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Lesson Title: Art and Math measurement

Length: 1 hour

LESSON JUSTIFICATION

Who are my students**?** (Student information, interests, and needs specific to the content of this lesson)
There are 29 fourth graders in the classroom. There are a few more boys than girls. The demographics are varied. Most are Hispanic with different countries of origin, several are African-American, and a few are white, several are probably mixed racially. Some students are often absent, one of these students when he is present does not involve himself in the class but sits with his head on his desk or begins to act out. There is at least one other student that when he gets bored also begins to act out. There are a number of other students who get distracted easily and spin around on their wobble chairs. Some of the students are slow in reading and writing. At least five are behind in math. Some of the students have an IEP, while the Special Ed. teacher is in the process of rewriting these, one is currently for Emotional Behavior, one for speech, one for autism, and one for specific learning disability.

What **conditions/ limitations** might impact the planning and delivery of the lesson?
As I mentioned above, the one student might act out, and if he does not, there are a number of other students who get distracted easily and spin around on their wobble chairs. Some of the students are slow in reading and writing. At least five are behind in math and might struggle in following the lesson.
The students' desks are frequently being rearranged. The space is tight, and they do not have much extra room for moving around.

What are you teaching? An integrated art and math lesson focusing on units of measurement. The students will be guided in drawing realistic portraits and figures using heads, eyes, and noses as units of measurement.

Why do students need to know this content? Understanding units of measurement is a first grade concept that students should know by this point, however, it needs to be continually fortified.   The students will be building upon this knowledge by also focusing on proportions and drawing to scale. Working with measurement scale is a fourth-grade level concept and lays the foundation for later work with proportions and fractions.

Why did I select the instructional strategy(ies) utilized in this lesson? Provide a research/theory connection to support the instructional strategy.   When "students use and translate among external representations—contextual, physical, visual, verbal, and symbolic—their mathematical knowledge becomes stronger, deeper and more usable in solving problems (Greeno 1987; Lesh, Post, and Behr 1987; Webb, Bosinkel, & Dekker 2008, cited in *Taking Action* Huinker, 2017)

How does this lesson connect with and build on previous/subsequent lesson(s)?
The guidance counselor has tried to encourage the class to make goals for themselves and think about their future. In showing the video about the Pixar studies, my hope is to enkindle dreams to think big and reach for great possibilities in life. School in fourth-grade might seem pointless at times to students, but I want to help them see everything as a building block to their future. Many of the students enjoy drawing and I want to encourage that, but also to encourage them to do well in their other work and help them to see how the two can complement each other.

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ACADEMIC LANGUAGE
Drawing proportionally to scale.
Vocabulary: **Units of measurement** **Proportion** **Measurement scale** **figure**
OR Discourse (Circle one):
Student support tool: Paper, pencils

STANDARDS AND LEARNING OBJECTIVES

Standard	Content Objective	Assessment:	
CCSS.MATH.CONTENT.1.MD.A.2 Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.*	**SWBAT draw multiple copies of a unit shape (oval representing a head) in order to measure the height of a fourth grader.**	*Tool(s): paper, pencils*	
		Indicators/Criteria: *Show a vertical line of multiple copies of an equally sized head shape with no gaps or overlaps.*	
		Feedback:	
Standard Anchor Standard 1: Generate and conceptualize artistic ideas and work VA:Cr1.1.4a Brainstorm multiple approaches to a creative art or design problem.	**SWBAT discuss how math and art might be related or how they can be used together. They will specifically reflect on how both are used to create animated movies.**		

Standard	SWBAT apply a common artist's technique of measurement for drawing figures – they will draw and measure figures by number of heads tall.		
Anchor Standard 2: Organize and develop artistic ideas and work. VA:Cr2.1.4a Explore and invent art-making techniques and approaches.			
Standard CCSS.MATH.CONTENT.4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.	**Content Objective** **SWBAT draw a figure to scale based upon the diagram they created using the measurement of a head.**	**Assessment:** *Tool(s): Paper, pencils*	
		Indicators/Criteria: A figure that matches the height of their line of head shapes.	
		Feedback:	

MATERIALS

Pencils, paper, PowerPoint, internet connection

INSTRUCTIONAL STRATEGIES AND LEARNING TASKS

Time	Instructional Strategies/Learning Task	Differentiation
15 minutes	Who thinks art and math are related? Students are invited to share how they think they are related. None will probably think about how the two are connected in making movies. **Art, math and the movies** **Watch short film on Pixar and the Kahn academy.** https://www.khanacademy.org/partner-content/pixar/ **https://www.khanacademy.org/partner-content/pixar/start/introduction/v/pipeline-video** This is just to give you a small taste into the extent how many talents are needed for making a movie. Art, science and math work together. Right now, the type of math that you are doing in fourth grade might seem challenging at times, but I encourage you to push your brains to try to understand it as best as you can, so that you can do well in more advanced math as you get older. We are going to be working on some measurement math that is more often used	

	by artists. When you get older, I encourage you to learn higher level math so that you can work with more advanced computer programs in a variety of work. Our main objective today will be that you can **draw a figure to scale using a specific type of measurement.** (Give appropriate wait time for answers to the following questions.) What does the word figure mean? The body of a person. Who can tell me what it means to draw something to scale? You heard this word when you were learning about maps in social studies. It means that you will not draw it exactly the size it is in real life, but the proportions will be similar. What does proportions mean? It means that if my waist is exactly in the middle of my body in real life, it should be in the middle in my drawing.	
7 minutes	*If time is an issue, this activity can be omitted.* **Blind contour** – this activity acts as a warm up to guide the students in developing hand and eye coordination and helping them to focus on what they are actually seeing. Students are invited to look at an object or person and draw without looking at their paper.	
10 minutes	**When you are measuring an object, what do you do?** You use an appropriate type of measurement depending on the object – what **are types of measurement that you use to measure yourself?** Feet, inches, pounds, ounces… **When you are measuring yourself in feet, what is important that I do with a ruler? Can I just stick the ruler in the air and then jump a space?** (*Demonstrate*) The ruler has to match up exactly from the previous spot that I left off. Almost everywhere in the world people use what is called the metric system in order to measure – the metric system corresponds well with the base ten system in math – base ten is our normal counting system, which means that the place value changes with groups of ten, so there are ten ones in the tens' place, ten tens in the hundreds' place and ten hundreds in the thousands' place and so on. In the metric system, we have groups of 100 – there are 100 centimeters in a meter. "Centi" means 100 in Latin. There are 1000 millimeters in a meter and there are 1000 meters in a kilometer, which is close is size to what we more often call a "mile" here in the USA. Here in the USA, we use the measurements of inches, feet, yards and miles. They do not work so well in groups of tens or hundreds. **Does anyone know how many inches are in a foot? (12) How many feet in a yard? (3) How many yards in a mile? (1760) How many feet in a mile? Who can do the math? If there are 3 feet in a yard and 1760 feet in a mile…how many feet are in a mile? (5280)**	

30 minutes	Now we are going to get into the art portion of our lesson! Does anyone know what many artists use to measure the human body when they are drawing? They measure by heads! Why would they measure by heads? Because even if people have different size heads, they usually are about the same number of heads high according to their structure. How many heads high is a fourth grader's body? Demonstrate artists' sighting technique: Ask for three volunteers, invite one student at a time to come to the front of the room. Everyone else should take their pencil and hold their arms outstretched to measure with their eye the size of their classmate's head and then to count how many heads high the person is. They should repeat this with the other two classmates. On the paper, they should now draw a stack of ovals (heads) as tall as a fourth grader is. Remind them each oval needs to be the same size. Show an example on the board. See accompanying PowerPoint or draw one's own example. Give time for students to replicate. Challenge them to begin their own figure drawing.	
	Now consider where the waist is – it should be at the half-way point, in the middle of the figure – 2 ½ heads for a fourth grader. *Where are the shoulders and how wide are they? Not immediately after one head, give space for a neck…Have student volunteers stand up again to measure. If possible take pictures of students and post on the smartboard.* *Once a general figure is drawn, discuss the features of the face.*	
	Measuring a face…how many eyes wide is a face? How many eyes long is a face? *Estimate – where do you think the eyes are in the head? Closer to the top, bottom or exactly in the middle?* *Thumbs up if you think near the top, thumbs to the side if you think in the middle and thumbs down if you think near the bottom.* *Now measure! Your eyes are exactly in the middle of your head!*	
	Talk about angles, intersecting edges, comparative measurements…	
	Optional video of an animator talking about his work with art and math connections. **https://www.khanacademy.org/partner-content/pixar/animate/ball/v/intro-animation?ref=Pixar_Recommended_videos**	

Closure

Ask students why they think mathematical measurements are important to art. These are some possible correct answers: In order to draw objects proportionally, to draw objects to scale, to make good use of the space on the paper.
This is just part of how math and art are connected, we could continue talking about how angles and symmetry are important for art, as well as mechanical engineering and computer science for making movies. Also, no matter what type of work you do, everyone needs to know enough math to pay bills…It can be expensive to make movies, all those people working together need to be paid. Someone has to handle the money and take care of that part of the math.

https://www.quora.com/How-could-math-be-used-in-filmmaking

SELF-ASSESSMENT/REFLECTION

For the most part, this lesson went really well. The students were enthused and engaged throughout the lesson, both those inclined towards math and those inclined towards art paid attention during the video and participated in the activity afterwards. They were impressed at how many people it takes to make a Pixar-movie. The images chosen to exemplify drawing figures also got them excited.

I did skip the part of "blind contour" because of time and also, I decided that it did not support the math aspect of the lesson anyway. We also did not get beyond the initial drawing of the figure. While I mentioned the aspect of the waist being in the middle, we did not go into this in detail and we did not have time to look at the proportions and measurements within the face. That would have had to be another lesson.

I was afraid asking for volunteers to come to the front would not work, but the students were excited to do so. However, most of the other students only watched me do the measuring and did not copy my actions, however, I did not demand that they imitate it either. Nevertheless, it gave them a general idea and many of the students found it interesting that they were all approximately the same number of heads high even though they were of varied heights. If these students were at a higher grade studying internal proportions, we could have made some math connections, however, at this point I also did not want to get distracted from the line of external measurement.

I found the integration of art with math helpful for me as an instructor because it showed to me which students understood units of measurement and which students had misconceptions. Some had drawn large spaces in-between their "head" units, others had overlaps or the size of the head changed dramatically as they repeated it. Another "mistake" I saw several times was that even though they maybe had their line of heads correct when they drew their figure they did not maintain the same size of head.

The lesson might have gone even better if I had anticipated that the students might not understand that the head needs to remain the same size as their line of measurement. Then I could have explicitly taught that aspect. As a follow-up lesson, we could have made comparisons of what happens if the head is a different size from the line of measurement. This would have led to the internal proportions remaining the same.

Additionally, I could bring in other points of reference on the figure, for example that the waist will be at the half-way point. In this way, figure drawing could also be integrated with a study of simple fractions. The class that I was working with was just not ready for fractions.

Talking about angles, intersecting lines, and comparative measurements would also have had to be another lesson.
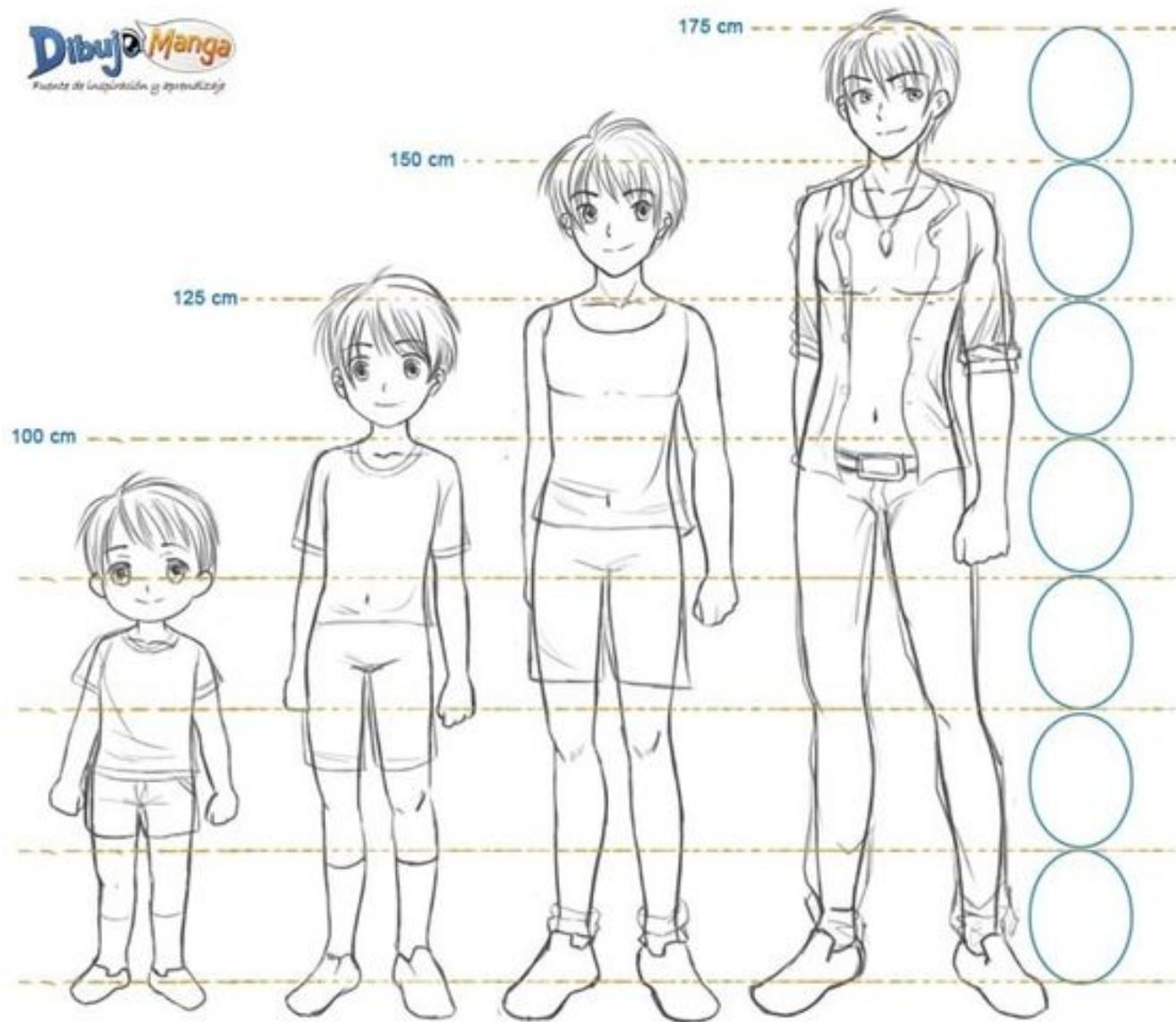
I know there are also many animation apps and programs out there that grade school students could use. The students wanted to make a movie after watching the video and doing this lesson. If such possibilities were available, this lesson and accompanying videos would serve as a good introduction.
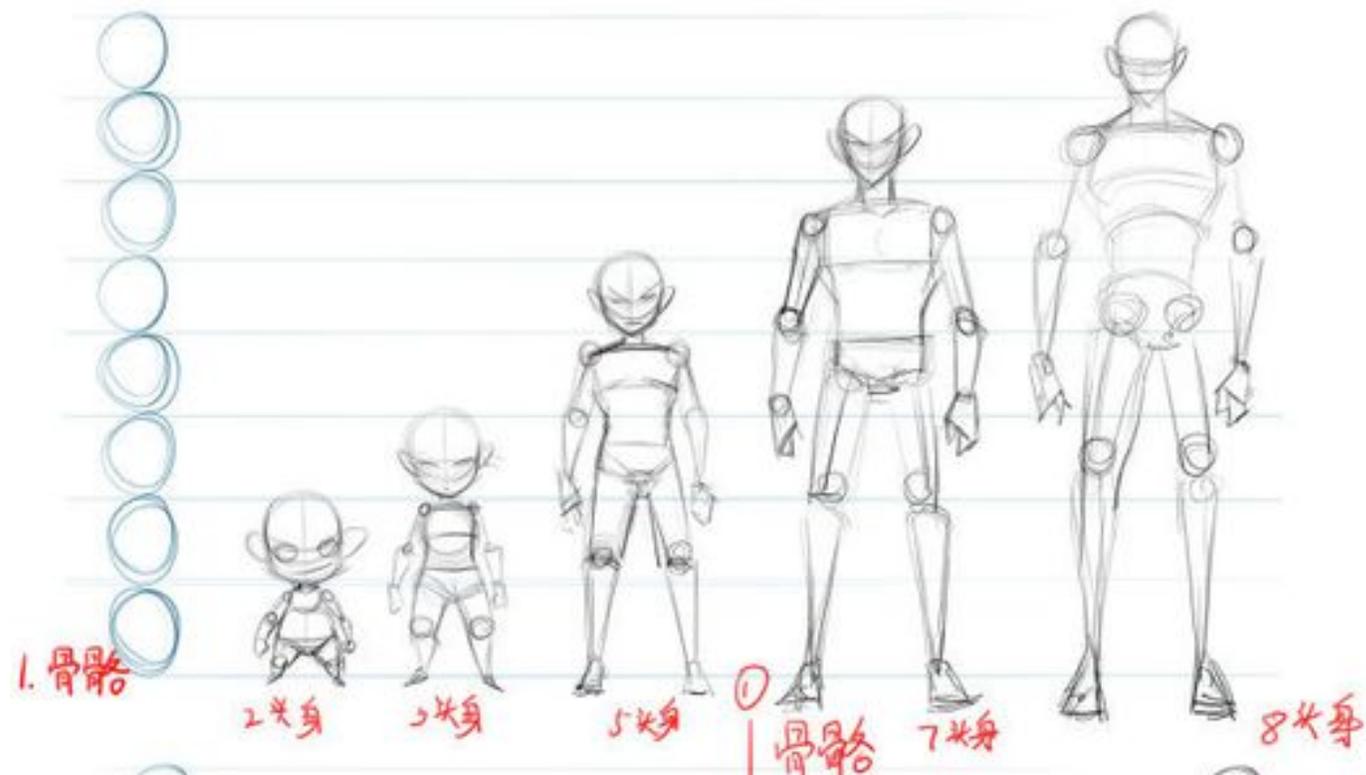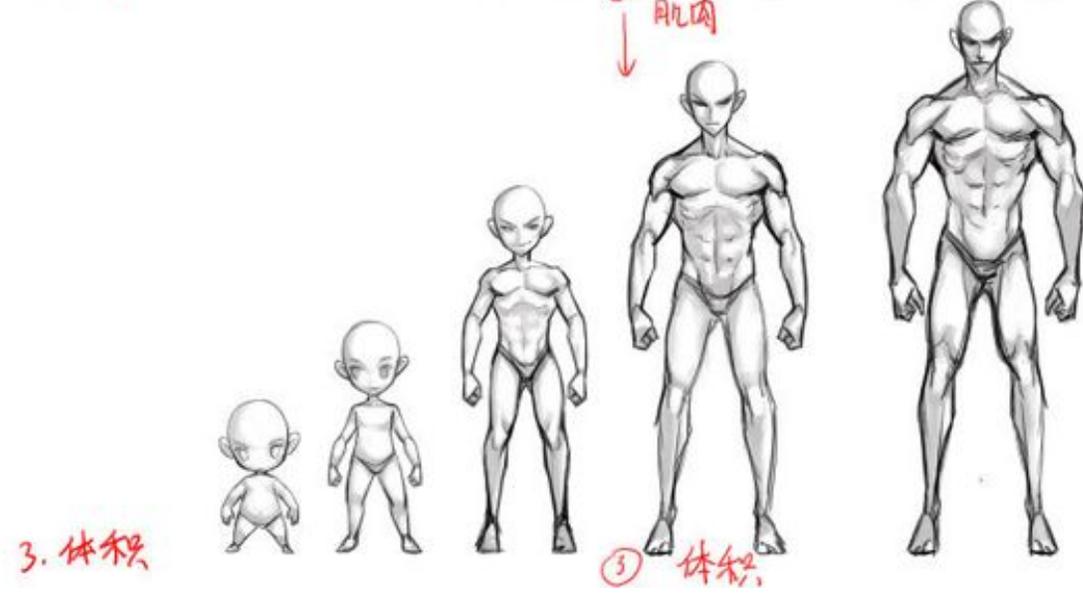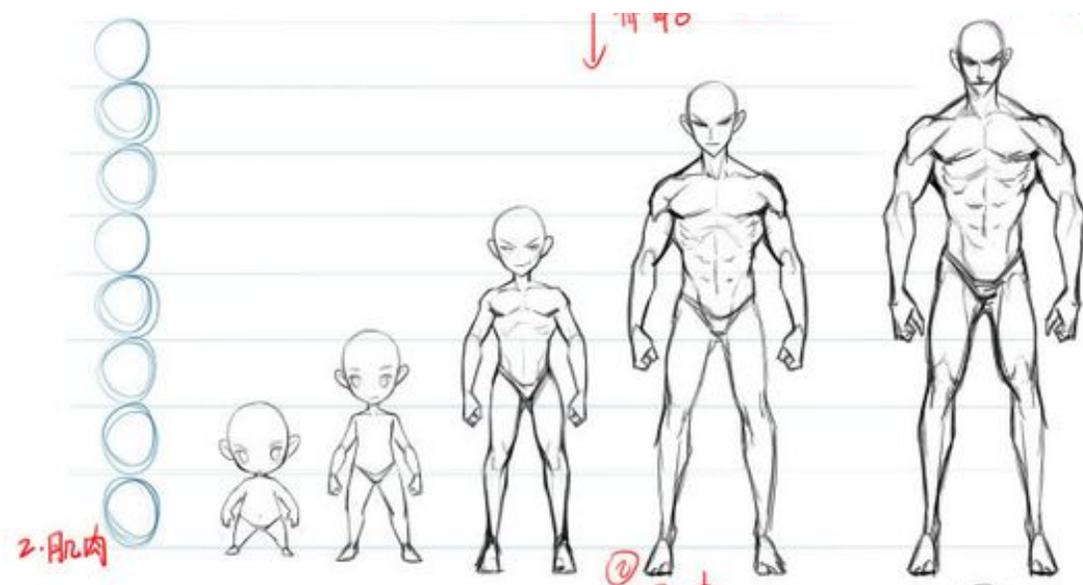
Math and Art

Fourth grade

https://www.khanacademy.org/partner-content/pixar/

https://www.khanacademy.org/partner-content/pixar/start/introduction/v/pipeline-video

How many heads high?

2.肌肉

④肌肉

3.体积

③ 体积

4.设计

https://www.khanacademy.org/partner-content/pixar/animate/ball/v/intro-animation?ref=Pixar_Recommended_videos