



iCubed@UMBC

Exploring Student Success in Science, Technology, Engineering and Mathematics

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Background

- iCubed@UMBC is the abbreviated name for the 5-year, NSF-funded project entitled, "Evaluation, Integration and Institutionalization of Initiatives to Enhance STEM Student Success."
- This investigation uses multi-treatment randomized control trial methodology to explore the effectiveness of four different academic support initiatives on Freshman students majoring in STEM disciplines.
- Interventions extracted from our university's successful scholarship programs
- Evaluation activities, including feedback from focus groups, will analyze the impact of the support initiatives on several measures of STEM student success and inform the possible institutionalization of cost-effective initiatives.

Experimental Design

- Freshman students meeting the following criteria are invited to participate:
 - 1) intend to pursue a STEM major
 - 2) are eligible to register for MATH 106 or higher;
 - 3) not participants in structured scholarship programs
 - Students are randomly assigned one of five possible teams (interventions)
 - Students, after signing informed consent:
 - 1) complete a background survey
 - 2) attend a Welcome Week Event and pick up Team T-shirt
 - 3) participate in Team activities during their freshman year
 - 4) complete an end-of-year survey
 - 5) participate in focus groups
- (Team activities briefly described in their corresponding sections)

Guided Protocol for On-going Risk Assessment

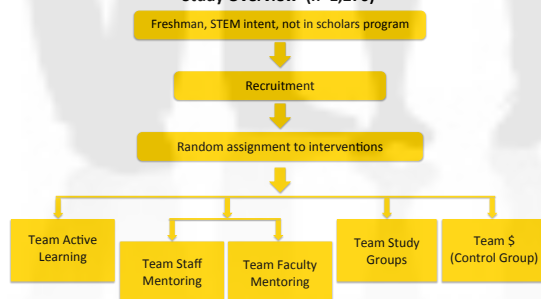
- Analyzed historical data from 2004-2008
- Significant differences by race, ethnicity, in-state status, and major
 - Psychology majors 7% more likely to persist in a STEM major than biology majors
 - C or better in first math course: 14% more likely to persist in a STEM major to at least the 3rd semester & 11% more likely to persist at UMBC
- STEM grades significantly impact retention in the major
 - 10% increase in the fraction of STEM courses that the student earns a C or better leads to a 2% increase in the probability of being retained in a STEM major to at least the 3rd semester
- Non-STEM grades also impact retention
 - 10% increase in the fraction of STEM courses that the student earns a B or better leads to a 0.4% increase in retention in a STEM field

Risk Assessment (Teams Staff and Faculty Mentoring, only)

Five triggers for invitations to individual mentoring sessions:

- Quiz Zero scores from Mathematics/Statistics Department
- Early Warning Survey (EWS) sent out very early in semester to all STEM instructors of students in mentoring groups to identify students
- FYI Alerts (campus-wide system)
- Student self-identification
- First semester grades

Study Overview (n=1,270)



iCubed@UMBC Participants (2011-2014)			
	Cohort 1	Cohort 2	Cohort 3
Team Active Learning	71	126	113
Team Faculty Mentoring	41	56	57
Team Staff Mentoring	34	80	52
Team Study Groups	84	138	116
Team \$	77	114	111
Totals	307	514	449

Team Study Groups

- Each semester, team meetings are held to discuss the importance of study groups and inform students how to form and maintain study groups
- iCubed Coordinator uses course rosters to assist students in finding study group partners
- Office hours are offered weekly

Team Study Groups Participation (% by year)			
	Cohort 1	Cohort 2	Cohort 3 ¹
Early semester meetings	14%	49%	32%
Mid-semester meetings	5%	5%	0%
Office hours	6%	8%	7%

¹ report information collected before the end of Cohort 3 participation.

Team Active Learning

- Active learning offered in the CASTLE classroom in four key foundational courses:
 - MATH 150 (Pre-calculus Mathematics)
 - MATH 155 (Elementary Calculus)
 - MATH 151 (Calculus and Analytical Geometry 1)
 - MATH 152 (Calculus and Analytical Geometry 2)
- Team Active Learning participants are encouraged to enroll in CASTLE discussion sections of one of these math courses during their freshman year

Team Active Learning (% Enrollment by semester)					
	Fall 2011	Spring 2012	Fall 2012	Spring 2013	Fall 2013
In CASTLE	27%	13%	32%	17%	25%
In Non-CASTLE	40%	63%	57%	54%	53%
Not enrolled in Math course	33%	17%	11%	26%	20%
Other	-	7%	-	3%	2%

Team Staff Mentoring

- Group mentoring meetings held by a staff mentor (2 in fall, 1 in spring)
- Activities focused on STEM success
- On-going risk assessment by iCubed staff
- Students invited to individual mentoring sessions based on risk assessment status

Team Staff Mentoring Participation (% by year)			
	Cohort 1	Cohort 2	Cohort 3 ¹
1 st Group meeting	38%	40%	42%
2 nd Group meeting	37%	16%	17%
3 rd Group meeting	24%	14%	-

Team Faculty Mentoring

- Group mentoring meetings held by faculty mentor (2 in fall, 1 in spring)
- Activities focused on success in the major
- On-going risk assessment by iCubed staff
- Students invited to individual mentoring sessions based on risk assessment status

Team Faculty Mentoring Participation (% by year)			
	Cohort 1	Cohort 2	Cohort 3 ¹
1 st Group meeting	28%	51%	42%
2 nd Group meeting	25%	25%	17%
3 rd Group meeting	24%	20%	-

Team \$

- Members serve as the Control group
- Matriculate through their freshman year without iCubed@UMBC intervention
- Each student receives a \$50 gift card to UMBC Bookstore

Lessons Learned

- Multiple communication strategies are needed for recruitment, participation, & retention
- University-wide collaboration and coordination is critical to the project
- Building a sense of community among students is essential
- Scheduling students in specific discussion sections is challenging
- Faculty workshops were needed for uniform understanding of active learning
- Mandatory student attendance is needed in active learning discussion sections
- Must overcome stigma among new freshmen about participation in study groups
- Study group information must be introduced early and often
- Students value personal interaction with faculty and staff
- Some students may choose not to respond despite repeated communication attempts
- Non-academic factors pose additional risks to student success and retention

UMBC Research Activities

- Evaluating effects of the interventions on grades, credits earned, and retention in STEM fields & UMBC
- Analyzing results to date, which are preliminary - no systematic patterns detected (five semesters of outcomes for cohort 1, three semesters of outcomes for cohort 2 & no outcome data on cohort 3)
 - Random assignment of students to interventions appears to be statistically valid
 - Student characteristics do not vary in significant ways across the interventions
 - Background characteristics of participants differ from eligible non-participants (i.e., high school grades and gender)
- Hosting student focus groups after first year of participation
- Planning to evaluate the effects of iCubed participation on student graduation rates, enrollments in graduate school, and earnings

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