Welcome fellow Recovering Traditionalists to Episode 162: Approximation, Precision, & Accuracy in Measurement

Before we get into the episode, this week's positivity comes from Bethany who is a member of the Build Math Minds PD site and a winner of one of our Monthly Math Goody Boxes. Each month inside the PD site, I create a Monthly Missions for the members. Everyone who completes the mission fills out a form and that enters them into the drawing for the goody box. It's filled with some of my favorite things, some mathy, some just personal. This Month's mission for our members is to snap a picture of something mathematical in their life. Then I'm compiling those into a Google Slide file that shows the picture and gives mathematical questions you can ask students. It's looking like that completed document will have over 100 slides of images that the BMM members can use to have Math Talks with their students. I'm excited to see how our mission ends up this month. So if you are a BMM member, don't forget to get your picture submitted so you have a chance to win this month, and if you aren't a member yet you can go to BuildMathMinds.com/bmm to become a member.

So here is what Bethany sent to us after she received her Math Goody Box:

We just returned from winter break today and the goodie box arrived over the break. To say I'm overwhelmed and humbled is an understatement. Your generosity is well beyond anything I imagined or quite frankly feel I deserve! I will send a more formal thank you in the mail, but wanted to reach out right away to pass my thanks on to anyone who had a part in putting it together for me.

And yes, I've had this for a while now because she sent it to me back in January…but Bethany I really appreciate you letting us know that you enjoyed the goodies and you do deserve everything that is in there. My friend, Heidi, who works with me packs up all those boxes and ships them out. In fact she ships out everything here at Build Math Minds. So if you ever purchase anything from our site, just know one of my good friends is the one packaging it all up and I couldn't do it without her. And she helps me publish this Podcast every week too…so thanks Bethany for acknowledging the others who help me get everything out to you guys and Heidi, thanks for being a part of my team here at Build Math Minds.

Alright let's get into the math stuff…

It's been a while since I talked about ideas for building students' understanding of measurement. Today I'm going to share a piece from the book Guiding Children's Learning of Mathematics by Steve Tipps, et. al. This book is a textbook, so it can be quite expensive. I'll link to the most current version but I personally have the 12th edition and if you can find a past version for cheaper I say get that one.

In my version of the book, there's a part in Chapter 18 where they are talking about what teachers should know about teaching measurement and the first section of that is one Approximation, Precision, and Accuracy. On page 470-471 they start off discussion Approximation:

"…The fact that measurement is always approximate stems from the nature of measurement and measurement units. At least theoretically, for any unit of measurement chosen, another smaller unit exists.

Counting the smaller units of measure yields a more precise measure for an object. For example, the height of a door measured with a meterstick might be more than 2 meters. If a decimeter is used to measure the door, the result might be a little more than 22 decimeters. Using a centimeter as the unit might show a measure of more than 222 cm but less than 223 cm. If it were practical to measure with millimeter units, the door might be a little more than
2,226 millimeters.

Each subsequent measurement is more precise, but the precision can be improved indefinitely (theoretically, if not practically) by measuring with smaller, still more precise units. Even if the measurement appears to be exact, we recognize that it is not. Saying "exactly 12 o'clock" or "A football field is exactly 100 yards long" is misleading. While you were saying 12:00, the time had already changed. A marked football field is approximately 100 yards long, rather than exactly 100 yards long. It may be 1 inch shorter or 1 inch longer than 100 yards.

Precision and Accuracy.
The difference between precision and accuracy is important. Precision refers to units of measure. Inches are more precise than feet or yards. Milliliters are more precise than liters.
Accuracy refers to the care with which a measurement is made. If the finish line for a 100-meter dash is only 99.8 meters from the start line, then the measurement is not accurate. An inaccuracy of this sort would negate records set on the track.

The need for precision and accuracy depends on the measurement setting. Ball bearings for the U.S. space program must be manufactured to a tolerance of 0.00001 centimeter. Cutting cloth for a shirt does not require the same accuracy, but miscutting by an inch can have serious results in fitting the shirt. An optician who measures the bifocal line inaccurately will prepare glasses unsuited for the user. Household measuring cups and spoons are precise enough for cooking but not for chemical and pharmaceutical purposes. Measuring four cups of flour rather than three, however, may ruin the cake…"

So as you are having students work on measuring items, provide opportunities for students to discuss how measurements really are all Approximations. Encourage students to be as Accurate as possible, but remind them that it is an approximation. Then present opportunities for students to discuss how Precise they need to be in certain measurement situations.

Until next week my Fellow Recovering Traditionalists, keep Building Math Minds.

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