MAA Instructional Practices (IP) Guide

A Quick Overview and Action Plan

Why is the IP Guide Needed?

Among other concerns, we're losing students intending to major in STEM fields: (% of students planning to major in the following fields who do not graduate in that field.)

- *45% of Engineering Majors*
- *35% of Biological Sciences Majors*
- *30% of Chemistry or Physics Majors*

David Bressoud, Macalester College, *Why colleges must change how they teach calculus*, San Francisco Chronicle, 1/31/2018.

Urgency: CBMS Statement on Active Learning

Conference Board of the Mathematical Sciences (CBMS) – Signed by all Presidents of the 12 Societies (including MAA, AMS, ASA, AMATYC, AWM, NAM, NCTM, SIAM)

We call on institutions of higher education, mathematics departments and mathematics faculty, public policy-makers, and funding agencies to invest time and resources to ensure that effective active learning is incorporated into post-secondary mathematics classrooms. (July 15, 2016)

What We Know!

- Success in mathematics opens opportunities for students.
- A wealth of research literature exists on how mathematics instructors can facilitate rich, meaningful learning experiences and on what instructors can do to improve teaching and learning at the undergraduate level:

Effective teaching and deep learning require student engagement with content both inside and outside the classroom.

IP Guide: Companion to CUPM Curriculum Guide 2015

- The MAA has a long tradition of developing the CUPM Curriculum Guide, which provides course recommendations along with sample syllabi for mathematical sciences courses.
- However, readers want to know about the specific teaching strategies faculty have found to be effective with their students.

The IP Guide serves as a companion to the Curriculum Guide to provide information on evidence-based instructional practices that promote student learning!

IP Guide Purpose

The IP Guide aims to share effective, evidence-based practices instructors can use to facilitate meaningful learning for students of mathematics.

Download from MAA.org

Instructional Practices Guide | MAA_IP_Guide_V1-2.pdf

Secure | https://www.maa.org/programs-and-communities/curriculum%20resources/instructional-practices-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 opportunities for students. A wealth of research literature exists on how mathematics instructors can facilitate rich, meaningful learning experiences and on what instructors can do to improve teaching and learning at the undergraduate level: **Effective teaching and deep learning require student engagement with content both inside and outside the classroom**. This Instructional Practices Guide aims to share effective, evidence-based practices 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!

With that big picture in mind, this guide is written from the perspective that teaching and learning is a force for social change. Beyond the confines of individual instructors' classrooms, beyond their decisions about what mathematics to teach and how to teach it, there are societal forces that call upon all mathematics instructors to advocate for increased student access to the discipline of mathematics. Inequity exists in many facets of our society, including within the teaching and learning of mathematics. Because access to success in mathematics is not distributed fairly, the opportunities that accompany success in mathematics are also not distributed fairly. We in the mathematical sciences community should not affirm this inequitable situation as an acceptable status quo. We owe it to our discipline, to ourselves, and to society to disseminate mathematical knowledge in ways that increase individuals' access to the opportunities that come with mathematical understanding.

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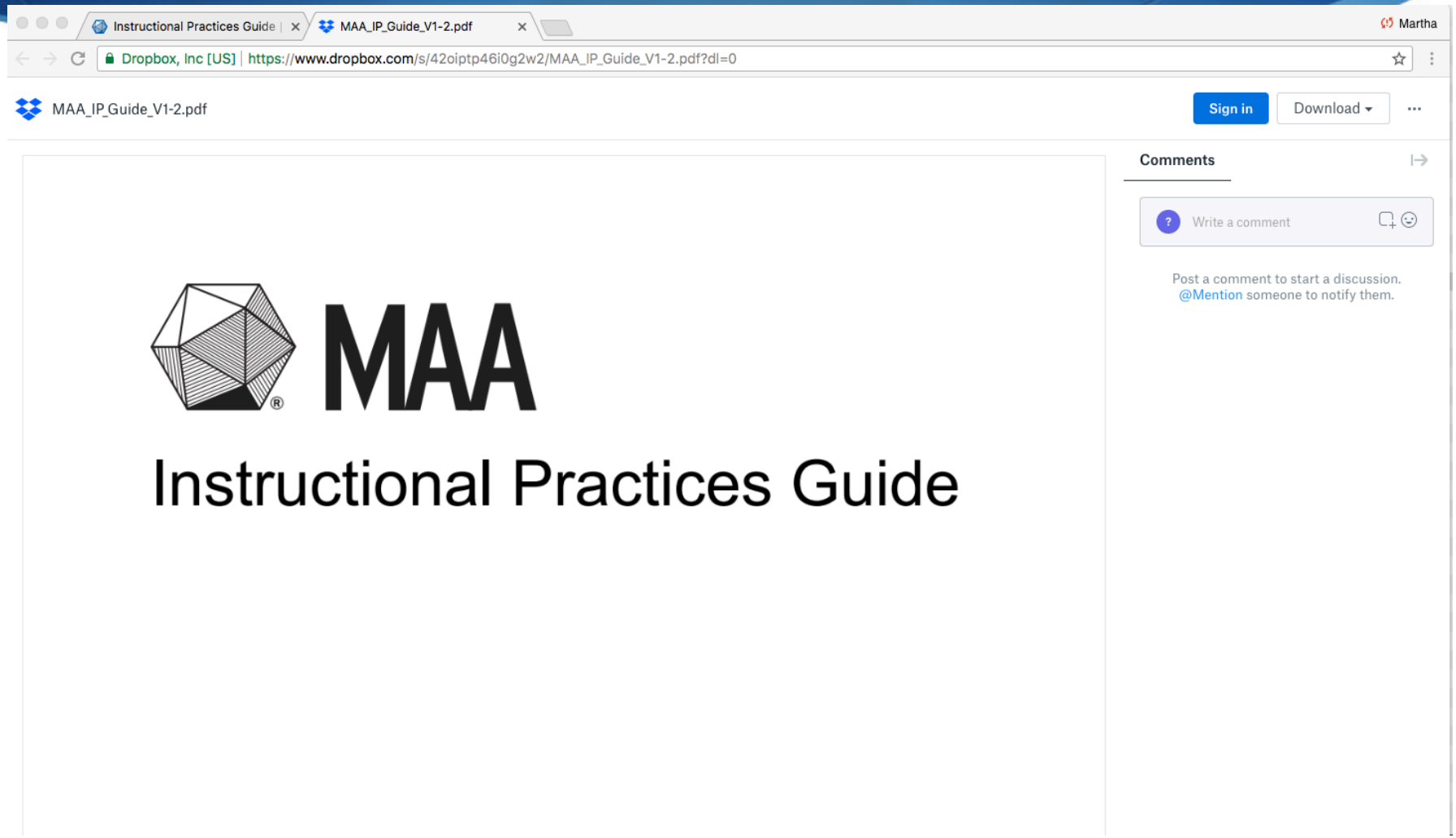

IP Guide Overview:

The IP Guide is based on the concept that effective teaching is supported by three foundational types of practices:

Classroom Practices,

Assessment Practices, and

Design Practices

all informed by empirical research as well as the literature on technology and equity.

Intended Audience?

The IP Guide is intended for all instructors of mathematics:

From the Graduate Assistant to the most experienced senior instructor.

From the contingent faculty member at a 2-year institution to the new faculty member at a doctoral-granting institution.

From the faculty member who wants to transform her own teaching to the person who leads professional development for graduate students or faculty.

Administrative Participation

The IP Guide is also intended for Administrators who want to work with faculty to initiate systemic change in their departments and across their institutions.

Classroom Practices Chapter

- Provides examples of teaching practices, both inside and outside the classroom, that foster engagement.
- Describes how to select appropriate mathematical tasks that contribute to building a sense of community within the classroom.

Assessment Practices Chapter

- Builds on policy assessment documents from various associations – NCTM, ASA, MAA, etc…
- Centers on the interplay between formative and summative assessment to examine the teaching and learning of mathematics with a strong focus on learning outcomes.

Design Practices Chapter

- Provides a brief introduction to instructional designs that help achieve desired learning outcomes, based on theories of design, along with potential challenges and opportunities.

How to Read the IP Guide

- Based on the reader's experience, one may choose to read the IP Guide in an order other than the one presented.
- Classroom Practices are mentioned first in an effort to engage the reader who is just beginning to transform their teaching; as the reader gains more experience with the student-centered practices, she can move back and forth among the chapters as needed.

Vignettes/Advice

- Each section includes helpful and easy-to-follow vignettes to illustrate instructional practices.
- The IP Guide also offers advice on how to avoid particular pitfalls along the way.

Serving a Diverse Student Body

- A vast body of evidence strongly supports the transformational power of these student-centered practices in prompting changes in instructors and students at all levels from all demographic backgrounds.
- Such transformation can promote diversity, inclusion, cultural responsiveness, and social justice within the mathematics community.

Cross-Cutting Themes

- Technology and Equity are two important topics that are intertwined in each chapter. The themes are also given special attention at the end of the IP Guide.
- Readers are encouraged to reflect on how they integrate technology into each of the practices and how their practices promote equity in the mathematics classroom.

Summary

The IP Guide is our call to the mathematical sciences community:

- to scale up the use of evidence-based instructional strategies and
- to collectively and individually hold ourselves accountable as professional educators for improving the learning experiences of all students.

Join us in practicing and promoting evidence-based strategies that powerfully engage students in rich mathematical learning experiences!

Examples

- What topics will we see in the IP Guide?
- Take a brief tour!

Classroom Practices (CP) Table of Contents

Classroom Practices (TOC cont'd)

- CP.1.6 Just-in-Time Teaching (JiTT)
- CP.1.7 Developing Persistence in Problem Solving
- CP.1.8 Inquiry-based Teaching and Learning Strategies
- CP.1.9 Peer Instruction and Technology

One-minute Paper

Enables “instructors to review submissions quickly and obtain formative feedback about student learning.” (p. 17)

One-minute Paper CP.1.4

- Takes approximately a minute to complete
- Typically integrated at the end of a class session or topic
- Instructor poses a question that prompts students to reflect on their learning
- Students answer the question in writing and turn it in. However, they could also submit their response via an online learning system.

Classroom Vignette: One-Minute Paper

In second-semester calculus Dr. Kessler introduced Taylor series during his class. He wants to assess what students understood from the class session as well as what they felt they did not fully grasp in order to address these points in the next class session. As such, at the end of the class period, he asks them to take one minute to explain (one of the following) in concise, complete sentences:

- What are the three most significant things you learned today about Taylor series?
- What are you left wondering about Taylor series?
- Is there anything that still is unclear about Taylor series for you?
- Why are you studying Taylor series?

(MAA IP Guide, 2017, p. 17)

Classroom Vignette: One-Minute Paper

He collects the one-minute papers and reviews them before the next class. He uses responses to

- the first question to determine how much students said they learned,
- the second question to connect student "wonderings" to the next class session, and
- the third question to construct follow up in-class or homework tasks.

He also makes sure students write their names on the paper, so he can plan individualized follow up if necessary with some students.

(MAA IP Guide, 2017, p. 17)

Connection to Assessment Practices

- A.P.1.3 Formative and Summative Assessment
- A.P.2. Formative Assessment Provides Feedback and Creates an Assessment Cycle
- A.P.2.1. Implementing Formative Assessment
  - Provides strategies/More Vignettes
  - The quality of formative feedback is essential: "The premise underlying most of the research conducted…is that good feedback can significantly improve the learning processes and outcome, if delivered correctly" (Shute, 2008, p. 154)

Connections to Design Practices
DP.2.5. Using formative and summative assessment in design

- Formative assessment can be student activities that allow students to better understand what they are learning and to assess their own progress in learning.
- It can also be an activity that instructors use to inform their own instruction.
- In every lesson the instructor should include opportunities to gauge student progress as students proceed through the content.
- Links back to the Minute Paper Vignette in C.P.1.4

How is IP Guide Being Used? What People are Saying!

- Individual Basis
- As a text for a Faculty Reading Group
- As a resource for professional development with TA's and Faculty.

Conclusion

- Please help the MAA is spreading the word about the IP Guide.
- Watch for upcoming sessions (workshops, paper sessions, panels) at JMM and MathFest on the IP Guide. All are invited to attend and give presentations.
- Contact the MAA Committee on the Teaching of Undergraduate Mathematics (CTUM) if you want to be more involved or learn more about using the IP Guide.