

Investigating the Rationality of Teacher Decisions: Mathematics in Community Colleges

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Outline

I work with community colleges

My work is driven by the French notion of *contract* governing a learning-teaching situation (Brousseau, 1977)

I study instruction ([Cohen, Ball, Raudenbush, 2003](#)), in particular, how teachers justify what they do in their practice

- Professional obligations as revealed by breaching norms of behavior in trigonometry classrooms (Herbst & Chazan, 2010, Mesa & Herbst, 2011)

Community Colleges, I

Enroll a large number of undergraduates in the U.S. (between 48% and 53%, depending on where you look)

Are responsible for substantial remediation in Mathematics and English

Are called “teaching institutions:” Typical load is 15 credits *per term* (three terms per year)

Ratio of full-time to part-time instructors in mathematics is 1 to 4 across the U.S.

Community colleges, II

Five distinct functions: vocational training, job re-training, community enrichment, transfer, general education (associate's degree)

Small classes: up to 25 students for remediation courses, up to 30 in college courses

Affordable, local, non selective → diversity of students and teachers: preparation, students' goals and interests, level of physical ability...

**Community college instructors
teach mathematics to A LOT of
people yet we have very little
knowledge about what that
looks like**

(NSF CAREER, DRL 0745474)

The Didactical Contract, I

- Teacher and students gather not because they want to be together but because being together is a requirement of their job. The teacher, the student, and mathematics (as content of studies in a course) are kept together by virtue of an implicit contract...

The Didactical Contract, II

- Identifies that there is some content that students must learn, with the help of the teacher
- Makes the teacher responsible for the student's acquisition of that knowledge
- Makes the students responsible for taking part of the activities that the teacher organizes with the goal of learning, including those in which they demonstrate they have learned.

Norms: the ways in which the individuals define how to enact these basic hypotheses of the contract

(Brousseau, 1997)

Professional Obligations

Disciplinary

- The mathematical knowledge the teacher organizes needs to be a valid representation of the mathematical knowledge handled by the discipline.

Individual

- The student has the right to be and feel as he or she can within certain boundaries provided by the institution and still deserve the teacher's attention.

Interpersonal

- There is a group of many students, with diverse needs, sharing space, time, and attention.

Institutional

- The institution has its ways of doing things, schedules, curriculum assessment,...

(Herbst, 2003; Herbst & Chazan, 2011)

How do teachers justify what they do? Practical Rationality

- Each of the obligations (discipline, individual, interpersonal, institutional) issues a number of professional principles that warrant courses of action from which a teacher chooses what to do. Those principles are professionally shared: they are owned by the collective and require avowal; they change at a historical timescale and socialize individuals into them.

(Herbst & Chazan, 2012)

Important premises

All people involved in the situation are rational beings; they do things in these situations by responding to binds and constraints.

Decisions are not *just* consequences of their (or their students') beliefs (only), knowledge (only), views of students/teachers (only), views of content (only), etc.

Under adequate circumstances it is possible to describe the reasons and conditions under which teachers make instructional decisions.

Why community colleges again?

Classroom observations, artifacts, interviews with administrators, faculty and students, and surveys revealed a very consistent set of norms that regulate mathematics instruction in these classrooms:

Students participate, teachers ask lots of questions, teachers and students cover all the (very stuffed) curriculum, students are praised by their hard work, examples are important tools for learning, teachers present all content...

(Mesa, 2010, 2011, 2012; Mesa, Celis, Lande, 2012; Mesa & Herbst, 2011)

We set off on the task of identifying how teachers justify those behaviors, what are the obligations they respond to when they do things in teaching that produce these 'norms'.

Research Question(s)

1. How do teachers justify what they do?
[i.o.w., what are the professional obligations that impinge on their contract with their students or that 'justify' the enactment of these norms governing the contract?]
2. Are there differences between full-time and part-time instructors?

A word (or more) about methodology

Breaching situations – not direct questions

Animations – not videos

Group discussions – not individual interviews

What do we look for?

When teachers recognize that a norm has been
'violated' → what is odd or out of place?

How they perceive their 'allegiance' to the
norm → Agree? Disagree? Try to fix it?

What reasons do they give for that 'allegiance'?

We'll try this out: Two Layers

- Watch a clip from an animation that contains hypothesized breaches

The teacher's layer

- Discuss it as 'teachers'

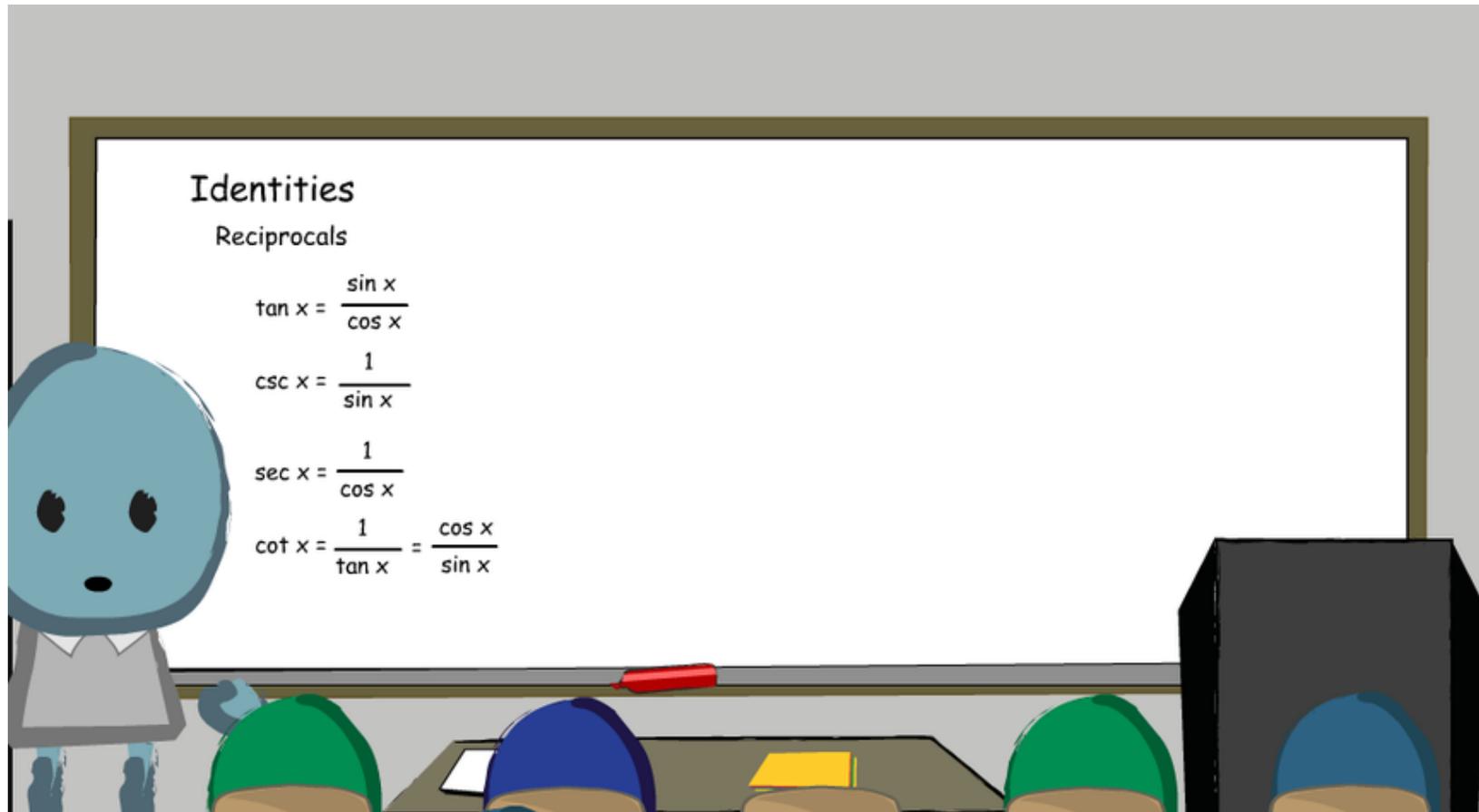
The researcher's layer

- Comment on how the 'teachers' dealt with the situation

Layer 1: Teacher

The task: Use Pythagorean identities to find values for $\cos x$, $\tan x$, $\sec x$, and $\csc x$, given values (ratios) for $\sin x$ and $\cot x$.

Layer 1: Teacher



Layer 1: Teacher

- What kinds of things caught your attention?

Layer 2: Researcher

- What types of events did this group of teachers discussed?
- What norms were they talking about?
- What was their reaction?
- How did they justify that reaction?

From the Corpus

Norm: A teacher should acknowledge all students' questions.

Breach: teacher keeps ignoring one student's questions

Outcome from the discussion: the teacher(s) can reject the situation, accept it, or repair it

Outcome justified by one or more obligations

Excerpt 1, FT

M: The student with the tie needs a hearing aid [group laugh].

W: Yeah? Why and what did you notice that made you say that?

M: Well he kept saying 'could you repeat the question?' So he's, in my experience, that would be a student that's trying to slow the class down intentionally.

W: Uh huh. So it's this guy right here that you're talking about? [points to the character in the animation]

F: The suit.

M: Yeah in the suit. So I would isolate him and deal with him after class say 'hey, look, we've gotta cover this material; let's have you sit in the front row or straighten out.'

W: So you think he's being kind of purposely disruptive?

M: That would be my guess.

W: Yeah.

M: But not knowing him not seeing his facial expressions I can't read that from here.

Norm: a teacher should acknowledge all students' questions

M: The student with the tie needs a hearing aid [group laugh].

W: Yeah? Why and what did you notice that made you say that?

M: Well he kept saying 'could you repeat the question?' So he's, in my experience, that would be a student that's trying to slow the class down intentionally.

This teacher is 'siding' with the teacher in the animation, accepting the breach that we proposed. He is saying that there are situations in which teachers are not *obligated* to answer a student question. The teacher assigns this student the role of *intentionally slowing down the class*.

In making that statement, the teacher is revealing allegiance to the class, recalling his responsibility to making sure that the class goes at a steady pace. → Interpersonal

Norm: a teacher should acknowledge all students' questions

W: Uh huh. So it's this guy right here that you're talking about? [points to the character in the animation]

F: The suit.

M: Yeah in the suit. So I would isolate him and deal with him after class say 'hey, look, we've gotta cover this material; let's have you sit in the front row or straighten out.'

The teacher will 'deal with him after class' (*repair*) not using class time for this. In stating 'we've gotta cover this material' he is actually accounting for his obligation to an *institutional* mandate, established by the curriculum he has to cover. In asking the student to 'sit in the front, straighten out' he is not suggesting that this is necessarily for the benefit of that particular student, but for the benefit of the class (*interpersonal*)

Norm: a teacher should acknowledge all students' questions

W: Uh-huh T1 you're shaking your head and T2, you both have things to say?

T1: The tie and the glasses are making me think he's an older student who really needs to be assisted [group laugh] but I don't... I know what you're talking about the student being disruptive... I don't think he's one just judging from the blue blob [laughs]. He should be in the front clearly as some one said um but I'm thinking he's just one of those that's just gonna have a slow [pause] and the teacher is ignoring him and just moving on so fast and sometimes something like that you need to pick... they need more time to be able to think about the answer they're not gonna [get it right away].

Norm: A teacher should acknowledge all students' questions

T1: The tie and the glasses are making me think he's an older student who really needs to be assisted [group laugh] but I don't I know what you're talking about the student being disruptive but I don't think he's one just judging from the blue blob [laughs]. He should be in the front clearly as some one said um but I'm thinking he's just one of those that's just gonna have a slow [pause] and the teacher is ignoring him and just moving on so fast and sometimes something like that you need to pick... they need more time to be able to think about the answer they're not gonna [get it right away].

Ignoring the student's question here is problematic. The teacher is moving too fast, she has to think about an answer for the student and respond. T1 does not agree that the student is disruptive. Features of the student make her think he might need help (glasses and tie). The teacher has to slow down to give students *like him* more time so they can think. This rejects the breach and suggests an obligation towards *individual* students, here represented by the tie student.

Principles behind disciplinary obligations

Official definitions of mathematical objects and official statements of theorems are ultimate arbiters of what should be taught. **A teacher is free to decide what the definition of a mathematical object of study will be.**

(knowledge)

The way mathematicians go about solving mathematical problems is relevant to appreciate students' mathematical work. **It is irrelevant.** (practice)

Mathematical ideas can help understand or solve real world problems. **Mathematical ideas are unrelated to worldly problems.** (Application)

Principles behind individual obligations

[These] students are capable of learning. **Not all students are capable of learning.** (cognition)

Certain comments or practices can upset students. **Math activity has no effect on students** (emotion)

The fact that one student had an idea does not mean all students had that same idea. **If a student thought of one thing, all others must have as well.** (identity/diversity)

Students may need clear distinctions between acceptable and unacceptable behavior. **Anything that students do is acceptable; it is in their nature to do it.** (behavior)

Principles behind interpersonal obligations

Students are entitled to offer various solutions to a problem. **Only the best solution must be presented to the whole class** (shared discursive space)

Students must watch their behavior in the space to allow others to participate. **Movement in the room has no effect on others.** (space)

Students act in ways that are inclusive of others. **All relational acts by students (even disruptive ones) are natural, therefore acceptable.** (shared social relations)

Principles behind institutional obligations

Students in trigonometry have been exposed to some ideas before.

Everything covered is new to the students (curriculum)

The teacher needs to know at some point in time how well students are doing. Students are responsible to monitor their own learning.

(assessment)

The teacher needs to use a specific approach to teaching. Teachers decide pedagogical practices on their own. (pedagogy)

A topic must use a given number of lessons. Teacher can use as many lessons as needed to exhaust the topic. (time)

Teachers seek collegiality and sharing of ideas to solve problems of practice. Teachers can ignore that others with similar predicaments and rights coexist in the department. (colleagueship demands)

What have I learned?

It is possible to identify professional obligations that constrain decisions teachers make as they teach in community college departments.

These professional obligations appear to operate similarly between full-time and part-time faculty, with some exceptions:

Institutional Obligation about time:

PT: A topic must use the given number of lessons

FT: Teacher can use as many lessons as needed to exhaust a topic even at the expense of other topics

Individual Obligation about students' cognitive capabilities:

PT: These students are capable of learning

FT: Not all students are capable of learning

What next?

The identification of professional obligations can serve faculty development purposes as some obligations might be malleable to change

Institutional Obligations

Curriculum:

~~Students in trigonometry have been exposed to some ideas before.~~

Everything covered is new to the students

Collegueship demands:

FT: Teachers seek collegiality and sharing of ideas to solve problems of practice.

PT: Teachers ignore that others with similar predicaments and rights coexist in the department.

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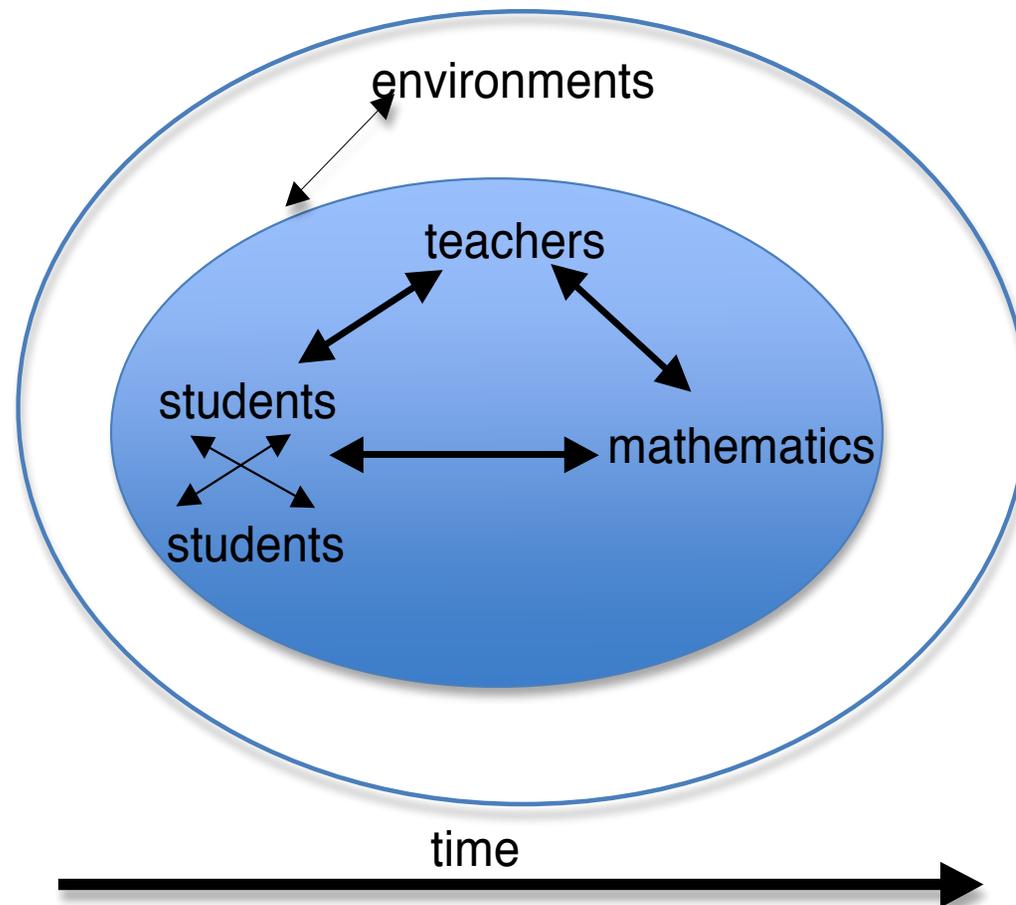
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TMCC

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Instructional Triangle



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