2nd Annual Meeting
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# A National Model for Engineering Mathematics Education- The Western Michigan University Experience

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# WMU-CEAS Statistics

- 2159 undergraduate students, and 367 graduate students
- 398 freshman students in Fall 2009
- 178 new undergraduate transfers in Fall 2009 for CEAS (full time)

Source: Office of Academic & Institutional Research, Fall Enrollment 2009, WMU

# The Beginning ENGR 1990 at WMU

- A presentation in Fall 2007 by Dr. Nathan W. Klingbeil to WMU's CEAS Faculty on Wright State University's Math education model for engineering disciplines.

# ENGR1990 – Our Motivation

- 55.7% of all engineering freshmen (avg. 2005-09) required some math lower than Calculus I
- It takes some of them 3 or more semesters to be allowed to take engineering courses
- ENGR1990 allows freshmen to start taking engineering courses from their first semester.

# ENGR1990 – Our Motivation

- Increase students' retention
- Increase or maintain their engagement
- Increase performance in Math and Engineering courses

# ENGR 1990- Curriculum Process

- Targeting Pre-Calculus Students
- MAE and ECE Departments Approvals
- Mathematics Department
- College Approval
- University Curriculum Committee
- A Positive Outcome

# ENGR 1990 - Course Description

- **ENGR 1990 Engineering Mathematics (3 credit hrs: 2 hrs lecture, 3 hrs lab)**

  Application of mathematics to introductory engineering problems. Topics include mechanical and electrical engineering applications using algebra and trigonometry, vectors, sinusoids and harmonic functions, systems of equations and matrices, simple derivatives and integrals, and simple linear differential equations.

  Prerequisite: MATH 1110 (Algebra II) or ACT MATH Score (24-26) or equivalent or Permission of Instructor.

# ENGR1990 - Course Content Development

- Spring 2009 and Summer 2009
  - Review of Wright State University materials
  - Develop additional materials

# ENGR1990 - Course Content

- In parallel to Pre-calculus course content and with Algebra II content review/emphasis
- Course materials can be found on http://www.mae.wmich.edu/faculty/kamman/engr_1990.htm

# ENGR1990 - Course Contents

- Applications in ECE and MAE
- Matlab simulations
- Pspice Simulations
- Video presentations
- Recitations

# ENGR 1990 – Implementation

- Fall 2009: 1st time offering with 16 students from two majors (ECE and MAE)
- Spring 2010: 2nd time offering with 7 students from ME only.
- Fall 2010: 3rd offering with students from two majors (ECE and MAE), incorporating findings from course reviews.

# ENGR 1990 – Formative Evaluation Plan

- Developed evaluation instruments
- Evaluation by course instructors
- Evaluation by independent reviewers:
  - ECE faculty member
  - MAE faculty member
  - CCE faculty member
  - IME faculty member
  - External to WMU
- Evaluation by students
- Received HSIRB approval

# ENGR 1990 – Formative Evaluation Results (Preliminary)

- Performance comparison - ENGR1990 students and MATH 1180 (Pre-calculus) students; and CHEM 1100/1110.

- ENGR 1990 students have a statistically significant (a<0.05) higher successful completion rate in MATH 1180 (grades =/> C) – 66.7% (ENGR 1990 students) vs. 28.0% (comparison group of 25 students in same section of MATH 1180)

- No statistically significant difference in CHEM 1100/1110

# ENGR 1990 – Formative Evaluation Results (Preliminary)

Statistically significant ($\alpha$<0.05) increase in pre- and post-survey in Fall 2009

- Confidence about my ability to use trigonometry to solve engineering problems
- Confidence about my ability to use vectors to solve engineering problems
- Confidence about my ability to use simple differentiation to solve engineering problems

# Lessons Learned and Next Year Plan

- Adjust course material based on Colleagues reviews conducted this summer
- One more Offering (Fall 2010) for both majors (ECE and MAE)
- Summative Evaluation in Spring 2011 and Summer 2011.

# QUESTIONS?

