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Please enjoy this complimentary excerpt from
Upper Elementary Mathematics Lessons to Explore,
Understand, and Respond to Social Injustice.

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SOCIAL JUSTICE OUTCOMES

- I like knowing people who are like me and different from me, and I treat each person with respect. (Diversity 6)
- I have accurate, respectful words to describe how I am similar to and different from people who share my identities and those who have other identities. (Diversity 7)
- I feel connected to other people and know how to talk, work and play with others even when we are different or when we disagree. (Diversity 9)

MATHEMATICS CONCEPTS

- Adding and subtracting multiples of 10 based on place value and properties of operations.
- Multiplying whole numbers by multiples of 10.
- Understanding and making generalizations about place value; specifically, understanding and justifying that a digit in one place represents 10 times what it represents in the place to its right.

LESSON 5.6 CHALLENGING ABLEIST ASSUMPTIONS IN MATHEMATICS PROBLEMS

Courtney Koestler, Jennifer R. Newton, and Jan McGarry

SOCIAL JUSTICE CONNECTION

This lesson explores the issue of human diversity (i.e., different kinds of bodies), disability, and ableism. This lesson is meant to be launched during or after a typical lesson found in many textbooks that assumes students all have “typical” bodies, such as having 10 fingers, and are able to participate in “typical” ways. Students can use critical literacy skills to examine the mathematics lesson as presented as usual (in many textbooks), as well as resources in their classroom to see how bodies, disability, and ableism are presented. Oftentimes the topic of disability in mainstream classrooms is invisible or explicitly not talked about unless absolutely necessary, and it is important for students to see both children and adults with disabilities represented in their classrooms through empowering ways. Disabilities should be portrayed in ways that avoid deficits and stereotypes and instead accurately describe the disability and/or portray people with disabilities living their lives (whether or not disability is the focus).

DEEP AND RICH MATHEMATICS

This lesson engages students in using their bodies (i.e., their fingers) as a physical representation to support skip-counting groups of 10. At the same time, students will also unpack this common practice to begin a conversation about body diversity.

Resources and Materials

- Chalkboard/whiteboard, chalk/markers, or someplace else to record students’ thinking
- Choose among the following books to include in your classroom library:

Picture Books

- *All Are Welcome* by Alexandra Penfold
- *The Bug Girl* by Sophia Spencer

- *Emmanuel’s Dream: The True Story of Emmanuel Ofosu Yeboah* by Laurie Ann Thompson and Sean Qualls
- *Hello Goodbye Dog* by Maria Gianferrari
- *I Am Not a Label* by Cerrie Burnell
- *A Kids Book About Disabilities* by Kristine Napper
- *Mama Zooms* by Jane Cowen-Fletcher
- *Rescue and Jessica: A Life-Changing Friendship* by Jessica Kensky and Patrick Downes
- *Terry Fox and Me* by Mary Beth Leatherdale
- *What Happened to You?* by James Catchpole and Karen George

Chapter Books

These may be more appropriate for older grades.

- *Braced* by Alyson Gerber
- *Roll With It* by Jamie Sumner
- *Intersectional Allies: We Make Room for All* by Chelsea Johnson, LaToya Council, and Carolyn Choi

Reference Books for You

- *Critical Literacy Across the K–6 Curriculum* by Vivian Maria Vasquez

Additional Resources

- Article: “How to talk to your kid about disabilities,” by Caroline Bologna, *Huffington Post*, March 1, 2021 (<https://bit.ly/32Svi68>)
- Lesson: Learning for Justice, “Picturing Accessibility: Art, Activism and Physical Disabilities” (<https://bit.ly/3oeLVkC>)
- Lesson: Learning for Justice, “What Is Ableism?” (<https://bit.ly/3oe0kh9>)
- Lesson: Learning for Justice, “What Is a Disability?” (<https://bit.ly/3lrFFUG>)

MATHEMATICS PRACTICES

- Construct viable arguments and critique the reasoning of others.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

LESSON 1 FACILITATION

Introducing Assumptions

Launch (30 minutes)

- A common elementary mathematics activity is to count by tens by counting all the fingers in the classroom. This implicitly makes an ableist assumption that all people have 10 fingers. This lesson engages students in questioning those assumptions and thinking about different mathematical contexts we can use for making tens. Prior to implementing this lesson, we recommend you consider your classroom and how you want to frame the topic. This is important for all classes, but it is especially critical if you have any students who do not have 10 fingers. The *Resources and Materials* section has several links that can be helpful in thinking about how to discuss these topics with your students. If you have a student(s) who does not have 10 fingers, we suggest you discuss the lesson with the family and child to make sure you are approaching it in a way that feels inclusive and supportive to the student(s). While we provide suggestions for some possible approaches to navigating this space, you should adjust based on your context. Say something to students like this:

I have been thinking a lot about today's activity and wanted to talk to you about it. It is an activity that is in a lot of textbooks because it is usually really good at getting kids to think about patterns in our number system, but I also am wondering about some assumptions it makes about kids and bodies. Let's look at the task and think about some of the hidden assumptions it makes before we start.

TEACHER NOTE

You should adjust what you would say depending on your context. For example, if you have already done work with critical literacy, your students may be familiar with the idea of how authors' assumptions and biases can be analyzed. If not, you may have to discuss it a bit more, perhaps by asking if they know what an assumption is and if they can give any examples. For more information, see Vivian Maria Vasquez's (2016) book, *Critical Literacy Across the K–6 Curriculum*.

- Say to students: *The activity that is usually in textbooks is to “figure out the total number of fingers in our class by counting by tens.”* (You may want this displayed on the board as well.) If students need additional support, you may want to explicitly ask:
 - + *What does this problem assume about people's bodies? About their fingers?*
 - + *How do you know the problem assumes this?*

- Have students share their responses and ask the class: *Does everyone in our world have 10 fingers? Why or why not?* Students may have examples of people in their lives who were born with a different number of fingers or who lost a finger(s) during their lifetime. If not, explain that this could happen. If you have a student who does not have 10 fingers in your class, be mindful of not expecting them to speak as a “representative” for those with a different number of fingers and of not allowing other students to do the same.
- At this point, we offer two possible ways to move forward in the lesson. You may choose to continue with the activity as it is commonly stated (count by tens to find the total number of fingers in the class), or you may ask the class to brainstorm other things that come in tens that you can use for the problem (we especially recommend this second approach if someone(s) in the class does not have 10 fingers). You might tell the class: *The mathematics goal for this problem is to count by tens, but since not everyone has 10 fingers, let’s think of some other things that could come in tens that we can count by instead.* The class might suggest ideas like boxes of markers, bags of marbles, or the tens sticks from base-10 blocks. Choose one of these, and prepare one for each person in the class plus several extras before continuing the lesson. Alternatively, you can have the base-10 sticks available and suggest to the class that you use these to represent whatever group of 10 objects the class has agreed on. Give each student one of the tens.
- Tell the class, *We’re going to count by tens to see how many ___ we have in our whole class.*
- Have students raise their hands or objects as they say their numbers (10, 20, 30 . . .). You can keep track of the count by listing the numbers, drawing a number line, or using other ways your students suggest to record the numbers.

Explore (30–45 minutes)

- Try it more than once, starting with different students. Ask students to describe what they notice. Ask students questions about what would happen in different scenarios. Here are some examples:
 - + *If there are any students absent from class, what would be the number of [objects] if they were present?*
 - + *What if the art, music, and physical education teacher joined the class?*
 - + *What if we had 35 students in our class?*
 - + *What if we counted the whole third grade, which has 78 students?*

- Be sure to entertain multiple strategies for solving the tasks (e.g., counting by tens, adding on by the multiple of 10). As you work, record the problems and solutions (e.g., $18 \times 10 = 180$) in a vertical list off to the side or on chart paper that you can refer back to in the next lesson when the class will look for patterns.

Summarize (20 minutes)

- Briefly summarize the mathematical strategies that students used or ask them to identify any common strategies. Then say that you'll be exploring problems with tens more next time. Next, read one of the suggested children's books. It may be good to have several books to choose from and to begin a study of how disability is explored similarly and differently in the books. We suggest that you continue to have books like those suggested in the *Resources and Materials* in your classroom throughout the school year so that students see these are a part of the classroom library, and not just as part of a lesson on disability.
- While you are reading and/or once you are done reading, have students share questions they have about differences and disabilities.

LESSON 2 FACILITATION

Exploring Place Value

Launch (20 minutes)

- Remind the class of your work last time, both about questioning the hidden assumptions in mathematics problems and your mathematical strategies. Explain that today you will focus more on the mathematical strategies and in a future lesson you will return to exploring hidden assumptions and inclusion in mathematics problems.
- The list of problems from Lesson 1 (e.g., $18 \times 10 = 180$) should be displayed to the side of the board, but do not focus on it yet. Pose some questions like the following to the class: *How many tens does it take to make 780? How do you know?*
- Review the meaning of the place value for a number like 780. What does each digit stand for? Point out that the 7 stands for 7 *hundreds*, and ask them how many *tens* we can think of this as. Point out the connection to the previous problem: 780 stands for 7 hundreds and 8 tens, but it can also be thought of as 78 tens.
- Review the list of problems solved from Lesson 1 (e.g., $18 \times 10 = 180$) and the list of problems solved today. Ask the students if they notice any patterns. You can also ask more explicitly: *What happens when we multiply a number by 10?* Students will likely notice that you “add” a zero to the end

of the number. You should question or clarify the use of the word “add” and point out that they don’t mean, for example, $18 + 0$. You can suggest that another word they can use is “append” or that we might think of this as moving the digits one place to the left (i.e., ones move to the tens place, tens move to the hundreds place, and so on).

- Write this as a class conjecture. If students are not familiar with that term, explain that it’s something that you think is true in mathematics, but you need to explore it more to determine if it’s always true or not. Tell the class that today they will be working with examples, base-ten blocks, and pictures to try to determine if this is always true and to then prove that it’s true.

Explore (20 minutes)

- Students work in pairs or small groups to explore the conjecture. They may want to begin with several examples, then ask them to think about how they can show that it would work with any numbers. Encourage them to think about how they can use base-10 blocks and/or drawings to show what is happening and why that makes this true. Question groups about how they can use what they learned from the warm-up to help them on this problem (e.g., that 780 has 78 tens).
- It may help to have students first think about single-digit numbers (e.g., 7×10) before thinking about double-digit numbers. Circulate among the groups, see what they are thinking, ask probing questions, and make decisions about what explanations to have students share and in what order.

Optional Extensions

It is likely that most students will implicitly stick to whole numbers. Depending on the progress and understanding of the class, you may choose to challenge individual groups or the whole class with different types of numbers such as fractions or decimals. This can be helpful for a conversation about how to modify and/or limit conjectures. The conjecture could be limited to whole numbers, or it could be modified to include decimals by being precise about shifting digits one place value to the left as opposed to appending a zero. The conjecture does not apply to fractions. You can also explore what happens when we *divide* a number by 10.

Summarize (30 minutes)

- Have some or all groups share their thinking about why multiplying by 10 results in appending a zero to the end of the number. Before starting, tell students that when they listen to groups share, they should think of compliments (i.e., something they found valuable about the group’s *mathematics*) and questions (i.e., things they didn’t understand or want to understand better). The class should engage in a discussion around the different explanations.

- End by highlighting the key strategies that students used and emphasize that mathematicians often spend a long time developing a clear proof that something is true, so it's not something you usually figure out in one day. Depending on the progress made, you may choose to revisit this concept in the future.
- Explain that next time you will return to a focus on the hidden assumptions in mathematics problems.

TAKING ACTION

Remind the class that this lesson began by identifying the hidden assumptions in the common mathematics task: *Figure out the total number of fingers in our class by counting by tens*. Read the book, *Intersectional Allies: We Make Room for All*, by Chelsea Johnson, LaToya Council, and Carolyn Choi. As with any book, you should prepare by prereading *Intersectional Allies*, as there is text in other languages.

Discuss generally what it means to be an ally to others, asking students what they think the word means and asking for examples of allyship. For example, you may ask: *What are the ways that the children in the book acted as allies for their friends? What are ways families supported other families?*

Next, discuss how allyship was framed in the books you used in the previous section. Were there friends, adults, and others that offered supports and accommodations that provided access to people in the books? In what ways?

Taking Action Option 1

Ask students if they know of examples of supports and accommodations that provide access to people with disabilities at their school or in public buildings (e.g., automatic door openers, braille lettering on signs, accessible parking, accessible restrooms).

Ask students to analyze the ways in which the school building is welcoming and safe for different kinds of people, especially for those with different kinds of disabilities. If possible, invite a guest speaker, such as a local disability advocate, to collaborate.

If or when students find issues with accessibility, support them in taking action by communicating via letters or a presentation with building and district administration, school board members, and community members.

Taking Action Option 2

As an ongoing investigation, have students examine ways in which people are portrayed in the books in your classroom, including in your mathematics curricular materials.

For example, you may compare how people with disabilities are represented in *All Are Welcome* by Alexandra Penfold (i.e., where the children just happen to be using a wheelchair or a white cane but not specifically discussed as having disabilities) versus in *Emmanuel's Dream: The True Story of Emmanuel Ofose Yeboah* by Laurie Ann Thompson and Sean Qualls (i.e., where his true-life story is illuminated about what it was like growing up with a disability).

Students can note places in their textbooks where there are assumptions that everyone in the classrooms is the same, especially in terms of being able-bodied. They may choose to take action by writing letters to different audiences, such as the textbook publishers or district administrators (curriculum coordinators), to describe their findings, let them know how this is not an accurate depiction of people in their classroom and/or world, and give suggestions of ways to make the task or lesson more inclusive. While this activity is ideally student-led, students may need some assistance in developing more inclusive tasks.

COMMUNICATING WITH STAKEHOLDERS

Before teaching this lesson, you should reach out to families, parents/caregivers, and also administrators in your building to provide an overview of the topics included in this lesson (different kinds of bodies, disability, and ableism) and the kinds of the discussions that might emerge. This will help you anticipate ways to be sensitive to and inclusive of the students in your classroom. Any information you receive about specific students or their family members (about differences or disabilities) should stay private, unless they give you explicit permission to share. And, as mentioned earlier in the lesson, take care not to place any student(s) in a position where they have to speak as a “representative” for those who are different or who are disabled.

ABOUT THE AUTHORS



Courtney Koestler is a proud former public school teacher and currently serves as the Director of the OHIO Center for Equity in Mathematics and Science in the Patton College of Education at Ohio University. Their work centers on critical literacy and critical pedagogies in early childhood and elementary education.



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Jan McGarry is an elementary teacher in Athens, Ohio. She has had the privilege of working with first and second graders in Appalachia for 20 years. Jan has a passion for fostering inclusive classroom families that center students' voices and encourage connections with the community and current events through the lens of social justice education.

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