The Need for Equity-Minded Access Strategies in STEM

- STEM is one of the fastest growing employment sectors
- STEM is one of weakest in majors and diversity retention
- Diversity facilitates innovation, adaptation, global connections
Effective Strategies to Increase Diversity in STEM Fields

1. Summer bridge programs with academic enrichment and college orientation
2. Workshops and seminars on college success skills
3. Tutoring by peers or staff
4. STEM learning center with drop-in help
5. Academic advising
6. Mentoring by peers or faculty
7. Research experience
8. Career counseling and awareness
9. Financial support
10. Curriculum and instruction reform


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**ASEMS**

**University of Arizona**

Arizona’s Science, Engineering, and Math Scholars Program
University of Arizona

- Tucson, AZ
- Research 1 university
- Population: 33,732 undergraduate & 7,817 graduate students
- 30.5% underrepresented minorities
  - (Hispanic, African-American, American Indian, Alaska Native, Native Hawaiian or other Pacific Islander)
- Arizona Assurance financial aid program
- Arizona education funding

Initial Challenges

- Concerned about diversity of pool of applicants into undergraduate research programs
- Otherwise qualified applicants being declined from low GPAs
- Minimum GPA 3.0 to enter UR programs
Initial Challenges

• UA Collaborative for Diversity in STEM & Retention Committee
  • 55% of freshmen left STEM by junior year

• Lower grades during first two years
  • Heavy STEM course load & too many units
  • Not taking advantage of academic policies (e.g. withdrawal & Grade Replacement Opportunity)
  • Course load not balanced with other responsibilities

Arizona’s Science, Engineering and Math Scholars Program (ASEMS)

• Began as a pilot in spring 2011
• Mission: AEMS ensures more STEM students primarily from underrepresented and underserved backgrounds are earning college degrees and graduating in STEM by empowering them with the tools they need to succeed while recognizing their unique needs and assets.
Tsui’s 10 Strategies & ASEMS

- Summer Bridge Program
- Mentoring (peer or faculty)
- Research Experience
- Tutoring (peer or staff)
- Career Counseling and Awareness
- Learning Center (dedicated to STEM, drop-in help)
- Workshops and Seminars (on college success skills)
- Academic Advising
- Financial Support
- Curriculum and Instruction Reform

ASEMS Target Population

Promising STEM students who are underrepresented and underserved in STEM, which includes:

- First generation college students
- From low-income families
- Have physical or learning disabilities
- Transferred from community colleges
- Underrepresented minorities or females
ASEMS Target Population (cont’d)

- Middle GPA: 2.0+ through 3.2
- Initial cohorts of 25 freshmen and 25 sophomores/year
- Current serving ~ 240 students/year

Persistence Rates of UA Students Who Started in STEM

<table>
<thead>
<tr>
<th></th>
<th>Traditional*</th>
<th>First Generation and/or Low Income</th>
<th>ASEM Scholars</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th year persistence rate</td>
<td>68%</td>
<td>56%</td>
<td>90%</td>
</tr>
<tr>
<td>Still in STEM by 4th year</td>
<td>55%</td>
<td>49%</td>
<td>81%</td>
</tr>
<tr>
<td>5-year graduation rate</td>
<td>61%</td>
<td>47%</td>
<td>74%</td>
</tr>
<tr>
<td>6-year graduation rate</td>
<td>65%</td>
<td>51%</td>
<td>86%**</td>
</tr>
</tbody>
</table>

Source: Office of University Analytics and Institutional Research (UAIR) and UAccess data on ASEM Scholars.

*Traditional does not include first generation, low-income, or students with disabilities. Based on average of 2007, 2008, 2009 FTFT cohorts.
**First cohort of 28 students have reached the 6-year mark in spring 2016.
Persistence Success: ASEMS 5-year graduates

- 74% graduated with a 3.0+
- 32% graduated with a 3.5+
- 40+% continued to graduate or professional school
- 100% were first generation or from low-income households

- 57% were underrepresented minorities
- 79% were female

Core Features - One-unit Success in STEM Colloquium

- Freshmen & transfers
- Early exploration of careers and opportunities
- Foster faculty interaction: mixers, office hours, guest speakers
- Encourage utilization of campus resources
- Staff, faculty, & peer mentoring
- Learning strategies
Core Features – Academic strategies coaching

- Faculty expectations
- Course load review and weekly schedule planning
- Long-term course planning to succeed, not just graduate
- Early grade check and reflection
- Utilize academic policies

Core Features - One-unit Research Readiness course (sophomores)

- Early exposure to research: lab shadowing
- Exposure to career pathways
- Match research interests early
- Professionalism in research
- Connect to next steps
- Graduate student panels
New Features / New Phase

- Support from U.S. Department of Education TRiO Student Support Services (SSS) grant and a foundation grant
- Tutoring
- Study groups
- Financial assistance
- Cohort of community college transfer students
- Space
- More community building activities

Non-Cognitive Strategies - Community of belonging

Mentoring from equity-minded faculty, staff, & peer mentors = “safe space”

- Relatable – shared backgrounds & diversity
- Believed in their potential
- Needed better guidance early on strategies
- Reinforce sense of belonging – 1-on-1
- Students’ backgrounds mattered: family responsibilities, work hours, first generation
Non-Cognitive Strategies - *Normalizing their experiences*

- Academic situations (grades)
- Extending time to graduation
- Utilizing campus resources
- Growth mindset
- Letters from upper division students*


Equity-Minded Strategies - *Highlight strengths*

- Diversity is actually a strength
  - Inclusive Engagement Workshop / faculty panel
  - Diverse perspectives are needed in STEM
- Reflect on talents & resiliency
Challenges

- 240 students/year now – scaling up
- Finding lab shadowing hosts
- Financial needs (housing, summer tuition)
- Faculty mentors
- Family pulls
  - Family outreach needed ... low turnout at family orientation

Montana State University
Why Equity Minded Strategies Matter in Montana

1. 42nd in the nation for median household income
2. 38th in the nation for percent of households receiving food stamps
3. 10th in the nation for individuals without health insurance
4. 9th in the nation for percentage of households who are food insecure
5. 8th in the nation for children without health insurance
6. 5th in the nation for number of grandparents raising grandchildren
7. 3rd in the nation for percentage of civilians who are veterans
8. 2nd in the nation for number of children who live apart from parents (foster care)
9. 1st in the nation for number of suicides per 100,000 people
10. Montana is also ranked 40th in the nation for college affordability.

On average, families in Montana need to invest 32% of their income for each college going member to attend college.

MSU - Quick Facts & Context

- Land grant, high research, high undergraduate institution
- STEM dominant and liberal arts infused institution
- Total student enrollment – 15,688
- Residency - FTIC - 51 “in” vs 49% “out”
- FTFT Retention – 76.7%
- 6 year grad rate – 52.6%
- Pell Eligible – 27%
- Gender – 53% male
Effective Strategies to Increase Diversity in STEM Fields

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Hilleman Scholars Program
2016 Hilleman Scholar Descriptive Stats
n=51

- 220 Invited
- 100% Montana Residents
- Average High School GPA: 3.11 (n=50)
- Average ACT Composite Score: 20.46 (n=48)
- Average SAT Score: 1,173 (n=9)
- Average Percent Pell Eligible: .84
2016 Hilleman Scholar Hometowns: 26 Montana Communities

Program Design:
Access & Excellence – Leading to a Better Future
Program Design
Access & Excellence – Leading to a Better Future

• **Program Costs & Finance:**
  • Summer Success Academy:
    • $2,000 Stipend
    • Room & Board
    • Up to $2,000 bonus for GPA above 3.0
  • $4,000 per year ($400 per month X 10 months)
    • Pell Grant
    • Subsidized Loans
    • Unsubsidized Loans
    • AmeriCorps/Work-study and other options
  • Ancillary Goal to Prevent Parent Plus Loans

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Program Design
Access & Excellence – Leading to a Better Future

• **Summer Success Academy** – Math, Writing, Integration
• **Year 1:** Developing leadership and academic foundations to support self-authorship.
• **Year 2:** Developing a sense of self by learning and leading.
• **Year 3:** Responsibility to university community, whether as a tutor, student leader, research associate, or intern.
• **Year 4:** Role of being a citizen in a larger context. Working closely with community partners addressing their needs to make our communities and our state a better place to live.
Program Design
Access & Excellence – Leading to a Better Future

Summer Success Academy

• Curricular/Learning Reforms
  • WRIT 100 leading to WRIT 101
  • Writing Studio
  • Math Progression/Cohort/EdReady
  • Small Class Size/Mentoring Cohorts (10:1)
  • Learning Strategies and Career Development
  • Morning Reflections – Socratic Method
  • Research Day
  • Intensive Peer Mentoring
  • Residential Experience (Langford Hall)

Other Academic Year Highlights:

• Scholars required to participate in 10 hours of experiences per week designed to support both transition and expectation for academic achievement and personal development.

• Leveraging the Co-curricular:
  • Academic Support
    • Undergraduate Research
    • Mentoring
  • Student Support
    • Workshops/Lectures
  • Counseling
    • Academic Advising
  • Career Development
    • Academic Help Centers
  • Volunteering
    • Financial Coaching, etc.
Fall ‘16 Semester Outcomes

High School GPA by Hilleman, FTFT Reduced & FTFT for Fall 2016

- Quintile 1
- Quintile 2
- Quintile 3
- Quintile 4
- Quintile 5

High School GPA Average

- Hilleman
- FTFT Reduced
- FTFT
Fall to Spring Retention Comparison of Hilleman Fall 2016 & FTFT Reduced & FTFT for Fall 2015

ChampChange:
A Program for Incentivizing Extrinsic Motivation & Understanding Student Interaction within the Environment
The Nitty Gritty

Details:
• Akin to a frequent flyer point system
• Use CatCard at designated campus events, centers (22), and appointments to drive point accumulation
• Student WebPortal to view points/events
• Win weekly, monthly and end of semester prizes

Prizes Include:
• $1,000 tuition credits
• Electronics
• Bobcat apparel
• Sporting Goods
• Restaurant Gift Certificates
• Much more...

The Application of ChampChange Data in an Institutional Context

• Incentivizes engagement and in some cases behavior change
• Provides infrastructure to build templates and expected breadcrumb trails for students
  • Academic Success & Career Plan
• Advisors/Coaches in AYCSS can view points/participation
• Provides a descriptive measure for assessment of programs
• Provides critical descriptive environmental data –
  • 500,000 engagements in AY15-16
• Provides critical data for predictive models to inform retention strategies.
Fall 2015 – Fall 2016 - Total Engagement Counts – Recorded in ChampChange
Entire FTFT Cohort

<table>
<thead>
<tr>
<th># of campus engagements</th>
<th>0</th>
<th>1 to 4</th>
<th>5 to 10</th>
<th>11-19</th>
<th>20+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Registered Fall 2016</td>
<td>58.8%</td>
<td>58.8%</td>
<td>68.2%</td>
<td>77.8%</td>
<td>84.9%</td>
</tr>
<tr>
<td>Registered Fall 2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# of students
- n=80
- n=410
- n=380
- n=460
- n=1174

2019: 82% goal FTFT retention rates
75.91% FTFT actual retention rates
Fall 2015 – Fall 2016 – By Total Engagement Counts – Recorded in ChampChange
FTFT Cohort - STEM Majors Only

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<tr>
<th># of campus engagements</th>
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<td>0</td>
</tr>
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<td>Not Registered Fall 2016</td>
</tr>
<tr>
<td>Registered Fall 2016</td>
</tr>
</tbody>
</table>

# of students
- n=33
- n=193
- n=179
- n=242
- n=611

2019: 82% goal FTFT retention rates
75.91% FTFT actual retention rates

The College of Wooster
The College of Wooster

- Small liberal arts college in rural Ohio
  - Approximately 2,000 students
  - 14% URM
  - 9% International
  - 55% Female
  - 100% Complete Senior Thesis (Independent Study)
- 25% of degrees are in Science and Math
  - Biology, BCMB, Chemistry, Computer Science, Geology, Mathematics, Neuroscience, Physics
- No formal faculty professional development center

The College of Wooster Strategies

1. Summer bridge programs with academic enrichment and college orientation
2. Workshops and seminars on college success skills
3. Tutoring by peers or staff
4. STEM learning center with drop-in help
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STEM Success Initiative

- Academic support
  - STEM Zone (student learning community)
  - Zone Interns for Introductory STEM Courses (tutors/mentors)
  - STEM Studio course (support course)
- Faculty development
  - Introductory STEM Faculty Learning Community
- Community and cultural initiatives
  - Peer mentoring
  - STEM community events and career panels

STEM Zone

- Students most often cite the readily available help as best part of Zone
  - Peers
  - Zone Interns
  - Professor office hours

  “[The most valuable aspect is] the opportunity to struggle through and solve problems with peers.”

  “It is a space dedicated specifically for STEM, so it is a very focused environment to study in. It also develops a STEM community at Wooster.”
STEM Zone Attendance and Grades

- Zone Attendance is a consistent, significant predictor of Introductory Biology and Chemistry final course grade (p < 0.05)

Introductory Course WDF Rates

- Course Withdraw/DF rates were lower for Introductory Biology and Chemistry after Zone formation
Persistence of Underrepresented Minority Students

- Fall to Spring persistence is increasing for underrepresented minority students

Introductory STEM Faculty Learning Community

- All faculty participants (n=26) have agreed that the learning community has been a positive experience

Benefits:
- Improved pedagogy
- Supporting students

"I have tried new approaches due to ideas in [the learning community]. It has changed how I give feedback back to my students and now I ask them to reflect on their exams as well."
More Recent Programs

- Mentoring dedicated to STEM
  - Dedicated STEM peer mentors
  - Alumni connections
- Career and internship panels
  - How to find and apply for internships
  - Diversity in STEM careers panel
- Used book donation program
  - Introductory Chemistry, Biology and Math books for students with financial need

The College of Wooster Challenges

- Faculty time and turnover
- Dedicated space for STEM Zone
- Scaling up to include other STEM disciplines
- Supporting needs of diverse community
- Supporting motivated underprepared students
Common Successful Strategies

- Academic support through dedicated STEM tutoring/coaching
- Data mining to form strategy and shape assessment
- STEM community events
- Financial support
- Conversations across campus regarding inclusive excellence

Common Challenges

- Underprepared students' academic needs
- Just in time responses
- Students' financial needs
- Scaling up programs
- Students seeing themselves as scientists, engineers, and mathematicians
- Relating STEM to other areas, issues
- Improving STEM faculty instruction
Questions and thoughts?