

The STREAMS Experience in Improving Student Success in STEM at Bridgewater State University



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Abstract

STREAMS, an NSF-STEP grant held by Bridgewater State University, implements best-practice approaches to increasing the number of STEM graduates. STREAMS interventions include a summer bridge program, a mentoring program, curricular changes promoting inquiry-based teaching, Structured Learning Assistance in gateway courses, a Residential Learning Community, and better transfer student advising and articulation. Here, we focus on the assessment strategies that encourage curricular change and evidence of increased student success in science and math at Bridgewater.

Data Promoting Institutional Change – Project Compass

Bridgewater State University's Project Compass Grant from the Nellie Mae Foundation led to a deeper, institution-wide study of the success rates of all students, but first generation, low-income, and minority students in particular. The initial ideas for STREAMS grew out of sharing of Project Compass data, and further analyses used to support the grant also were done as part of the Project Compass work.

Semester	All STEM				Engineering				Natural Sciences			
	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)
Fall 2010	144	144	144	144	144	144	144	144	144	144	144	144
Fall 2011	144	144	144	144	144	144	144	144	144	144	144	144
Fall 2012	144	144	144	144	144	144	144	144	144	144	144	144
Fall 2013	144	144	144	144	144	144	144	144	144	144	144	144
Fall 2014	144	144	144	144	144	144	144	144	144	144	144	144

Retention data combined for all BSU STEM majors.

Semester	Freshmen (all)				Sophomores (all)				Juniors (all)				Seniors (all)			
	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)
Fall 2010	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
Fall 2011	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
Fall 2012	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
Fall 2013	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144
Fall 2014	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144

Retention data combined for all BSU STEM majors. The same was discussed with all other STEM majors.

STREAMS Initiatives

A best practices approach to STEM student success based on STEM and multi-cultural literature – focus on group work, inquiry, increased student support and advising.

1. Course Development Grants – encouraging group work & inquiry particularly in gateway courses
2. Structured Learning Assistance – all STEM gateway courses, mandatory for all students
3. Summer Bridge Program – residential, undergrad research focus for 16 students
4. Residential Learning Community – for STEM majors, multi-year community
5. Increased Transfer Coordination – articulation, advising, course development at Cape Cod and Massasoit Community Colleges
6. Networking / Mentoring – for new native and transfer students with reflective e-portfolios

Grant activities began Summer 2010. We are in grant year 2 of a 5 year grant.

Student D, F, W, and I grades in gateway STEM courses were shared with departmental faculty, who designed new teaching modes. Bridgewater's rates are similar to peer institutions, but STREAMS looks to reduce these rates to below 20%.

Course	Count	Total Enrollment	D Count	F Count	W Count	I Count	Total DFWI	DFWI Rate (%)
STEM	144	144	20	14	0	0	34	23.6%
MATH	151	253	35	19	40	0	94	37.2%
COMP	101	216	10	16	49	2	77	35.6%
MATH	141	179	11	19	0	0	30	16.8%
MATH	100	800	95	74	80	1	250	31.3%
PHYS	243	318	13	4	7	0	24	7.6%
BIOI	121	62	14	6	8	0	28	45.2%

Project Compass analysis showed no statistically significant difference in the progress of low income, first generation, women, or minority students compared to the average in STEM retention.

FIRST-TIME FULL-TIME FRESHMEN (ALL STUDENTS)

Semester	STEM Retention Rates				Fresh-Step Completion	Soph-Junior Retention
	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)		
2005	121	121	38.0%	38.0%	18.0%	54.0%
2006	148	148	44.6%	44.6%	24.1%	72.7%
2007	137	137	58.0%	58.0%	28.0%	66.7%
2008	140	140	64.3%	64.3%	32.0%	66.7%

FIRST-TIME FULL-TIME FRESHMEN (LOW-INCOME AND/OR STUDENTS OF COLOR)

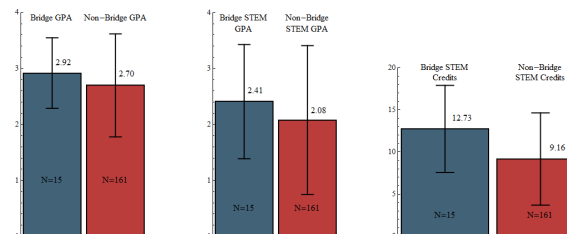
Semester	STEM Retention Rates				Fresh-Step Completion	Soph-Junior Retention
	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)		
2005	36	36	58.3%	58.3%	28.3%	66.7%
2006	39	39	51.3%	51.3%	24.1%	56.2%
2007	47	47	61.7%	61.7%	31.1%	75.0%
2008	43	43	65.1%	65.1%	32.0%	69.8%

FIRST-TIME FULL-TIME FRESHMEN (WOMEN ONLY)

Semester	STEM Retention Rates				Fresh-Step Completion	Soph-Junior Retention
	Enrolled	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)	Enrolled (by the incoming semester)		
2005	56	56	51.8%	51.8%	19.3%	62.1%
2006	55	55	59.1%	59.1%	28.2%	66.7%
2007	71	71	64.9%	64.9%	34.3%	70.6%
2008	75	75	73.3%	73.3%	33.3%	75.0%

Summer Bridge Program

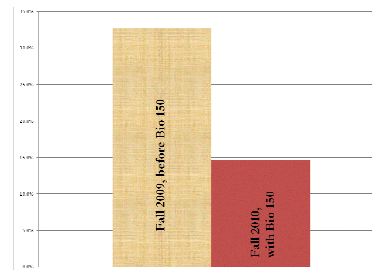
- 15 students in Summer 2010, 16 students in Summer 2011
- Residential, 3-week program
- Students complete 2 college-level courses
 - Physics 199: Scientists at Work, a writing intensive Core Curriculum course
 - Math 125: Integrated Science and Math, an introduction to pre-calculus and calculus
- Students work in groups of 4 in a research lab for 30 hours – mentored by a peer (senior undergrad) and faculty member



Overall GPA, STEM Courses GPA, and STEM Credits Earned during the 2010-2011 academic year for 2010 summer bridge participants and declared STEM majors. There were no statistical differences in gender, ethnicity, income-status, first-generation status, Math SAT, high school GPA between the two groups. Only the STEM Credits Earned comparison is statistically significant ($p=0.05$) at $p = 0.016$.

Structured Learning Assistance

1. Small group, inquiry based work added or integrated into introductory biology, calculus, chemistry, computer science, and physics courses.
2. Based on the idea that an advanced student peer leader can elicit greater student interaction with the material (more honest questions, open discussion).
3. Strong inquiry / discovery aspects to designs – with faculty from each department creating their own models.
4. Fully implemented in Biology 121 in fall 2010 – with positive results!
5. Piloted in calculus, physics, chemistry in spring 2011. Computer science pilots in fall 2011.
6. Fully implemented in calculus and physics, strong chemistry presence in fall 2011.



Rate of students receiving a grade of D, F, W, or I in Biology 121.

The Biology 121 SLA model was to require all students to sign up for a co-requisite, pass / fail, 1 credit course (Bio 150) delivered in groups of 8 students led by 1 senior undergraduate.

The co-requisite course met for 2 hours per week and focused on inquiry activities, case studies reinforcing lecture topics, sharing of notes, and general study skills.

The historical DFWI rate has been in excess of 30% for many years, but the STREAMS sponsored SLA reduced the DFWI rate to under 15%.

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