

One solution to two problems: Teacher education students as teachers of undergraduate developmental mathematics

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Funded by Michigan State University and the National Science Foundation Award DUE-124540

Why this project?

Math
Perspective

- Remedial math at MSU: over 1000 students per year out of 7800 freshman
- High failure rates: 15-25% drop or fail
 - Another 10-20% below 2.0
- Prerequisite for College Algebra
- Essential for later success in STEM-related fields

Why this project?



Teacher
Education
Perspective

- Future math teachers need realistic teaching experiences (Grossman et al., 2009)
- Implementing high-leverage practices with knowledgeable peers as “mock” students is problematic

The remedial course: Math 101

A non-credit, online course using the ALEKS computer adaptive system

On-campus teaching assistants monitor completion of ALEKS homework and administer on-campus exams



What are the ongoing challenges in teaching remedial math?

Reducing failures and drops in Math 101 from ~30%

Students' attitudes about math and math courses
(Larnell, 2010)

Students' prior knowledge and math coursework
experience varies widely in Math 101

Disparities in achievement levels and ALEKS
performance

The enrichment course: Math 101E

A non-credit, on-campus enrichment seminar (Intermediate Algebra Workshop) that meets twice a week for two hours a session

Open to students taking 101, an online developmental math course using ALEKS

~ 10 sections per semester. Enrollment in most sections capped at 20.

Most taught by undergraduate LAs (some of who are students taking secondary math ed coursework).

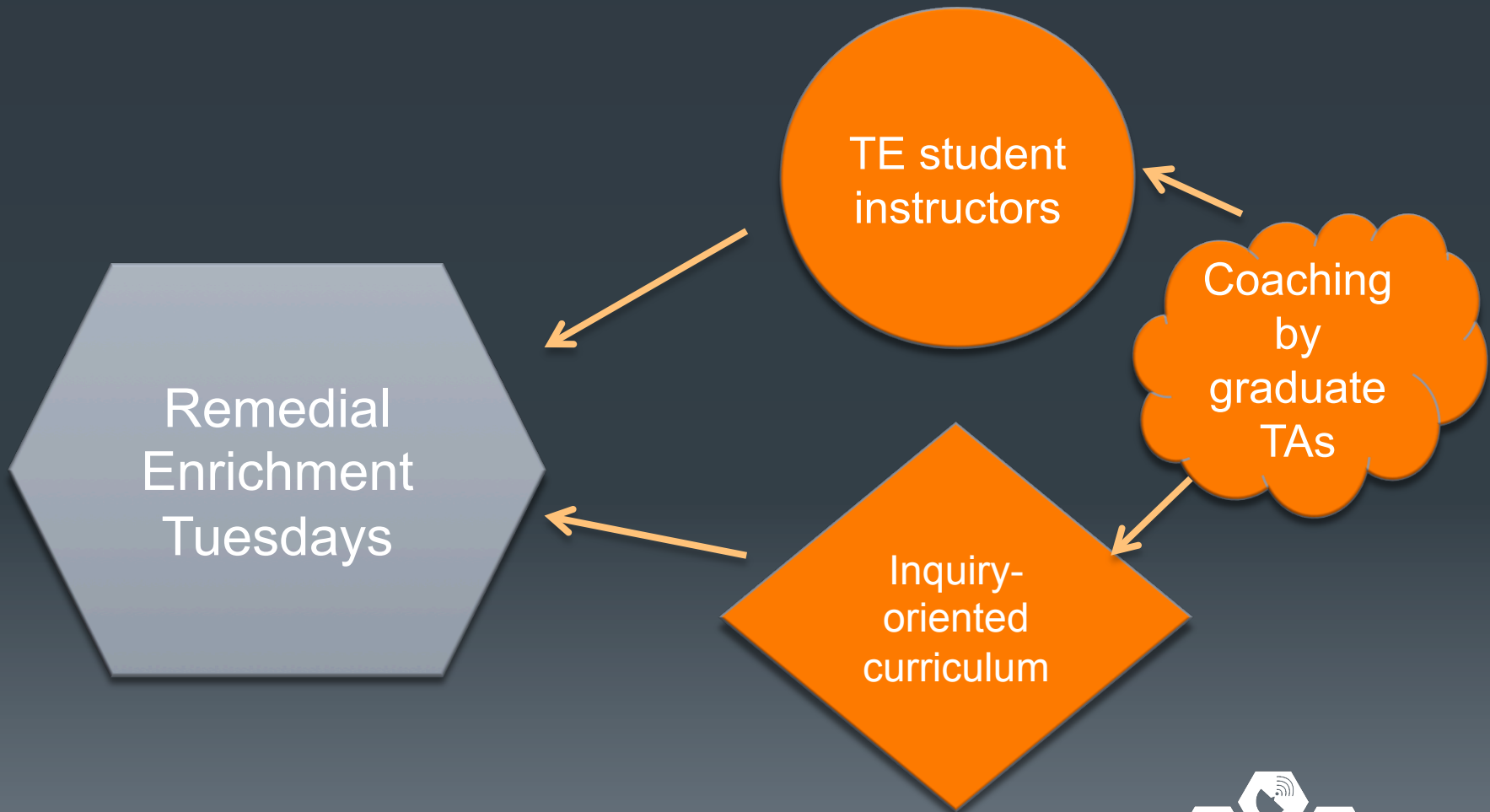
Who takes remedial enrichment?

Approximately 40% are minorities by race

Approximately 15% intend to pursue STEM majors (based on 2012 data)

Some future mathematics teachers

Pilot Intervention



Inquiry-oriented curriculum

Remedial math students need to develop more than just procedural knowledge. Tasks in lessons were designed to develop conceptual understanding, problem solving skills, and reasoning.



Research Questions

To what extent does an intervention involving inquiry-oriented and high-cognitive-demand instruction enacted by prospective mathematics teachers help remedial mathematics students gain mathematical proficiency?

(How does this intervention affect the development of the PSTs as math teachers?)

What data do we have?

- Course data:
 - ALEKS (homework, assessments, time on task)
 - Exams (final and interim)
- Math Placement Exam scores
- College Algebra enrollment and grades
- Math 101E and PSTs written reflections

Pilot Study Population

- Group 1: Math 101 only ($n=701$)
- Group 2: Math 101E, non-intervention ($n=71$)
- Group 3: Math 101E, intervention ($n=34$)

Total: 806 students

101E students start out behind

Study Group	n	MTH placement exam				ALEKS Pre-score			
		Med	IQR	\bar{x}	σ	Med	IQR	\bar{x}	σ
Group 1	701	7.0	3.0	6.4	1.9	44	27	50	26
Group 2	71	6.0	2.0	6.0	1.8	38	18	42	22
Group 3	34	7.0	2.0	6.1	1.7	43	20	42	19
All	806	7.0	3.0	6.3	1.9	43	26	49	26

- Scores for 101E (Groups 2 & 3 together) are significantly lower than those for Group 1 (101 only)
- Statistically, Groups 2 & 3 are equivalent on these measures

Comparative final results

Study Group	n	Final Exam				ALEKS Post-score			
		Med	IQR	\bar{x}	σ	Med	IQR	\bar{x}	σ
Group 1	701	134	64	121	51	209	44	198	45
Group 2	71	135	44	128	44	220	38	205	47
Group 3	34	138	50	136	35	218	25	216	25
All	806	134	62	123	50	211	41	200	44

- Group 3 (intervention) scored higher on both measures: **final exam** and **ALEKS post-test**.
- Not statistically significant, but practically, predicts a higher grade in College Algebra by half a grade point.

Withdraw, Fail, D

- Group 3 had lowest rate of failure/withdraw/D
- Group 3 had **NO** students who apparently dropped the course
- Group 3 had **NO** students with zero on both the final exam and final grade

	Grade of 1.0 or 1.5	% <2.0
Group 1	17.3	48.9
Group 2	16.9	47.9
Group 3	11.8	38.2
All	17.0	48.3

Enrollment & performance in College Algebra

Study Group	Number Enrolled		College Algebra Grade		
	Remedial Math Fall 2012	College Algebra Spring 2013	% Enrolled in College Algebra	≥2.0	≥3.0
Group 1	701	435	62.1	56.6	20.7
Group 2	71	51	71.8	45.1	7.8
Group 3	34	27	79.4	55.6	14.8
Group 4	0	742		55.3	31.4

- Group 3:
- Higher percentage enrollment
- Comparable % with 2.0 or higher

But getting 2.0 is not good enough...

Pilot Results Summary

- Enrichment students start out behind other remedial students
- Enrichment students end up even with or ahead of other remedial students on the various measures
- **Intervention** students have the best performance
- These results carry over into College Algebra

Current work

- Second round of implementation Fall 2013
- Writing items to assess mathematical proficiency and attitudes and beliefs
- Developing models to predict
 - Remedial course outcomes
 - College Algebra outcomes
- Collecting longitudinal data about the pilot cohort to follow their progress

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Reflections from TE 407 students

“I really enjoy the fact that we have a micro-teaching lab, because being able to connect what we've talked about in lecture and put it to use in the classroom as been really neat to see.”



Reflections from TE 407 students

"The micro teaching lab observation and discussions about them have helped me change my ways of thinking what makes a 'good' teacher. How you can question students to help lead them to the answer without being too direct. It is still going to take time before it becomes second nature but it has definitely had an impact."

Reflections from TE 407 students

“ I'd say the 5pm meetings on Tuesdays really help us to unravel all the different aspects of what is happening in the MTL.... these meetings help clear up what and why we did, if it worked, and what we could do differently. I think the transparency it brings allows us to better accept changing of our 'image' of teaching from 'telling' to 'student-based learning'.”