Mathematics as a FirstSTEP to Success in STEM

PIs: Tom Cheatham, Ginger Rowell, Donald Nelson, Chris Stephens, Elaine Tenpenny
Coordinators: Brad Rudnik, Teresa Wade

GOAL: Increase STEM retention & graduation rates for freshman STEM majors with Math ACT of 19 to 23.

- First-time, full-time freshman (FTFTF)
- Cohorts of about 40 STEM majors
- Math ACT subscore: 19-23
- 52% female, 48% male
- 44% African American, 46% Caucasian
- Assisted 186+ at risk STEM majors

INTERVENTIONS

- Summer Math Bridge (before starting MTSU)
- Academic Successes

<table>
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<tr>
<th>Academic Successes</th>
<th>FirstSTEP versus Control: Success &amp; Retention Rates</th>
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<tr>
<td>Passed Precalculus (A, B, C)</td>
<td>69%</td>
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<tr>
<td>Passed Calculus I</td>
<td>58%</td>
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<tr>
<td>2nd Year STEM Major Retention</td>
<td>52%</td>
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<td>2nd Year STEM Majors that Qualify for Sophomore Status</td>
<td>24%</td>
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<tr>
<td>To Junior Retention in STEM</td>
<td>40%</td>
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- Summer Mathematics Bridge (2 weeks in July)

**Activities**
- Technology-based individual learning
- Hands-on activities based on daily topics
- Faculty lecture (model college class)
- Peer-led cooperative learning groups

**Topics of Study**
- Factoring polynomials, simplifying rational expressions,
- Equations of lines (slopes, writing equations of lines, graphing)
- Quadratics (find the vertex, standard form, max, min, graphing)
- Solving quadratics and rational equations, applications

**Assessment**
- Pretest of pre-calculus readiness skills create individualized study plans
- Posttest measures student gains and pre-calculus readiness

- 1st Year: Required Mathematics Tutoring Pre-Calculus, Calculus I; Seminar Class (1 credit P/F)
- 2nd Year: Required Math Classes; Required Tutoring, Research Seminar; Summer Research Assistants

- Math Curriculum Innovations

- Summer Introductory Research Team

- Introductory Research Experience

  A three-week, professor-led, team-based, introductory research project after the freshman year. Projects have resulted in 88 presentations and 6 publications.

- Mathematics Curriculum Innovations

  Focused algebra course; POGIL-like supplemental instruction; Pathways to Calculus pedagogy in pre-calculus; pre-semester 4-day readiness workshops for (pre) calculus.

ACTIVITIES

**Academic Year Seminar**

1 hour per week for first 2 years

- Year 1: Additional math instruction, study skills/metacognition, intrusive advising, career exploration, required tutoring
- Year 2: Create a poster based on summer research, submit poster for presentation, resume development, interview skills, cover letters

**Conclusions**

- With assistance, students with poor math preparation can persist as STEM majors at a rate equivalent to students who are not at-risk.
- Some form of readiness preparation is needed prior to each math class & tutoring during the class helps.
- Dealing with life issues is just as important as addressing poor academic preparation.
- It is difficult to predict which at-risk students will succeed in STEM. It involves more than academic potential.

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