National Council of Teachers of Mathematics

Robert Q. Berry III
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President's Messages

Messages by Robert Berry

Personalized Learning and Mathematics Teaching and Learning

Personalized learning is one of many instructional approaches to support mathematics teaching and learning. However, a consensus on the definition of personalized learning is lacking, which leaves a range of ideas on what it might entail. These may include (a) customization, (b) student groupings, and (c) flexibility of instruction. Customization focuses on tailoring experiences and instruction for students' needs, interests, goals, and backgrounds. This suggests that personalized learning should have some humanizing aspects focused on knowing and understanding who students are as people and as learners of mathematics. Discussions on student groupings in personalized learning range from one-to-one (one-on-one) to small groups to whole-class experiences. Too often one-to-one and whole-class approaches are positioned in contrast; in fact, they can be complementary for deepening students' understanding of mathematics and for supporting them to develop a positive personal relationship with mathematics. Flexible instruction includes not only pacing of instruction but also time and space for students to engage with mathematics.

Personalized learning is often part of an instructional approach that supports the needs of individual learners. Many perspectives on personalized learning have focused primarily on improving test scores and achievement while ignoring the humanizing and social aspects of mathematics teaching and learning. For example, I have been exposed to several approaches to personalized learning that focused on tailoring mathematics tasks and problems to learners to find solutions with little emphasis on how they make sense of mathematics, how they use their mathematical understanding to find solutions, and why their solutions do or do not make sense. Personalized learning can be a space in which learners give voice to the ways they think mathematically, represent and discuss their mathematical ideas, and use mathematics to make sense of their worlds. Personalized learning can help learners see themselves as doers of mathematics by providing supports for developing understanding and perseverance, as well as for engaging in collaborations with peers to unpack mathematical thinking.

Imagine personalized learning as each and every student being provided with a personalized teacher of mathematics who understands his or her needs, knows his or her interests and background, and is highly knowledgeable about mathematics teaching and learning. Imagine students having broad access to their personalized teacher to ask questions and that their personalized teacher is able to extend their mathematical thinking. While I recognize that one-on-one instruction is unrealistic, I still grapple with whether this condition of having a personalized teacher for personalized learning would be enough for students to be productive learners of mathematics in a democratic society. I grapple with this because I find value in students being connected to other students who are diverse in their thinking about mathematics, have diverse backgrounds to bring different perspectives about mathematics representations and ideas, have varying worldviews, and are co-learners for clarifying and critiquing one

another's mathematical ideas. My grappling makes me think about ways that personalized learning is connected to ambitious mathematics teaching and about how personalized learning could support individual learners while creating spaces for individuals to engage other learners.

I often draw on the eight Mathematics Teaching Practices in NCTM's Principles to Actions: Ensuring Mathematical Success for All (NCTM, 2014) as a framework for unpacking mathematics teaching and learning. Below are descriptions of the teaching practices with questions to ponder that are related to personalized learning for mathematics.

1. Establish mathematics goals to focus learning.

   o How does personalized learning support learning progressions that build up students' mathematical understanding, increase student confidence, and support mathematical identity?
   o How does personalized learning ensure that each and every student has the opportunity to learn rigorous mathematics content and develop mathematical processes and practices?

2. Implement tasks that promote reasoning and problem solving.

   o How does personalized learning support tasks that require reasoning, problem solving, and mathematizing our world through mathematical modeling?
   o How does personalized learning support culturally relevant mathematics tasks?

3. Use and connect mathematical representations.

   o How does personalized learning support the use of multiple representations so that students can draw on multiple resources and funds of knowledge?
   o How does personalized learning ensure that students develop connections among multiple representations to deepen their understanding of mathematical concepts and procedures?

4. Facilitate meaningful mathematical discourse.

   o How does personalized learning use discourse to elicit students' ideas and create space for students to interact with peers?
   o How does personalized learning allow students to develop language to express mathematical ideas and how does it position each learner with mathematical authority and competence?

5. Pose purposeful questions.

   o How does personalized learning pose purposeful questions to understand students' mathematical thinking?
   o How does personalized learning support purposeful questions to deepen students' mathematical understanding?

6. Build procedural fluency from conceptual understanding.

   o How does personalized learning connect conceptual understanding to procedural fluency to provide students with a wide range of options for entering a task and building mathematical meaning?
   o How does personalized learning routinely connect conceptual understanding and procedural fluency to deepen learning and reduce mathematical anxiety?

7. Support productive struggle in learning mathematics.

- How does personalized learning allow time for students to wrestle with mathematical ideas in ways that support perseverance and sense making?
- How does personalized learning offer enough support and scaffolding (without over-scaffolding) to facilitate students' progress on challenging work?

8. Elicit and use evidence of student thinking.

- How does personalized learning elicit students' thinking and make use of it to support learning?
- How does personalized learning support a culture in which mistakes and errors are viewed as important reasoning opportunities?

I encourage you to use the questions above to begin discussions on personalized learning in mathematics teaching and learning. I am interested in learning about the promises and challenges of personalized learning. Please share your successes and challenges on MyNCTM.org

Robert Q. Berry, III

NCTM President

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