reading*
- *Writing*
- *Listening and Speaking*
- *Written and Oral Conventions*

English-Language Arts - An Essential Discipline

"The ability to communicate well - to read, write, listen, and speak - runs to the core of human experience. Language skills are essential tools not only because they serve as the necessary basis for further learning and career development but also because they enable the human spirit to be enriched, foster responsible citizenship, and preserve the collective memory of a nation."

(From the Introduction to English/Language Arts Standards - http://www.cde.ca.gov/be/st/ss/engintro.asp)

How Does Music Relate to the California English-language Arts Content Standards?

Reading

Word Analysis, Fluency, and Systematic Vocabulary Development
Students know about letters, words, and sounds. They apply this knowledge to read simple sentences.

Concepts About Print

- Music is written on a staff that includes symbols for notes and rests.
- The music follows from left to right.
- The musical lyric is broken up into syllables under the notation, also moving left to right.

- Each note, rest, or sign is a symbol much like letters that make up words.
- Show children a song book and locate the words and syllables under the musical notes.
- See the notation section on how music is written and discuss how symbols can have meaning in music as well as in visual arts, dance, and drama.
- Create own symbols for sounds. Some contemporary music notation uses different graphic representations.

Phonemic Awareness

- Most music lyrics produce rhyming words.
- Count the syllables in words, names, and objects.
- The words of the musical lyric are separated into syllables according to the rhythm of the music.
- Find the rhythm of words through clapping, tapping, or playing the syllables on a rhythm instrument.
- The rhythm of the music is closely related to the rhythm and natural accents in words and sentences.
- Call attention to the vowel-consonant sounds.
- Singing emphasizes vowel sounds, particularly on long tones.
- Teach the children how to place vowels as they sing.
- The ee-eh-ah-oh-oo sounds are typically used in a choral warm-up. Have students warm up their voices with this set of vowels by starting with different consonants - mee-meh-mah-moh-moo or tee-teh-tah-toh-too.
- You can also practice diphthongs in words like "game" or "I" or "oh."
- As children sing, exaggerate enunciation of consonants.
- Make sure you hear the beginning and ending consonants as you sing.
- Distinguish differences between similar consonants (t and d, m and n) and call attention to blends, diphthongs, partners, etc.

Decoding and Word Recognition

- Focus on consonants and short and long vowel sounds in lyrics.
- Identify sight words and focus on "not throwing away" any words (like the, an, and) as you practice singing a phrase.
- Have children take a deep breath before singing a phrase and make sure all words are clearly enunciated and expressed in their performance.
- Breathing is an important process in singing.
- Controlling the flow of air throughout a sentence helps in public speaking.
- Practice giving each syllable an equal flow of air as you expend your breath.

Vocabulary and Concept Development

- Use songs that help students develop vocabulary and understand concepts.

- Never teach children a song with words they do not understand. Always provide instruction and definition of the meaning of song lyrics.
- Use songs with repetition to help with memorization.
- Use songs as a mnemonic device to help children remember or recall information.

Reading Comprehension

Students identify the basic facts and ideas in what they have read, heard, or viewed. They use comprehension strategies (e.g., generating and responding to questions, comparing new information to what is already known).

Structural Features of Informational Materials

- Locate the title, table of contents, name of author, and name of illustrator.
- Music is titled and written by a composer. Often music is written by the composer and the lyrics are written by a lyricist.
- Collections of music are bound in books.
- Call attention to the difference between a book with music notation and a book with words only.

Comprehension and Analysis of Grade-Level-Appropriate Text

- Use songs that tell a story.
- Use pictures or bring in props that help students comprehend meaning.
- Use songs that related to life experiences and challenges.
- Locate songs that retell familiar stories.
- Ask questions about the words and ideas in a song for clarification and understanding.

Literary Response and Analysis

- Students listen and respond to stories based on well-known characters, themes, plots, and settings.
- Use stories with music and character theme songs.
- Demonstrate how music enhances the story. Improvise sound effects and musical cues in a story or book.
- Listen for musical themes for characters. "Peter and the Wolf" is a good example of musical themes for each character.
- Discuss the mood of background music in movies, TV, cartoons, etc.

Narrative Analysis of Grade-Level-Appropriate Text

- Music, particularly folk music, can tell stories of real events and people.
- Lives of folk heroes and historic events can be learned through folk songs.
- Patriotic and holiday songs can enhance celebrations and provide children with textual information through songs and lyrics.
- Multicultural music gives children a better understanding of the diverse world around them.

- Music companies like Putumayo focus on music from around the world - http://www.putumayo.com/.

Writing Strategies

- Children can write out lyrics in poetic form.
- They can create "poems" about stories, events, people, objects, etc. that can be put to music.
- Teachers often use common melodies and create new lyrics to go along with a topic of study.
- Children also can learn to write basic music notation.
- Rhythmic notation is easy to create.
- Melodic notation is more difficult, but children can learning that the notes of a staff sit on lines or in spaces.
- Melodic notation follows pitch with low notes lower on the staff and high notes higher on the staff.
- It is not necessary to use traditional notation with young children. However, the concepts of high and low can be pictured in other ways.
- Children can "draw" the melody as they listen to music.

Written and Oral English Language Conventions

- The standards for written and oral English language conventions have been placed between those for writing and for listening and speaking because these conventions are essential to both sets of skills.
- For young children, most musical activities involving literacy with text will focus on oral communication or aural reception and discrimination.
- Singing lyrics involves using phonetic knowledge and having an understanding the sounds of letters.
- Music is organized in phrases much like a conversation. Musical phrases are similar to sentences or textual phrases.
- The give and take of a musical conversation can be a focus for improvisation. As one person plays the question, the next listens and responds to the answer musically. Using the pentatonic (5-note) scale with only the black keys on the piano or the black tone bars gives the students tools for improvising musical conversations.

Listening and Speaking

- Students listen and respond to oral communication.
- To participate in music requires understanding and following one-and two-step oral directions.
- Information and ideas are shared.
- Generally lyrics are coherent and presented in complete sentences.
- Songs describe people, places, things, locations, actions, etc.
- Children learn to recite short poems, rhymes, and songs.
- Some songs tell stories in a logical sequence with verses relating events sequentially and choruses providing the repetition on the main theme between verses.

Resources for Literacy:

- Music and Literacy - MENC - http://www.menc.org/networks/genmus/litarticles.html
- Music and language mechanisms - http://www.menc.org/information/advocate/brain.html
- Put Reading First - http://www.nifl.gov/partnershipforreading/publications/reading_first1.html
- Put Reading First Parent Guide - http://www.nifl.gov/partnershipforreading/publications/reading_first2.html
- National Reading Panel Publications - http://www.nationalreadingpanel.org/Publications/researchread.htm
- Reading Tips - http://child-reading-tips.com/Music-And-Literacy-And-Numeracy.htm
- Songs for Teaching - http://www.songsforteaching.com
- Reading Rockets - http://www.readingrockets.org/article.php?ID=478
- Zoo-phonics Research Page - http://www.zoo-phonics.com/Research.html
- Music and literacy and numeracy - http://www.child-reading-tips.com/music-and-literacy-and-numeracy.htm
- Pentatonic Music Collection - http://www.pentatonika.com/ - A great source of songs and literacy activities for teachers!
- Music and the Brain Research Articles - http://www.educationthroughmusic.com/brainarticles.htm
- Music and Language (ESL) - http://www.dtae.org/Adultlit/Connections/music.html
- CIRCLE - Literacy Ideas for Preschool - Bright Ideas - http://www.uth.tmc.edu/circle/bright.htm
- Coast Music Therapy Tips - http://www.coastmusictherapy.com/tips.html

How Does Music Relate to the California Mathematics Content Standards?

Students understand small numbers, quantities, and simple shapes in their everyday environment. They count, compare, describe and sort objects, and develop a sense of properties and patterns.

Number Sense

- Students understand the relationship between numbers and quantities (i.e., that a set of objects has the same number of objects in different situations regardless of its position or arrangement)
- Rhythm is made of of sounds in varying lengths.
- Music has a steady beat but the speed varies according to tempo. Children can clap, tap, or march to a steady beat as they count.
- Tempo is measured by how many beats in a minute. These beats are naturally divided into equal parts called measures.
- Children can learn to recognize long tones and short tones.
- They can count syllables in song lyrics.
- Count the number of beats in a short children's song.
- Help the children feel the equal division of beats by measures. Most children's music is counted by duples - twos or fours. (**1**-2-**1**-2 or **1**-2-**3**-4). However, some music is triple, counted by threes or sixes. (**1**-2-3 or **1**-2-3-**4**-5-6). Children can learn to aurally discriminate between duple and triple meter as they learn to group notes in patterns of twos and threes.

Algebra and Functions

- Children can sort and classify note values by long, short, equal.
- They can identify steady, consistent beats and comprehend fast and slow tempos.
- They can learn auditory discrimination as well as identify, sort, and classify note values in rhythmic notation.
- Musical notes are symbolic representations of values in length of time.
- Children begin to understand that various symbols represent different values as they learn rhythmic notation.
- Children can learn to hear the mathematical relationships between whole, half, quarter, eighth, sixteenth notes.

Measurement and Geometry

- Students understand the concept of time and units to measure it; they understand that objects have properties, such as length, weight, and capacity, and that comparisons may be made by referring to those properties.
- Auditory discrimination can be useful in giving children a sense of time and measurement.
- Note which note is shorter or longer and which tempo is faster or slower.
- In understanding concepts of time, children can watch the second hand on a clock as they count the number of beats in a minute for different tempo markings.
- Music is a measurement in time.
- The musical timeline has a beginning, middle, and end.
- Musical games, songs, movements, and dances can also help teach children concepts of over, under, high, low, etc.
- A musical round is a more complex way of understanding how patterns can be repeated at different time intervals, creating harmony as the melodies flow from each part.
- Understanding how scales are created with whole and half step combinations for major, minor, and other modes requires mathematical understanding of the properties of tones and how they combine logical in a tonal pattern.
- Learning to play harmony on an instrument allows children to create chords and chord progressions based on the different numbers of the scale.
- A typical major scale has 8 tones.
- A typical harmonic progression might be based on the first, fourth, and fifth tones of the scale.

Geometry

- Children can recognize the geometric circles as notes and learn the different multiplication principles of the notation stems, flags, etc. as they signify doubling of note values.
- See the ratios of note values in the rhythm section.
- Students in third grade are beginning to learn fractions. Rhythmic notation is a tangible method of demonstrating fractions in sound.

Acoustics

- Older students study acoustics as a part of physics. The physics of sound once again provides a mathematical proportional measurement of the frequency of vibration for varying tones or pitches. Each tone in this

overtone series has a fundamental tone with a natural mathematical ratio of vibrations.

- The emphasis or strength of certain frequencies results in the timbre or tone quality of the sound.
- Young children can recognize the difference between a musical tone and noise. Auditory discrimination can be developed through listening and describing the elements of tone.
- Children can begin to recognize the sound of different instruments.
- Older students can use MIDI (musical instrument digital interface) programs to compose with a computer.
- Advanced students can sample or digitize sound to analyze the frequencies that contribute to the timbre of tone.
- Through sound synthesize and digitizing, students can create, manipulate, and store sound digitally on the computer.

Statistics, Data Analysis, and Probability

- Students collect information about objects and events in their environment.
- Music is made up of patterns - rhythmic, melodic, and harmonic.
- Children can learn to categorize and record results of patterns in graphs, charts, and notation.
- In addition, the discussion of acoustics is an interesting study in data analysis.

Mathematical Reasoning

- Students make decisions about how to set up a problem.
- Music is another method of mathematical reasoning.
- Children use sound and notation as manipulatives in the process.
- Written notes are pictorial representations of sound. Making music - either through performance or composition - is a problem solving activity.
- Students who play an instrument learn by trial and error what works and what doesn't.
- Musical performers are constantly analyzing their performance to improve accuracy, as well as create the desired tone quality.
- Developing reasoning and problem skills are essential for a performer or composer.
- Understanding music of different cultures requires a level of reasoning as children listen discriminately to different instrument and vocal timbres.

Resources for Math

- Mozart Math - http://www.mozartmath.com/
- Selected Math Lessons from Mozart Math - http://www.mozartmath.com/lesson.cfm
- Musical Intelligence Neural Development - the MIND Institute - http://www.mindinst.org/index.php
- Math - Great Beginnings - http://math.about.com/blbeginnings.htm
- UK - Stages in Literacy and Numeracy - http://www.surreycc.gov.uk/sccwebsite/sccwspages.nsf/LookupWebPagesByTITLE_RTF/Stages+involved+in+developing+numeracy+skills?opendocument
- Helping Your Child Improve Literacy Skills - http://www.surreycc.gov.uk/sccwebsite/sccwspages.nsf/LookupWebPagesByTITLE_RTF/Helping+your+child+to+improve+their+numeracy+skills?opendocument
- Numeracy Activities - http://www.teachingideas.co.uk/maths/contents.htm
- Australia - Basic Skills - Literacy and Numeracy - http://nefs.dest.gov.au/literacy&numeracy.htm
- Improving Literacy and Numeracy with ICT - http://www.tsof.edu.au/courses/course_Detail.asp?BookConID=BC-5730
- Zero to Three - http://www.zerotothree.org/cpe/tip_2002_11.html - Encouraging Numeracy Skills in your Program
- Preschool Counting Songs - http://preschoolrainbow.org/counting-theme.htm
- Music and Math a la Mozart - http://www.studyworksonline.com/cda/content/explorations/0,,NAV2-95_SEP1237,00.shtml
- Math and Music - http://www.math.niu.edu/~rusin/papers/uses-math/music/
- Math Archives- Art and Music - http://archives.math.utk.edu/topics/artMusic.html
- Music and Math from Riverdeep - http://www.riverdeep.net/current/1999/10/100299.music_math.jhtml