The Mathematical and Theoretical Biology Institute Community Learning Model

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What is MTBI?

- Mathematical and Theoretical Biology Institute
  - Summer REU began 1997
  - Recruit and retain underrepresented minority (URM) graduate students
- Since 2005
  - More than10 MTBI alumni earn PhDs per year
  - More than 8 URM PhDs per year
  - 50% of Latino/a PhDs in Math Bio

Who Participates?

- ≥22 new undergraduates
- ≥4 returning undergraduates
- ≥12 graduate students
- ≥6 faculty/postdocs
- Guest lecturers

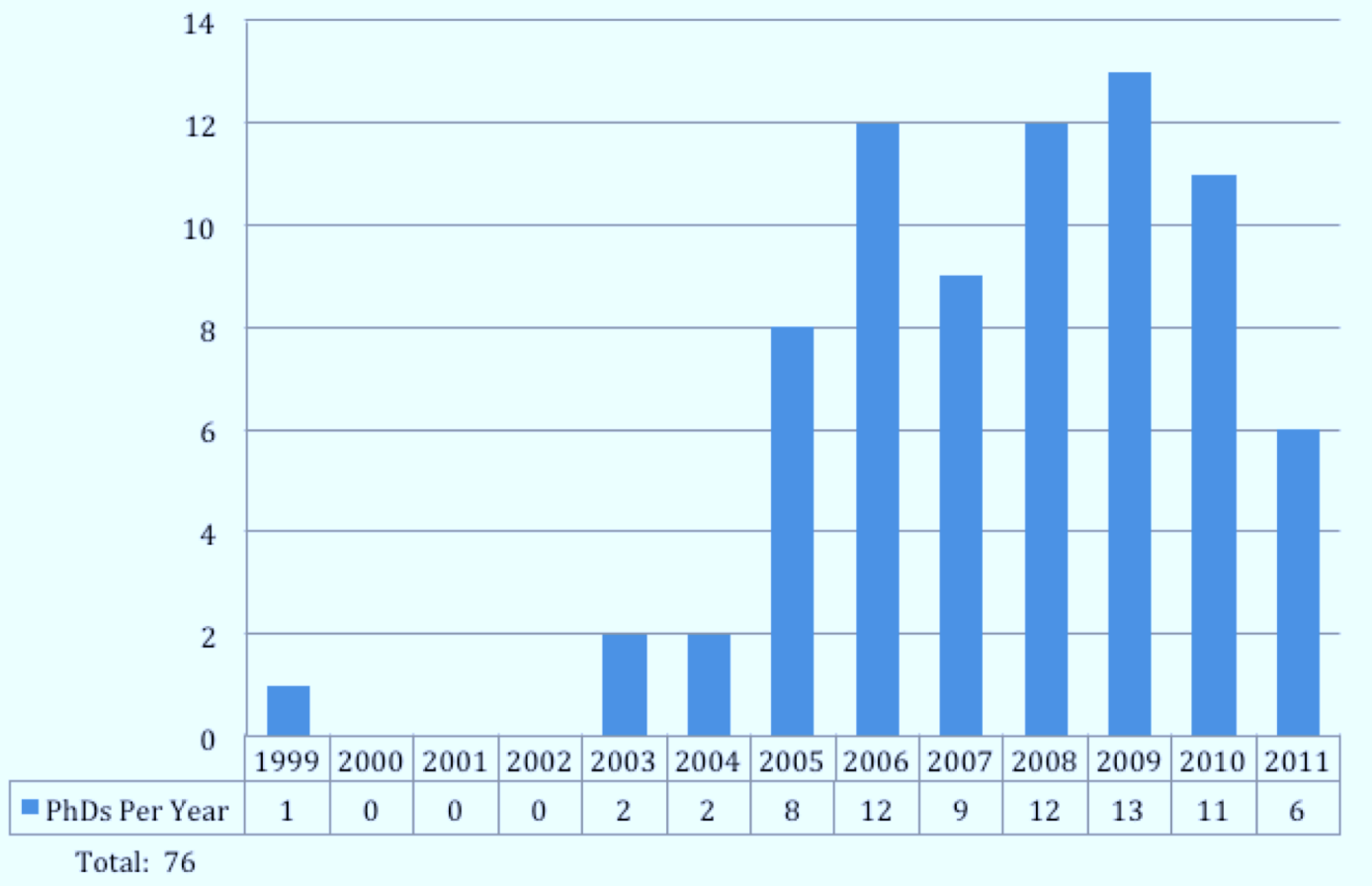
What do they do?

- Eight week summer program
  - First half lecture & homework
  - Second half student driven research projects
- Students return for multiple summers as peer mentors, graduate mentors, and faculty

Does it work?

- 340 students, 62 returning students
  - 73% enrolled in a graduate program
  - 73% of these URMs

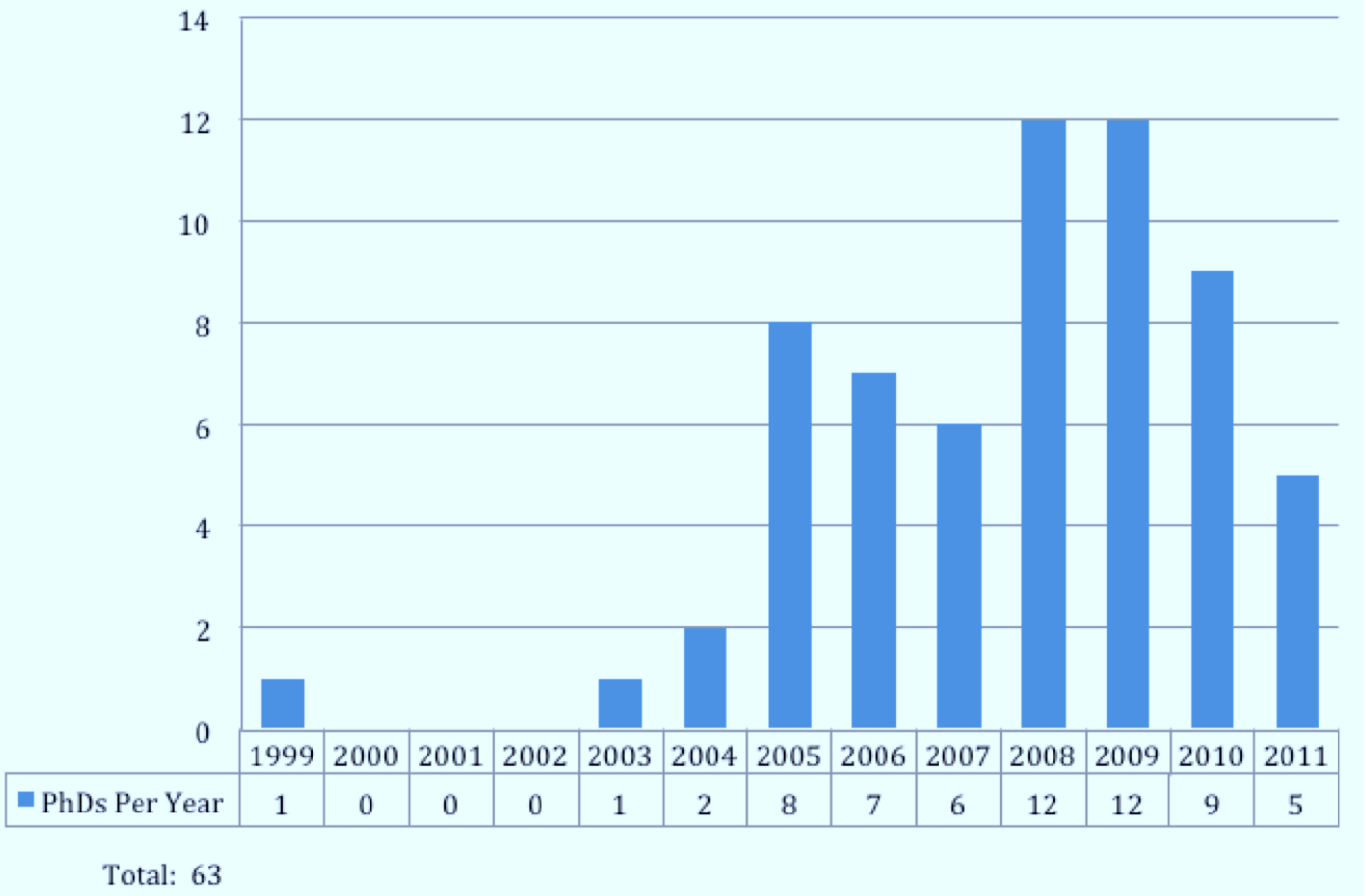
Total PhDs (mid 2011)



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
PhDs Per Year	1	0	0	0	2	2	8	12	9	12	13	11	6

Total: 76

US URM PhDs (mid 2011)



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PhDs Per Year	1	0	0	0	1	2	8	7	6	12	12	9	5

Total: 63

Some Research

- 144 technical reports as of 2010
- Award winning presentations
- Many refereed publications including:
  - Crisosto, Kribs-Zaleta, Castillo-Chavez, & Wirkus, 2010. *Community resilience in collaborative learning.*

Why does it work?

We don't know

- MTBI is designed for education in research, *not* research in education
  - Ability to change the model is very limited
  - Future work: anthropological, collaborative
- ...but we have some guesses:

Piaget, Vygotsky, Bandura

- Three perspectives
  - Development of concept in the individual
  - Development of individual in society
  - Alteration of individual attitudes and behavior
- Not incompatible. Different units of analysis

Piaget

- Evolution of schemes of mental actions (understandings) through biological metaphor
  - Learning is a complex adaptive system
  - Dynamic equilibrium
  - Assimilation of stimuli to schema
  - Accommodation of schema to stimuli
  - Reflection on action generates new abstractions

Vygotsky

- Learning through social assimilation
  - Students grow to join an intellectual society
  - Communication becomes internalized
  - Zone of Proximal Development (ZPD)

Bandura

- Primarily concerned with behavioral change
  - Academic success
    - Graduate school recruitment and retention
  - Self-efficacy
  - Pro-socialness

Genuinely Collaborative Problems

- Assignments and research projects are too long and too difficult for one student, but can be accomplished by 3-5 (ZPD)
- Collaboration becomes genuine rather than assigned (pro-social)
- Faculty and students live, work, and eat together

Student Driven Research

- Students are the experts
- Faculty become genuine collaborators (ZPD)
- Students have set challenging goals and succeed (self-efficacy)
- Genuine research experience (self-efficacy)

Diversity

- Students come from many different cultural, economic, and educational backgrounds
  - Students choose meaningful topics (motivation, self-efficacy)
  - Chagas disease, bulimia, three-strikes law, high school drop out rates, gang recruitment, SB 1070 & TB, infant addiction, raves & ecstasy, bipolar disorder, ADHD, beauty culture & depression, obesity, diabetes, gulf oil spill, smog in LA, border vaccination policy, MTBI

Diversity

- Students come from many different cultural, economic, and educational backgrounds
  - Researchers like me (self-efficacy)
  - Academic & cultural experience broadens ZPD
  - Opportunities for conflicting understandings (Assimilation, reflection)

Returning Students

- Crisosto, Kribs-Zaleta, Castillo-Chavez, & Wirkus, 2010
  - Peer-recruitment generates a backward bifurcation
  - Requires more energy to start a collaborative learning community than to keep one going
  - Returning students make the community (pro-socialness) highly resilient
- Role models & peer pressure to complete grad school (self-efficacy)

Is it replicable?

- Replicated and reformulated at University of Puerto Rico, Loyola Marymount, Miami University in Ohio
- Requires a lot more energy to start a community than to run one.

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