



(How) Can Mathematics Teaching Be Taught?

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Association of Mathematics Teacher Educators Annual Meeting • Fort Worth TX

February 10, 2012

SCHOOL OF EDUCATION UNIVERSITY OF MICHIGAN

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Our problem

1. Evidence of teaching effects → increased interest in importance of *teaching*
2. Broad skepticism about the efficacy of teacher education and professional development
3. → focus on recruitment, outcomes, instead of training → does not augur well for redressing educational inequity and uneven quality
4. But we are often not effective advocates for teacher education, either.

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What great teachers often say about teaching

"Teaching has always come naturally to me."

"I have learned what I do from experience; I like to pass on what I know to student teachers."

"I can't explain what I do –- teaching is really an art and you have to follow your intuition a lot."

"I have developed my way of doing things that works for me and my style."

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What's wrong with this?

1. Undermines the idea that teaching is a profession that can be developed through careful unpacking of the practice and a common technical language
2. Perpetuates the belief that teaching is individual
3. Reinforces the predominance of "style" over skill

If teaching is individual and must be figured out by each person on the job, then there is little hope of ensuring that all young people receive skillful instruction.

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Features of strong training for responsible practice

1. Clear specification of skills, capabilities, and qualities of performance necessary for basic independent practice
2. Detailed developmental clinical training, progressing from observing to simulations to supervised apprenticeship to supervised independent practice
3. Performance assessment of individual competence before allowing independent practice

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Key questions for today

1. Can teaching be taught? Cultural beliefs, inheritances, and necessities
2. Three challenges that make teaching difficult to teach
   - Underdeveloped language
   - Particularity
   - The unnatural way of knowing content
3. Toward a profession of teaching

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1. Can teaching be taught?

Things to consider in answering this question:

What *is* teaching?

✓Cultural beliefs

✓Societal inheritances

✓Necessity

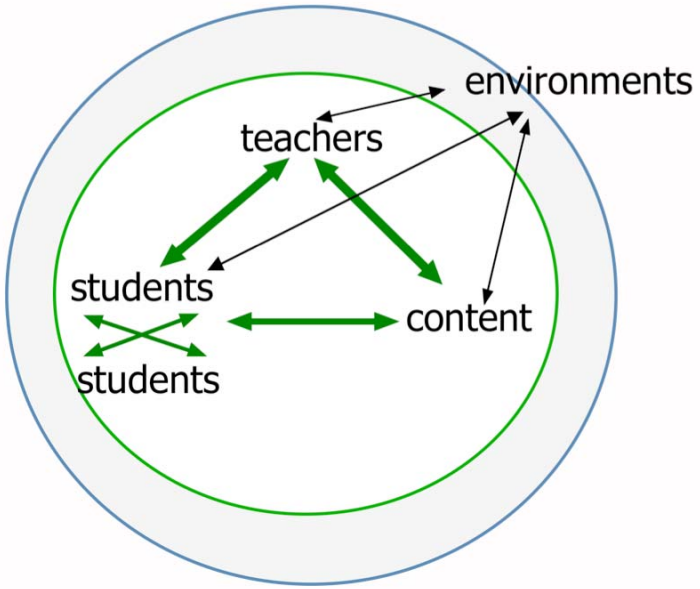
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What is "teaching"?

It is not:

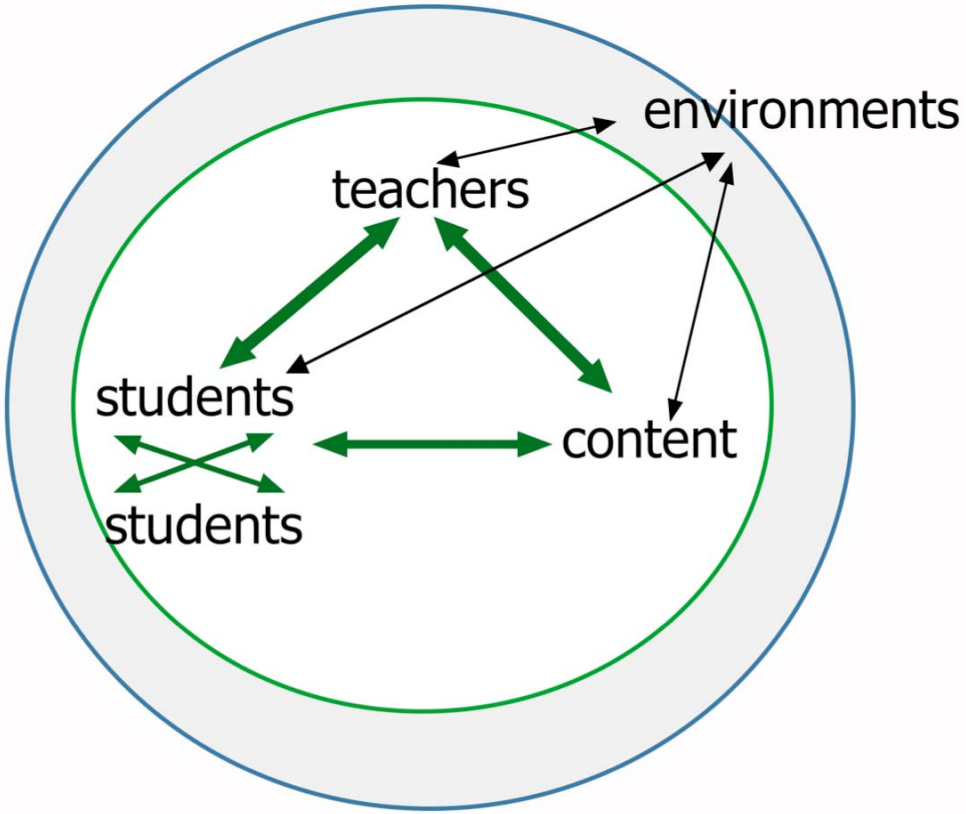
- What teachers do
- The cause of students' learning
- "Natural"
- Primarily intuitive and improvisational

Teaching is what is *co-produced* by students and teachers in contexts, around specific content and curriculum.



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What is "responsible" in teaching?



Takes responsibility for:

1. deliberately maximizing the quality of the interactions . . .
2. . . . in ways that maximize the probability that all students learn
3. . . . worthwhile content and skills

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Cultural beliefs

- Good teachers are born
- Teaching is a natural and creative act
- Trying to detail teaching is to de-professionalize it and make it "technical"

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Societal inheritances

- Teaching requires eased entry and wide decision range (Lortie,1975)
- Teaching is a individual occupation, deeply structured in the history of U.S. schooling
- Teacher licensure by proxy (e.g., program completion, program recommendation)
- Democracy and education → control by the public, not a profession

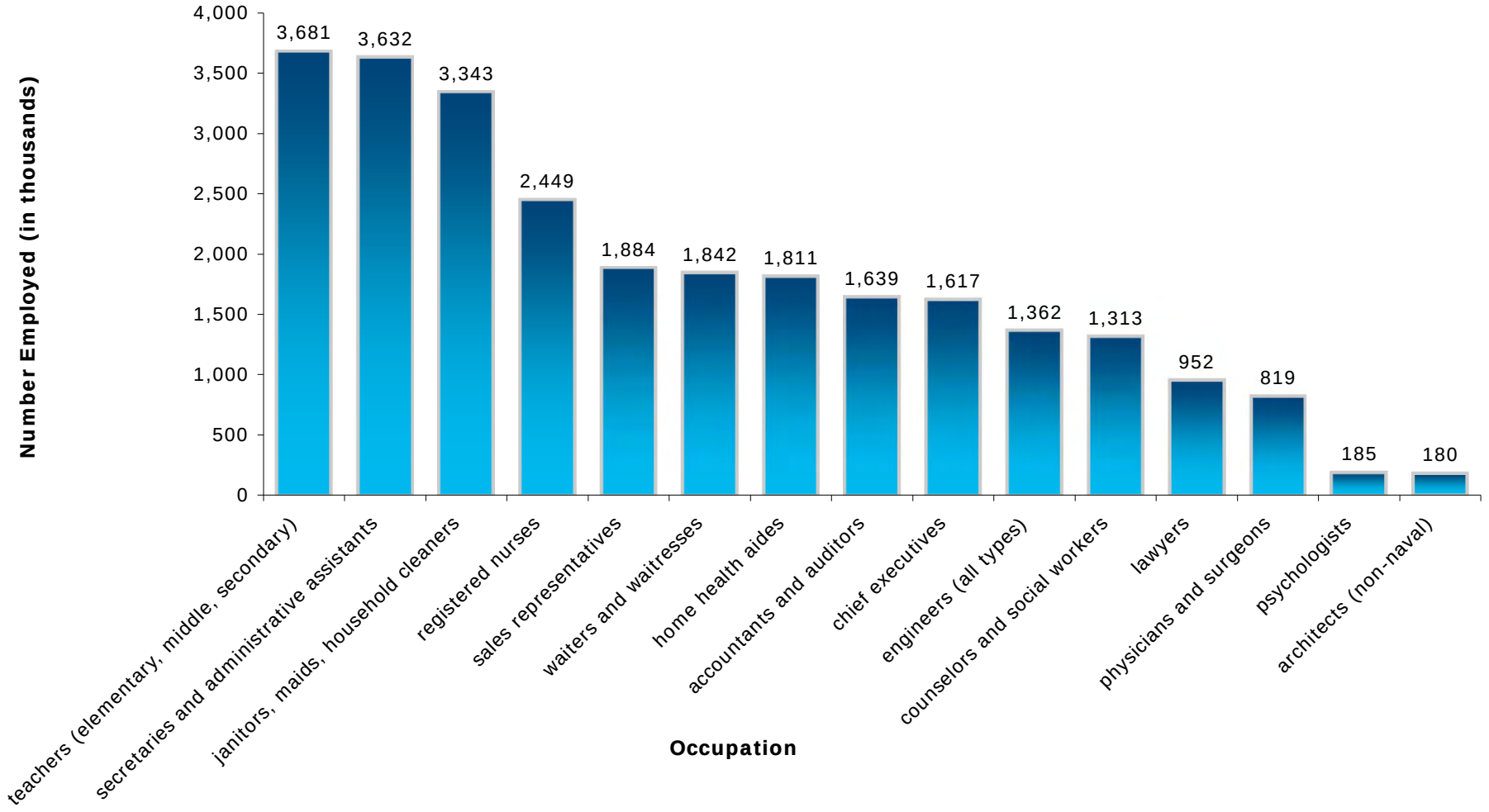
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Sheer necessity

- Educational inequity, and the power of skillful teaching
- Teaching as unnatural, intricate, and deliberate work
- The scale of the need

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The realities of scale



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2. Three challenges in trying to teach teaching

① Underdeveloped professional language

② Particularity and context

③ Unpacking

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① Underdeveloped professional language

1. Many different terms in use for the same (or similar) elements of the work:
   - Cooperative learning, small group work
   - Warm up, "do now," sponge
   - Discussion, dialogue, whole group lesson
2. Inadequate discrimination for critical elements of the work: e.g., questions, explaining, review
3. Confounding of evaluative and other labels for teaching overall with straight description of specific aspects of the work: e.g., Student-centered, constructivist, direct, teacher-centered, inquiry-oriented, reform-oriented
4. Other parts of the work lack terms altogether

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EXPLORATION #1
Do we have a language of practice?

- Watch two short (1:20 min.) video clips, each from an upper elementary math class
- Have transcript to support
- Try to name specific elements of the work
- How much common language do we have?

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Mercedes



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Lauren



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How much common language do we share? Why does this matter?

- Teaching anything depends on being able to unpack and name the work (compare with teaching mathematics)
- Imprecise terminology can obscure important elements of the work of teaching
- Difficult to make the practice visible and to make important distinctions without common technical language

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② The particularity of teaching

- Subject matters
- Context matters
- Teaching is about teaching something in particular to someone(s) in particular

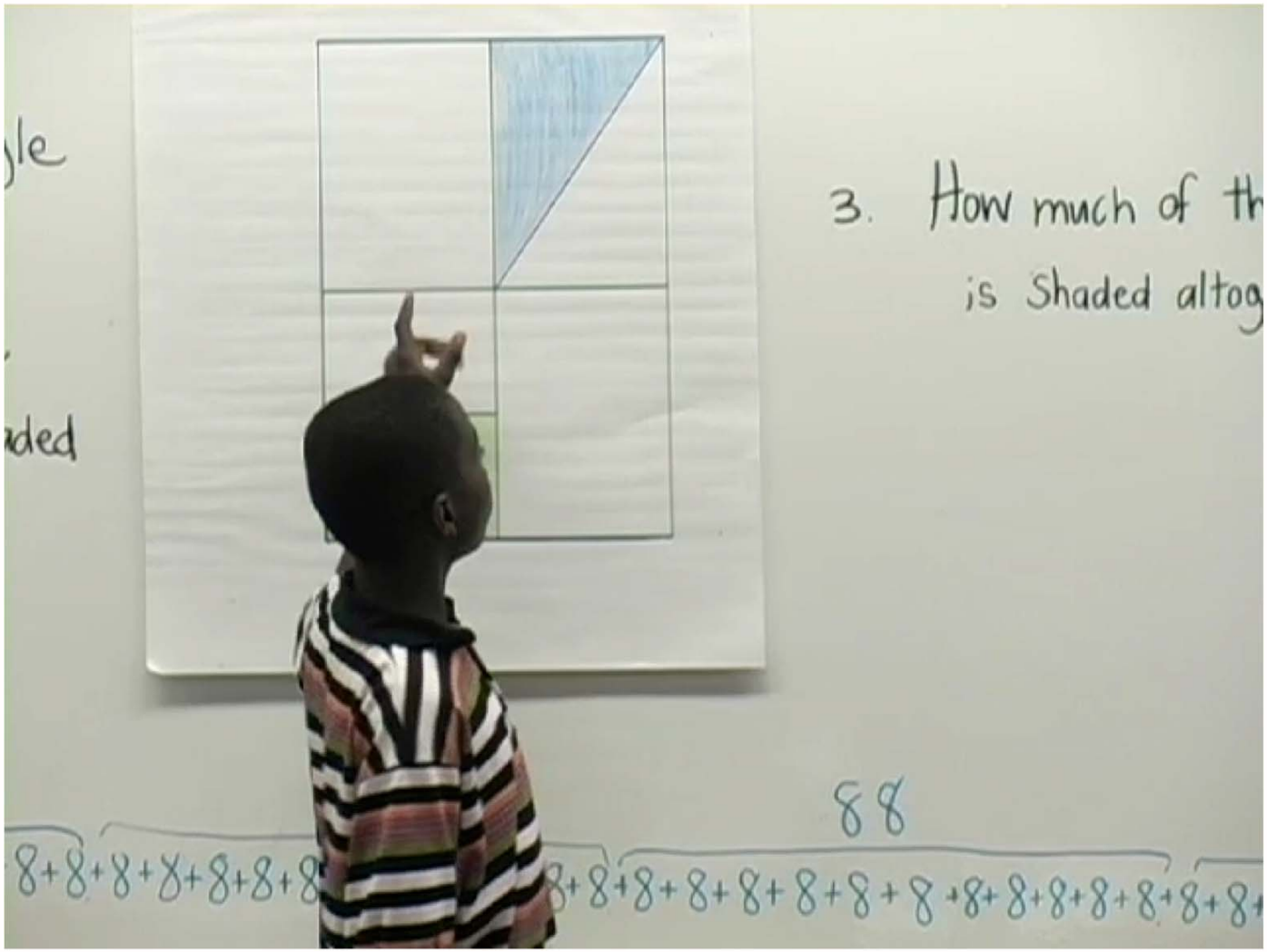
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EXPLORATION #2
How particular is teaching?

- Consider the two short video clips again
- Watch a third video clip
- Three different contexts, different topics, different teachers
- Try to name specific elements of the work across the three segments
- Is anything here part of what you could call general professional practice across the differences in style, topic, students, contexts?

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Deborah



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Some common instructional practices

1. Managing whole group discourse equitably and in support of all students' learning
   - Allocating turns to speak
   - Supporting practices of listening and speaking
   - Using public writing surfaces
2. Designing and posing questions for specific instructional purposes
3. Establishing norms and routines for classroom discourse and work that are central to mathematics
4. Making content (e.g., specific problems, ideas, processes) explicit through explanation, modeling, representations, and examples
5. Recognizing particular common patterns of student thinking and development in a specific mathematical domain
6. Implementing organizational routines, procedures, and strategies to support a respectful and equitable learning environment

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How particular is teaching? Why does this matter?

- If it is all contextual and personal, then the common comprises mostly principles and values
- Leaves much to the individual practitioner to develop his or her own practice
- Is this a blueprint for responsive and responsible teaching for all students? Or is this a risky proposition in the interest of all students?

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③ "Unpacking"

- A paradox of teaching: In order to teach, must know mathematics very well oneself; in order to teach, must think, know, and keep learning it from learners' perspectives
- What is it to *unpack* mathematics with an ear to someone else's mind?

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An example: Analyzing errors

What mathematical steps could have produced this answer?

(a)

$$\begin{array}{r} 49 \\ \times\ 25 \\ \hline 405 \\ 108 \\ \hline 1485 \end{array}$$

(b)

$$\begin{array}{r} 49 \\ \times\ 25 \\ \hline 225 \\ 100 \\ \hline 325 \end{array}$$

(c)

$$\begin{array}{r} 49 \\ \times\ 25 \\ \hline 1250 \\ 25 \\ \hline 1275 \end{array}$$

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EXPLORATION #3
What is involved in knowing into someone else's perspective?

- How many different mathematically sound ways can you adapt your understanding that $7 \div 0 \neq 0$ and explain it to:
  - A fourth grader
  - A high school student

Work with 1-2 other people and actually produce explanations. Analyze the strengths and problems of each one.

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Listening to learners' ideas



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What is involved in unpacking? Why does this matter?

- Unlearning what is tacit
- Relearning into multiple forms
- Putting one's own thinking on the back burner, and being genuinely attentive to someone else's thinking
- Much more than a special kind of academic task: Doing this in real time, interactively

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3. Toward a profession of teaching

What do we need to make the practice of teaching broadly learnable in ways that are reliable, equitable, and responsible?

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Common resources for building professional practice

1. Develop a common technical and professional language for critical elements of the work (e.g., questions)
2. Build broadly shared and accessible collections from practice (student thinking, classroom episodes, "textbook cases," unpacking of common core mathematical ideas and practices) from a wide and representative set of contexts and communities
3. Develop ways to work on practice collectively that help to define what is common, what is contextual, what is personal/ stylistic

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Common professional standards for practice

1. Agreements about the specific high-leverage capabilities necessary for independent responsible practice
2. Direct assessments of those capabilities

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What *is* TeachingWorks?

- A national organization housed at the University of Michigan School of Education
- Focused on improving the standard of teaching practice by building strong professional infrastructure for the training, development, and assessment of teaching
- Engaged in four main arenas of work:
  1. Advancing the development of a **common professional core** for teaching
  2. Creating and distributing **resources** for a comprehensive practice-based curriculum
  3. Building **training** for those who work with teachers
  4. Conducting and using **research** on teaching, on professional training and assessment of teaching, and relations to students' learning
- Based on work done at the University of Michigan in our own programs and also in partnership with other programs and organizations

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