

Re-envisioning the Calculus Sequence

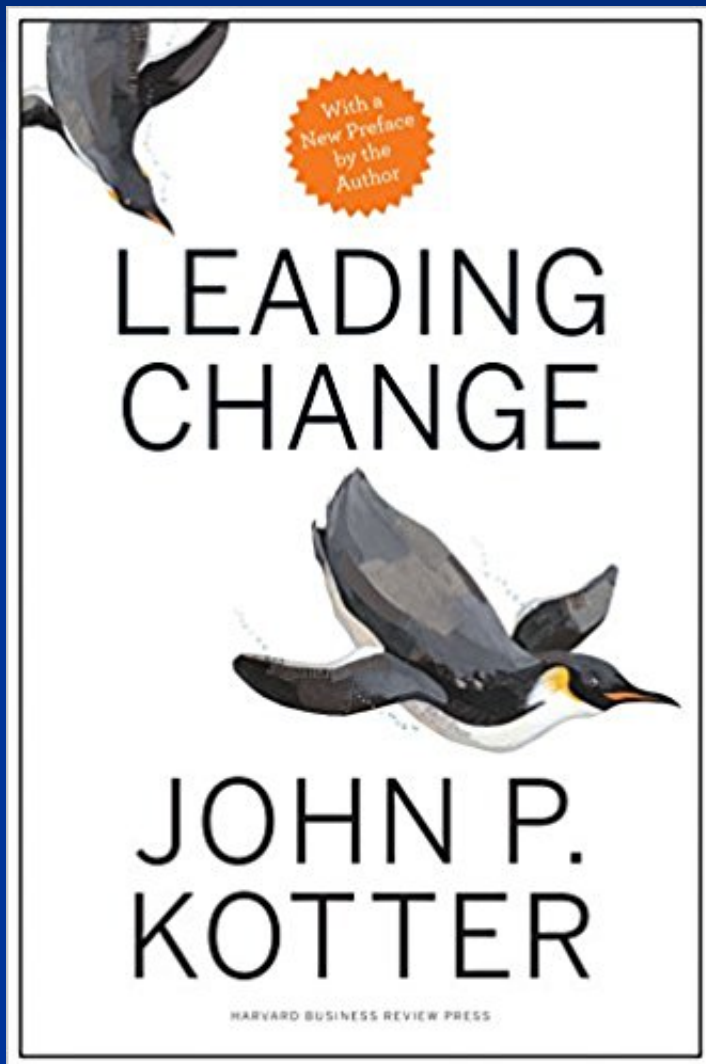
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How do I tell this developing story?



John P. Kotter
is the Konosuke
Matsushita Professor of
Leadership, Emeritus,
at Harvard Business
School and
is cofounder of Kotter
International.

Eight Stage Process of Creating Major Change

by John B. Kotter

- 1) Establish Urgency**
- 2) Create a Guiding Coalition**
- 3) Develop a Vision and Strategy**
- 4) Communicate the Vision**
- 5) Empower Broad-based Action**
- 6) Generate Short-Term Wins**
- 7) Consolidate Gains & Create More Change**
- 8) Anchor New Approaches in the Culture**

1) Establish Urgency

- a) Culture of Constructive Restlessness**
- b) National Analysis and Dialogue**
- c) No prophet is accepted in their own home**

1) Establish Urgency

a) Culture of Constructive Restlessness



Bill Johnston
Butler



John Wilson
Centre

Wilson's Principle

Think about the question:

Is how we are teaching
MAT XXX perfect?

If we think so, then we are justified
in preserving the status quo.

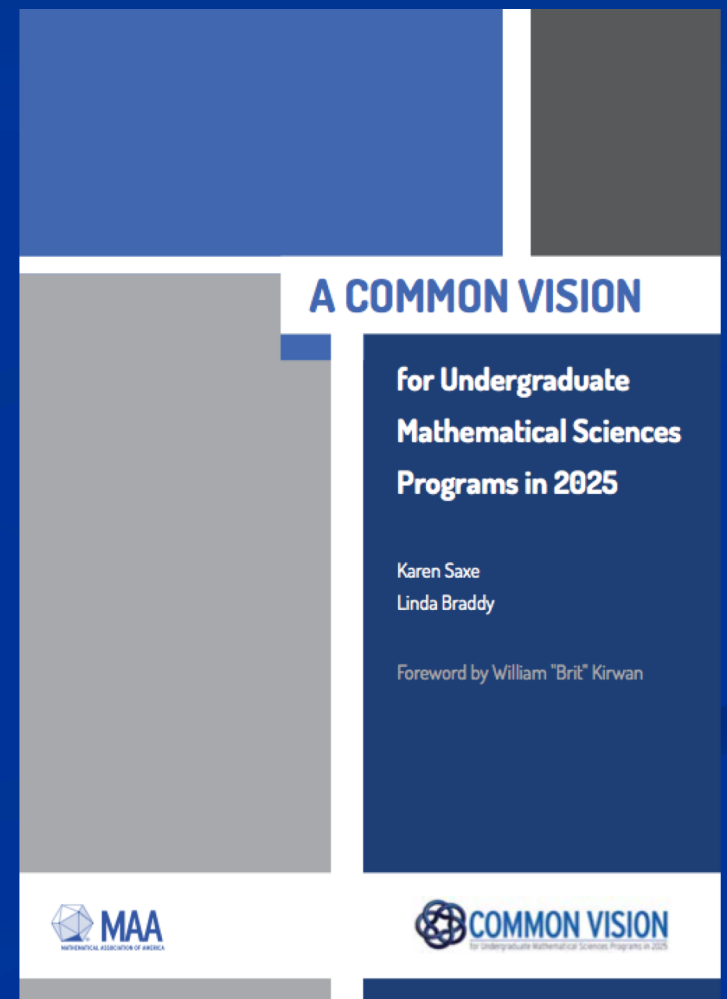
If not, then we are compelled to
think and reflect – to envision ways
in which what we do might be
better. And, when we find some
idea, to thoughtfully act.

1) Establish Urgency

b) National Analysis and Dialogue

A study of seven Curriculum Guides from

- American Mathematical Association of Two-Year Colleges (AMATYC)
- American Mathematical Society (AMS)
- American Statistical Association (ASA)
- Mathematical Association of America (MAA)
- Society for Industrial and Applied Mathematics (SIAM)



1) Establish Urgency

b) National Analysis and Dialogue

THE STATUS QUO IS UNACCEPTABLE !!!

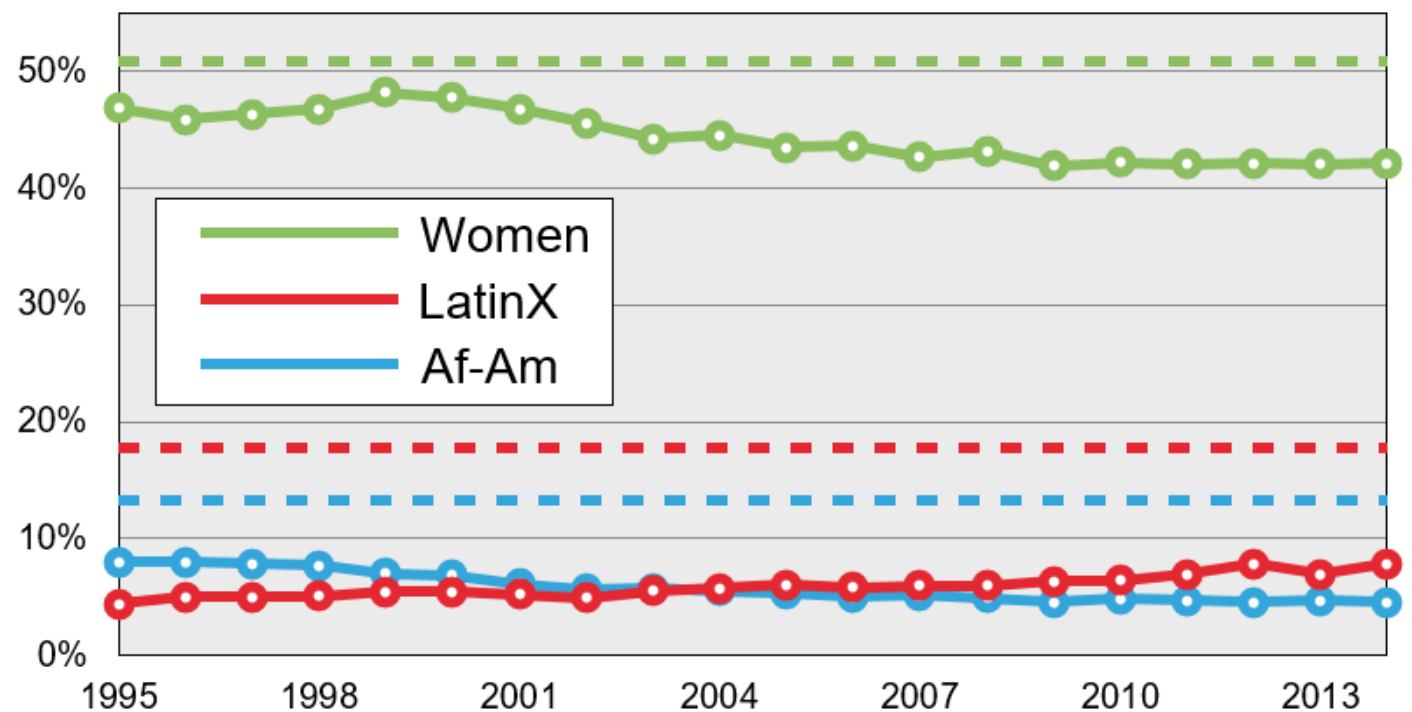
- Update curricula
- Articulate clear pathways
- Scale up use of evidence-based pedagogical methods
- Remove barriers facing students at critical transition points and encourage persistence
- Establish stronger connections with other disciplines

1) Establish Urgency

b) National Dialogue

*Issues
with
Equity,
Diversity,
and
Inclusion*

PERCENT OF U.S. BACHELOR'S DEGREES IN MATH/STATISTICS EARNED BY MEMBERS OF CERTAIN UNDERREPRESENTED GROUPS



1) Establish Urgency

c) No prophet is accepted in their own home (Luke 4)



Danny Kaplan
Macalester



Bill Velez
Univ of Arizona



Chad Topaz
Williams



Ben Klein
Davidson



Tom Halverson
Macalester

1) Establish Urgency

c) No prophet is accepted in their own home



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2) Create a Guiding Coalition

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3) Develop a Vision and Strategy



3) Develop a Vision and Strategy

Why Change?

- Constructive Restlessness
- Shifting toward “student-ready calculus”
- Our “audience” is different
 - more varied math backgrounds
 - more varied math interests and needs
 - more diverse
- We are different
 - active learning
 - awareness of diversity and inclusion
 - connections to other disciplines
 - focus on persistence

3) Develop a Vision and Strategy



3) Develop “Guiding Principles”

Every course

- is organized in a way that engages all students and promotes educational equity.**
- could be a good entry point into the calculus sequence, based on student background.**
- could be a good exit point, based on student interest.**

3) Develop “Guiding Principles”

Every course

- is organized in a way that engages all students and promotes educational equity.
- could be a good entry point into the calculus sequence, based on student background.
- could be a good exit point, based on student interest.
- **has a persistent emphasis on multidisciplinary interactions.**
- **incorporates some theoretical mathematical thinking.**
- **uses multiple perspectives (numerical/analytical, discrete/continuous, theory/application, etc.) to investigate topics.**
- **incorporates activities where students utilize technology to further engagement.**

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Also, for the sequence as a whole,

- **There is a smooth increase in difficulty.**
- **Some concepts and applications are intentionally layered.**

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3) Develop Curricular Models - 1

Calculus 2.5

- Integration Techniques
- Multivariable Derivatives & Integrals

Calculus 3.5

- Vector Calculus
- Sequences and Series

3) Develop Curricular Models – 1.5

Calculus 2.5

- Integration Techniques
- Multivariable Derivatives & Integrals

Calculus 3.5

- Vector Calculus
- Sequences and Series

Calculus 3.75

- Vector Calculus
- Sequences and Series
- Calculus Theory
 - Definitions of Limit, Derivative, Integral
 - Evidence/Partial Proofs of MVT and FTC

3) Develop Curricular Models – 2

Math 1

- Modeling with Functions
- Dimensional Analysis
- Estimation
- Derivatives
- Optimization
- Multivariable Functions
- Partials & Optimization
- Integrals & FTC

3) Develop Curricular Models – 2

Math 1

- Modeling with Functions
- Dimensional Analysis
- Estimation
- Derivatives
- Optimization
- Multivariable Functions
- Partials & Optimization
- Integrals & FTC

Math 2

- Modeling with Functions
- Derivatives – numerical, exp growth, separable DEs
- Integrals – apps, numerical, FTC, substitution, parts
- Multivariable functions, partials, optimization
- Double, Triple Integrals
- Limits – intro & L'Hop
- Improper Integrals

3) Develop Curricular Models – 2

Math 1

- Modeling with Functions
- Dimensional Analysis
- Estimation
- Derivatives
- Optimization
- Multivariable Functions
- Partials & Optimization
- Integrals & FTC

Math 3

- Vector Calculus
- Sequences and Series
- Calculus Theory

Math 2

- Modeling with Functions
- Derivatives – numerical, exp growth, separable DEs
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Thanks!!

Questions?

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