The MAA's Instructional Practices Guide: Introduction to a New Resource

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Beth Burroughs

On behalf of the IP Guide Writing Team

Leadership Team

- Martha Abell, *Georgia Southern University*
- Linda Braddy, *Tarrant County College*
- Doug Ensley, *Mathematical Association of America*
- Lew Ludwig, *Denison University*
- Tensia Soto-Johnson, *University of Northern Colorado*

Steering Committee (Lead Writers)

- James Alvarez, *University of Texas, Arlington*
- Ben Braun, *University of Kentucky*
- Beth Burroughs, *Montana State University*
- Rick Cleary, *Babson College*
- Karen Keene, *North Carolina State University*
- Gavin LaRose, *University of Michigan*
- Julie Phelps, *Valencia College*
- April Strom, *Scottsdale Community College*

Writers

- Scott Adamson
- Jess Ellis
- Bill Martin
- Ayse Sahin
- Aditya Adiredja
- Angie Hodge
- John Meier
- Kimberly Seashore
- Spencer Bagley
- Brian Katz
- Victor Piercy
- Mary Shepherd
- Derek Bruff
- Elizabeth Kelly
- Mike Pinter
- Robert Talbert
- Randy Boucher
- Klay Kruzcek
- Chris Rasmussen
- Diana Thomas
- Joe Champion
- Brigitte Lahme
- Chrissi Von Renesse
- Laura Watkins
- Ted Coe
- Rachel Levy
- Jack Rotman
- Claire Wladis
- Beth Cory
- Luis Leyva
- Behnaz Rouhani
- Phil Yates
- Jessica Deshler
- Patti Frazer Lock
- Milos Savic
- Maria Del Rosario Zavala
- Jackie Dewar
- Guadalupe Lozano

Aspirational Intention

- What can mathematicians do address inequity?

Aspirational Intention

- What can mathematicians do address inequity?
- Focus on our teaching
  - Use what is known about ambitious teaching practice
  - Resist the urge to rely on habits

Challenge

- It is hard to change practice that is embedded in our culture

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  - Mathematicians don't shy away from what is hard

Challenge

- It is hard to change practice that is embedded in our culture
  - Mathematicians don't shy away from what is hard
- View of mathematics as accessible to all
  - Hard when our own identity has been formed in a culture of mathematics-as-identifier-of-exclusive

Overview

- Classroom Practices
- Assessment Practices
- Design Practices

Features

- Vignettes
- Cross-cutting themes
  - Technology
  - Equity

Classroom Practices

- Fostering Student Engagement
- Selecting Appropriate Mathematical Tasks

Fostering Student Engagement

- Building a classroom community
- Wait time
- Responding to student contributions
- One minute paper/exit tickets
- Collaborative learning strategies
- Just-in-time teaching
- Developing persistence in problem solving
- Inquiry-based teaching and learning strategies
- Peer instruction and technology

Selecting Appropriate Mathematical Tasks

- Intrinsic appropriateness
- Extrinsic appropriateness
- Theoretical frameworks for understanding appropriateness
- How to select an appropriate task
- Choosing group-worthy tasks
- Communication
- Error analysis of student work
- Flipped classrooms
- Procedural fluency from conceptual understanding

Example CP.1.3

Responding to Student Contributions in the Classroom

A group of students are working on a problem together at the board and Dr. Bird hears one of them make a strong (correct or incorrect) assertion. None of the other students question the assertion.

Discuss

How would you respond?

Possibilities

She works with just that group and asks the student to revisit the assertion and explain their thoughts out loud. If the assertion is incorrect, she waits to see if the student self-corrects, if another student makes a suggestion, or if she can ask a follow-up question that helps the student recognize the incorrect assertion. If the assertion is correct, she waits to see if students in the group can defend the assertion, answer probing questions related to the assertion, and that they are not just accepting the assertion due to the dominance of the group member or for other reasons.

Possibilities

She regroups the class and shares the assertion. She then uses some form of think-pair-share to help students examine the assertion for what makes sense and what needs further reasoning.

Possibilities

She introduces the assertion on a homework problem or assignment as an example of student reasoning and asks the students to explain why the assertion is correct or incorrect (and perhaps also what related idea is correct). Alternatively, she presents the assertion on the homework and asks students to claim whether the assertion is true and to justify their answer.

Vignette 2

In the middle of a lecture Dr. Brown poses a question to the class. A student who rarely speaks up volunteers an incorrect answer.

Discuss

How could you respond?

Possibilities

Dr. Brown responds by asking the student to explain their reasoning. After the student has explained their reasoning, Dr. Brown poses a question to help clarify, offers a counterexample, or validates any correct reasoning while offering "another way to reason about the original question" that helps bridge the student response with the expected one.

Possibilities

If Dr. Brown is familiar with the misconception, he may say "yes, it's really common or tempting to think about it that way, but here's an example that doesn't fit the pattern." He then offers "it may be more helpful to think about the concept…" Many times, he validates the student's response by thanking them for bringing up the idea that he intended to mention the pitfall or tempting misconception.

Possibilities

Dr. Brown may pose the answer as a "conjecture" and ask students to work in pairs and reason about the conjecture.

Discussion

Appropriately handling student responses, whether correct, incorrect or unexpected, and embracing student contributions in the classroom directly affects the learning environment and can encourage student-centered learning in the classroom. To encourage student responses and participation, it is important to recognize the value of and model probing when students offer correct and incorrect responses.

Discussion

If Dr. Brown only engages groups who make incorrect assertions, this implicitly communicates that there may be something incorrect with their mathematical reasoning. Instead, Dr. Brown established classroom norms for which following up with individual students and groups is not interpreted as a sign of being incorrect, but rather part of the classroom participation structures.

Developing Persistence in Problem Solving

Practical Tips

- Choose challenging tasks that are beyond students' current abilities because they can motivate students. These should require students to struggle constructively.
- Set up the lesson carefully. Be enthusiastic about the tasks. Acknowledge that the tasks require persistence

- Provide opportunities for intrinsic rewards.
- Encourage students to develop and value a growth mindset.
- Give students plenty of time
- Have students work in groups. Feeling socially tied to peers is an important psychological factor that drives persistence.
- Resist the urge to tell and allow students to struggle.

- As needed, pull the class back together for brief discussions or mini-lessons
- Prepare appropriate prompts ahead of time to support the persistence for students at various stages in their mathematical understanding.
- As appropriate, talk to students about the metacognitive strategies involved in mathematical problem solving.
- Close the lesson with a summarizing discussion

CP.2.4 How to Select an Appropriate Mathematical Task

- Do I have clearly-stated learning objectives, and do students have access to those objectives?
- Does the task align with my learning objectives?
- Does the task meet students at their level of expertise?
- Is the task well-constructed in terms of building students' intellectual development?
- Is the task suitable for the physical environment?

Assessment Practices

- Basics
- Formative assessment
- Summative assessment
- Promote student communication
- Conceptual understanding
- Assessment in large-enrollment classes
- Assessment in non-traditional classrooms

Design Practices

- Designing for equity
- Student learning outcomes
- Challenges and opportunities
- Theories of instructional design

Questions for Design

- Who are the students in this course?
- What are the course learning goals?
- What does learning look like in the context of this course?
- What promotes student participation?
- How is this course inclusive?
- How will I provide students with feedback?
- How will I gather information to improve?

Cross-cutting Themes

- Technology and Instructional Practice
- Equity in Practice

Four Dimensions of Equity

Gutierrez (2009) offers:

- Access
- Achievement
- Identity
- Power

Quotations

Responding to student contributions in the classroom

"From an equity stance, one of the most powerful ways an instructor can build community and student confidence is to reframe errors"

Quotations

Developing persistence in problem solving

"Many tasks meant to actively engage students in the classroom work best if students understand that persistence is valued and is integral to doing mathematics."

Landscape

- CBMS statement on active learning
- CUPM guide to majors in mathematical sciences
- GAISE Framework
- NCTM Principles to Action
- AMTE Standards for Teachers of Mathematics

Discussion

We anticipate that this document will be used by classroom instructors as well as mathematics educators who offer collegiate professional development.

Does the guide reach the target audience?

Discussion

Is the guide written in such a way that the typical user will find it readable and informative?

Stated another way, does the Guide seem accessible and usable?

Discussion

Is there something missing?

Are there any topics or issues that should be addressed in future editions of the Guide?

Or are there topics or ideas that can be addressed with additional readings or links?

Discussion

What do you view as the strengths and weaknesses of this document?

Questions

- Other comments or ideas?

Review copy available at

- https://drive.google.com/file/d/0B1_9eUlkoHa6dHFqRjJ1a2JyLXc/view
- Email feedback to densley@maa.org