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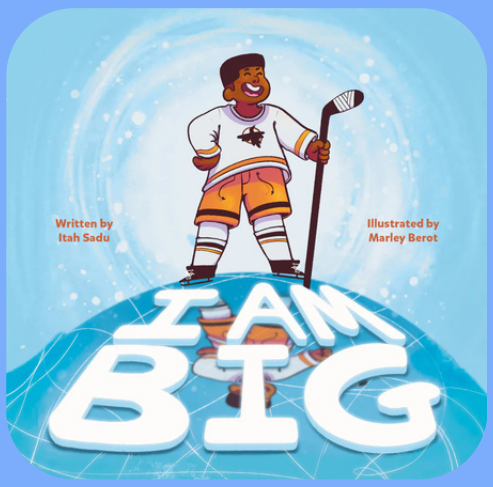
MATH IN LITERACY



I AM BIG

Written By

Itah Sadu

Illustrated By

Marley Berot

FIELDS ACADEMY

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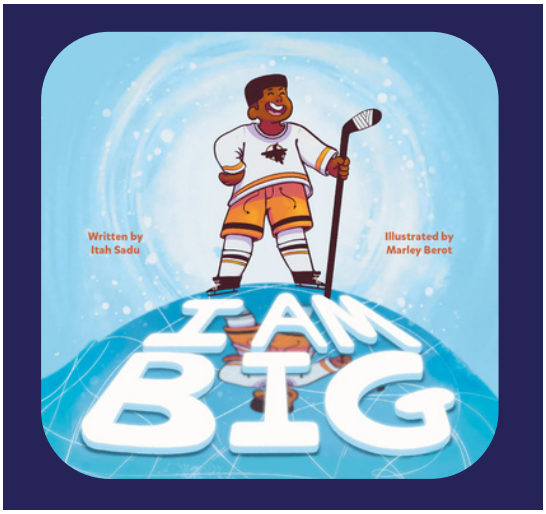

COMPARING HEIGHTS AND BODY MEASUREMENTS

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Appropriate For

Grades K – 6

People Required

This activity is best done with a group of 3 or more people. A combination of adults and children works well for this activity.

Brief Description

In this activity we will compare height and body measurements and look for patterns and ratios.

Materials

Measuring tape, string, chart paper, sidewalk chalk (optional)

Preamble

In the book the main character talks about how he is both big and small; how his size is bigger than that of his classmates and teammates, yet he is still only 9 years old. Using this as a starting point for discussion of how people are different sizes and grow at different rates, this activity will help us organize and compare heights and gain an understanding of differences, and similarities, in various individuals.

Preparation

Read the book and use it to discuss how children grow at different rates and how some people are short and some are tall, and how we all have similarities and differences in what a human body looks like.

Additional Resources

This activity covers concepts related to organizing information, graphing, measurement, comparing, and ratios. You can learn more about numbers and counting and ratios on our website: https://fieldsacademy.ca/iambig/

Prompting Questions

Who do you think is the tallest person in our group (the group can include parents/guardians, siblings, friends, etc)? What about the shortest? How can we compare people's heights and check to see who is the tallest / shortest? What methods can we use (measuring tape, standing back to back, eyeballing it, etc)?

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ACTIVITY 1 - COMPARING HEIGHTS

Step 1

Everyone writes down a guess for what they think the order of heights should be. Then ask everyone in the group to line up in order of height. When you come to an agreement as to the order, compare it to your guesses. Write down the final order on a piece of paper and set it aside.

Step 2

Measure everyone's height in cm and write them on a piece of paper. Working in pairs you can measure yourself with a measuring tape, or by standing against a wall with a measuring device attached to the wall, or, for a bit of fun, lay down and have your partner draw an outline of you on the ground and then use a measuring tape or ruler to measure the height of the outline. Record everyone's height on a piece of paper.

Step 3

Look at the measured heights and put them in order. For younger children or children who need a visual representation to compare larger numbers you can use place value blocks. If you don't have physical blocks you can find virtual ones at polypad.amplify.com. If multiple people are the same height, you can order them alphabetically or you can use even smaller measurements (include the millimetres) to see who is taller.

Note: you can either round your measurements to the nearest centimetre or, for students comfortable with them, you can include the millimetres as a decimal.

For example 96cm + 3mm = 96.3 cm. This is because a millimetre is 1/10th or 0.10 of a centimetre so 3mm = 3 * 0.1 = 0.3cm

Step 4

Step 4: Compare the measured heights order to your height order from Step 1 and see if they are the same or different.

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ACTIVITY 2 - COMPARING OTHER LENGTHS

We can also do measurements of other body lengths (like legs, arms, torso, head, etc) and compare. You can also add in things like distance between eyes, finger span, step length, who can reach the highest, or another measurement they come up with. Note: Unless everyone is comfortable, avoid width measurements such as waist, arm, or leg circumference to ensure this activity isn't associated with measuring weight or body shaming. Discuss how taller people typically have longer legs or arms and ask questions as to why this might be? Are there any situations in your group where someone has longer legs but is shorter than someone else? Feel free to have fun with different measurements and comparisons.

ACTIVITY 3 - COMPARING OTHER LENGTHS

For children who are comfortable with more advanced math topics, we can start comparing different body ratios between members of the group and see where there are differences and similarities.

For this activity, have everyone in the group measure the following:

- Height
- Foot length
- Arm span
- Distance from middle toe to ankle, ankle to knee, knee to hip
- Distance from middle finger tip to wrist, wrist to elbow, elbow to shoulder
- Top of head to bottom of chin

Write all of these measurements for each person on a separate piece of paper. Then compare things like:

- Height (top of head to bottom of feet) to arm span (middle finger tip to middle finger tip when arms are held perpendicular to the body); typically 1:1
- Height to femur (knee to hip); typically 1:4
- Head to body; typically 1:8 to 1:6 for a child and 1:4 for an adult
- Nose length to finger width; about 1:2 or 1:3

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ACTIVITY 3 - COMPARING OTHER LENGTHS (cont'd)

Example 1

Say a child's height is 94cm and their arm span is 92cm (it won't be exactly equal), then the ratio is 94 : 92 (height : arm span). You can round and simplify these ratios to make them easier to compare. For example you could round 94 and 92 to 90 and have a ratio of 90 : 90. Since each side can be divided by 90 you have a simplified ratio of 1:1.

Example 2

A child's height is 122cm and their head from top to chin is 23cm. This is a ratio of 122:23 (height : head), we can round these numbers to make them easier to work with to 120:20, both of these can be divided by 20 to give 6:1 or we read this as the height is 6 times the number of heads, or we need 6 heads to make 1 height.

For more information on calculating ratios check out the videos found at: https://fieldsacademy.ca/iambig/ (specifically the "Ratios", "LCM and GCF", and "Multiples and Factors" videos). Once you find the Greatest Common Factors (GCF) of the height and head height numbers you can use this number to divide the height and head height numbers to give you your ratios.

Think of other things you can compare and then look at the ratios for everyone in your group. These can include things like length of nose compared to distance between eyes, or length between middle finger tip and wrist to length of middle toe to ankle. Have fun with it!

Discuss why different people may have different ratios and what ratios are similar. For children they can have different ratios from adults because they are still growing.

Also discuss why different ratios might be an advantage, such as someone with longer legs having a longer gait (or distance between their feet when the walk) potentially making them a faster runner.

Technology Integration:

Use a spreadsheet like Excel or GoogleSheets and have it calculate the ratios so you get more precise numbers (1 : 2.3 instead of 1 : 2 for example). The spreadsheet example at the end of this document shows you the formulas to use.

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ACTIVITY 4 - AVERAGE RATIOS

You can also calculate the average of all the measurements and then calculate ratios based on that. Then everyone can compare their individual ratios to the average ratios. Note: this makes for a good discussion. Everyone should be a little bit 'off' from the average and you can discuss how there is no such thing as a truly average person. This story highlights this really well: www.lesswrong.com/w/lt-gilbert-s-daniels-and-the-mythof-averages

To calculate an average add all the numbers up and then divide by the number of entries.

For example, if there are 5 children in a group and their heights are 90cm, 95cm, 88cm, 101cm, and 106cm the average is:

90 + 95 + 88 + 101 + 106 = 480
480 / 5 = 96

Therefore the average height of the 5 children is 96cm.

Note: this average can be done with both children and adults included. You can discuss how adding in taller or shorter people can 'skew' the average for height (for example if there are more tall people then the average height is taller, same if there's more shorter people). However, the ratios, when averaged, won't have this skew. Why? (Hint: it has to do with the fact the ratio is constant / similar for everyone so the average ratio will be similar as well).

Technology Integration:

Use a spreadsheet like Excel or GoogleSheets and have it calculate the averages of all the measurements. Example spreadsheet at the end.

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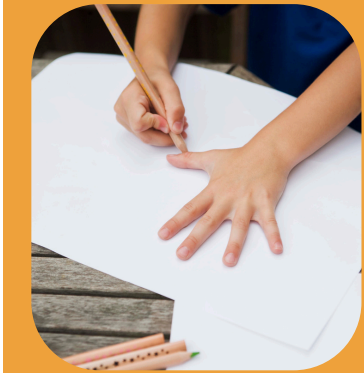
EXTENSIONS

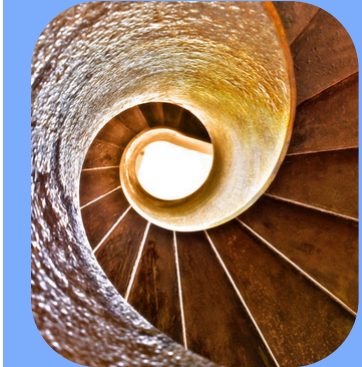


Extension 1

Instead of measuring the limbs directly, have everyone in the group trace an outline of someone else in the group either on the ground using chalk or on a chart paper or wall and measure that way. Discuss how these measurements won't be as accurate as measuring directly but can be a bit more fun.

Extension 2

Discuss the differences between intuitive ordering (how we can just look at two people and compare their heights) and using data to organize the same information and how this relates to how computers operate - they require data to calculate these things, they can't do it by intuition alone like humans can.



Extension 3

You can use the ratios to discuss the Golden Ratio of approximately 1.618 and encourage the students to see if they can find measurement comparisons that are close to that. You can then discuss how this ratio is found in many natural formations, and how we use it in art. Further details can be found here: https://sciencenotes.org/golden-ratio-definition-examples-properties-and-history

Extension 4

You can often look up the height of many celebrities online. You can use these heights to compare members of your group with celebrities.

Note: most of these measurements are in feet and inches so you may need to do some conversions. You can either use the following equation or an online calculator.

1 foot = 12 inches
1 inch = 2.54 cm

Example: Taylor Swift is 5'10" (5 feet, 10 inches)
5 feet = 5*12 inches = 60 inches
60 inches + 10 inches = 70 inches
70 inches = 70*2.54cm = 177.8cm or 1.778m

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FINAL DISCUSSION

Use the book and the activity to discuss the differences and similarities in heights and measurements found in each individual in the group. Be sure to keep the discussion positive and focused on celebrating differences and how in growing children these differences may change over time. Spreadsheet Example Column I shows the equations used; note, I have broken down the steps for the ratio calculations. If you are comfortable with Excel there are more efficient ways to do it.

SPREADSHEET EXAMPLE

Column I shows the equations used; note, I have broken down the steps for the ratio calculations. If you are comfortable with Excel there are more efficient ways to do it.

	A	B	C	D	E	F	G	H	I
1	Name	Height (cm)	Head Height (cm)	GCD	Height for Ratio	Head for Ratio	Ratio		Equations Used
2	Ajax	90	15	15	6	1	6		In column D =GCD(B2:C2), then in column E =B2/D2, column F =C2/D2, then G =E2/F2, the ratio is this number : 1; for other measurements change the 2's to 3's, 3's to 4's and so on
3	Barbara	95	16	1	95	16	5.9375		
4	Constance	88	14	2	44	7	6.285714286		
5	Dion	101	17	1	101	17	5.941176471		
6	Ester	106	18	2	53	9	5.888888889		
7									
8	Total	480	80						=SUM(B2:B6)
9	Average	96	16				6.010655929		=AVERAGE(B2:B6) or =B8/5; use C2:C6 for the head height and G2:G6 for the ratio