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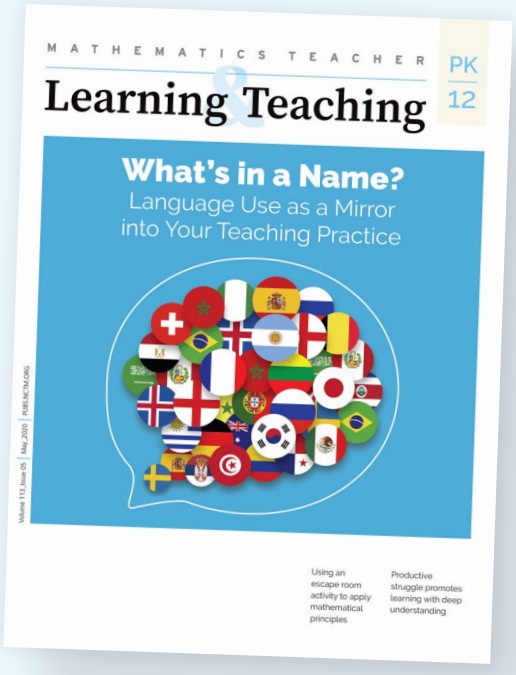

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Walking Away from a Mathematics Problem Is OK

Providing students the autonomy and choice to learn when productive struggle becomes unproductive is a core teaching belief in the author's classroom. This article tells the story of one student's ability to know and express when his frustration was too great and how he chose to walk away from his work and return the next day.

Zachary Champagne

I teach in a multiage classroom where I have 16 first- and second-grade students, ages 6, 7, and 8. Like other educators, I believe in the importance of productive struggle. I want my students to understand that working toward a solution, even when that path is tricky and challenging, is worthwhile. But what I do not want is tears. For me, no mathematics problems are worth tears. I want to help my students find the line between productive struggle (NCTM 2014) and unproductive struggle (Warshauer 2011). In this article, I share the story of what happens in my classroom when a student needs to walk away from a mathematics problem.

MCINTYRE'S REQUEST

In early January, my students were studying sunflowers as part of an interdisciplinary unit. We grew sunflowers, measured their growth over time, journaled about them, and drew pictures of them. In addition, students were invited to construct sunflowers out of pattern blocks and then use these geometric abstractions of sunflowers to explore the composition of their flowers numerically.

After the students built their flowers, I took pictures of them. The next day, I asked students to use the printed picture of their flower to count the number of hexagons, trapezoids, tan rhombuses, blue rhombuses, triangles, and squares they had used in their designs. Students were also tasked with determining the total number of pattern blocks they had used, and they could use whatever strategy made sense to them to figure this out.

During our first day of work, students busied themselves with building a variety of colorful and geometric flowers. I moved around the room, checking in with students and engaging in conversations with them about the geometric ideas in their designs. Students were also checking in with one another, and they excitedly talked about their individual designs.

I came upon McIntyre and his work see (figure 1). His classmates and I were both impressed by the symmetrical design, and we found it unique how he had the trapezoids and squares interact. The inner part of the flower does not fit neatly in the outer ring of hexagons and squares. This was special to his design, and we all found it visually pleasing. McIntyre's smile grew wider with each comment from his classmates.

However, on the second day, when I asked students to count the individual and total number of shapes in their sunflowers, I came upon McIntyre with his head down; figure 2 shows his work.

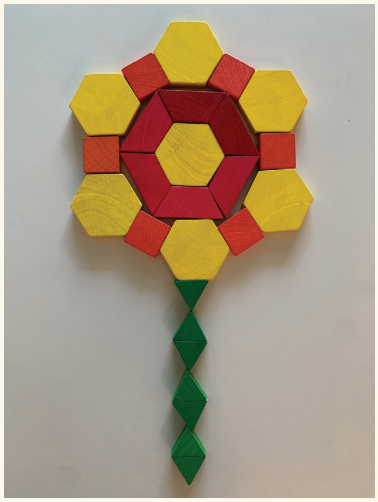
To make his flower, McIntyre had used seven hexagons, six trapezoids, seven triangles, and six squares, and yet when he figured out the total number of pattern blocks he used, he came up with 43. After McIntyre finished and checked with his partner, Manny (whose

name is on the paper), he was stymied. After he and Manny talked through his work, McIntyre was sure that his work was incorrect. He had even taken his pencil and crossed out the whole paper because he knew he was stuck and his answer was incorrect. When I first knelt down next to McIntyre's desk, his strategy for determining the total number of blocks was not immediately clear to me. However, I was curious and eager to hear his thinking.

But before I could ask him any questions about his work, McIntyre asked, "Can I do this tomorrow? It's too hard." McIntyre looked defeated. The confidence and pride he had shown yesterday when building his sunflower had now changed to sadness and despair.

In the past, the idea of letting a student walk away from a mathematics problem would have seemed preposterous to me. After all, isn't productive struggle something that we want for our students? Don't we want them to power through difficulties and challenges?

Fig. 1



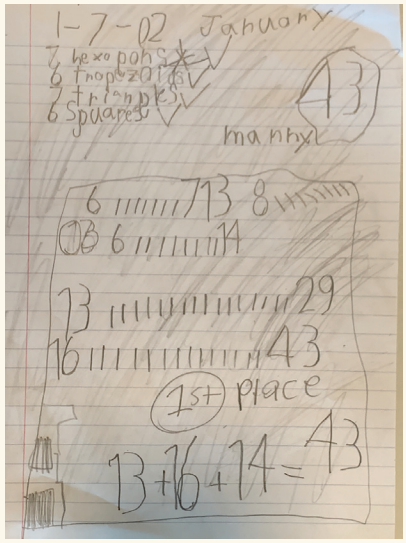
McIntyre's flower design was visually pleasing and unique in the way he used squares and trapezoids.

PRODUCTIVE STRUGGLE, UNPRODUCTIVE STRUGGLE, AND WALKING AWAY

Principles to Actions: Ensuring Mathematical Success for All (NCTM 2014) describes productive struggle as "embracing a view of students' struggles as opportunities for delving more deeply into understanding the mathematical structure of problems and relationships among mathematical ideas, instead of simply seeking correct solutions" (p. 48), whereas Warshauer (2011) describes unproductive struggle as when an opportunity or task does not allow for a student to make progress toward "sense-making, explaining, or proceeding with a problem or task at hand" (p. 21).

Yes, I believe that we want our students to engage in productive struggle, but not at the expense of their understanding or their relationship with mathematics. What I want is for my students to be empowered to find the difference between those two spaces. I want to offer them choice and autonomy to learn when something moves from productive to unproductive. To encourage this big work, I choose to not only *let* my students tell me when something is too much but also *encourage*

Fig. 2



This shows McIntyre's first attempt at determining the total number of pattern blocks he used.

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Although I once believed that mathematics was about "just working hard and getting through it," I do not believe that anymore.

them to do so. In fact, the following agreement is a fundamental part of our classroom community:

It's okay to walk away from a math problem.

Now if reading that sentence has you imagining chaos in your classroom and leaves you feeling anxious, stick with me for a minute. Many of us were taught through our own education and life experiences that mathematics is scary and that we should endure some pain to get through it. In fact, we can all probably recall a time in our own mathematics journeys in which we were told something like, "Well, you just need to get through this. . . . It's going to be hard, but you just have to do it." So now, many of us equate mathematics learning with a struggle that goes beyond a productive one. For many of us, those experiences were the ones that laid the foundation for our own struggles, fears, and anxiety in mathematics.

Although I once believed that mathematics was about "just working hard and getting through it," I do not believe that anymore. So, here is why I believe allowing students to walk away is one of the most important things we can do:

- *Making space for students to walk away from a problem shows we trust them (*Kohn 1993*).* It communicates to our students that they are the most important drivers of their own learning and that we trust them to tell us when something is too much or when they might just need space from the problem. It lets them know that we understand that their lives are much more complex than mathematics class, that sometimes they may not be in the right headspace to solve that particular problem, or that they have gotten lost in the specifics or computation of the problem. Perhaps most importantly, this trust helps build a strong relationship with our students. It lets them know that we believe that their voice matters.
- *We give ourselves, as educators, permission to walk away from work and come back later*. One of my favorite things to do with other educators is to solve mathematics problems together. I have come to understand that if a problem is truly worth solving, it may push us to a point of frustration. I have found that the best thing to do when that happens is to walk away from it. Because space is helpful. Space provides perspective. Sometimes I will come back to it. Sometimes I will not. I believe that both are OK, and I want to empower my students with the same opportunity that I provide myself.
- *We allow students to walk away from work in other content areas* (Miller 2013*,* Ray 2001). Many of us feel more comfortable with the idea of letting students walk away from something outside of mathematics. We teach them that it is OK to start a book and decide not to finish it if it is too difficult or you just are not interested in it. We model how you may start drafting a new piece of writing, get a bit stuck, and put it away for it a bit. You may come back to it at some point, or you may come up with a better idea for your writing and go in a completely different direction. Both are OK. So, why not let our students do this in mathematics class? Sometimes tough mathematics problems are not solved in a single sitting. I have come to understand that sometimes more time than is allocated in one mathematics class is exactly what is needed to tackle tough problems.
- *Frustration can lead to mathematics anxiety (*Hackworth 1992*,* Stuart 2000*).* A serious and often overlooked part of my job as a teacher is helping students understand and believe that they are "good" at math. Research and experience tell us that mathematics phobia is real, and it affects student learning (Boaler 2016). It also disproportionally affects girls, women, emergent multilingual students, and students of color (Furner and Duffy 2002). In my time as an educator, I have watched far too many students get to the point of tears when working on a mathematics problem. For me, no mathematics problem

is worth tears. We should give our students, and convince students to give themselves, permission to walk away when their progress has come to a halt. My experience has been that the students who need the opportunity to walk away the most are far too often those who get that opportunity the least. I have seen this belief about teaching and learning go a long way in helping students create a positive relationship with mathematics and be mathematics positive.

So, what does this actually mean in the classroom? For me, it means that I need to let go of some of my power in the classroom to make space for students to say, "This is too much for me today" or "I need more time on this tomorrow." It is a way to empower my students to take control of their own learning and to help them know their limitations and expectations. I have given my students permission to say to me, "I need to walk away."

MCINTYRE'S STORY—WHAT HAPPENED NEXT?

So, let's return to McIntyre to see how this actually played out in my classroom. McIntyre had just said to me, "Can I do this tomorrow? It's too hard."

My response was simple. "Yes, you can."

So, we put it up for the day, and McIntyre joined our closing meeting where students shared strategies for determining the total number of pattern blocks in their flower designs. I kept a close eye on McIntyre to see how he was interacting with these ideas. Although he did not have any outward epiphanies during this meeting, he was showing that he was listening to his classmates.

The next day, before our morning meeting, I asked McIntyre if he was ready to work on his pattern block flower. He seemed a bit trepidatious about this, but he agreed to take another look.

Our conversation went like this:

Mr. Zak: What do you think about trying a new strategy to determine how many total pattern blocks there were if you had seven hexagons, six trapezoids, seven triangles, and six squares?

McIntyre: OK. I can do that. But, then I'm gonna have to get a different sheet. I want to start over.

As he pulled out another sheet of paper, McIntyre gestured back to his paper from the previous day, with its frustrated pencil cross outs.

McIntyre: You know when you are trying to figure out something and you get all crazy and you don't even notice that you have more lines than you are supposed to have? That's what happened to me.

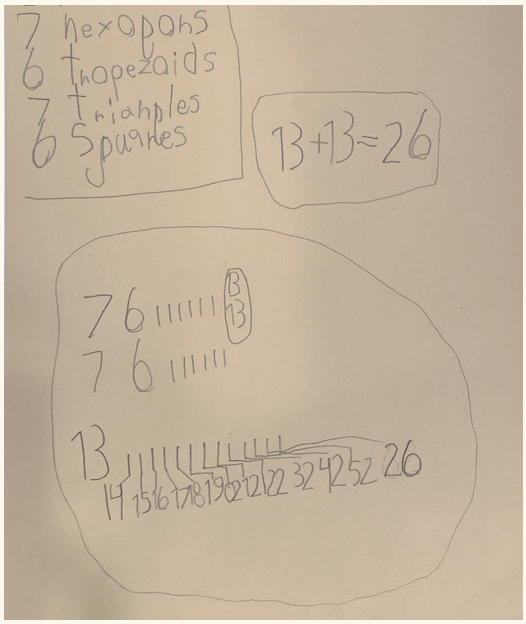
Mr. Zak: Yeah, I think that's really awesome that you realized that, and sometimes that happens to me too. Sometimes, we can get caught up in our strategies when we are thinking deeply about math. I think starting fresh sounds like a great idea!

McIntyre: OK.

I wanted to see how McIntyre was thinking about this. So, in an effort to present him agency in solving this problem, I walked away and let him work. As I walked away, I could not stop thinking about how well he was able to articulate what was so difficult about the work yesterday.

I came back about 10 minutes later, and I was so excited to see his work (see figure 3)! McIntyre took his original strategy of counting on from the larger number and was able to determine the correct number of pattern blocks in his sunflower. You will notice that he has a few reversals of his digits (e.g., 23 – 25), but this did not impede his understanding of what the total number was.

Fig. 3



McIntyre's second draft shows renewed focus and clarity.

Although I had openly suggested that he try a new strategy, McIntyre was confident enough in his own mathematical thinking to revisit his original strategy and execute it beautifully. When I checked on him after he finished, this was our conversation.

McIntyre: OK, so see, it goes 7, 6, 7, 6 [*talking about the number of pattern blocks*].
Mr. Zak: Yep.
McIntyre: So, I did 7 [*he pointed to each line one at a time*], 8, 9, 10, 11, 12, 13. And that's 13 there. And, then there's another 13 there. I did the same thing I did there. And I noticed I had two 13s. So, I did 13 + 13. And all I had to do was figure out what 13 + 13 was. So, I put 13 and then 13 lines, and I counted all of them, and that is 26.
Mr. Zak: Wow, McIntyre. This is lovely thinking. Do you feel better about your work?
McIntyre: Yes.

After he finished his work, I asked McIntyre if he would be comfortable sharing his thinking during morning meeting, and he agreed. This turned out to be a great example for our class of how and when walking away from a mathematics problem can be helpful. McIntyre was beaming during his share at the morning meeting. He smiled while he showed his work, and the whole class benefited from hearing a story of what it means to walk away from a mathematics problem. Video 1 is a short clip of McIntyre discussing how walking away from a mathematics problem has helped him as a mathematician.

CONCLUDING THOUGHTS

Allowing students to walk away from a mathematics problem is a simple move (in the loveliest sense of the word *simple*), but it can also be a difficult one in the moment. It requires us to trust our students. It requires us to give away some of the power we hold as teachers and make space for students to tell us when the work is too much. I have been surprised by what students can do when they have the autonomy to make choices for themselves. In my experience, they do not take advantage of it. In fact, they seem to take the work more seriously. More often than not, they come back ready to tackle the problem. —

Video 1 McIntyre Explains How Walking Away from a Mathematics Problem Helps Him

Watch the full video online.

REFERENCES

Boaler, Jo. 2016. *Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching*. San Francisco, CA: Jossey-Bass.

Furner, Joseph M., and Mary Lou Duffy. 2002. "Equity for All Students in the New Millennium: Disabling Math Anxiety." *Intervention in School and Clinic* 38, no. 2 (November): 67–74.

Hackworth, Robert D. 1832/1992. *Math Anxiety Reduction*. Clearwater, FL: H & H Publishing Company.

Kohn, Alfie. 1993. "Choices for Children." *Phi Delta Kappan* 75, no. 1 (September): 8–20.

Miller, Donalyn. 2013. *Reading in the Wild: The Book Whisperer's Keys to Cultivating Lifelong Reading Habits*. Hoboken, NJ: John Wiley and Sons.

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

Ray, Katie Wood. 2001. *The Writing Workshop: Working through the Hard Parts (and They're All Hard Parts)*. Urbana, IL: National Council of Teachers of English.

Stuart, Vanessa. 2000. "Math Curse or Math Anxiety?" *Teaching Children Mathematics* 6, no. 5 (January): 330–35.

Warshauer, Hiroko Kawaguchi. 2011. *The Role of Productive Struggle in Teaching and Learning Middle School Mathematics*. Austin, TX: The University of Texas at Austin.

