

Cacophonous Conundrums

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for the STEM Education Center at WPI's STEM Educator Certificate Course

Subject: Science, Tech/Eng, Music **Grade Level:** 6 **Standards:** MA STE, Music & ELA (Common Core)

Overview

It's the year 2035 and you're beginning your first day of the new semester as an in-school symphony educator. As part of your duties as a full-time Springfield Symphony member, you are assigned to a local middle school to begin teaching and mentoring beginning musicians.



On your first day, you realize a major problem: Your students are playing consistently with no sense of intonation (being in-tune). You will get together with 2 of your fellow symphony teaching artists (classmates)

and develop 1 to 3 reproducible remedies for intonation. By the end of this project, you will be able to perform your first five notes in tune, perform as a trio a simple tune, and present the remedy you developed for superior intonation.

Standards

Note: Detailed learning targets and suggested vocabulary can be found [here](#)

6.MS-PS4-1. Use diagrams of a simple wave to explain that (a) a wave has a repeating pattern with a specific amplitude, frequency, and wavelength, and (b) the amplitude of a wave is related to the energy of the wave.

3.3-5-ETS1-2. Generate several possible solutions to a given design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem.*

Music 6th Grade: Performing-5. Develop and refine artistic techniques and work for presentation.

ELA Standard:

WCA-6-8.9 Draw evidence from informational texts (and scientific tools) to support analysis, interpretation, reflection, and research.

Assessment

[Performance Assessment Rubric](#)

Prior Knowledge

Students need to be aware of how to produce a stable tone on their primary instrument consistently. Students need to possess the ability to play their first 5 notes, concert Bb, C, D, Eb, and F. Students must possess the knowledge of transposition so that students can have conversations that reliably describe their experience.

Students also will build on 4th-grade physical science standard “develop a model of a simple mechanical wave (including sound) to communicate that waves (a) are regular patterns of motion along which energy travels and (b) can cause objects to move.

Materials

- Tablet
- Chromebook (for recording and presentation)
- Your instrument

Resources

- [TonalEnergy, Inc.](#)
- Additional classroom space for quiet environments for accurate readings

Timeline of Activities

Each lesson takes one, 30 minute class period.

[Student Instructions](#)

Duration	Activity	Instructions	Product
30 minutes Day 1	Introduction	Introduction of the problem: <ol style="list-style-type: none">1. Introductory slideshow2. Develop roles for individual members	Trios groupings are formed and group roles have been developed.
30 minutes Day 1	Initial EDP Development	In this phase, student groups are developing their sense of the issue they're confronted with. They will begin to understand that tuning is a dynamic process (as opposed to fixed) that requires a systemic method for mechanical behaviors that will support the effort of intonation.	Students are exploring the analyzer-tuner as a group and are making connections between the sensor's readings and environmental factors.

30 minutes Day 2	Trial set-up	In this phase, students are creating a way to record the experimental trials in order to measure the remedy's effectiveness. Students should conduct a minimum of 3 trials.	A table or record-keeping device for their trials. Developed and recorded a method for experimentation.
30 minutes Day 2	Intragroup share, compare, and contrast	In this phase students are reporting their findings within their groups and comparing and contrasting intonation outcomes in order to develop a beta-form remedy.	1 or 2 beta-form remedies.
5 minutes Day 3	Intergroup share, compare, and contrast.	Share each group's remedies with another group in the class. What things are similar across trial groups? What differences did you learn of? How does this new information help you refine your remedy?	A record of the comparison and contrasting done between groups; m determine how effective the other group's remedies seem to be.
20 minutes Day 3	Intragroup refinement	Intra Group discussion about if changes must be made to current remedy plans. If determined so, what changes are needed and why?	A record of changes to remedies based on intergroup discussions.
40 minutes Day 4	Test remedies	Determine which remedy best suits your needs and teach it to another class member. Record how well this goes and determine how many attempts it took for your subject to become "in-tune." Test this remedy together as a trio – apply the findings from your most successful trials to the performance of a simple tune which can be found in your Essential Elements manual (method book). Record each trial (minimum 3) of your performance-practice and then submit your best attempt.	A record of this remedy is applied on another student. Recording of a simple tune performed by the trio.
30 minutes Day 4	Results	Compile your findings and arrange the data to tell a story about how you developed a remedy for the intonation issue.	Raw data pulled together and sketched out into a presentation
30 minutes Day 5	Presentation/ Discussion	Pull together your group's presentation that details the efforts to find a remedy, results, and discussion of said results. This presentation should also include the recording of your group's performance.	Multimedia presentation

Culturally Responsive Teaching Strategies

Display a vast and various repertoire of folk melodies	The use of folk tunes that only make use of the first 5 notes (Bb, C, D, Eb, and F) allow many points of potential for familiarity. Using differing modalities also allows students to have different perspectives on the same dynamic relationship of intonation.
Integrate visual representations of data (benefits ELL students)	By using illustrations and photo-capturing to correlate changes in effectiveness to mechanical behaviors without needing too much formal English to understand the process

Technology

- Tablet
- [Tonal Energy Application](#)

Group Work

Students will form 2 trios composed of varied instrument groups and in-like instrument groups

Differing trios will provide students opportunities to be with groups of different people where they will practice listening and solving problems together.

Provides time with peers to process possible solutions and to share and communicate ideas with various members of the larger ensemble.

Students will have the opportunity to practice the tuning process several times with both expert and peer feedback

Career Connections

Students will have the opportunity to explore these videos of the manufacturing process of various commonly found instruments. What factors are instrument makers controlling for? What are the outcomes of these decisions?

Students will have the opportunity to meet with artisans from across the country who work on instruments and help to refine these tools for world-class stage and clandestine performances. Students will have the opportunity to speak to musicologists with a specialty in organology to explore the evolution of these artistic tools over human epochs, how they may change in the future, and what changes are happening now.

[Making Trumpets / Factory Tour - YouTube](#)

[Bach Trumpet Tour - YouTube](#)

- ▶ [STEAM: Meet A Saxophone Maker](#)
- ▶ [Selmer Saxophone Factory](#)
- ▶ [SELMER SAX FACTORY TOUR](#)