The MAA Guides: Evidence-Based Instructional Practices in Undergraduate Mathematics (2017) and the Curriculum CUPM Guide to Majors in the Mathematical Sciences (2015)

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Thank you to…

- Run Buckmire for organization and invitation.
- IP Guide Leadership team.
- Fellow Assessment Lead Writer Ben Braun (University of Kentucky)

The MAA Guides

- The Curriculum Guide (2015) … Available at:

https://www.maa.org/sites/default/files/pdf/CUPM/pdf/CUPMguide_print.pdf

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Helping departments consider HOW to teach.

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- "…The purpose of this Guide is to help departments adapt their undergraduate curricula to this changing landscape while maintaining the essential components of the traditional mathematics major. "

- Use of the guide may help departments establish more of a leadership role in the eyes of Deans and other departments.

CUPM Organization

- "Abridged" print version has:
  - -Introduction
  - -Overview
  - -Calculus, Linear Algebra and Data Analysis
  - -Beyond the Curriculum
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- "Abridged" print version has:
  - -Introduction and Overview
  - -Calculus, Linear Algebra and Data Analysis
  - -Beyond the Curriculum
  - -Preparation for Graduate Study
- "Full" on-line version has reports from:
  - -Course Area Study Groups … versions of common courses with content suggestions.
  - -Program Area Study Groups … tracks, concentrations, minors, etc.

Community Involvement

- Diverse audience of mathematicians was involved in creating and editing the document.

- Included representatives from other disciplines.

- Had preliminary data from *Characteristics of Successful Programs in College Calculus (CSPCC)*

https://www.maa.org/programs-and-communities/curriculum%20resources/progress-through-calculus/cspcc-publications

Community Issues…

- Lack of consistent terminology

Example: Linear Algebra is used for courses whose learning goals are quite different across institutions.

-First place to work on writing proofs?

-Intro. to high dimensional thinking for data science?

-Tool kit for scientists and engineers?

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-Tool kit for scientists and engineers?

- Alternate Pathways Models

-How much calculus in needed?

-Does first year placement deter majors?

Recommended Uses

- Faculty teaching a course or directing a program:
  - -Read appropriate CUPM section for ideas and vocabulary.
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  - -Especially useful for first time teachers/directors.

- Basis for departmental review or curriculum redesign
  - -Great background for any self-study.
  - -Useful for discussions with administrators about workload and strategies.

IP Guide – Big Picture

- Help to foster more effective evidence-based teaching by encouraging discussion.
- Encouraging colleagues to use available resources.
- Promote good teaching and increase student learning.

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- Materials and resources followed innovation.
- Improvement in Statistics Education via the GAISE reports.

IP Guide Organization

- Three Main Chapters
  - -Classroom Practices
  - -Assessment Practices
  - -Design Practices

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- Parallels with CUPM Guide
  - -Discussion at both course level and program level
  - -Wide ranging input from mathematics community
  - -Concern with equity issues

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- The former wanted careful grounding in empirical studies, the latter a more "user-friendly" version that encouraged people to adopt more active learning strategies.

- This "healthy tension" produced what we hope is a good balance between evidence based research and practical case studies and advice.

Example of Use: Assessment Chapter

- An instructor is strongly encouraged by a Division Chair and Undergraduate program director to modernize assessment in a core mathematics course.

- Classic case: Students do all assignments using software but tests are still pencil and paper.

- What can instructor do that is both theoretically sound and relatively easy to implement?

Background: Status Quo (course level)

- Traditional assessments for students:

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-Focus on grades, ranking, comparisons.

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- Traditional assessments for students:

-Timed Exams emphasizing facility in computation/ procedures.

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-Little analysis and change over time.

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-Student evaluations.

-Classroom visits or reputation.

-Published or copied teaching materials.

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- Traditional assessments for teachers:

-Student evaluations.

-Classroom visits or reputation.

-Published or copied teaching materials.

-NOTHING!!

The Assessment Chapter

- Opening Statement: Components of effective assessment include: stating high-quality goals for student learning, providing students frequent informal feedback about their progress toward these goals, and evaluating student growth and proficiency based on these goals."

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- Connection to design and practice are important but we tried to design chapters to ‘stand alone.’

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- In Context … they suit the course, the teaching realities (class size and format) and the students.

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Note on format: We have material on teaching fully on-line, with e-books, with computer homework systems.

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- Another instance of careful studies leading to inescapable conclusion leading to resources available.

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- Evidence is everywhere: D/F/W rates; STEM opportunities.
- Focus on what students need to succeed and continue.

A culture of assessment

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- But as we prepare students for careers in data science and analytics shouldn't we do better?

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- For better or worse, “fair” is a very difficult concept both mathematically and educationally.
- Flexibility, adaptability and being open to feedback are all welcome steps.

Program level …

- We can consider assessment at many levels:

-Individual students

-Courses

-Programs

-Faculty

Course Level…

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- Put emphasis on objectivity and growth.
- Avoid mixing formative (how to improve the course) with summative (faculty evaluation).

Program level

- Can be hard to manage because outcomes like persistence are medium and long term measures.
- There are often campus resources (IR, IT, Registrar) that can be accessed.
- Can use quantitative and qualitative data (without being anecdotal.)

Faculty Assessment

- Avoid mixing the use and application of formative and summative measures. (A common error!)
- Carefully thinking about assessment as a process can be instructive for teachers.
- Equity matters here too.

Resources

- The GAISE report:

http://www.amstat.org/asa/education/Guidelines-for-Assessment-and-Instruction-in-Statistics-Education-Reports.aspx

For equity issues:

http://www.nctm.org/Standards-and-Positions/Position-Statements/Access-and-Equity-in-Mathematics-Education/