



CENTER FOR
SCIENCE AND
MATHEMATICS
EDUCATION

Characteristics of Successful Programs in College Calculus: Masters Institutions

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The Masters University Sample

College	UG / Grads	Setting	Popular Client
MA 1	9,000 / 1,000	Suburb: Large	Engineering
MA 2	5,000 / 500	Town: Distant	Teacher Ed
MA 3*	7,000 / 5,000	City: Large	Economics
MA 4	13,000 / 1,000	City: Small	Engineering

Commuter schools • Medium selectivity • 3 public
High inspiration survey scores
Beat MA expected pass rate



1. The Best Instructors Teach Small Calculus

College	Calc 1 Instructors are...	Cap
MA 1	“best possible teachers”, veterans and like the “plum assignment”	40
MA 2	Full-time faculty only.	35
MA 3	Picked carefully. “A-Team”	28
MA 4	Faculty want to teach calculus!	35

because...



“Let's put our good people in calculus and make sure we're doing a good job there so we attract majors.”

- Chair, MA2

(In contrast to highly selective colleges.)



2. Course Coordination and Culture

	Calc Coord	Faculty Collaboration	Chair	Math & Math Education
MA 1	minimal, rotates	Strong informal culture	30 yrs, hired all	Math Ed faculty in Math
MA 2	minimal, rotates	Informal culture, mentoring	6 yrs	Close, 2/3 maj Math Ed
MA 3	guides new people	Univ conf, Dept pedagogy retreat	1 yr	Director of UG in Math Ed, works w/ new
MA 4	minimal, rotates	Very collegial, collaborative	12 yrs, hired 2/3 faculty	BS in Math Ed

(not 3.) Not Common Themes

	Placement Test?	Common Final?	Faculty Dev Center?	Student Tracking?	Reform Teaching?
MA 1	Accuplacer, SAT, interview	Some Qs	No	Yes, use data	A little
MA 2	No	No	Yes, fall conference	Yes, for accrediting	Lecture w Compassion
MA 3	Written test, now Dean's online	No	Yes, remedial	No	A little
MA 4	State ACT cut score or campus test	Common final, 30 yrs	No	No	Lecture w Compassion

Teaching Technique (Rough % of Class Time)

	Reform Teaching?	Pure Lecture	Lecture with Questions	Student Presentations	Problem Solving (1 or more)
MA 1	A little	15%	65%	8%	10%
MA 2	Lecture w Compassion	28%	68%	5%	0%
MA 3	A little	11%	63%	1%	25%
MA 4	Lecture w Compassion	16%	73%	0%	2%

3. Strong Math Student Community

	Student Gathering Space	Majors formal work w Calc 1?	Student Research Support
MA 1	informal	Upper div UGs help in classroom	research, travel w faculty to conferences
MA 2	Windowed student room in center of faculty offices	Upper div UGs weekly sessions	No
MA 3	Math tutoring room, run by students, near faculty offices	No	No
MA 4	Pi Mu Epsilon math club room, near faculty offices	No	research, travel w faculty to conferences

Communities of Practice: Faculty

- Lave & Wenger
 - How do communities reproduce themselves w/o formal schooling?
 - How do newcomers learn to be expert old-timers?
 - Newcomers do legitimate work, get feedback, watch old-timers doing advanced work
- Faculty Communities in Case Studies
 - CoP with productive culture that values teaching, faculty collaboration and continual improvement
 - set by strong chair or strong math ed influence



Communities of Practice: Students

- Students (despite commuter schools)
 - Tinto - social connection and belonging
 - Treisman - social connections around visible academic work
 - Lave and Wenger - social trajectories around academic work

 - Depts think of the Calc 1 students as the newcomer majors!
 - Physical places where old-timers are visible to newcomers
 - Rooms, clubs, travel together to conferences
 - (or SI structure where old-timers help newcomers)

- Ask Me Afterwards
 - Trading Zones as a better model for students than Communities of Practice? (Peter Gallison, Mary Huber)



What to do with these findings?

Henderson, C., Beach, A., & Finkelstein, N. (2011). Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature. *Journal of Research in Science Teaching*, 48(8), 952-984.

Ineffective change strategies:

- Developing and testing “best practice” curricular materials and then making these materials available to other faculty
- “Top-down” policy-making meant to influence instructional practices

Effective change strategies:

- are aligned with or seek to change the beliefs of the individuals involved;
- involve long-term interventions, lasting more than one semester;
- require understanding a college or university as a complex system and designing a strategy that is compatible with this system