Culturally Responsive Math Guide

WELCOME

Welcome to the Almost Fun Culturally Responsive Math Guide! Connecting young minds to culturally responsive learning materials is central to Almost Fun's mission, and we are delighted that you are joining us on this journey.

PURPOSE OF THIS GUIDE

When it comes to culturally responsive teaching, it seems like there are few resources that provide concrete examples of what it looks like and how to sustainably implement it in a math classroom. This guide is purposed to address this need.

Our goal is to equip you with guidance and content that can be used to build an engaging and meaningful math curriculum that centers on and values your students' diverse backgrounds and experiences. While we understand that effective teaching goes beyond having a good lesson plan, we believe that a well-designed curriculum better positions you to flex your teacher moves and cultivate a culturally responsive learning environment.

In the next sections, we'll walk you through important principles and methods regarding culturally responsive teaching, highlight a tool you can use to evaluate your existing teaching materials, and share specific lesson and project ideas you can incorporate into your curriculum to boost its cultural responsiveness.

CULTURALLY RESPONSIVE TEACHING 101

Let's start by defining culturally responsive teaching. If you're already familiar with its definition and components, feel free to skip ahead to the next section!

Coined by Geneva Gay and built off the work of Gloria Ladson-Billings, culturally responsive teaching is a pedagogical approach that focuses on affirming and leveraging students' individuality to make meaningful connections to their cultures and experiences and improve the learning capacity of students who have been marginalized educationally.

Five key characteristics of a culturally responsive curriculum are:

REPRESENTATION

Your curriculum contributes towards creating a space in which students are exposed to a diversity of cultures and identities and feel seen in their differences.

Representation is more than just a token gesture in which white male characters are swapped out for BIPOC or female characters. Your curriculum actively pushes back against negative narratives about people of color and other marginalized groups.

POWER & PARTICIPATION

Students don't feel like they have to choose between their cultures and the perceived culture of power in order to participate in your classroom. Your curriculum provides ample opportunities for you to get to know your students, for your students to get to know you, and for your students to get to know each other.

Your curriculum communicates to your students that the authority of math knowledge does not solely reside in you. Your lessons are student-centered and actively provide opportunities for students to seek each other as thought partners.

Students have a stake in choosing how they learn and how they demonstrate their understanding. This cultivates a higher investment of interest and motivation.

RELEVANCE

In order to make learning relevant, you need to have a good sense of who your students are. Parents and families often get a bad rap in the education sector, but they carry immense "**funds of knowledge**" and can be one of the greatest resources to understanding your students and the world they experience.

Your curriculum should use your students' cultural experiences as a foundation upon which to develop knowledge and skills. Content learned in this way is more significant to the students and facilitates the transfer of what is learned in school to real-life situations.

COGNITIVE DEMAND

Culturally responsive teaching is not about watering down the curriculum and making it "easier." Setting high expectations communicates to your students that they can master challenging material and meet learning goals through effective effort.

A culture of high expectations demands high levels of support and trust. You have to take on the role of a warm demander who "expects a great deal of your students, convinces them of their own brilliance, and helps them to reach their potential in a disciplined and structured environment."[1]

ACADEMIC SUPPORT FOR ENGLISH LANGUAGE LEARNERS

Your curriculum should consistently employ strategies that work to remove language barriers that limit English language learners from grasping meaning and actively participating in learning activities and discussions.

[1] https://thenewpress.com/books/multiplication-for-white-people

Culturally Responsive Math Teaching Mindset

We're just going to keep it real because this probably isn't a surprise to you: culturally responsive teaching is no easy task, and when you take on the added challenge of incorporating it into math instruction, things get even more difficult.

So while there needs to be a sense of urgency, it's important to **be kind to yourself** as you craft and refine your teaching practice. It's also important to look at this as an **upfront investment** that will not only benefit your students, but also benefit you. When you invest time into designing a curriculum that relates to and captures your students' interests, you minimize the occurrence of "misbehavior" in your classroom, which is really just behavior in response to a negative experience.

Another important element to consider is how you define math for yourself and your students. The notion that math is a universal, objective language can be misleading. Technically speaking, **math is objective; however, the context in which we apply it can be subjective and obscuring**.

Rather than thinking about math as a language, think about it as an **alphabet** - an aggregate of letters, numbers, and symbols that can be strung together to derive new meaning and used to defend, persuade, challenge, and even manipulate accepted truths.

It's often said that "beauty is in the eye of the beholder." Similarly, math is in the **mind of the beholder**. Students mastering their ABC's in math means students developing a toolkit that empowers them to better understand their world and challenge the status quo.

Culturally Responsive Lesson Plans

Reshaping your curriculum is no easy task, so our team has developed a working library of culturally responsive lesson templates to help get you started.

Given that each classroom operates under different constraints, feel free to modify these lesson templates as needed. Rather than make assumptions about what your students are interested in, these lessons are structured to help you **learn** about your students and incorporate their varied interests into your curriculum.

These lesson templates align with Common Core Math Standards for 6-8th grade and follow the 5E Instructional Model. Our hope is that integrating these lesson ideas into your curriculum will create opportunities for you to engage in culturally-responsive teaching.

LESSONS

CCSS.MATH.CONTENT.6.NS.B.4

CCSS.MATH.CONTENT.7.NS.A.1

ADDING AND SUBTRACTING FRACTIONS

ENGAGE (WARM-UP)

Two days before this lesson, ask students to bring in a recipe for their favorite food. It can be a home recipe that they get from their family or one they find on the internet, but one of the ingredients must be a fraction quantity.

The day before this lesson, pick a recipe that you want to focus on and prepare for the Explore section.

The day of the lesson in class, ask 2-3 students to share the story behind the recipe they brought in.

EXPLORE

Using the recipe you picked, give students tools that can be added or subtracted to get to the recipe amounts using 1) addition and 2) subtraction. Possible examples:

- Recipe calls for ½ cup of flour. Tell students they have 1 cup and ¼ cup measurement tools to get to ½ cup.
- Recipe calls for ⅜ cup sugar. Tell students they have ½ cup, ¼ cup, and ⅛ cup.
- Recipe calls for 1 ⅜ cup chocolate. Tell students they have 2 cup, ½ cup, ¼ cup, and ⅛ cup.

EXPLAIN

Use the addition & subtraction equations from explore to answer the essential questions below. Be explicit about needing the same denominator to add or subtract.

- How do we add and subtract fractions?
- How do we find the least common multiple?

ELABORATE

Pick out a couple recipes that have shared ingredients and ask students to calculate:

- How much of each shared ingredient do they need to buy in order to make all the recipes?
- Provide students with a list of ingredients + quantities available to buy, and ask them to figure out 1) how many of each shared ingredient do they need to buy based on the amount they need and 2) how much do we have left of each shared ingredient after making each recipe?

ADDING AND SUBTRACTING FRACTIONS (continued)

EVALUATE

Discussion questions from this lesson:

- Why can't we add or subtract two fractions with different denominators?
- What's another reason we might want two fractions to have the same denominator?

BE MINDFUL OF

This lesson requires some prep work - make sure you choose recipes and plan for the equations you want to use.

INDEPENDENT PRACTICE

The following lessons from our site can be used for independent practice for students:

- Add & Subtract Fractions (www.almostfun.org/lessons/add-subtract-fractions)
- Basic Fractions (www.almostfun.org/lessons/basic-fractions)
- Equal Fractions (www.almostfun.org/lessons/equal-fractions)
- Mixed Fractions (www.almostfun.org/lessons/mixed-fractions)
- Fractions to Decimals (www.almostfun.org/lessons/fractions-to-decimals)

CCSS.MATH.CONTENT.6.NS.A.1

CCSS.MATH.CONTENT.7.NS.A.2

DIVIDING AND MULTIPLYING FRACTIONS

ENGAGE (WARM-UP)

Ask your students how many of them feel like they have enough space in the classroom.

Share that it's recommended that each student has 75-100 square feet of space. In some higher-income areas, students have as much as 200 square feet of space each and in many lower-income, urban areas, students have as little as 10-15 square feet of space each.

Ask students to guess how much space they have, and then to measure the exact length and width of the classroom, and count the total number of students in the class.

EXPLORE

Tell the students that about ⅔ of the classroom space is reserved for their seating. Ask them to calculate the amount of space each student has based on the total size of the room, the space they get, and the number of students in the class.

Ask the students to use the number they get to then calculate the space each student would get if the class were half as big.

EXPLAIN

Use the explore exercises, answer these essential questions. Make sure that for the last explore activity, students are dividing the fractional value they get for space by ½.

- What does it mean to divide a fraction by another fraction?
- How do we divide a fraction by another fraction?
- How do we multiply and divide fractions?

ELABORATE

Ask students to come up with a story for dividing one fraction by another and multiplying one fraction by another.

For example, ½ multiplied by ⅓ could be represented by half the snacks in your house going to you and two friends, so each friend gets ½ x ⅓ of the snacks.

Dividing ½ by ⅓ could represent a pizza party you plan where each person should get ½ a slice. But, only ⅓ the number of people you thought would show up actually did - so then each person gets ½ ÷ ⅓ = slices of pizza.

EVALUATE

Discussion questions from this lesson:

- Explain in your own words why dividing by a fraction is the same as multiplying by the inverse of that fraction.

BE MINDFUL OF

Make sure the units you pick for measuring the classroom result in fractional values for length and width.

INDEPENDENT PRACTICE

The following lessons from our site can be used for independent practice for students:

- Multiply & Divide Fractions (www.almostfun.org/lessons/multiply-divide-fractions)
- Basic Fractions (www.almostfun.org/lessons/basic-fractions)
- Equal Fractions (www.almostfun.org/lessons/equal-fractions)
- Mixed Fractions (www.almostfun.org/lessons/mixed-fractions)
- Fractions to Decimals (www.almostfun.org/lessons/fractions-to-decimals)

CCSS.MATH.CONTENT.6.NS.C.5

CCSS.MATH.CONTENT.6.NS.C.6

CCSS.MATH.CONTENT.6.NS.C.7

CCSS.MATH.CONTENT.7.NS.A.1

NEGATIVE NUMBERS AND ABSOLUTE VALUE

ENGAGE (WARM-UP)

Ask students to raise their hands if they play video games. Then, ask students to keep their hands raised if they've played a video game that has healers. Ask one of the students to explain:

- What happens to a character's health when they are attacked?
- What happens to a character's health when they are healed?

EXPLORE

Draw a number line and ask students to come up with 3 other situations where quantities might be described as negative vs. positive and place two sticky notes for each situation on the number line.

If you're teaching remotely, try using Jamboard (www.jamboard.google.com).

Help students understand how absolute value might be used for comparisons in those situations. For example, in video games, explain that positive and negative numbers can be used to describe change in health due to another character's actions. The more negative the effect is, the less health the character has left. The more positive the effect is, the more health the character has. Absolute value can be used to explain overall power or change and compare how powerful a healer is to how powerful an attacker is.

EXPLAIN

Using the Explore exercises, answer these essential questions:

- How are positive and negative numbers used to describe quantities?
- Where are negative numbers and fractions represented on a number line?
- How do we compare two negative numbers and the absolute values of numbers?
- What does absolute value mean?

ELABORATE

Draw a number line on the board, divide students up into groups, and place a sticker at 0 for each group.

Cycle through the groups and give each group a comparison (i.e. which is bigger: -3 or -7 ; |-3| or |-7|). If the group gets it right, move their marker to the right 1 spot. If they get it wrong, move their marker to the left 1 spot.

EVALUATE

Discussion questions from this lesson:

- Every time you answered a question, how much did your score change by? Which concept does this represent?
- How would we order the teams by their final placement on the line from biggest to smallest?

BE MINDFUL OF

Students feeling discouraged from lower positions on the number line. Encourage them to discuss and understand their errors.

If a group is struggling, consider upping the change in score of later questions to be more.

INDEPENDENT PRACTICE

The following lessons from our site can be used for independent practice for students:

- Negative Numbers (www.almostfun.org/lessons/negative-numbers)
- Greater Than & Less Than (www.almostfun.org/lessons/greater-less-than)
- Absolute Value (www.almostfun.org/lessons/absolute-value)

CCSS.MATH.CONTENT.8.NS.A.1

CCSS.MATH.CONTENT.8.NS.A.2

RATIONAL AND IRRATIONAL NUMBERS

ENGAGE (WARM-UP)

Play this clip (www.youtube.com/watch?v=0u5N1ClUCK8&t=317s - starting at 5:17) from a British vs American words/accents video - 1 or 2 minutes is enough.

Then, generate a list of 3-5 words that are commonly pronounced differently from person to person (caramel, almond, salmon, pecan, mischievous, GIF, etc.) For each word, do a rapid fire across the room where each student quickly says the word.

The purpose of this activity is to get students thinking about how the same word can be pronounced differently across and within cultures. This is similar to how some numbers can have multiple representations.

EXPLORE

Provide students with an unsorted list of rational and irrational numbers and task them with rewriting the numbers as a fraction of two integers:

$$0.75, \sqrt{4}, -3, 3.14159265359(\pi), \sqrt{2}, \sqrt{\frac{4}{9}}, 1.25, \sqrt{10}, -\sqrt{16}$$

Let students know there are three numbers in the set that can't be rewritten as a fraction of two integers.

EXPLAIN

Cover these essential questions:

- What is the difference between an irrational and rational number?
  - Connection: Rational numbers can be rewritten as a fraction of integers. Similar to how the same word can be pronounced differently, a rational number can be presented differently without losing the accuracy of its values.
  - Irrational numbers can't be represented as fractions of two integers. So three numbers that students couldn't transform into integer fractions are examples of irrational numbers.
- How do we write the decimal version of a repeating rational number?
  - Connection: Just like how the Latin phrase "et cetera" is used at the end of a list to indicate that further, similar items are included. We use bars to indicate which numbers repeat infinitely in the decimal version of a repeating rational number.

    Example: ⅓ = 0.333333... = $0.\overline{3}$, 4/11 = 0.36363636... = $0.\overline{36}$

RATIONAL AND IRRATIONAL NUMBERS (continued)

- How do we estimate irrational numbers and compare values?
  - Connection: When it comes to translating words between languages, you may run into a situation where a word or phrase doesn't directly translate into another language. For example, the Spanish phrase "te quiero" doesn't have an exact English translation. It's more meaningful than an "I like you" but less meaningful than an "I love you."

    Rough translation: I really care for you but don't quite love you.

    Even though there isn't an exact translation, we're still able to piece together English words to get close to the original meaning of the Spanish phrase.

  - The same can be done when estimating the value of irrational numbers using perfect squares in order to make comparisons. Ex: $\sqrt{10}$ is much closer to $\sqrt{9}$ than it is to $\sqrt{16}$, so we can estimate that $\sqrt{10}$ is equal to a number within the range 3.1-3.3.

ELABORATE

Construct a large number line on the board (-10 to +10). Place students into groups and provide them with 3 sticky notes that each have a rational or irrational number on them. Have each group identify each number in their set as rational or irrational. Then have students place their sticky note where they believe is most appropriate on the

- Consider using smaller sticky notes for this activity to allow enough space for students to place their numbers on the line.
- Consider using colored stickers to allow students to label the rational and irrational numbers using some color code.
- If using a large number line is not possible, consider providing each group with their own number line and then pairing up groups to check each other's work.

EVALUATE

True or False - Students must decide and defend their answers:

- If you divide one irrational number by another, the result is always irrational. (false)
- If you divide a rational number by an irrational number, the result is always irrational. (false - zero divided by anything equal zero, which is rational)
- The circumference of a circle is always irrational. (false - if the diameter is equal to a rational number over pi, the circumference is rational.)
- The area of a circle is always irrational. (false - If the radius is a rational number divided by the square root of pi, the area of the circle can be rational.)
- The hypotenuse of a triangle can be either rational or irrational. (true)

RATIONAL AND IRRATIONAL NUMBERS (continued)

BE MINDFUL OF

Make sure that all accents and pronunciations are respected, especially if you have ELLs in your room who may already be self-conscious of their accents.

CCSS.MATH.CONTENT.6.RP.A.1

CCSS.MATH.CONTENT.6.RP.A.2

CCSS.MATH.CONTENT.7.RP.A.1

CCSS.MATH.CONTENT.7.RP.A.2

RATIOS AND PROPORTIONS

ENGAGE (WARM-UP)

Tally everyone's favorite music artist and set up a ratio between the top two artists.

EXPLORE

Estimate the number of students in the school, and then using the tally data collected, estimate:

- the number of students whose favorite artist is the class's favorite artist.
- the number of students whose favorite artist is the class's second favorite artist.

EXPLAIN

Cover these essential questions:

- What is a ratio and how do we represent it?
- What is the difference between part-to-part and part-to-whole ratios?
- What is the relationship between a part-to-part ratio and a rate?
- What is a proportion?
- How can we use proportions to solve for an unknown value and make predictions?

ELABORATE

Break students up into groups, and give them data on racial breakdowns in the population and in the medical field (data on next page), specifically within doctors.

Ask groups to figure out if there is a proportion between the two for the Black and Latinx populations or if there's underrepresentation.

EVALUATE

Discussion questions from this lesson:

- Explain the answer you arrived at in the Elaborate exercise.
- Do you think there should be proportions or equal representation in medicine? Why or why not?
- Why could underrepresentation be a problem?
- Why do you think there is underrepresentation among certain demographics? Why do you think there is overrepresentation among certain demographics?

RATIOS AND PROPORTIONS (continued)

BE MINDFUL OF

Be active in moderating discussion - stay watchful for the emergence of stereotypes that may come up and support students in breaking down assumptions they might be making.

INDEPENDENT PRACTICE

The following lessons from our site can be used for independent practice for students:

- Ratios (www.almostfun.org/lessons/ratios)
- Proportions (www.almostfun.org/lessons/proportions)
- Unit Conversions (www.almostfun.org/lessons/unit-conversions)

Race and Ethnicity	Number of Active Doctors in America (2018), *in thousands*	Number of People in America (2018), *in thousands*
White	516	197,535
Asian	157	18,545
Hispanic	54	59,640
Black or African	46	40,861
American Indian or Alaska Native	3	2,420
Other	17	7,100
Unknown	127	794
Total	920	326,895

CCSS.MATH.CONTENT.6.EE.A.2

CCSS.MATH.CONTENT.6.EE.B.5 - 9

CCSS.MATH.CONTENT.6.EE.C.9

SOLVING EQUATIONS AND INEQUALITIES - 1 VARIABLE

ENGAGE (WARM-UP)

Ask students to think about the longest they've ever waited in line for something. Ask them to write on a sticky note what they waited for and how long they were willing to wait.

EXPLORE

Pick one of the situations and times a student wrote down. Tell the class to imagine we're waiting in line for whatever it is and the maximum total time we're willing to wait for. Ask the class to estimate the time it takes for one person in front of them to get what everyone is waiting for.

Now ask the class to write an equation that represents this situation where x is the number of people we can have in front of us such that we wait the maximum amount of time we're willing to wait.

Then ask students to write an inequality that represents the same situation, but all the values of x where we wait no more than the maximum amount of time.

EXPLAIN

Cover these essential questions:

- What are the steps in solving an equation with one variable?
- How do we use inverse operations to isolate and solve for a variable?
- How do we represent a two-variable equation on a graph?

ELABORATE

Share that we can use linear equations to understand many different issues.

For example - understanding minimum wage.

Find the cost of rent in your state and the minimum wage (http://bit.ly/wage-data). Many folks support others as well, so part of their income, let's say $500 a month, goes to supporting family.

Ask students to set up the equation and determine the number of hours someone would need to work at minimum wage to make a livable wage each month.

EVALUATE

Discussion questions from this lesson:

- What are some situations in your own life that you could use a linear equation in?
- In your own words, why is setting up a linear equation helpful?

INDEPENDENT PRACTICE

The following lessons from our site can be used for independent practice for students:

- Basic Linear Equations (www.almostfun.org/lessons/equations)
- Graphing Linear Equations (www.almostfun.org/lessons/linear-equation-graph)
- Slopes (www.almostfun.org/lessons/slope)
- Slope-Intercept Form (www.almostfun.org/lessons/slope-intercept)
- Graphing Linear Inequalities (www.almostfun.org/lessons/inequality-graph)

CCSS.MATH.CONTENT.6.G.A.1

CCSS.MATH.CONTENT.6.G.A.3

CCSS.MATH.CONTENT.7.G.B.6

CCSS.MATH.CONTENT.8.G.A.1

GEOMETRY

ENGAGE (WARM-UP)

For this lesson, we're going to use a game called Tangram. Ask students to cut out the shapes and try using them to create the larger pictures.

EXPLORE

Ask students to calculate the area of one of the more complex shapes by adding up the areas of each individual shape. Ask them to calculate the area of another more complex shape and push them to realize the two complex shapes have the same area.

EXPLAIN

Essential questions to cover:

- How do we calculate the area of a polygon by breaking it down into smaller shapes?
- How does rotating or flipping a shape change it? Is it congruent to the initial shape?
- How does scaling down a shape change it? Are the two shapes similar or congruent?

ELABORATE

Show this video on architecture: www.youtube.com/watch?v=KfMzBirNnok, and explain that geometry is used heavily in designing rooms and buildings.

Ask students to design their dream apartment using Floorplanner(www.floorplanner.com) with the following constraints:

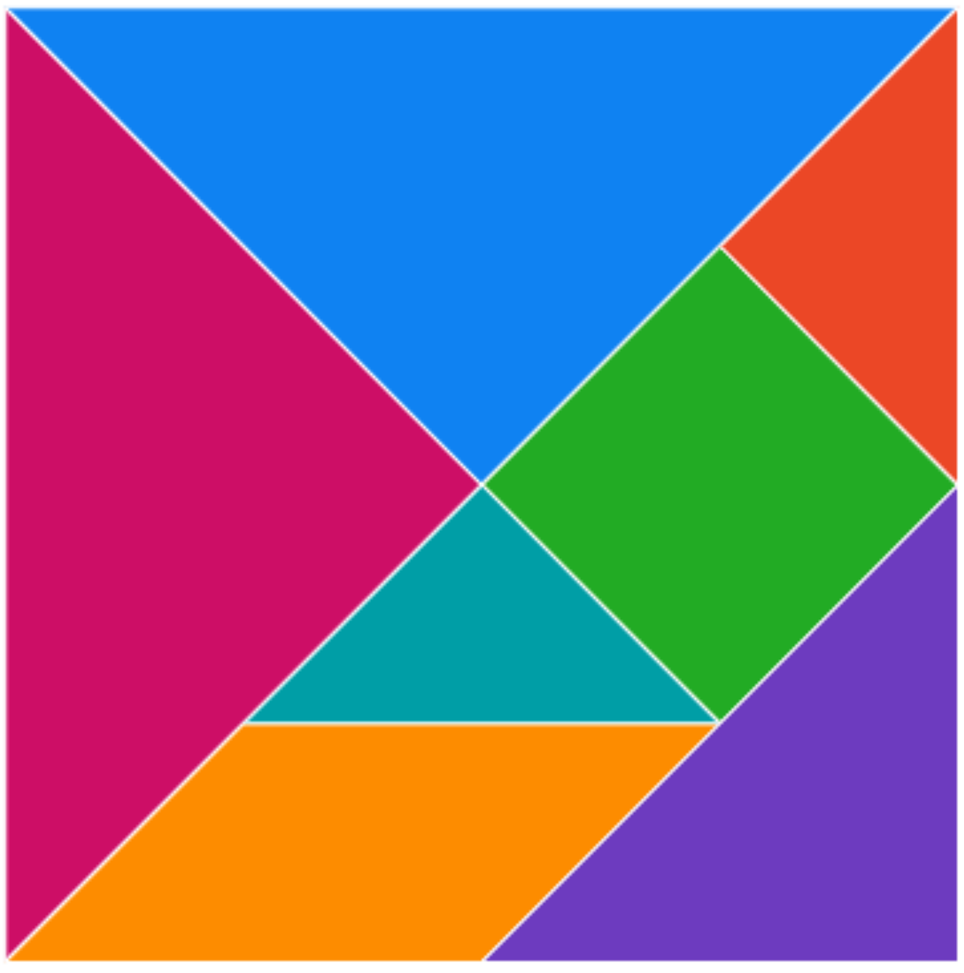
- Must be less than or equal to 800 sq feet
- Must have at least 3 rooms
- Each room must be a different shape

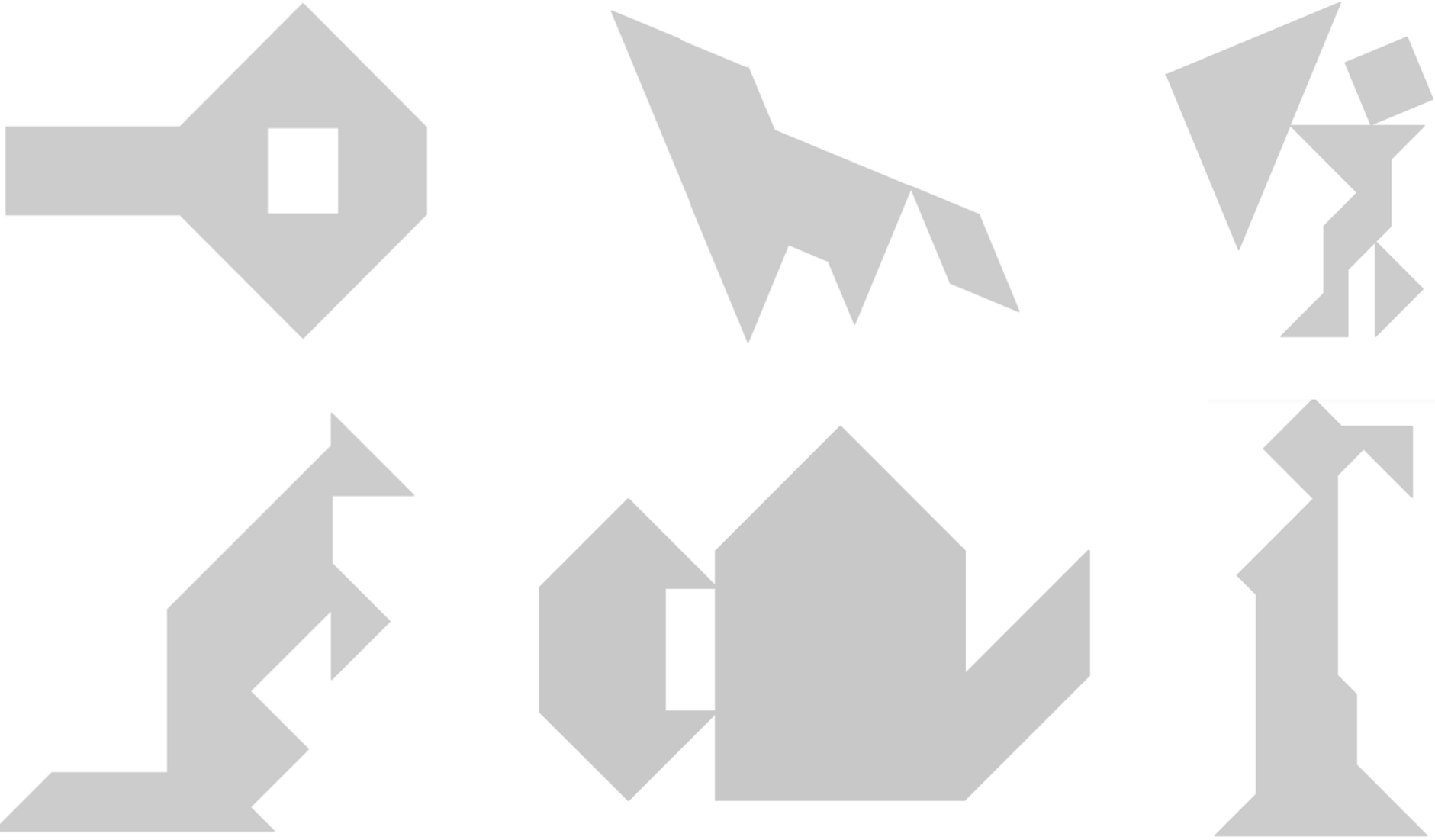
EVALUATE

Discussion questions from this lesson:

- Why might we have different constraints for building and designing a building?
- How does geometry help us design physical objects or places?

GEOMETRY (continued)





CCSS.MATH.CONTENT.8.G.B.7

PYTHAGOREAN THEOREM

ENGAGE (WARM-UP)

Show students this Buzzfeed Quiz (www.buzzfeed.com/daves4/left-handed-checklist) and highlight the ways different objects are not designed for those who are left-handed.

(Either for homework or live in class) Ask students to think about experiences they've had that are not designed for certain people. Here are some examples to kick things off:

- Most video games are not designed for those with visual impairments.
- Seats/headrests in cars are not designed for those with ponytails.
- Really high kitchen cabinets are not designed for people who are shorter.
- Girl's/women's pant's pockets are not designed for people who need to put things in their pockets.

EXPLORE

Ask students to think about 5 things they experience at school, on the way to school, or at home that would be more difficult for someone with a physical handicap. Ask them to think about how they might fix those problems. Ask students to share ideas all together or in small groups.

While sharing, if a ramp is mentioned, point out this is a common solution we see, and the focus of this lesson will be on designing ramps. If it's not mentioned, then introduce this as a common problem/solution and the focus of the lesson.

EXPLAIN

Explain that geometry and the Pythagorean Theorem are essential to designing ramps. Essential questions to cover before the elaborate exercise are as follows:

- How do we calculate the area of right triangles and quadrilaterals?
- How do we use the Pythagorean Theorem to solve for side lengths in a right triangle?
- How do we use the Pythagorean Theorem to find the distance between two points?
- How do we draw a scale drawing of an actual, geometric shape?

PYTHAGOREAN THEOREM (continued)

ELABORATE

Ask students to imagine they are designing ramps for the school.

- Option 1: Ask students to find a place in the school where a ramp could be beneficial and measure the vertical height the ramp needs to meet.
- Option 2: Split the students into groups and tell each group to imagine a ramp in the school that needs to meet a vertical height of a different height.

Share that the maximum slope of a ramp in the U.S. must be 1 inch of rise for 12 inches of horizontal distance, and the ideal width is 48 inches for the ramp. So, given this requirement and the vertical height, ask the students to find the side lengths for the right triangle formed by the ramp.

Ask students to then calculate the surface area of the ramp using the ideal width for the ramp and the side lengths they just calculated.

EVALUATE

Discussion questions from this lesson:

- What do we notice about the horizontal length of the ramp we designed?
- Given how long it has to be, what are some other ways to design ramps to use less horizontal space? Push students to think about ramps that wrap around / zig-zag.
- Why is it important to think about accessibility for everything we design?
- Why does representation matter when it comes to designing solutions?

BE MINDFUL OF

If you have a differently abled student in your class, don't put them on the spot to answer questions. Give them the opportunity to participate as any other student would in the lesson.

CCSS.MATH.CONTENT.7.SP.C.5

CCSS.MATH.CONTENT.7.SP.C.6

CCSS.MATH.CONTENT.7.SP.C.7

PROBABILITY

ENGAGE (WARM-UP)

Break students up into groups, give them a list of events, and have them rank them in order of likelihood - from least likely to most likely. Feel free to use your own list or draw some inspiration from this one:

- Winning the lottery
- Becoming a successful Instagram influencer
- The sun comes up tomorrow
- Someone you know starts the next TikTok dance trend
- A BTS & Drake collab
- A quirk about you as a teacher occurs (Ms. Kossia saying "um" in a class)
- Rihanna comes out with a new album this year
- TikTok gets banned
- A Nicki Minaj and Cardi B collab

EXPLORE

Ask the groups share, explain, and defend their rankings and their methodologies. Ask them what they think the probability is that their most likely, least likely, and a medium likely event are to happen.

EXPLAIN

Using the Explore exercises, answer these essential questions:

- What is probability?
- What does a probability near 0 mean? What does a probability near 1 mean?
- How do we estimate the probability of an event happening?

PROBABILITY (continued)

ELABORATE

Break students up into groups of 4. In each group, 2 students will be players and 2 students will be informants (1 for each player). The two players will play rock, paper, scissors 10 times, while their informants help keep track of what the other player is playing and provide advice.

After all 10 games, ask each informant/player pair to calculate the probabilities of the other player choosing rock vs. scissors vs. paper. Ask them to then estimate what the other player is most likely to play.

EVALUATE

Discussion questions from this lesson:

- How do we use previous data to predict future events?
- Explain that Netflix uses your previous viewing data to predict the probability you'll like a new show or movie to then recommend you. Ask students to think about other products or services they use that do something similar.

CCSS.MATH.CONTENT.6.SP.A.1-5

UNDERSTANDING AND MEASURING DATA

ENGAGE (WARM-UP)

Draw axes on a Jamboard (www.jamboard.google.com) or on the whiteboard. Ask students to check the screen time on their phones (either the night before for homework or in class) and answer one of the following questions:

- What is your daily average?
- How much time do you spend on YouTube?
- How much time do you spend on Snapchat?

In class, give them sticky notes to write down their answer. If students don't have access to their phones or you don't want to assign this the night before, here are some other questions you can ask -

- How many siblings do you have?
- How long does it take you to get to school?
- How many jobs have you ever had?

Tell students that all these questions are non-statistical questions and a statistical question would be "What is the daily average screen time for the students in my class?" or "How long do the students in my class take to get to school?"

EXPLORE

Ask students to:

- Guess what the difference between a statistical and non-statistical question is.
- Place their sticky notes on the board to create a histogram of their data.
- Identify different types of information that can be drawn from the histogram.
- Describe the shape of the histogram in their own words.

EXPLAIN

Essential questions to answer:

- What is the difference between a statistical and non-statistical question?
- How do we describe a set of data using language (i.e. spread out, bell curve, clustered)?
- How do we describe a set of data using calculations like mean, median, interquartile range, and deviation?

UNDERSTANDING AND MEASURING DATA (continued)

ELABORATE

Break students into groups, and ask them to analyze this salary data (http://bit.ly/media-salary-data) - note that summary data for your reference is in the second sheet. Either ask each group to analyze one racial or gender group, or ask all students to look at all groups to calculate:

- The mean and median pay for Asian, Black, Latinx, Native American, and White individuals.
- The mean and median pay for Male and Female individuals.

EVALUATE

Discussion questions from this lesson:

- What are the differences we see in pay across gender? Across race? Within intersections of both?
- Which data calculations can we use to prove that a group is underpaid?
- Why do you think the pay gap exists? Do you think that people should have to negotiate for higher salaries? Do you think two people doing the same work should get paid the same?

BE MINDFUL OF

The direction this conversation takes can create tension potentially - make sure you feel comfortable driving conversation and pushing students to be thoughtful, critical thinkers without excluding anyone or ganging up on anyone.

The point of these questions is to push students to analyze and think about their gut reactions to situations, not to arrive at one, singular answer.

CCSS.MATH.CONTENT.7.SP.A.1

CCSS.MATH.CONTENT.7.SP.A.2

DRAWING INFERENCES FROM SAMPLE DATA

ENGAGE (WARM-UP)

The day before the lesson, ask students to pick a movie, TV show, new album, or song to survey their classmates on. Once they've agreed on one option, ask each student to survey 10 of their friends to rank their selection on a scale of 1-10, i.e. "How would you rank the movie Rush Hour on a scale of 1-10, 10 being 🔥?"

The day of the lesson, ask students to calculate the mean and median of their sample data, and then ask students to share their results with the class.

EXPLORE

Break students up into groups and have them analyze their sample data together to answer the following questions:

- Can we use our data to guess at the average ranking of the whole school? Why or why not?
- What could we do to make the sampling/surveying more representative of the whole school?

EXPLAIN

Essential questions to cover:

- What is a random sample?
- How do we use data from a random sample to draw inferences (conclusions) about the larger population?

ELABORATE

Let's say the school is trying to decide whether or not to start school 1 hour later (or if it's still relevant, whether school should be 100% virtual). How would you find a representative sample of the school to survey to see if this is what the people want? Push students to think about everyone affected - students, teachers, parents, guidance counselors, administrators, cafeteria staff, bus drivers, etc.

If there's time, ask students to think about what change they would like to see in the school and have them survey a representative sample to see if people agree/disagree.

DRAWING INFERENCES FROM SAMPLE DATA (continued)

EVALUATE

Discussion questions from this lesson:

- Why is it important to only draw conclusions from a representative or random sample?
- What problems can occur if we draw conclusions from a non-representative sample?
- How might stereotypes and generalizations form due to biased sampling?
- What questions should we ask when presented with data from a sample?

CCSS.MATH.CONTENT.8.SP.A.1

CCSS.MATH.CONTENT.8.SP.A.2

UNDERSTANDING BIVARIATE DATA

ENGAGE (WARM-UP)

Ask every student to think about their current favorite song, and then ask them to share what they love about that song. Write down all these different attributes. If students are having trouble thinking of reasons, suggest some of the following:

- How easy it is to dance to a song
- How energetic a song is
- How loud a song is
- The lyrics of the song

Have students discuss which trait they think most determines whether or not a song is a hit.

EXPLORE

Students will then explore different auditory traits of songs and how popular they are (data here: http://bit.ly/spotify-music-data). Break students into groups and ask them to randomly pick a song trait out of a hat (or cup or bowl).

Give each student group the data on their song trait and the top rank the song reached. Ask them to plot the data, where the x-axis is the song trait value and the y-axis is the rank.

Ask each group to share their results and describe the trend they see.

EXPLAIN

Essential questions to answer:

- How do we construct a scatterplot?
- How do we describe patterns like clustering, outliers, positive/negative association, linear association, nonlinear association?
- How can we use a line to approximate a linear relationship? (i.e. draw a line that closely models a linear relationship)
- How do we interpret the slope of the line we use to approximate a linear relationship?
- How do we use two-way tables to compare two data variables?

UNDERSTANDING BIVARIATE DATA (continued)

ELABORATE

Ask students to estimate a line for their trait (if possible) and to explain what the slope means. Ask students to use the vocabulary of clustering, outliers, positive/negative association, linear association, and nonlinear association to describe each of the relationships found.

- The mean and median pay for Asian, Black, Latinx, Native American, and White individuals.
- The mean and median pay for Male and Female individuals.

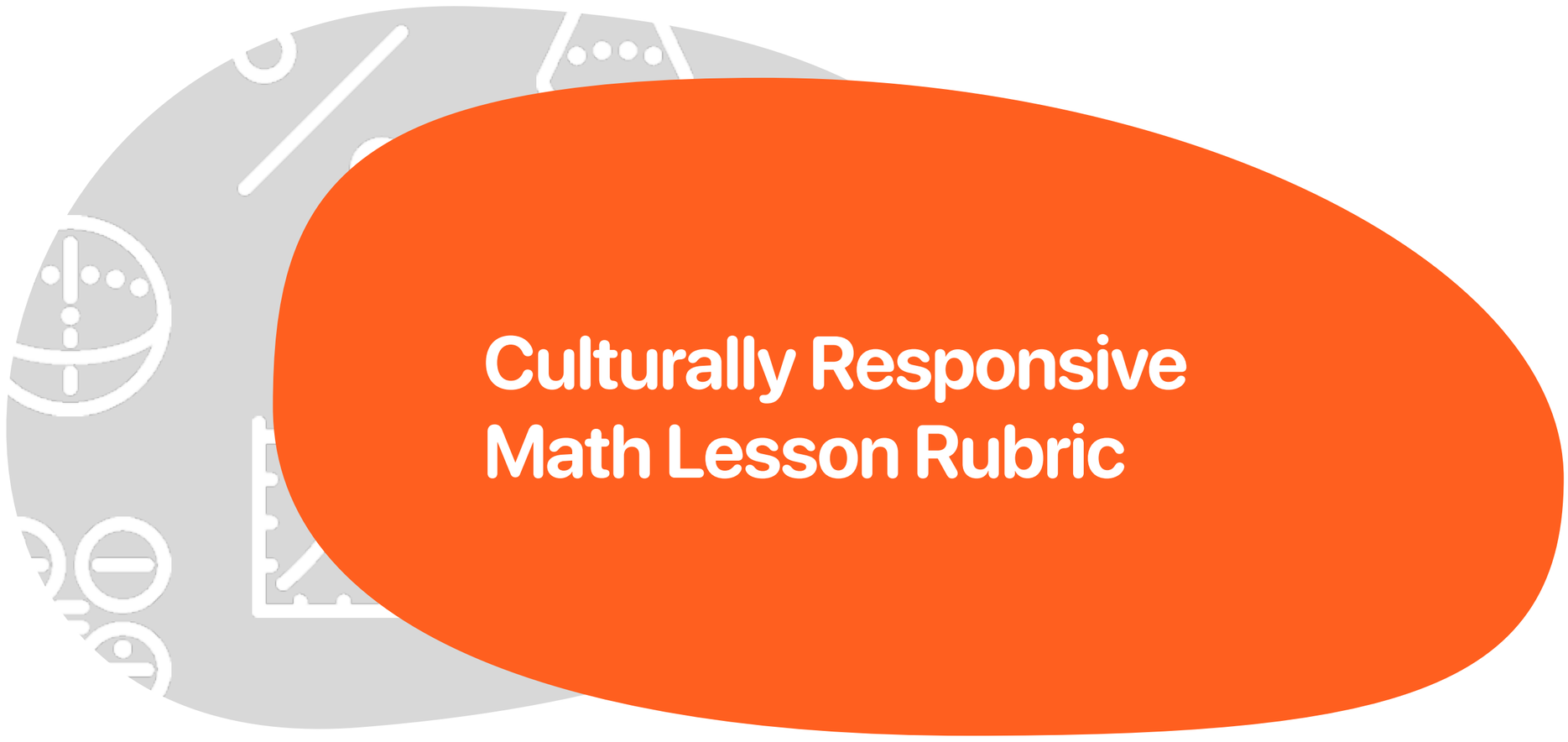
EVALUATE

Discussion questions from this lesson:

- How can plotting data help us visualize relationships?
- What's the value of determining an approximate line for a linear relationship?
- Was there anything surprising about the data you collected? Would you collect any other data to help inform your conclusions? Do you think there were any problems with the data collected?

BE MINDFUL OF

Some of the songs on the Billboard list have explicit lyrics. We've added a column so you know which ones those are. You can either keep those songs, remove them from the data set, or hide song names. Whatever works for you!



Culturally Responsive Math Lesson Rubric

In order to make progress towards a culturally responsive pedagogy, you have to be in a constant state of reflection. You need to be consistently evaluating where your curriculum stands and identifying appropriate next steps. We hope that you'll take advantage of our curriculum evaluation tool for support.

We've designed this tool to help you review existing curricula and envision equitable learning experiences. You can evaluate one or many lessons across 5 categories:

For each category, you'll be asked to complete a questionnaire and use your responses to rate how culturally responsive your lessons are. Completing all five categories will provide a more comprehensive analysis. However, if you don't have the time or capacity to do that, you can complete a questionnaire and rubric for an individual category and get a more limited evaluation.

To create this tool we drew upon elements from NYU's Culturally Responsive Scorecard [1], TEACH Math's Culturally Responsive Mathematics Teaching Lesson Analysis Tool [2], and Boston Public School's "look fors" for high expectations [3].

[1] https://steinhardt.nyu.edu/metrocenter/ejroc/culturally-responsive-curriculum-scorecard
[2] http://www.mathconnect.hs.iastate.edu/documents/CRMTLessonAnalysisTool.pdf
[3] https://www.bostonpublicschools.org/Page/373

CURRICULUM AUDIT - REPRESENTATION

We'll start by doing an audit of representation of the people present in your lessons - whether they're in word problems, warm-ups, or relevant connections you're making.

1. Tally the gender/sexuality and race/ethnicity of people present in your lessons:

	Straight Girl/Woman	LGBTQ+ Girl/Woman	Straight Boy/Man	LGBTQ+ Boy/Man	Non-Binary	**Total**
Asian/ Pacific Islander						
Black/African						
Latinx						
Middle Eastern						
Native American						
White						
Multiracial						
Racially Ambiguous						
People w/ Disabilities						
Total						

2. Please check the family structures represented in your lessons:

- ☐ Heterosexual parents
- ☐ Single parents
- ☐ Adopted or foster children
- ☐ Same-sex parents
- ☐ Relatives living with family
- ☐ Other: _____
- ☐ N/A

CURRICULUM AUDIT - REPRESENTATION

3. Please indicate the ethnic and cultural traditions, languages, religions, names and/or clothing referenced in your lessons:

- ☐ Traditions: _____
- ☐ Clothing: _____
- ☐ Languages: _____
- ☐ Religions: _____
- ☐ N/A

4. Please check all of the following that apply to your lessons:

- ☐ The lessons do not communicate negativity or hostility toward people of marginalized backgrounds through verbal or nonverbal insults, slights or snubs.
- ☐ Characters of color are not assumed to have low family wealth, low educational attainment and/or low income.
- ☐ Characters of diverse cultural backgrounds are not represented stereotypically, or presented as foreign or exotic.
- ☐ Diverse characters are rooted in their own cultures and are not ambiguous.
- ☐ N/A

CURRICULUM RUBRIC - REPRESENTATION

Looking at your answers, circle the category below that best represents your lessons.

Culturally Destructive	-2	The lessons reinforce stereotypes and portray people of color in inferior and destructive ways.
Culturally Insufficient	-1	The lessons have culturally and racially ambiguous characters. Few characters and stories are portrayed in a culturally and historically accurate way.
Emerging Awareness	0	The lessons represent some groups in diverse and dynamic ways but not at all. Some characters are portrayed in culturally and historically accurate ways, while others are still depicted as stereotypes.
Culturally Aware	1	The lessons capture a decent representation of diverse characters, who are generally portrayed in accurate and dynamic ways.
Culturally Responsive	2	The lessons capture a wide representation of dynamic characters that are reflected in accurate and appropriate cultural and historical contexts.

CURRICULUM AUDIT - POWER & PARTICIPATION

1. Please check all of the following that apply to your lessons:

- [ ] The lessons provide opportunities for students to learn **from** one another.
- [ ] The lessons provide opportunities for students to learn **about** one another.
- [ ] The lessons provide opportunities for the teacher to learn **from** their students.
- [ ] The lessons provide opportunities for the teacher to learn **about** their students.
- [ ] The lessons incorporate structured choice for students.
- [ ] The teacher's primary role in the lessons is to facilitate learning not to lecture.

CURRICULUM RUBRIC - POWER & PARTICIPATION

Looking at your answers, circle the category below that best represents your lessons.

Culturally Destructive	-2	The authority of mathematics knowledge primarily resides with the teacher. The teacher acts as the sole judge of whether or not answers are correct. Mathematical contributions in the lessons are almost exclusively from the teacher. Student mathematical contributions are minimal.
Culturally Insufficient	-1	The authority of mathematics knowledge primarily resides with the teacher and select students. The lessons only elicit mathematical contributions from select students.
Emerging Awareness	0	The authority of math knowledge between teacher and students is sporadically shared. In each lesson, there is at least one instance where the teacher calls on several students so that multiple mathematical contributions are accepted and valued. Teacher elicits some substantive math
Culturally Aware	1	The authority of math knowledge is shared between teacher and students. Multiple forms of student mathematical contributions are encouraged and valued. The teacher and students elicit substantive mathematics contributions. Students learn to coexist.
Culturally Responsive	2	The authority of math knowledge is widely shared between the teacher and students. All mathematical contributions are valued and respected. Student mathematical contributions are actively elicited by the teacher and among students. Students learn to coexist, fit in, and belong.

CURRICULUM AUDIT - RELEVANCE

1. Please check all of the following that apply to your lessons:

- [ ] The lessons incorporate students' life experiences.
- [ ] The lessons incorporate students' interests.
- [ ] The lessons are informed by students' families and/or communities.
- [ ] The lessons prompt students to reflect on their own bias.
- [ ] The lessons prompt students to consider multiple points of view, especially points of view from marginalized people/communities.

2. Please check all of the following that apply to your lessons:

- [ ] The lessons present mathematics as a tool students can use to analyze and make sense of the world they experience.
- [ ] The lessons prompt students to formulate mathematically-based arguments to address issues that matter to them and/or affect them.

CURRICULUM RUBRIC - RELEVANCE

Looking at your answers, circle the category below that best represents your lessons.

Culturally Destructive	-2	The lessons center White or Eurocentric ideas and culture throughout the majority of instructional materials. Microaggressions, biases, and deficit perspectives are prevalent. The lessons are disconnected from students' lives.
Culturally Insufficient	-1	The lessons predominantly center White or Eurocentric ideas and culture in most of the instructional materials. Students are seldomly encouraged to think critically, or take action to combat inequity. The lessons provide weak connections to students' lived experiences.
Emerging Awareness	0	The lessons occasionally center multiple perspectives. Some critical questions are posed to students. Non-dominant knowledge systems are acknowledged and mentioned a few times throughout the lessons. There are few opportunities for the teacher to connect students' learning to real life issues and action.
Culturally Aware	1	The lessons center people of color, marginalized populations, and multiple perspectives. The lessons provide multiple opportunities for students to think critically. There are several opportunities for teachers to connect students' learning to real life issues and action.
Culturally Responsive	2	The curriculum is likely humanizing, liberatory, and equity oriented. Instances of centering multiple perspectives are abundant throughout the curriculum. There are clear prompts, activities, and content that connect students' learning to real life issues and actions. There are many opportunities for teachers to engage cultural responsiveness.

CURRICULUM AUDIT - COGNITIVE DEMAND

1. Please check all of the following that apply to your lessons:

- [ ] The lessons are informed by formative assessment and include appropriate scaffolding.
- [ ] The lessons prompt the teacher to clearly and consistently communicate expectations for student work, effort, and behavior.
- [ ] The lessons are appropriately cognitively demanding and challenging for all students.
- [ ] The lessons prompt the teacher to clearly and consistently model how students can master challenging material and meet learning goals through effective
- [ ] The lessons prompt students to use math terminology in their explanations.

2. Please check all of the following that are used in your lessons:

- [ ] Engaging hooks/intros
- [ ] Hands-on activities
- [ ] Inquiry-based activities
- [ ] Small group discussions
- [ ] Whole group discussions
- [ ] Debates
- [ ] Stations
- [ ] Group work
- [ ] Individual checks for understanding
- [ ] Closure
- [ ] Extension activities
- [ ] Scaffolds

CURRICULUM RUBRIC - COGNITIVE DEMAND

Looking at your answers, circle the category below that best represents your lessons.

Culturally Destructive	-2	There are no opportunities for mathematical analysis or exploration. Students receive, recite, or memorize facts, procedures, and definitions. Virtually no features of mathematical discourse and communication occur. There is no evidence of conceptual understanding being required. The lessons convey that the material may be too challenging for some students, and do not provide opportunities for the teacher to model how students can master the material through effort.
Culturally Insufficient	-1	There are few opportunities for mathematical exploration, but tasks do not require analysis to complete. Students primarily receive, recite, or perform routine procedures without analysis or connection to underlying concepts or mathematical structure (rote learning). There are few opportunities for mathematical discourse and communication. The lessons convey that the material is challenging, but rarely provide opportunities for the teacher to model how students can master the material through effort.
Emerging Awareness	0	There are multiple activities that incorporate mathematical exploration and analysis and require students to think deeply about the procedures and concepts they use to solve problems. There are multiple opportunities for mathematical discourse and communication. The lessons convey that the material is challenging, and provide some opportunities for the teacher to model how students can master the material through effort. There are some opportunities for students to share their understanding and engage in mathematical discourse and communication.

CURRICULUM RUBRIC - COGNITIVE DEMAND (continued)

Culturally Aware	1	The majority of lessons include task(s) that incorporate mathematical exploration and require analysis. The majority of lessons require students to think deeply about the procedures and concepts they use to solve problems and provide opportunities for students to develop their own explanations. The majority of lessons prompt students to engage in mathematical discourse and communication. The lessons convey that the material is challenging, and provide many opportunities for the teacher to model how students can master the material through effort.
Culturally Responsive	2	Each lesson includes task(s) that incorporate mathematical exploration and require analysis. Each lesson prompts students to engage in complex mathematical thinking, develop and share their own explanations, and engage in mathematical discourse. The lessons position the teacher to clearly and consistently model how students can master challenging material and meet learning goals through effective effort.

CURRICULUM AUDIT - ACADEMIC LANGUAGE SUPPORT FOR ELLS

1. Please check all of the following strategies used in your lessons:

- ☐ Use of body language and gestures to express appropriate words
- ☐ Use of objects (realia)
- ☐ Use of cognates (words in two languages that share similar meaning, spelling, and pronunciation)
- ☐ Use of graphic organizers and manipulatives
- ☐ Use of visual guides and infographics
- ☐ Checks for understandings throughout the lesson

CURRICULUM RUBRIC - ACADEMIC LANGUAGE SUPPORT FOR ELLS

Looking at your answers, circle the category below that best represents your lessons.

Culturally Destructive	-2	There is no evidence of a language scaffolding strategy for ELLs. Students who are not yet fully proficient in English are ignored and expected to fend for themselves.
Culturally Insufficient	-1	Although there is no explicit use of language strategies for ELLs, students' use of their first language is tolerated. There is a primary focus on correct usage of English vocabulary.
Emerging Awareness	0	In each lesson, there is at least one language scaffolding strategy used to develop academic language (i.e., revoicing; use of cognates; translated tasks/text; use of graphic organizers; strategic grouping with bilingual students).
Culturally Aware	1	In each lesson, there is sustained use of at least a couple of language strategies, such as the use of revoicing and attention to cognates, direct modeling of vocabulary, use of realia, strategic grouping of bilingual students or encouragement of L1 usage is observed at least between
Culturally Responsive	2	In each lesson, there is deliberate and continuous use of language strategies, such as gesturing, use of objects (realia), use of cognates, revoicing, graphic organizers and manipulatives are observed during whole class and /or small group instruction and discussions. The main focus is the development of mathematical discourse and meaning making, not students' production of "correct" English.

FINAL EVALUATION RESULTS

Record each individual section's results here, and add up to get your total score:

REPRESENTATION	
POWER & PARTICIPATION	
RELEVANCE	
COGNITIVE DEMAND	
ACADEMIC LANGUAGE SUPPORT FOR ELLs	
TOTAL	

Each of the categories outlined in the rubric are critical to cultivating an environment in which students feel a sense of belonging and a connection to their learning. The individual scores you selected for each category, help you identify specific opportunities for improvement in your curriculum. The total score gives you a sense of where your curriculum stands when everything comes together.

-10 .... -5 .... 0 .... 5 10

😜 😬 😅 😃 🤗

NEXT STEPS

Don't beat yourself up if your score(s) are low. The important thing is that you're here, which shows an initiative to build awareness and make progress towards becoming a culturally responsive educator. We hope that you will use your score(s) in conjunction with student feedback to develop targeted next steps for cultivating an equitable, rigorous learning environment. If you don't already have an established routine for eliciting student feedback, consider using Panorama's Student Survey.

Remember that while it's important to have a sense of urgency, it's equally important to recognize that this is a marathon not a sprint. We'd rather you be late to the party, than for you to rush the process and do harm to yourself and others as a result. Dr. Arnisa Amante-Jackson said it best, "Oppression took multiple lifetimes to build and will take multiple lifetimes to dismantle."