Mathematics and Science For Sub-Saharan Africa

(MS4SSA)

Worcester Polytechnic Institute

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STEM-Africa Initiative
University of Michigan
Unique among peer institutions in its engagement of science as a trans-Atlantic Affair

- Furthers US-Africa STEM research collaborations,
- Nurtures early-career scientists on the continent (staff challenge)
- Increase enrolment of African Scholars in STEM graduate programs
- Bi-annual Conference on US-Africa STEM Research and Collaborations and Diasporas involvement
Unique among peer institutions in its engagement of science as a trans-Atlantic Affair

Large Conference on US-Africa STEM Research and Collaborations and Diasporas Engagement

Africa – US Frontiers in Science
May 29 - June 2, 2017, Yaounde, Cameroon
The structure of introductory mathematics at UM

- Student expectations and effort
- Instructional uniformity
- GSI/junior faculty training program

◆ Calculus Concept Inventory
◆ Served as model for Institutions in US & Canada
The Course Goals
- Establish constructive student attitudes about the value of math by highlighting its link to the real world.

- Develop a wide base of math knowledge:
  - Symbol manipulation
  - Understanding of concepts
  - Geometric visualization
  - Problem-solving
  - Predicting
  - Generalizing

- Strengthen general academic skills:
  - Critical thinking
  - Writing
  - Giving clear verbal explanations
  - Understanding and using technology
  - Working collaboratively

- Increase the amount of student-instructor contact.

- Persuade more students to continue in subsequent math and science courses.
• **Transforming undergraduate STEM education**, with focus on first year Mathematics

• KNUST (Ghana);

• OAU, UYO, MOU (Nigeria);

• MUST (Malawi);

• MUNI (Uganda);
MCAP

• Export the Michigan model to a(n Urban) District setting
  – Familiarize High School Students with expectations of college Calculus courses
  – Align School Instructional efforts with college expectation
  – Cultivate high student expectation and interest in mathematics
  – Nurture ties between HS and college Math practice/practitioners
Michigan Calculus Achievement Program

Elements:

- Instructional Content and Delivery

- Secondary Mathematics Lab (Professional Development)

- Academies / Action Inquiry Model
MCAP

Overarching challenge is *Curricular (Mis)alignment*

*Intended* (Written curricula)
*Delivered* (Taught in class)
*Assessed* (Standard, expectations)
*Attained* (what students actually know)

- Bridges applications and concepts
- Instructional techniques and tools
MCAP…

- WebWork-based instructional technology
  - Assignment/Assessment management system
  - Focus on student engagement/expectation
  - Available off premise
  - Learning community and parent partnership
  - In-service professional development programs

Improved curricular coherence
Secondary Math Lab
School-based math academies as a reform model

School-based process to achieve cohesive integration of:

• Math reform: MCAP as top-down

• Literacy across the curriculum (writing)

• College knowledge (including parent engagement)
A vision for systemic improvement

Knowledge Resources

Secondary Mathematics Lab

UM Secondary Mathematics Teacher Education Program

Programmatic Resources

Michigan Calculus Achievement Program MCAP

School-Based Math Academies

DPS High School Mathematics Instruction

Algebra Project

Resource Use
Overview

- Michigan Calculus Achievement Program (MCAP)
- Algebra Project
- Secondary Mathematics Laboratory
- Secondary Teacher Education
- School-Based Academies
- Discussion