

The Baker of Seville

An Opera about Opera!



Education Guide

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THE ATLANTA OPERA

Table of Contents

Welcome	3
Audience Etiquette	4
How Do You Put On An Opera?.....	5
The Elements of Opera	7
Uncovering the Plot	12
Error Patrol!	13
What's in the Goody Basket?	14
Critic's Corner.....	15
Opera Critic.....	16
Combining Art with Music	17
Director Says!	19
Opera Vocabulary.....	21
The Science of Music	23
History of The Atlanta Opera.....	27

Welcome!

THIS ATLANTA OPERA EDUCATION GUIDE WAS CREATED TO:

- Acquaint both you and your students with the opera *The Baker of Seville*;
- Familiarize students with the world of opera (vocabulary, history, etc.)
- Provide an innovative, multidisciplinary approach to teaching required skills and curriculum, including Georgia Performance Standards and QCC Objectives.

WHAT TO EXPECT

- We will be performing a half-hour operatic comedy in English for your students.
- There is an entertaining plot and the show is also an educational introduction to opera.
- Our show requires attentive silence from the audience, but it is also interactive.
- We will be singing with a pianist not an orchestra.
- The opera may take place in your school's gymnasium or cafeteria rather than an auditorium, so students may be seated on the floor.
- You and your students will be invited to ask questions at the end of the performance.

SYNOPSIS

After a brief introduction where the tenor and the baritone make a deal with the audience to do something special during their arias, Maria comes on the scene. She is very poor and needs to feed her children. Upon entering, she notices a baker's stand and agonizes over whether or not to steal a baguette. When she takes it, Enrico (the baker) challenges her to a duel. Maria begs for mercy. Enrico falls in love with Maria and says that if she will marry him, he will feed and care for her children. Maria is in love with Antonio (the tenor), but for the sake of her children agrees to marry Enrico. How will it all turn out?

Come and see *The Baker of Seville*!

The Baker of Seville uses familiar arias and ensembles from the standard operatic repertoire to expose students to the music and concepts of singing, voice types, conductor, etc. through dialogue, recitative and singing.

SOURCES

- Overture from Rossini's *Il Barbiere di Siviglia*
- "O mio babbino caro" from Puccini's *Gianni Schicchi*
- "Là ci darem la mano" from Mozart's *Don Giovanni*
- Tchaikowsky's *Romeo and Juliet*
- "Una furtiva lagrima" from Donizetti's *L'elisir d'amore*
- "Votre toast je peux vous le rendre" (Toreador Song) from Bizet's *Carmen*
- "Smanie implacabili" from Mozart's *Così fan tutte*
- Sextet from Act II of Donizetti's *Lucia di Lammermoor*
- Finale from Rossini's *Il Barbiere di Siviglia*

Audience Etiquette

Before your students see *The Baker of Seville*, prepare them for the unique and special experience of attending a live performance. A key to getting the most from an opera performance is “give and take.” The audience and performers have an interactive relationship. When the audience is at its best, the performers will put on the best show possible.

BASIC POINTS TO COVER IN CLASSROOM DISCUSSION

- When you are part of a live audience, there are some guidelines to follow. These rules set standards for considerate behavior so that everyone – you, your neighbor, the guy in the back row, the actors, the musicians – can get the most out of the performance. Can you think of some behaviors that would not be appropriate during a live show? Would it bother you if your neighbor did these things?
- The opera you will see today is going to be performed by three singers who are accompanied by a pianist. The mainstage productions The Atlanta Opera produces are performed on a stage with full sets, costumes, lights, and orchestra at the Cobb Energy Performing Arts Centre.
- Attending an opera is not like watching TV. The actors on the stage can see (and hear!) you. Be respectful of all the hard work that has gone into the performance. Don't stand up, talk to your neighbor, or otherwise call extra attention to yourself inappropriately. It's okay to laugh at the funny parts, but don't call out at the wrong time.
- It's okay to applaud and to laugh. In Italy, audience members say “Bravo!” to show that they are enjoying the performance.
- Pay attention! It is a story that you must follow to understand!
- Sometimes going to the opera is a dress-up event. Do you expect others to act differently when they are dressed up?

CLASSROOM ACTIVITY: **WHY DRESS UP?**

Using two sets of costumes, have one group of students dress in casual clothes (baseball caps, t-shirts, sneakers, etc) and another group dress in “opera-going” attire (coat and tie, fancy jewelry, etc. Overdo it! Have fun!) Arrange the students as if they were in the audience at an opera and have them act out the behavior that their costumes seem to indicate.

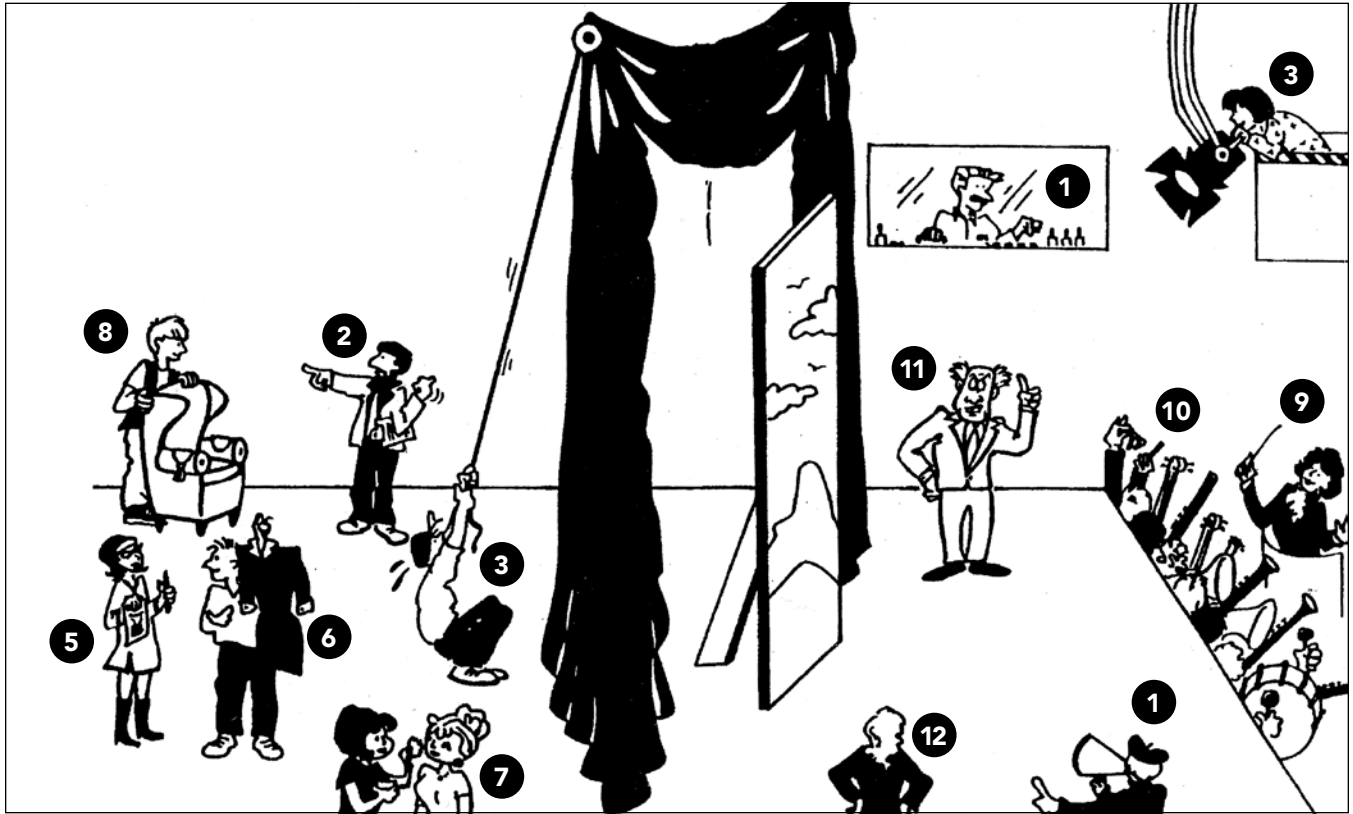
This could get a little rowdy but that is the idea! This activity is perfect for illustrating how “dressing up” calls for good manners and can demonstrate the good manners that are expected from an opera audience.

Title:	Audience Etiquette
Grade Levels:	K-5
QCC Standard:	Fine Arts, <i>Critical Analysis and Aesthetic Understanding</i> Describes and demonstrates the role and responsibility of the audience.

How Do You Put On An Opera?

DIRECTIONS

Many people work together to present an opera performance. Look at the illustration and definitions to see some of the different jobs on an opera set.



WHO'S BACKSTAGE?

Artistic Director: the head of the opera; makes all the final decisions

Stage Director: handles the acting portion; helps the singers become actors; shows actors how to move and gesture **1**

Music Director: instructs singers on singing and musical style; leads music rehearsals

Production Manager: coordinates between the artistic and business aspects of production; insures that everything happens on time **12**

Technical Director: coordinates the lighting, set, costumes, and the crews that handle those things **4**

Stage Manager: assists singers and technical staff during rehearsals and performances **2**

Set Designer: plans or designs the sets and scenery; supervises set construction

Lighting Designer: plans or designs the color, intensity, and frequency of the light onstage **3**

Costume Designer: plans or designs the costumes and supervises their construction

How Do You Put On An Opera? (cont.)

Wardrobe Mistress: assists with the costumes, how to take care of them, and how they are to be worn **6**

Dresser: helps performers dress in their costumes properly

Wigs and Makeup Designer: designs and oversees hairstyles, wigs, and makeup **7**

Properties Manager: designs and oversees all moveable objects that are not part of the set or costumes (props) **8**

Choreographer: invents dances and movements and teaches them to the dancers and/or cast members

Crew or Stagehands: assist in construction, installation, and changes of the set, costumes, lights, and props **13**

WHO'S ON STAGE? 11

Cast: all singers and actors who appear onstage

Actors: performers who have dialogue but do not sing

Principal: a singer who performs a large role in the opera

Comprimario: a singer who specializes in the small character roles of the opera, from the Italian meaning “next to the first”

Supernumeraries or Supers: actors who participate in the actions but do not sing or speak

Dancers: performers who dance or move to present movement

Chorus: a group of singers who mostly sing together, sometimes containing actors and dancers who do not sing, but who are part of the group as a whole

WHO'S IN THE PIT?

Conductor: interprets the composer's score and makes sure both the singer and the orchestra are together at all times **9**

Orchestra: the musicians who play the musical instruments **10**

Title: How Do You Put On An Opera?

Grade Levels: K-5

QCC Standard: Fine Arts

Connections:

- Identifies the correlation between dance and other subjects.

Artistic Skills and Knowledge: Creating, Performing, Producing:

- Demonstrates growth in knowledge of music vocabulary appropriate to the level.

- Describes career opportunities in the field of music.

Critical Analysis and Aesthetic Understanding:

- Describes and demonstrates the role and responsibilities of the audience.

The Elements of an Opera

An opera is a musical work in which the actors sing most of the dialogue. The art form was developed in Italy at the end of the 16th century and is based on folktales, popular literature, dramas and comedies. Opera has remained a popular art form for centuries because of its unique ability to tell a story by combining music, drama, and spectacle.

MUSIC

Music moves the action of a story, expresses emotions and moods, and deepens our understanding of the characters.

- *Orchestra*: In most cases, operas are accompanied by a group of musicians. Led by a conductor, an orchestra is an ensemble that is comprised of string, woodwind, brass and percussion instruments.
- *Score*: Musicians read from a score which is a notated piece of music showing each voice or instrumental part on its own staff.
- *Overture*: An overture is an orchestral piece that may be played at the very beginning of the opera before any action takes place on stage (not all operas have overtures).
- *Musical themes*: Musical themes are complete ideas that are crafted to be memorable to the listener. They are heard throughout operas and are associated with a particular character or characters, a situation, an idea, object or emotion.

Listed below are four types of musical forms composers use to help them describe how characters are feeling during the course of an opera.

- *Recitative*: Composed to sound like natural patterns of speech, a recitative is singing that has the rhythm of talking. It is used for conversation between characters or to move the plot of the story.
- *Aria*: A vocal solo expressing personal emotion or reflection.
- *Ensemble*: A piece that is sung by two or more characters at the same time (duet for two characters, trio for three characters, quartet for four characters, etc). Different melodies are sung simultaneously by each character involved in the ensemble.
- *Chorus*: Often providing background music for the above, a chorus is a group of people singing together in parts or in unison.

Each musical form is sung by singers in one of the six basic vocal categories which are listed below:

- *Soprano*: The highest female voice. In *The Baker of Seville*, a SOPRANO sings the role of Maria.
- *Tenor*: The highest male voice. In *The Baker of Seville*, a TENOR sings the role of Antonio.
- *Mezzo-Soprano*: The middle-range female voice.
- *Baritone*: The middle-range male voice. In *The Baker of Seville*, a BARITONE sings the role of Enrico.
- *Contralto*: The lowest female voice.
- *Bass*: The lowest male voice.

The Elements of an Opera (cont.)

DRAMA

Operas unfold a dramatic or comic story involving a protagonist, antagonist, and/or a hero/heroine. Actors that portray these roles must be very good at both singing and acting.

Certain character tendencies often exist for each vocal category. They include the following:

- *Soprano*: most often the heroine of the opera
- *Mezzo-Soprano*: mothers, older women, villains, servants, women playing men (called “trouser roles”)
- *Contralto*: old women, witches, comic roles
- *Tenor*: most often the hero of the opera
- *Baritone*: helpful companions, villains, sometimes heroes
- *Bass*: kings, villains, priests

Operas usually feature primary and secondary characters who figure in the dramatic flow of the story.

- *Principals*: The primary roles of an opera. These may be heroes/heroines, villains or other strong characters. Principal roles are sung by the more experienced artists who have already made a name for themselves in smaller roles.
- *Comprimarios*: The secondary roles of an opera. Comprimario roles are often confidantes, maids, servants, messengers, or medical personnel. They are usually sung by younger or lesser known artists.

Similar to a play, opera tells a story that is divided into acts and scenes. Each scene is further divided into numbers, each representing a different musical form (i.e. aria, recit., chorus number, or ensemble). In contrast to plays, the text is written with the intention of being accompanied by music.

- *Libretto*: The text of an opera.
- *Librettist*: The artist who arranges the text of a story to fit the accompanying music.

SPECTACLE

The spectacle of an opera encompasses sets, costumes, special effects, props and staging. These elements are combined to tell the story in a multi-dimensional manner.

- *Set*: The place where the action will occur on stage. Operas often have large, spectacular sets that reflect the time and place of the story being told.
- *Costumes*: The outfits worn by each actor to reflect the time and place of an opera as well as the personality of each character.
- *Props*: Items that may be carried onstage in an actor’s hands or that “dress” the set (such as furniture or decorative accessories).

The Elements of an Opera (cont.)

During the course of an opera, it is not uncommon to have a large number of people on stage. Many of these people will be chorus while the others will appear as supernumeraries or extras.

- *Super/Supernumerary*: A performer who appears in a non-singing role; a “super” might have a solo walk-on to deliver a message, or might be included as part of a large procession, for example.

The stage director impacts how the action is conveyed by assigning various blocking.

- *Blocking*: The patterns of movement of the people onstage as the opera progresses.
- *Stage Right/Stage left*: The division of the stage from the performer’s point of view; thus when a singer goes stage right, he moves to his/her right but to the audience’s left.
- *Upstage/Downstage*: The position on stage farthest or nearest the audience; because of the raked stage which was so prevalent in early opera houses, the farther “back” a singer went on the stage, the “higher” he seemed to become in stature, thus the distinction of being “up”-stage. Downstage, then, would be lower and closer to the audience.

BRAVO!

Audience members may shout this Italian word after an exciting aria, scene, act or performance. It is pronounced “brah-voh”. A female performer would be accorded a “brava” (the feminine form of bravo).

Title: The Elements of an Opera

Grade Levels: K-5

QCC Standard: Fine Arts

Connections:

- Understands and explains that other art forms may inspire musical compositions.

Artistic Skills and Knowledge: Creating, Performing, Producing:

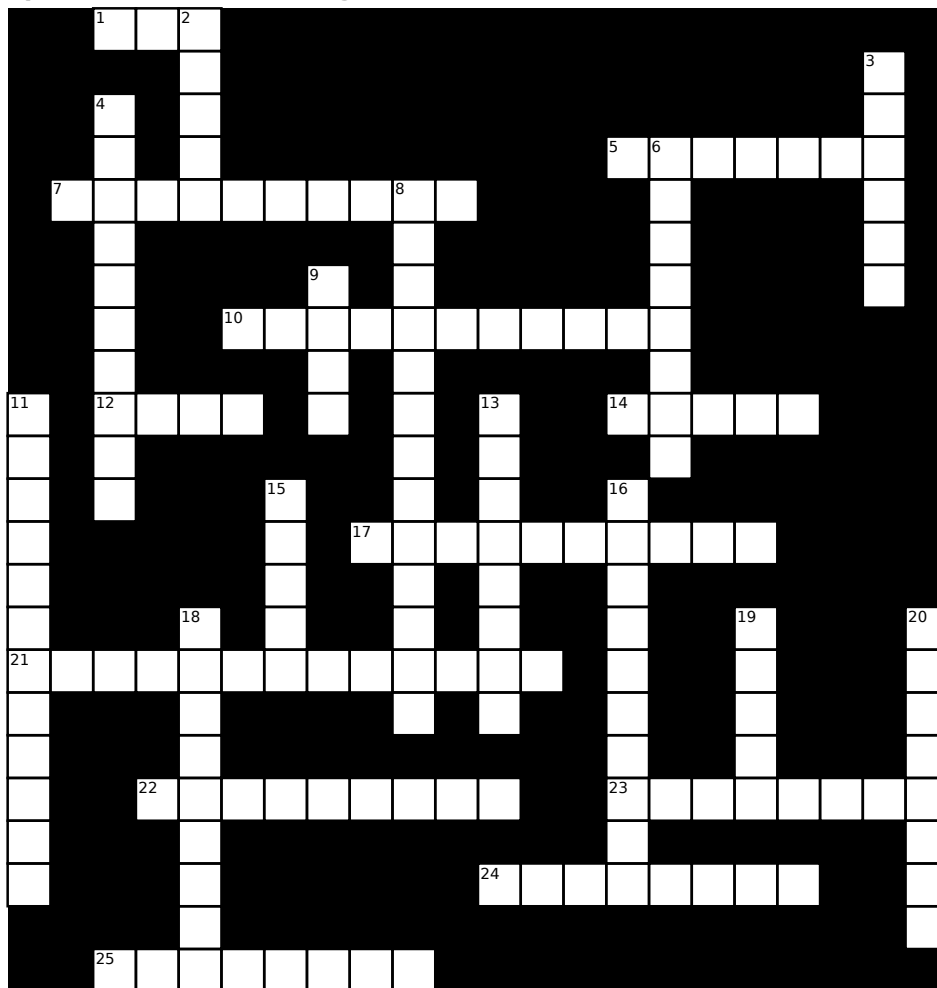
- Identifies various types of voices heard in choral performances.
- Demonstrates growth in knowledge of music vocabulary appropriate to the level.

Critical Analysis and Aesthetic Understanding:

- Recognizes relationship of text to music elements in repertoire
- Identifies the characteristics of performance styles of music being rehearsed and performed.

The Elements of Opera

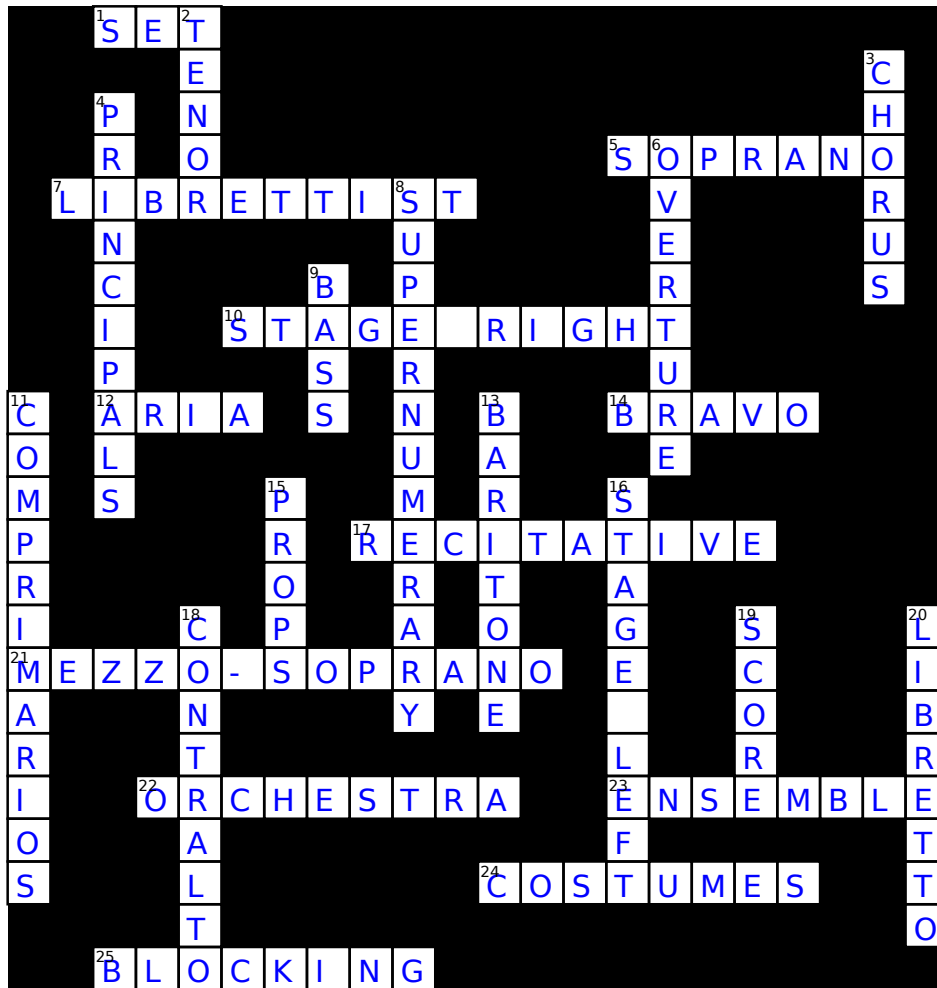
Test Your Opera Knowledge!



- | Across | Down |
|--|---|
| 1 The place where the action will occur on stage. | 2 The highest male voice. |
| 5 The highest female voice; most often the heroine of the opera. | 3 A group of people singing together in parts or in unison. |
| 7 The artist who arranges the text of a story to fit the | 4 The primary roles of an opera; may be heroes/heroines. |
| 10 The audience's left. | 6 An orchestral piece that may be played at the very beginning |
| 12 A vocal solo expressing personal emotion or reflection. | 8 A performer who appears in a non-singing role |
| 14 An Italian word that people may shout after an exciting aria, | 9 The lowest male voice; often kings, priests, or villains. |
| 17 A musical form that sounds like natural patterns of speech | 11 The secondary roles of an opera. |
| 21 The middle-range female voice; sometimes older women or | 13 The middle-range male voice; often helpful companions, |
| 22 A large group of musicians led by a conductor | 15 Items that may be carried onstage in an actor's hands or that |
| 23 A piece that is sung by two or more characters at the same | 16 The audience's right. |
| 24 The outfits worn by each actor to reflect the time and place | 18 The lowest female voice; often old women or witches. |
| 25 The patterns of movement of the people onstage as the opera | 19 A notated piece of music showing each voice or instrumental part |
| | 20 The text of an opera. |

The Elements of Opera

Test Your Opera Knowledge!



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 - 19 A notated piece of music showing each voice or instrumental part
 - 20 The text of an opera.

Uncovering the Plot

Every story has a plot. The events that happen in a story must go in a particular order to make sense.

DIRECTIONS

Draw a picture for each of the plot scenes described below. Then cut out each square and arrange them in the proper order to tell the plot of *The Baker of Seville*. You may wish to glue the squares onto another piece of paper to create your own comic strip.

<p>Enrico falls in love with Maria and asks her to marry him.</p>	<p>Maria steals bread from the baker's stand to feed her children.</p>
<p>Antonio and Maria realize something special about their family.</p>	<p>Enrico challenges Antonio to a duel.</p>

Title: Uncovering the Plot

Grade Levels: K-5

Perf. Standard: English Language Arts
Reading - Comprehension

- The student uses a variety of strategies to understand and gain meaning from grade-level text.

Social Studies

Economic Understandings

- The student will explain how money is used to purchase goods and services.
- The student will explain that people must make choices because they cannot have everything they want.

Error Patrol!

DIRECTIONS

Be on the lookout for errors! Each sentence in the passage below has an error in capitalization, punctuation, or grammar. Cross out each error. If a correction needs to be made, write the correct work of punctuation mark in the space above each line.

Opera and musical theater has much in common. Both types of performance combines music singing, and acting. Do you know the difference between opera and musical theater. Some people saying that the difference is that musicals contain spoken words, and there are some musical that are completely sung. What were the real difference between the two?

One major difference between opera and musical theater, is the use of microphones. Musical theater singers often use microphones to help project they voices, but opera singers do not. All the power and Volume in an opera singer's voice come from inside his or her body. It takes years of study. And breath control to learn how to do this. Proper breathing was important to an opera singer. In order to hold notes for a long time, the singer must learn how to control the speed of their breath.

You might think that you can't not be an opera singer if you were not born with the gift of a beautiful voice. The truth is, almost anyone can develop a strong voice, but it takes lots of practice and, professional training. Even someone born with a beautiful voice be needing training in order to succeed as an opera singer. Many singers are not willing to put in years of hard work, but those do stand out from the rest.

Title: Error Patrol!

Grade Levels: K-5

Perf Standard: English Language Arts
Conventions

- The student demonstrates understanding and control of the rules of the English language, realizing that usage involves the appropriate application of conventions and grammar in both written and spoken formats.

What's in the Goody Basket?

DIRECTIONS

Maria wants to feed her children bread and other goodies from the baker.

Write the number word that matches each picture.

one pie




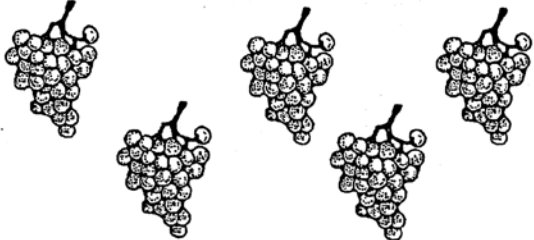


three apples

four bananas

six muffins

five grape bunches

two pears

	
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Title: What's in the Goody Basket?

Grade Levels: K-5

Perf. Standard: Mathematics

Number and Operations

- Students will count collections of up to 100 objects by dividing them into equal parts and represent the results using words, pictures, or diagrams.

Critic's Corner

Be an opera critic. Think about the opera and share your ideas with us on this page.

1. Circle the words that you think tell about the opera:

funny great cheerful hard to understand sad
helpful boring silly fun to watch too long

2. How did the opera make you feel? _____

Why? _____

3. Will you tell other students to go see this opera? _____

Why or why not? _____

4. What was your favorite thing about the opera? _____

5. If you could change one thing about the opera, what would it be? _____

Please share your ideas with us and email responses to elden@atlantaopera.org, or mail to
The Atlanta Opera, 1575 Northside Dr, Bldg. 300, Ste 350, Atlanta, GA 30318.

Title: Critic's Corner

Grade Levels: K-5

QCC Standard: Fine Arts

Critical Analysis and Aesthetic Understanding

• Describes personal response to listening selections.

Combining Visual Art with Music

SUMMARY OF ACTIVITY

Students will be able to demonstrate through drawing and movement the tempo, mood and style of a given piece of music.

Time: 30-45 minutes

Setting: classroom

Materials: white paper; newspaper; crayons; pencils; musical piece that has lots of variances (i.e. Dukas' The Sorcerer's Apprentice)

OBJECTIVE

Students will visually represent changes in musical moods, tempos and style.

PROCEDURES

- Have the students place the white piece of paper in the middle of a sheet of newspaper (to protect the desks).
- Students may either draw with their eyes open or closed, though closed eyes tend to yield more interesting drawings. Explain to the students that they are to respond to the changes in the music. For example, when the music is fast they may draw quickly, when it is slow, they may be more slow and deliberate, etc.
- Promote the use of the entire sheet of paper.
- Play the piece for a few minutes. After you turn off the music, have the students discuss with you why they drew certain ways.
- Replay the piece, this time having the students use crayons or color pencils to add color to their creations. Again, remind them to use the music as inspiration for their color choices. You will probably want to play the whole piece at this point, giving them several minutes to complete their works of art.
- Have the students title their works and place them on the walls.

DISCUSSION QUESTIONS

- What do certain colors signify?
- How are different emotions brought out in music?
- Do you think that colors mean different things to people from different cultures?
- Why do you think that composers use different tempos and styles?
- Does changing a tempo or style change the feelings in a piece of music?

Combining Visual Art with Music (cont.)

EVALUATION

Have the students repeat this exercise listening to a popular piece of music and a classical piece of music. Discuss the differences and similarities.

Title: Combining Visual Art with Music

Grade Levels: K-5

QCC Standard: Fine Arts

Critical Analysis and Aesthetic Understanding

- Describes personal response to listening selections.
- Understands and explains that other art forms may inspire musical compositions.
- Recognizes how artists use selected subject matter, including symbols and ideas, to communicate a message.

Artistic Skills and Knowledge: Creating, Performing, Producing

- Plans, organizes, and creates artworks using: form, color expressing emotion, linear perspective, proportion, contrast.
- Creates a separate work of art that expresses a feeling or emotion (Emotionalism/Expressionism).
- Responds to music in a variety of instrumental and vocal styles and origins through listening, moving, singing, and playing instruments.

Director Says

SUMMARY OF ACTIVITY

Students will learn staging areas, and staging vocabulary by playing a game of “Director Says”.

- Time:** 10 – 30 minutes
Setting: classroom
Materials: masking tape
Subject: Drama, Physical education

OBJECTIVE

- Students will gain body awareness and awareness of space and distance relationship.
- Students learn vocabulary of theatrical staging.
- Students practice both taking and giving clear directions.

PROCEDURES

- Use masking tape to mark out the stage grid (see next page) on the floor (a clean, hard surface is best.)
- Stage areas can be designated by initials i.e. UC for Up Center.
- Decide whether students will play individually or in pairs or teams.
- The teacher designates one of the students as the “Director”. The remaining students are the “performers”.
- The “Director” gives out the direction: Move upstage, Move stage-right, Move to Up Center, etc. (The “Director” may give out direction to the entire group at once or to individuals.)

OPTIONS

Non-competitive play:

All students play individually, without time limits or “outs”.

Competitive play:

- Students play individually or in pairs and are “out” if they move in any direction other than the one the “Director” gives.
- The “Director” gives out directions with increasing rapidity, and any performer/team who moves in the wrong direction or hesitates is “out.”

Title: Director Says

Grade Levels: K-5

QCC Standard: Fine Arts

Artistic Skills and Knowledge: Creating, Performing, Producing

- Expands and uses basic drama and artistic theatre vocabulary
- Uses appropriate stage movement in drama activities.

Critical Analysis and Aesthetic Understanding

- Demonstrates awareness of and uses school, community, and professional resources for theatre experiences.

Director Says (cont.)

STAGE GRID

Back of Stage

Upstage Right	Upstage Center	Upstage Left
Center Right	Center Stage	Center Left
Downstage Right	Downstage Center	Downstage Left

Audience

Opera Vocabulary

DIRECTIONS

Match the Word with its Proper Definition!

Orchestra	A: A part of the opera in which the singers talk to each other.
Conductor	B: A song in which a character usually share their inner thoughts or feelings, in English it translates to “air”.
Score	C: All the singers and actors who appear on stage.
Overture	D: The lowest male singing voice.
Cast	E: A group of singers who mostly sing together; sometimes this group contains actors and dancers who do not sing, but who are part of the group as a whole.
Actors	F: An ensemble that is comprised of string, woodwind, brass and percussion instruments.
Opera seria	G: A notated piece of music showing each vocal or instrumental part on its own staff.
Principals	H: The words or text of an opera.
Comprimarios	I: This Italian word is used by audience members to shout to the singers if they think they have done a good job.
Supernumerary	J: Performers who have dialogue or action on stage, but do not sing.
Chorus	K: An opera with a very serious story.
Soprano	L: A singer who portrays a primary character in an opera.
Tenor	M: The highest singing voice in women and children.
Mezzo-Soprano	N: The individual who determines the musical direction of the singers and orchestra during the performances by using specific patterns of movement with his or her hands and a baton.
Baritone	O: A male voice between the tenor and bass.
Contralto	P: An orchestral piece that may be played at the very beginning of the opera before any action takes place on stage
Bass	Q: The highest adult male voice.
Libretto	R: From the Italian, meaning “next to the first”, a singer who performs a small character role in an opera.
Recitative	S: A performer who appears in a non-singing/non- speaking role, like an “extra” in a movie.
Aria	T: Female voice between the soprano and contralto.
Bravo	U: A comic opera.
Opera Buffa	V: The lowest female voice part.

Opera Vocabulary (cont.)

ANSWER KEY

F	Orchestra	M	Soprano
N	Conductor	Q	Tenor
G	Score	T	Mezzo-Soprano
P	Overture	O	Baritone
C	Cast	V	Contralto
J	Actors	D	Bass
K	Opera seria	H	Libretto
L	Principals	A	Recitative
R	Comprimarios	B	Aria
S	Supernumerary	I	Bravo
E	Chorus	U	Opera buffa

Title: Opera Vocabulary

Grade Levels: K-5

QCC Standard: Fine Arts

Artistic Skills and Knowledge: Creating, Performing, Producing

- Demonstrates growth in knowledge of music vocabulary appropriate to the level.

The Science of Music

The basic element of opera is the music we hear being sung or performed on instruments. But just how do we hear that music in the first place? Science and math play an important part in this musical process, and the field that studies the science of sound is known as acoustics.

BASIC CONCEPTS

- Sound is a form of energy that travels in invisible waves. To get an idea of what these waves might look like if you could see them, have two people stretch out a Slinky toy by holding on to each end. Then have someone tap one end of the Slinky and observe the wave as it ripples through the coils. These are called compression waves because they are created by a series of zones of compressed air followed by zones of less pressure. When someone sings or plays an instrument, these sound waves travel from the source to your ear where your eardrum begins to vibrate and sends a signal to your brain, which then perceives the sound as music.
- Sound waves have a frequency, which is the number of compression pulses that go past a fixed point in a given amount of time. Frequency is usually measured in terms of cycles per second, or hertz (Hz). The faster these sound waves cause your eardrum to vibrate, the higher the sound, or pitch, is. A soprano's high notes come from faster vibrations than the low notes of the bass singer.
- Sound waves also have amplitude. This refers to the amount of air that gets moved with each pulse of pressure (i.e., the size of the waves.) In music, the amplitude of a sound wave is perceived in terms of loudness. Sound waves can be amplified (made louder) by sending them through a solid wooden object or, even better, a hollow box like the body of a guitar. This is because the sound waves (vibrations) get transferred to the wood and the air inside of the box, making them vibrate as well. When this happens, the wood and the air are said to resonate. For singers, the chest and the sinus cavities in the head also serve as resonating cavities, thus making their singing sound louder than their speaking voice.
- The pitch of stringed instruments (violin, viola, cello, bass, harp, piano, etc.) is determined by the thickness, tightness or length of the string. Shortening the string causes the frequency of the vibrations to increase as does tightening the string, thereby causing the pitch to rise. Lengthening, thickening or loosening the string has the opposite effect.
- The wind instruments (flute, clarinet, oboe, saxophone, trumpet, trombone, tuba, French horn, etc.) produce sound by vibrating the column of air inside the instrument. Pitch is regulated by changing the length of the column of air by opening and closing valves or by pushing or pulling a slide.

The Science of Music (cont.)

- The sound of the human voice is produced by a column of air rushing past the vocal cords in the throat. The vocal cords are muscles that look like two rubber bands stretched side by side. When you breathe out with enough force, air rushes over them, they vibrate and cause sound. By changing the shape and length of these muscles, in much the same way as a string's pitch is changed, the pitch can be altered.

SOME HANDS-ON EXPERIMENTS TO HELP YOU LEARN MORE ABOUT SOUND:

- Hook a rubber band over the corner of a desk or table and stretch it out. Pluck the rubber band and listen to the pitch that it produces. See how the pitch changes as you make the rubber band longer by stretching it farther. Try this experiment with a number of rubber bands. Listen to the sounds you get when you stretch rubber bands of a different thickness to the same length. These are ways to alter pitch.
- Hit a tuning fork against a hard object and hold it in the air. How loud is the sound? Now try holding the bottom of the tuning fork against a table after you have hit it. How does the sound change? How about if you hold it against a hollow box? These are ways to alter amplitude.
- Hold a ruler firmly on the edge of a desk so that most of it sticks out over the edge. Hit the free end of the ruler with your other hand and watch it move up and down, making a sound. This up and down movement is vibration. Now change the length of the ruler that is hanging out over the edge of the desk and repeat these steps. How does this change the sound? By changing the length of the ruler, you can alter pitch.
- Roll up a piece of paper to make a cone with one end more open than the other. Put the small end of the cone to your mouth and speak into it. Listen to the sound you make. Then put the cone down and speak again. How is your sound different? The cone has amplified your speaking voice like a megaphone.
- Get 8 identical glasses (use glass ones and not plastic ones) and put varying amounts of water in each one. Then tap the side of each glass with a metal object. Listen to the different pitches you get with the different water levels. If you want an extra challenge, try to arrange the glasses so that they play a musical scale (do-re-mi-fa-so-la-ti-do, like the song.) You may have to add or subtract water from some of the glasses to get just the right notes.
- To make your own set of wind chimes, get some metal pipe (copper, aluminum, brass, steel, etc.) Hardware stores have a nice assortment of piping used in construction and it is often inexpensive. Each metal will have its own particular sound or timbre, and you may choose to use only one metal type or to mix and match several different types. Using a pipe cutter or a hacksaw, cut various lengths of pipe to give you an assortment of notes. The shorter the

The Science of Music (cont.)

pipe, the higher the pitch will be. Add one or more clappers that will strike the pipes near the middle as they blow in the wind. Soft clappers will make a mellow sound, hard ones a more brittle sound. You can also make wind chimes out of pieces of hard woods like maple or oak. Making them shorter raises the pitch. Also, sanding them to make the wood thinner will lower the pitch.

- One of the simplest musical instruments to construct is the old-fashioned “Coca-Cola Flute.” All you need is water and a glass soft drink bottle with a small neck (it doesn’t have to be a Coca-Cola bottle, but we are, after all, in Atlanta!) Pour a small amount of water into the bottle and then blow across the opening to get the air inside the bottle to begin vibrating. Add more water and try the same procedure. Keep repeating this process, comparing the pitches of the sounds you get with various water levels.

AN INTERESTING RELATIONSHIP BETWEEN SCIENCE, MUSIC, AND MATH

In Western music, every pitch that we sing or play is assigned a “name” to differentiate it from the others. We use the letters of the alphabet from A through G to name the pitches in a scale, and then start back again at A and run through the same sequence over and over. Each time we begin the sequence over again, we give a new number to the letter. Hence, a series of two musical octaves might be named as follows:

A_1 B_1 C_1 D_1 E_1 F_1 G_1 A_2 B_2 C_2 D_2 E_2 F_2 G_2

The vibrating frequency (Hz) of each pitch is assigned and is the same all over the world. Thus, when you go to an opera and hear the orchestra tuning before the performance, the A_4 to which they tune has the same 440 cycles per second in Atlanta as it is in London (though some orchestras do choose to tune to a slightly different note for musical purposes which I won’t even try to explain!)

Now here is the interesting mathematical relationship. Every time you repeat a note in the next octave, the number of cycles per second is exactly doubled. Using this formula, calculate the frequencies of the pitches that are missing in the following table.

Note	Frequency (Hz)	Note	Frequency (Hz)
C_1	32.7	C_2	65.4
D_1	?	D_2	73.4
E_1	41.2	E_2	?
F_1	43.6	F_2	87.3
G_1	49.0	G_2	?
A_1	?	A_2	110.0
B_1	?	B_2	123.4

The Science of Music (cont.)

ANSWERS TO PREVIOUS PAGE:

$$D_1 = 36.7 \text{ Hz}$$

$$E_2 = 82.4 \text{ Hz}$$

$$G_2 = 98 \text{ Hz}$$

$$A_1 = 55 \text{ Hz}$$

$$B_1 = 61.7 \text{ Hz}$$

Title: The Science of Music

Grade Levels: K-5

Perf. Standard: **Science**

Habits of Mind

- Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.
- Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.
- Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities.
- Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.

Physical Science

- Students will investigate light and sound.

Fine Arts

Artistic Skills and Knowledge: Creating, Performing, Producing

- Creates sound compositions, sound stories, and sound collages using body percussion, environmental sounds, and classroom instruments.

History of The Atlanta Opera

Opera has been beloved in Atlanta since 1866! Though there hasn't always been a local opera company, audience members throughout Atlanta have been enjoying opera for over 137 years.

It began when the Ghioni and Sussini Grand Italian Opera Company presented three operas in Atlanta in October 1866. They were well received and soon after, small touring companies began to bring full-length operas to Atlanta. When there wasn't a touring opera company in town, people would throw parties where they could entertain, often with musical presentations. Even without the presence of an opera in town, audience appreciation for opera was growing.

In 1910, New York's Metropolitan Opera first brought its opera tour to Atlanta. By this time, Atlantans were in love with opera. Once a year, for a full week during spring, people flocked to the city to see the Metropolitan Opera's wonderful performances and enjoy the many parties that were hosted throughout the city in celebration of the operas' arrival. It was a magnificent time! The opera was the place to see and to be seen, with people crowding the lobbies and balconies. This continued for nearly seven decades, with the exception of 1931-1939, when the Metropolitan was unable to tour due to the Depression.

Soon, citizens of Atlanta began to yearn for their own opera company, to represent and support local talent, as well as to provide performances throughout the year, instead of only once in the spring. Several smaller, local opera companies began to crop up. With the arrival of local opera companies, and with troubles of its own, the Metropolitan Opera discontinued its nationwide tour, giving its last Atlanta performance in 1986.

In 1980, The Atlanta Civic Opera was born as a result of two smaller companies merging together, the Atlanta Lyric Opera and the Georgia Opera. Since then, the company has changed and grown tremendously.

The Atlanta Opera was the first resident company in the new Cobb Energy Performing Arts Centre upon completion of the facility in fall 2007. Patrons and performers alike are extremely happy with the new theater, acoustically designed for opera.

Besides our mainstage performances, The Atlanta Opera has many services to offer. There are balls and galas to attend, dinners, concerts, opera classes and talks. The Atlanta Opera Studio, founded in 1980, brings children's opera (complete with sets and costumes) opera workshops and master classes to schools throughout the state in an effort to teach students about opera.

The Atlanta Opera strives to present quality opera productions, while educating and fostering a sense of appreciation for the opera within the community. So long as there are those in Atlanta who love music and the art of opera, we can continue to perform and to grow!