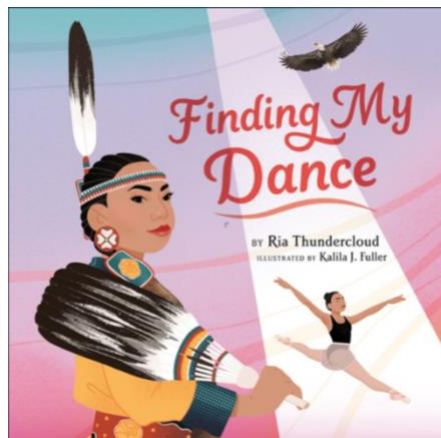


LESSON: Finding My Dance (Grades K-2)

+ OVERVIEW



In this design challenge, students will receive a problem inspired by the story *Finding My Dance* by Ria Thundercloud. In the story, Ria describes her journey of self-discovery through different forms of dance. The students will be presented with the following problem: “Ria got invited to perform a new dance at an upcoming festival. She is looking for musicians who can create unique instruments for her dance that play loudly enough for her to hear them from a stage 6 meters away. Today, you are going to put on your engineering hat to build some instruments for Ria’s dance performance.” Students will engage in a STEM challenge to build instruments in 25 minutes, create a rhythm to communicate choreography to Ria while she dances, and ensure the instruments can be heard on a stage 6

meters away.

+ 2021 Science TEKS covered in this design challenge

Kinder TEKS: K.2.B, K.1.E, K.1.G, K.2.D, K.6.A

Grade 1 TEKS: 1.1.B, 1.1.E, 1.1.G, 1.2.D, 1.6.A, 1.6.C

Grade 2 TEKS: 2.1.B, 2.1.E, 2.1.G, 2.2.D, 2.6.A, 2.6.C, 2.8.A, 2.8.C

+ Math TEKS covered in this design challenge

Kinder TEKS: K.2.A, K.2.C, K.5, K.6.E, K.7.A

Grade 1 TEKS: 1.3.D, 1.3.E, 1.5.A, 1.7.A

Grade 2 TEKS: 2.2.B, 2.4.A, 2.9.D

+ Music TEKS covered in this design challenge

Grade 1 TEKS: 1.2.A, 1.3.A, 1.4.A

Grade 2 TEKS: 2.2.B, 2.3.A, 2.3.C

+ The students will be able to:

- > Read *Finding My Dance*
- > Build a strong structure by understanding the physical properties of objects
- > Classify building materials by their physical properties
- > Classify objects by the materials from which they are made
- > Demonstrate that objects can be changed by cutting and folding
- > Combine materials to make a strong structure
- > Count forward and backward to at least 20 with and without objects
- > Use measuring tools to measure the length of objects
- > Demonstrate understanding of halves, fourths, and eights
- > Solve a problem using the engineering design process
- > Play classroom instruments in rhythmic patterns in groups
- > Move to a repertoire of music using locomotor and non-locomotor movement

+ Students will use the following STEM fluency skills:

- > Communication
- > Collaboration
- > Creativity
- > Critical Thinking
- > Resilience
- > Time/Resource Management
- > Innovation
- > Adaptability

+ Materials needed for this design challenge and their cost:

- > Construction Paper 1 counter per piece
- > Toilet Paper Rolls 1 counter per roll
- > Scotch Tape 5 counters per roll
- > Glue Sticks 4 counters per stick
- > Pony Beads 1 counter per 5 beads
- > Scissors 1 counter per pair
- > Markers 1 counter per marker
- > Plastic Eggs 2 counters per egg
- > Plastic Spoons 1 counter per spoon
- > Plastic Cup 3 counters per cup
- > Aluminum Foil Sheet 2 counters per sheet
- > Chenille Stick 1 counter per stick
- > Rubber Bands 1 counter per rubber band
- > Popsicle Sticks 1 counter per 2 sticks

Teacher's Note: For Kindergarten, we also recommend providing small building blocks at one counter per piece if available. Students will have some trouble using adhesives and scissors. As a result, extra care and monitoring will be needed to assist students. Higher-achieving students can be offered fewer sticks and straws per counter.

+ Facilitator materials needed:

- > *Finding My Dance* by Ria Thundercloud
- > Projector and computer
- > Slide deck for the lesson
- > Copies of the scorecard for each group
- > Copies of choreography instructions for each group
- > Timing device
- > Pair of rhythm sticks

+ FACILITATION GUIDE

SECTION	PROCEDURE
INTRODUCTION	Slide 1: Finding My Dance Slide 2: Read Aloud > Read <i>Finding My Dance</i> ▪ Summarize what happened on each page. ▪ Ask students if they like to dance or create music. Ask students whether they think different cultures use different instruments or have different dance styles. ▪ Explain to students that jobs specialize in designing and building equipment used in the music industry. The people who do these jobs are called engineers. They help design and build the things people see and use every day. Slide 3: Rhythm > Ask students: “How do you think musicians communicate with dancers without using words?” Allow students to share their ideas. ▪ Explain to students that before their team designs and builds a unique instrument for Ria, they need to understand how musicians communicate with dancers. ▪ Explain that musicians use different rhythms, tempos, and volumes to communicate with dancers. ▪ Say: “For today’s design challenge, we’re going to learn about how musicians use rhythm to communicate with dancers.” > Ask students: “What do you think rhythm is?” Allow students to share their thoughts. ▪ Explain that rhythm is the duration or length of sounds and silences that occur in music. ▪ Explain to students that a line of music has four steady beats that can be counted aloud: 1, 2, 3, 4. While some rhythm patterns look different, in a 4/4 meter there are four steady beats. • A whole note lasts for all 4 beats. • Two half notes last 2 beats each. • Four quarter notes last 1 beat each. • Eight eighth notes last half a beat each, so two eighth notes fit into one beat. • Rests represent moments of silence, during which there is a pause rather than a sound.

- Using rhythm sticks, play a simple rhythm pattern. Ask students to clap the pattern back. Repeat with a different pattern and ask if the patterns sound the same or different. Explain that changing the pattern changes the rhythm.
- Explain that engineers build instruments that produce different vibrations; the vibrations that are created produce a variety of sounds. Explain to students that they will be engineers today, designing unique instruments that create rhythms to help Ria know which dance moves to use.
 - *Teacher's Note: Only the facilitator should use the rhythm sticks. Students should respond by clapping or using body percussion, such as tapping their knees or shoulders. Keep rhythm patterns short (3–4 beats).*
- *It is recommended that facilitators use the beats found on slides 22 and 23, which students will be using for testing.*

Slide 3: Engineering Design 1

- > Ask students the question: What is engineering?
 - Explain to students that engineering is when engineers take what they know and apply it to solve problems by designing a product or process.
 - For example, phones could once only be used at home or in specific locations. Why is this a problem? (Needing to make a call outside the home). What solution did engineers design to fix that problem? (Cell phones).
 - *Teacher's Note: Any example can be used here, but focus on examples that students are familiar with.*

Slide 4: Engineering Design 2

- > Ask students the question: What are some examples of engineering jobs?
 - *Teacher's Note: If students have trouble giving examples, ask students who makes the things they use. Who makes refrigerators, cars, helmets, cell phones, and sneakers?*

Slides 5-7: STEM Careers

- > Show students pictures related to careers connected to the story.
- > Acoustic Engineering
 - Ask students what they see in the pictures.

- Explain to students that acoustic engineers study vibrations, noise, and sound quality. They assist with constructing theatres and music venues.
- Ask students where they think Ria performs. Ask students where they think engineers are involved in the creation of theatres or music venues. Explain that acoustic engineers work with other engineers called architects to build theatres with high sound quality.
- > Audio Engineering
 - Ask students what they see in the pictures.
 - Explain to students that engineers who install and operate audio equipment and software are audio engineers.
 - Ask students what music Ria listened to when she danced. Ask students who they think is involved with the production of music. Explain that there are engineers who create, install, and operate audio equipment when musicians are recording albums.
- > Software Engineering
 - Ask students what they see in the pictures.
 - The people who design the apps and video games used on devices like smartphones, tablets, laptops, and computers are called software engineers. They work to make devices more effective for users by designing new apps and writing code.
 - Explain that the programs that audio engineers use are coded by software engineers.
 - Explain that software engineers often create and follow detailed plans before building a program. In this design challenge, this role will create a plan for their instrument by deciding what materials to use, how it will make sound, and how it will communicate rhythm clearly enough for Ria to hear from 6 meters away.

Slide 9: Try the Trade:

- > Audiovisual Equipment Installers and Repairers
 - Ask students what they see in the pictures.
 - Explain that audiovisual equipment installers and repairers set up, test, and fix equipment such as speakers, microphones, projectors, cameras, and video screens. They help make sure people can clearly see and hear information during presentations, performances, and events.
 - Explain that audiovisual equipment installers and repairers help performers and audiences hear music and sounds clearly. In this design challenge, this role will test the

instruments the team creates to ensure the rhythms and sounds are audible from 6 meters away.

Slide 10: Engineering Design 3

- > Ask students the question: Who can be an engineer?
 - Anyone!

Slide 11: Engineering Design Process

- > Ask students if they think all engineers solve their problems in one try. Explain to students that it takes many tries to get something correct in engineering. In engineering, there is no such thing as a mistake, only opportunities to learn. It is okay to fail. Just find the mistake and correct it. In engineering, there is never one correct solution. There are always many solutions to a problem and always improvements that can be made. The steps that engineers take to find these solutions are called the *engineering design process*.
- > The teacher reads the first step to the students. (Identify)
 - What does identify mean? (To point out or find). Engineers design solutions. What do they need to know first before they can find the answer? (The problem)
 - How do people know when they have found the correct answer? In engineering, there are no correct answers, just better ones. Explain to students that there are expectations that engineers must meet, called *criteria*. For example, when engineering a football, what does a football need to do? (Bounce, look a certain way, have laces, have air inside, etc.). Those things are all called criteria. By comparing the design to the criteria, an engineer can determine if their solution will work. Is a child-sized football the same as an adult football? The criteria for both footballs include leather, white laces for the fingers, and shape. However, the two footballs would have different size criteria. The footballs are similar but differ in certain criteria.
 - Once the criteria are understood for the design challenge, what are some potential challenges that could make it difficult for an engineer to design their solution? (Money, time, materials, etc.) Explain to students that these rules are called *constraints* or rules that engineers must follow. Engineers are given constraints they must follow when solving a problem. Think about football again. What are college and professional footballs made from? (Leather). What if, instead, the rule (or constraint) was to not use leather? Could another type of football be made instead? Many

	of the footballs for sale are made of rubber because the engineer had different constraints. > The teacher reads the next step. (Imagine) ▪ Ask students what imagine, or imagination, means. Are these things real or tangible? They may not be real, but they help us imagine what things could be. In this step, see what materials are available, then brainstorm possible ideas/solutions to the problems. ▪ Explain to students that there are no right answers in engineering. Start with as many ideas as possible. > The teacher reads the next step. (Plan) ▪ The third big step of the engineering design process is to plan out the idea. Make sure that what is designed can be repeated. A plan will help an engineer identify where mistakes happen so they can be fixed. ▪ When planning, begin with the brainstorming phase. Each team member will contribute their ideas, and then the team will combine the different ideas! ▪ Once ideas are combined into a single group idea, determine what materials will be used for the solution and make sure the design meets the criteria and constraints of the project. > The teacher reads the next step. (Create) ▪ The fourth step is to create! Since this is the very first creation, it is called a <i>prototype</i>. A prototype is a first or preliminary model of something from which other forms are developed or copied. A prototype is created to test the engineer's idea or concept. Engineers ask themselves, "Did the idea work the way we wanted it to?" After testing the idea, the engineer will make improvements to the prototype. > The teacher reads the last step. (Improve) ▪ Finally, the last step is to improve. How does an engineer know if the prototype did well on the test? It must meet certain expectations and follow some rules. But how do engineers determine how well it met expectations and followed the rules? In school, how do you know if you mastered something? (Grades). The prototypes made today will be scored using a scorecard or rubric. By looking at the score, each team will determine if the design could be better. If improvements are needed, the team will revisit the plan and decide how to improve the score. Remember, there are no correct answers in engineering, just better solutions.
--	--

IDENTIFY

Slides 12-13: Identify – Problem

- > The teacher will read the bolded scenario to students.
 - Ask students what problem Ria is having right now.
- > Explain to students that they will put on their engineering hats today to help build instruments that are loud enough for Ria to hear on a stage and create a rhythm that will tell her how to dance (choreography).

Slide 14: Identify – Criteria: (Desired Outcomes)

- > Explain to students that criteria are what engineers use to determine if they have successfully solved the engineering problem.
- > A successful instrument design should include the following:
 - A height of 20 centimeters tall or wide
 - *Teacher's Note: Students in K-2 should not be expected to measure their instrument using standard measurements. The teacher will need to measure and mark a spot 20 centimeters away from where students are working. If there is no place to mark a height, a teacher could use 20-centimeter-long strings or a 20-centimeter dowel to measure alongside their instrument. Differentiate for higher-achieving students by setting the criteria to 30 centimeters.*
 - At least 5 different materials
 - Be played without falling apart for 30 seconds during the test
 - *Teacher Note: The teacher will be in charge of timing the 30 seconds.*
 - Be heard from 6 meters away when played
 - Create a rhythm that communicates choreography to Ria during the dance
 - *Teacher's note: Have students use the choreography guide to design the dance. The dance must consist of 2 or more moves. The teacher may want to help the class with this portion so that each group understands the beat and rhythm. It's recommended that each group write down its rhythm so that it can follow along when playing its instruments. The beat for each move should be played twice so the dancer can process what is being asked of them.*

Bonus points will be awarded for using multiple materials in the design.

Slides 15-16: Identify – Constraints (Rules)

- > Explain that constraints are the rules that engineers must follow.
- > Explain the following constraints for this engineering design activity:
 - Time Limit: Students will have 25 minutes to build the instruments.
 - *Teacher's Note: The teacher will time the design challenge and periodically give the students time checks to assist the teams with time management.*
 - Materials: Students will use no more than 20 items to build their instrument.
 - Counters: Students will have 20 counters to complete this challenge.
 - *Teacher's Note: 20 counters will be given to each group. Pre-bag the counters for easy distribution to each group. When students go to the supply table, they will hand the teacher one counter for each item they buy. They can buy up to 20 items to build their prototype.*
 - Collaboration: One design element from each team member must be used in the final design. Explain to students that a design element is taking one part of someone's idea and adding it to the team's design.
 - Redesign: Each team can test their prototype as many times as needed during the 25-minute design phase. Remind students what a prototype is. It is the first creation of their design.
 - *Teacher's Note: When a team is ready to test their design, they should raise their hand, and the teacher should assist the team with their score. If the team receives a low score on any part of the design, the team should redesign if they still have time.*

IMAGINE

Slide 17: Imagine – Explore Materials

- > Introduce materials to students by showing each item as you go through the materials list. Explain to students that when engineers describe items, they talk about properties like color, size, and flexibility. Ask students to identify the properties of each material. After each material, ask students if it is similar to any of the other materials we have shown and what the similarities and differences are.
 - Ask students to reclassify their objects based on what they are made of or how they can be used.

- > After students have practiced classifying the materials, they will be allowed to combine the materials however they wish to build an instrument that meets the criteria for Ria.

Slide 18: Imagine – Brainstorm Ideas

- > Give students one minute to individually design and draw a plan of what they think the instrument should look like. Emphasize that students should not talk during this minute or share ideas with each other. Remind students that their ideas will be used as design elements for the final design.
- > After a minute, give students five minutes to present and share their ideas with their group. Let students know that, when sharing, they should focus on the key aspects of their idea they like and want to use as design elements in the final design.
 - *Teacher's Note: If students struggle with an idea for their design, provide ideas without giving the solution. For example, "This is a design that I tried earlier but failed. What could I do to improve it?" Emphasize that the design failed to reinforce that it is okay to fail and to let students know they cannot copy the design and expect success.*

PLAN

Slide 19: Plan – Gather Materials

- > Hand out the scorecard that will be used during the design challenge. Review the testing criteria with the class and answer questions. The testing criteria will inform their design decisions.
- > Have students collaborate to come up with a final design. Let students know they must include at least one element from each team member for their final design.
- > Review the design criteria:
 - A successful instrument design should include the following:
 - A height of 20 centimeters tall or wide
 - At least 5 different materials
 - Be played without falling apart for 30 seconds during the test
 - Be heard from 6 meters away when played
 - Create a rhythm that communicates choreography to Ria during the dance
 - Bonus points will be awarded for using multiple materials in the design.
 - *Teacher's Note: Students will not be expected to rank themselves or calculate their scores, but the teacher should explain how they will earn points. The testing criteria will inform their design decisions.*

	> They will need to select the materials to be used for the design. Students will have 20 counters to purchase materials for their build at the classroom supply table. The prices used in this challenge can be found in the materials list. Students will raise their hands when they are ready to purchase materials and will be guided by the teacher. Students can go over the counter limit if they want, but remind them that they will lose points on their score card. Slide 20: Plan – Team Member Responsibilities (Career Role-Playing) > Assign each student a career role within their team. As students complete the challenge, they should make decisions and contribute from the perspective of their assigned career. This activity models how STEM and skilled trade professionals collaborate in the real world to design, build, test, and improve their prototype. ▪ <u>Acoustic Engineer</u>: Builds the instrument with assistance from the group ▪ <u>Audio Engineer</u>: Tests that materials are working as planned and keeps track of the building materials and budget ▪ <u>Audiovisual Equipment Installer</u>: Tests the instrument's ability to communicate sound over 6 meters and works with the team to make improvements, if needed ▪ <u>Software Engineer</u>: Draws the team's plan for the instrument and ensures it follows the plan
CREATE	Slide 21: Create – Design Your Instrument > Let students know to have fun, be creative with their designs, and work together. > Remind students that being an engineer is not about getting the solution on the first try. There is no right answer, just better solutions. Slide 22-23: Choreography Table – Design Your Dance > Have students use the choreography tables to design their own dance moves. ▪ <i>Teacher's Note: Support students in recognizing that, although the note values vary, each rhythm pattern occupies the same duration of four beats. Counting aloud (1, 2, 3, 4) while performing the choreography helps students with testing</i> Slide 24: Identify – Criteria > Display the reminder slide for students to look at while working.

	Slides 25-26: Create – Test > The teacher will bring the timer to each team when they are ready to test. The teacher will go through each category on the scorecard with the students while conducting testing. > The teacher will then recap the point total with the students and how many points the team received for each category.
IMPROVE	Slide 27: Improve – Redesign/Discussion > Students will reflect on their scores and discuss: ▪ What worked? • <i>Teacher's Note: Focus on the materials being used and ask what properties of those materials might have helped. Check whether any students combined materials to strengthen their instruments or improve their sound. Check whether any students cut or folded the materials to strengthen their instrument.</i> ▪ What did not work? • <i>Teacher's Note: Focus on the materials being used and ask what properties of those materials made the instrument not work well. Check whether any students cut or folded their materials and whether this weakened the instrument.</i> ▪ What do you want to improve? • <i>Teacher's Note: Focus on engineering aspects with students. Ask students if they found a solution or just part of one. Reinforce that it is okay not to succeed on the first try and that engineering is about making improvements over time. Ask students if they would design their instrument differently if they had no rules. Ask students if working together was difficult. Learning to work together is very important, and it is easier to find a solution with many ideas rather than just one idea.</i>

Choreography Table		
Beat Description	Beat Image	Dance Move
One whole note		The dancer spins 1 time
Two half notes		The dancer spins 2 times
Four quarter notes		The dancer takes 2 steps forward
Eight eighth notes		The dancer takes 4 steps backward
One half note and two beats of rest		The dancer takes 2 steps to the right
Two quarter notes, two beats of rest		The dancer takes 2 steps to the left

Mesa de Coreografía		
Descripción del Ritmo	Imagen del Ritmo	Movimiento de Baile
Una redonda		La bailarina gira 1 vez
Dos blancas		La bailarina gira 2 veces
Cuatro negras		La bailarina da 2 pasos hacia adelante
Ocho corcheas		La bailarina da 4 pasos hacia atrás
Una blanca y dos silencios de negra		La bailarina da 2 pasos a la derecha
Dos negras y dos, silencios de negra		La bailarina da 2 pasos a la izquierda