

Communicating Understanding in Mathematics

What is the goal for communication in the math classroom?

Mathematics learning experiences provide opportunities for students to make their thinking public verbally and/or in writing and subsequently engage in clarifying, refining, reflecting, and revising their ideas.

What do the standards say about communicating understanding in the math classroom?

[The Standards for Mathematical Practice](#) contain high expectations for communicating understanding. Math Practice 3, *construct viable arguments and critique the reasoning of others*, states “mathematically proficient students understand and use stated assumptions, definition, and previously established results in constructing arguments...they justify their conclusions, communicate them to others, and respond to the arguments of others.” Math Practice 6, *attend to precision*, affirms “mathematically proficient students try to communicate precisely to others [and] try to use clear definitions in discussions with others and in their own reasoning.”

NCTM’s Principles to Actions: Ensuring Mathematical Success for All states “effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.”

Why do we need to change our current practices?

[The Education Trust’s study](#) of more 1856 assignments revealed:

- Less than one-third, 32%, of assignments provided an opportunity for students to communicate their thinking or justify their responses.
- The majority of assignments were answer focused.

What is the significance of communicating mathematical understanding?

When we utilize instructional strategies that get students to share their thinking out loud, two very important processes occur. First, students are taking their ideas and thinking more deeply around them as they find the words that articulate their thought process. This helps them develop meaning and permanence for their ideas. Secondly, when students share their ideas publicly, other students benefit as they develop their own understanding and explore multiple perspectives and make connections between strategies.

Talking about mathematics is often not something that occurs naturally for students. Mathematical language is full of symbols and jargon. Students need a safe place to practice communicating their mathematical ideas with the support



of educators that will help them learn the nuances of the language as they develop the need for the words that will convey their thoughts. Of course, a main goal of math educators is for their students to perform well on high stakes assessments which include extended response items. In order for students to write about mathematics, they must first talk about mathematics. Once students are comfortable verbalizing their ideas they will be better equipped to use the precise language on their extended responses.

How will we know we are supporting this skill effectively?

All lessons should engage students in communicating their understanding either verbally or in writing. As teachers plan for instruction and reflect on how well their lessons met the learning goals, these reflection questions from [The Education Trust's Math Assignment Analysis Guide](#) (page 8) can help educators evaluate how well the goals for communication are being met:

- How often do I ask my students to justify a response, respond to an argument, or communicate their thinking to others?
- How can I incorporate SMP 3 and 6 into my assignments so that students are provided with opportunities to communicate their thinking using the language of math?
- When and how often do my students have the opportunity to participate in rich, structured, math conversations with their peers? As part of a whole class? In small groups?

NCTM's Principles to Actions: Ensuring Mathematical Success for All lists these student actions as evidence that students are engaging in "Elicit and use evidence of student thinking" (page 56):

- Revealing their mathematical understanding, reasoning, and methods in written work and classroom discourse.
- Reflecting on mistakes and misconceptions to improve their mathematical understanding.
- Asking questions, responding to, and giving suggestions to support the learning of their classmates.
- Assessing and monitoring their own progress toward mathematics learning goals and identifying areas in which they need to improve.



Tools and Strategies to support communicating mathematical understanding:

This checklist from The Inquiry Project lists 4 goals for productive discussions and 9 teacher talk moves that will support students as they communicate understanding.

- Talk Moves Checklist - https://inquiryproject.terc.edu/shared/pd/Goals_and_Moves.pdf

These warmup strategies are a great way to get students more comfortable with communicating understanding when first developing these skills.

- Math Talks - <https://www.ilteachandtalk.org/>
- Which One Doesn't Belong? - <https://wodb.ca/>
- Notice and Wonder - <https://illustrativemathematics.blog/2018/12/03/the-power-of-noticing-and-wondering/>
- What's Going on In This Graph? - <https://www.nytimes.com/column/whats-going-on-in-this-graph>

These strategies provide structure for students to share their ideas while engaging in task-based learning.

- Gallery walks - <https://earlymath.erikson.edu/preparing-gallery-walk/#:~:text=In%20a%20Gallery%20Walk%2C%20pairs,or%20comments%20they%20might%20have.>
- Alternatively, students can share their work presentation style and then field questions from the rest of the class.
- Promoting Mathematical Argumentation - <https://www.nctm.org/Publications/Teaching-Children-Mathematics/2016/Vol22/Issue7/Promoting-Mathematical-Argumentation/>
- Claim Evidence Reasoning - http://www.mathteachersinaction.org/uploads/4/0/7/1/40712613/engaging_in_argument_from_evidence.pdf

Resources:

Principles To Actions : Ensuring Mathematical Success for All. Reston, VA :NCTM, National Council of Teachers of Mathematics, 2014.

Dysarz, K., 2020. Checking In: Are Math Assignments Measuring Up? - The Education Trust. [online] The Education Trust. Available at: <https://edtrust.org/resource/checking-in-are-math-assignments-measuring-up/>.

Michaels, S. and O'Connor, C., 2012. *Talk Science Primer*. [online] Inquiryproject.terc.edu. Available at: https://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf.

