What's So Difficult About Task Difficulty?

How to maintain the cognitive demand and accessibility of math tasks!

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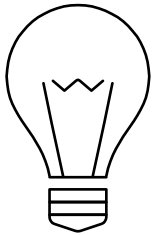
Outcomes

- Identify the features of **worthwhile math tasks**
- Understand how to make worthwhile tasks **accessible** while maintaining the **cognitive demand** of the task

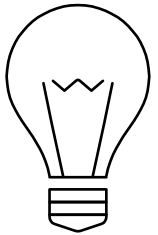
Worthwhile Tasks

Why?



- Promote and reveal students' mathematical **thinking**
- Increases **access**
- Establishes a high level of **rigor**

Why?



- When students are presented with meaningful and challenging work
  - Increased **engagement**
  - Increased academic **understanding**

[...] easy successes are not helpful; experience with ***success in challenging tasks*** *that require perseverance and even involve setbacks along the way lead to stronger efficacy beliefs.*

Gurganus (2017)

Feedback

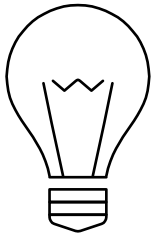
- Encourage **students** to do the bulk of the intellectual work (aka: thinking)
- Prompt **students'** mathematical thinking
- Help **students** make sense of things

Feedback

DO	AVOID
listen	taking over
prioritize kids' thinking	leading questions
ask "why?"	asking "how?"

Ginsburg (1997)

What?



Smith & Stein (1998)

- Complex
- Non-algorithmic
- Require **understanding** concepts and making **connections**
- Require considerable cognitive **effort** … may involve some anxiety

Give the fraction and percent for each decimal:

0.20 = _____ = _____

0.25 = _____ = _____

0.33 = _____ = _____

0.50 = _____ = _____

0.75 = _____ = _____

Smith & Stein (1998)

Create a real-world situation for the following problem:

$$\frac{2}{3} \times \frac{3}{4}$$

Solve the problem you have created without using the rule, and explain your solution.

Smith & Stein (1998)

Feedback: Model

DO

listen

prioritize kids' thinking

ask "why?"

AVOID

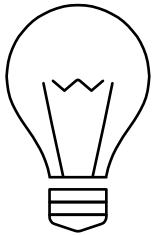
taking over

leading questions

asking "how?"

Ginsburg (1997)

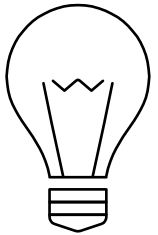
When?



- Regularly

- Students should consider worthwhile tasks as part of what it means to ”do math”

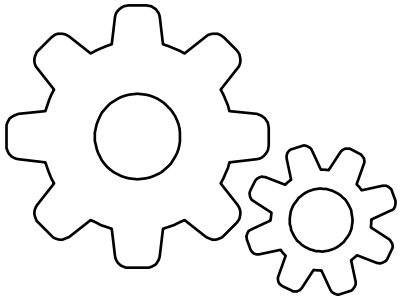
Who?



- Everyone

From Meh to Meaningful

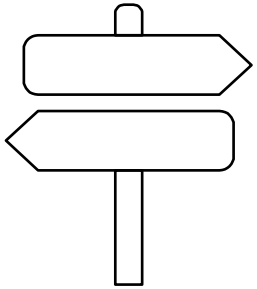
How?



- Reversibility
- Flexibility
- Generalizability

Dougherty et al. (2015)

Reversibility



- **Give students an answer or solution** and have them create a problem that would result in that answer or solution.

Simplify.

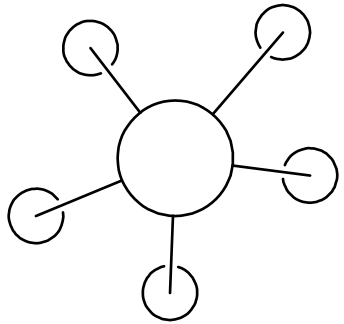
$4(3 + 5y)$

$12 + 20y$

Find two expressions that simplify to:

$12 + 20y$

Flexibility



- Asks the student to solve a problem in **multiple ways**.

$$-3 + (-8)$$

Feedback: Model

DO

listen

prioritize kids' thinking

ask "why?"

AVOID

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Ginsburg (1997)

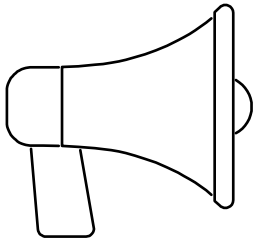
Generalizability

- Transform problems that have a single answer to provide opportunities for **pattern-building**, **conjecturing**, and **generalizing** mathematical facts and relationships

Fun Tees: Version 1	Fun Tees: Version 2
Fun Tees is offering a 30% discount on all merchandise. Find the amount of discount on a T-shirt that was originally priced at $16. 	Fun Tees is offering a 30% discount on all merchandise. • Find the amount of discount on a T-shirt that was originally priced at $16. • Suppose the T-shirt was originally priced at $17, $18, $19, $20, or $50. Describe the amount of discount on T-shirts at each price. • Write a number sentence that describes the amount of discount you will receive on any T-shirt that is offered at a 30% discount. Explain why this works.

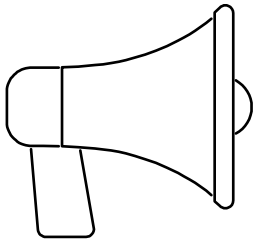
Smith & Stein (2018)

Discussion



- What are the potential challenges you see with making these types of curricular adjustments?

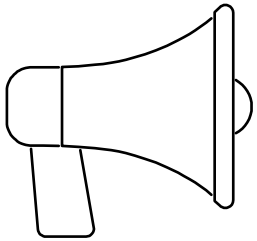
Discussion



- What instructional supports and routines could you put in place prior to introducing these more rigorous math tasks?

- Psst. How can you anticipate challenging behavior and address things proactively?

Discussion



- How might you collaborate with other professionals in your building or district to enact these adjustments?

Thanks!

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References

Dougherty, B., Bryant, D. P., Bryant, B. R., Darrough, R. L., & Pfannenstiel, K. H. (2015). Developing concepts and generalizations to build algebraic thinking: The reversibility, flexibility, and generalization approach. *Intervention in School and Clinic, 50*(5), 273–281.

Ginsburg, H. P. (1997). *Entering the child's mind: The clinical interview in psychological research and practice*. New York, NY: Cambridge University Press.

Gurganus, S. P. (2017). *Math instruction for students with learning problems* (2nd ed.). New York, NY: Routledge.

Smith, M. S., & Stein, M. K. (1998). Selecting and creating mathematical tasks: From research to practice. *Mathematics Teaching in the Middle School, 3*, 344–350.

Smith, M. S., & Stein, M. K., (2018). *5 practices for orchestrating productive mathematics discussions*. Reston, VA: National Council of Teachers of Mathematics.