

Choosing Tasks for Productive Struggle, Not Frustration

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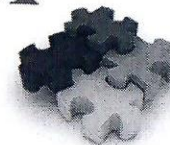
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Tasks for Productive Struggle

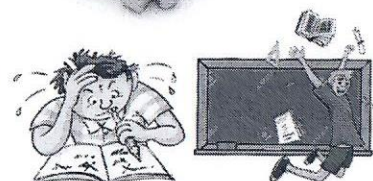
• Choose?



• Implement?



→ Students?



NCTM: What *is* Productive Struggle?

For teaching:

- Effective mathematics teaching supports students in **struggling productively** as they learn mathematics.
- Such instruction embraces 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.



(NCTM, 2014, p. 48)

Story 1: The Corvette Problem

In June 2013, a 1998 Corvette raced down the quarter mile drag strip at the Route 66 Raceway in Joliet, Illinois. The following data were provided on a time slip after the race:

Distance	Time
0 feet	0.734 seconds
60 feet	2.063 seconds
330 feet	5.387 seconds
$\frac{1}{8}$ mile	8.025 seconds
1000 feet	10.312 seconds
$\frac{1}{4}$ mile	12.259 seconds

We also know that the car crossed the finish line at a speed of 116.14 mph. For sports cars, a common measure of performance is the number of seconds it takes the car to accelerate from 0 to 60 mph. The driver of this Corvette would like to know, according to these data, how many seconds it took him to reach a speed of 60 mph. Your task is to determine this time, and support your claim mathematically. Include an explanation in words and a graph, if necessary.

Hallmarks of a Good Task

- The *problem solver* must decide what mathematics to bring in
- The task uses real-life (often messy!) data
- The task requires mathematical modeling

Story 2: Seven Billion People Problem

In November 2011, the 7 billionth person was born.



- Is it true that if you laid out all the people on earth end to end, they would encircle the earth 266 times?
- Is it true that if all 7 billion people stood shoulder to shoulder, we would all fit into Los Angeles?

Story 3: Condominium Community Problem

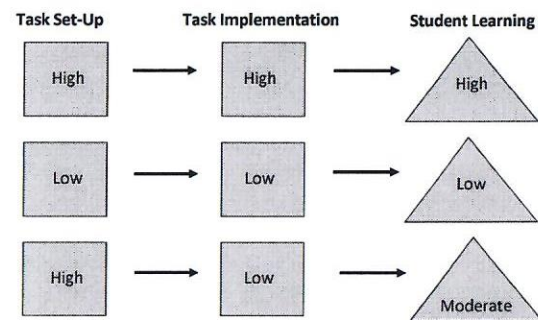
The Condominium Community Problem

In a particular condominium community $\frac{2}{3}$ of all the men are married to $\frac{3}{5}$ of all the women.

What fraction of the entire community are married?

(Assume each man is only married to one woman, and vice versa.)

Choosing and Implementing Higher-Level Cognitive Tasks: Effect on Student Achievement



(Stein & Lane, 1996)

Teacher's Role?

Support productive struggle in learning mathematics Teacher and student actions

What are teachers doing?	What are students doing?
<p>Anticipating what students might struggle with during a lesson and being prepared to support them productively through the struggle.</p> <p>Giving students time to struggle with tasks, and asking questions that scaffold students' thinking without stepping in to do the work for them.</p> <p>Helping students realize that confusion and errors are a natural part of learning, by facilitating discussions on mistakes, misconceptions, and struggles.</p> <p>Praising students for their efforts in making sense of mathematical ideas and perseverance in reasoning through problems.</p>	<p>Struggling at times with mathematics tasks but knowing that breakthroughs often emerge from confusion and struggle.</p> <p>Asking questions that are related to the sources of their struggles and will help them make progress in understanding and solving tasks.</p> <p>Persevering in solving problems and realizing that is acceptable to say, "I don't know how to proceed here," but it is not acceptable to give up.</p> <p>Helping one another without telling their classmates what the answer is or how to solve the problem.</p>

(NCTM, *Principles to Actions: Ensuring Mathematical Success for All*, 2014, p. 52)

What do these student responses mean?

- Initial reactions: uncomfortable!
- Opportunity for group discussions: increased confidence levels and *enjoyment!*
- We should do more of these types of tasks to promote productive struggle.

Productive Struggle: Recent Articles

Warshauer, H. K., (2015). Strategies to support productive struggle. *Mathematics Teaching in the Middle School*. 20(7), 390-393.

Warshauer, H. K., (2014). Productive struggle in middle school mathematics classrooms. *Journal of Mathematics Teacher Education*. 17, doi:10.1007/s10857-014-9286-3

The end.



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