MAA IP Guide: A Resource for Implementing Meaningful Mathematical Tasks to Foster Student Engagement

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MAA IP Guide

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Instructional Practices Guide

Guide to Evidence-Based Instructional Practices in Undergraduate Mathematics

Download the MAA Instructional Practices Guide now.

Success in mathematics opens opportun for students. A wealth of research literature exists on ho matics instructors can facilitate rich, meaningful g experiences and on what instructors can do to improve te ing and learning at the undergraduate level: **Effective teachin d deep learning require student engagement with c ent both inside and outside the classroom**. This Instruc al Practices Guide aims to share effective, evidence-based pra es instructors can use to facilitate meaningful learning for students of mathematics. Professional associations in the mathematical sciences along with state and national funding agencies are supporting efforts to radically transform the undergraduate education experience; it is truly an exciting time to be a mathematics instructor!

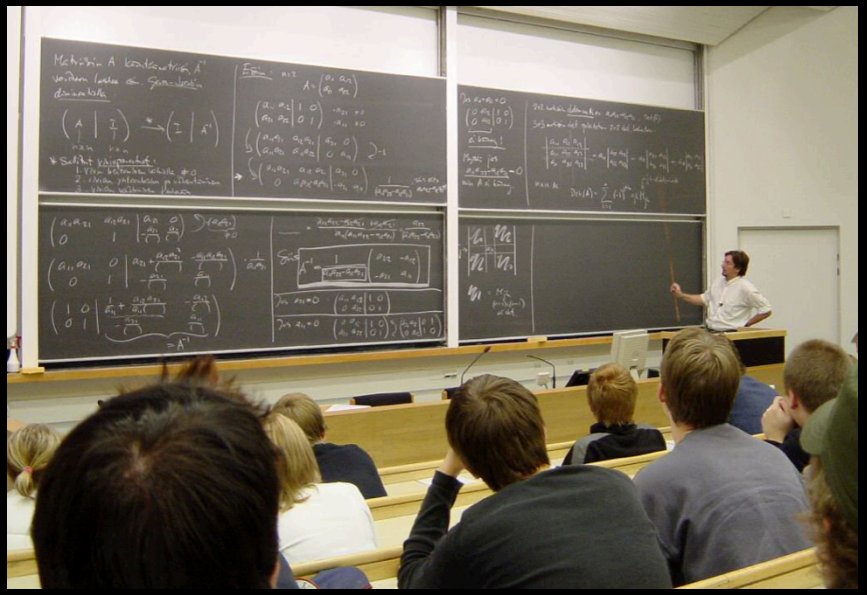
Thank you to the Classroom Practices writers!

- James Alvarez and April Strom (co-leads)
  - Scott Adamson
  - Spencer Bagley
  - Derek Bruff
  - Beth Cory
  - Jessica Deshler
  - Angie Hodge
  - Beth Kelly
  - Brigitte Lahme
  - John Meier
  - Chris Rasmussen
  - Jack Rotman
  - Robert Talbert

Q: Who is doing the thinking in the classroom?

Students?
or
You?

Is it 1958? Or 2018?



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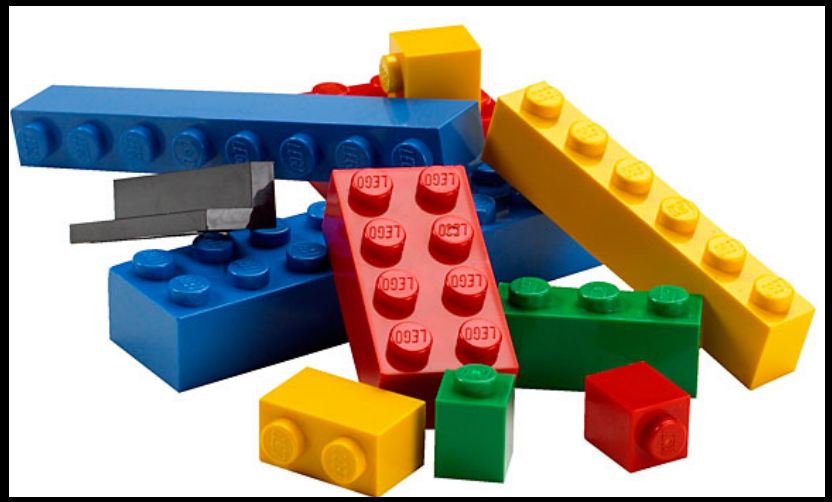
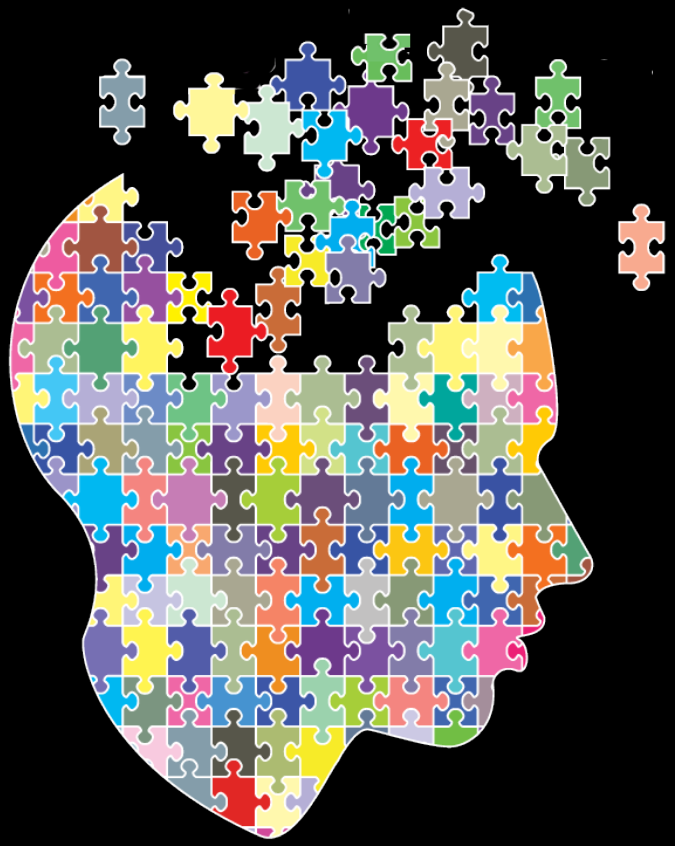

LEGO

Fostering Student Engagement in Math



- Active engagement
  - Idea that learning occurs when students construct their own knowledge through social interactions.
- Cognitive engagement
  - Idea that learning occurs when students are cognitively engaged in the mathematics.

Classroom Practices: Selecting Appropriate Mathematical Tasks

- Intrinsic vs. Extrinsic Appropriateness (Talbert)
- Theoretical Frameworks for Understanding Appropriateness
- Choosing Meaningful Group-worthy Tasks
- Communication – Reading, Writing, Presenting, Visualizing (MP3)
- Error Analysis of Student Work
- Flipped Classrooms
- Procedural Fluency Emerges from Conceptual Understanding (NCTM)

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Intrinsic vs. Extrinsic Appropriateness (Talbert)

- Intrinsic Appropriateness
  - the aspects of the task itself that lend itself to effective learning
- Extrinsic appropriateness
  - the external factors involving the learning environment that affect how well students will learn from the task.

Considerations for Selecting Appropriate Mathematical Tasks

- Do I have clearly-stated and concrete learning objectives defined for the lesson in which the task is going to appear, and do students have access to those objectives?

- Do I have actionable information, based on formative assessment or surveys, about my students' motivations, attitudes, and mathematical readiness for the task?

- Based on that information, does the task meet students at their level of expertise (not too easy, not too hard) and at their level of readiness (they are prepared to do the task apart from having the right level of expertise) and motivation (students have a reason to perform the task apart from extrinsic rewards and punishments)?

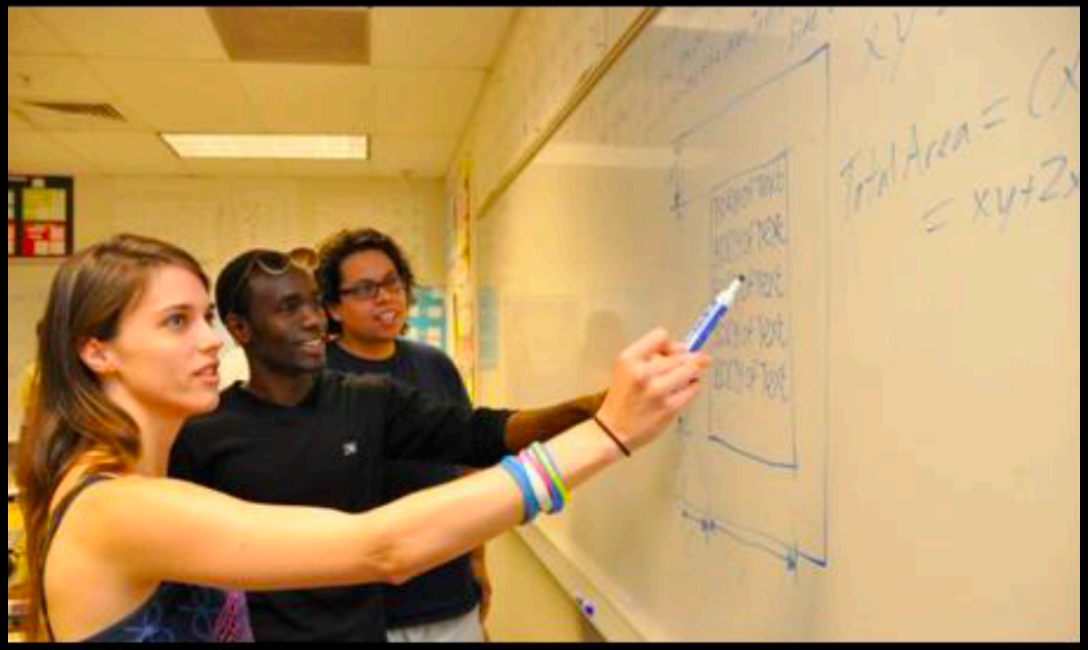
Choosing Meaningful Group-Worthy Tasks (Stein et al., 1996)

- Low-Level Cognitive Demand
  - Memorization Tasks
  - Procedures without Connections Tasks

- High-Level Cognitive Demand
  - Procedures with Connections Tasks
  - Doing Mathematics

Communication – Reading, Writing, Presenting, Visualizing (MP3)

- Common Core Standards for Mathematical Practice
  - MP3: Construct Viable Arguments and Critique the Reasoning of Others



Procedural Fluency Emerges from Conceptual Understanding (NCTM, 2014)

- Example: Dividing Fractions
  - Keep-change-flip

- "When students learn procedures in such a way that they are connected to conceptual foundations, they will have more success in using these procedures, will recall them for a longer period of time, and will be able to use these procedures flexibly and effectively in a problem solving situation" (NRC, 2005).

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Thank you!
Questions?

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