



Teacher-centered discussions around videotaped mathematics lessons: What can be learned?

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Outline of the talk:

- Background: The **VIDEO-LM** project and its rationale
- The framework of analysis we use with teachers
- Preliminary findings



Outline



Background

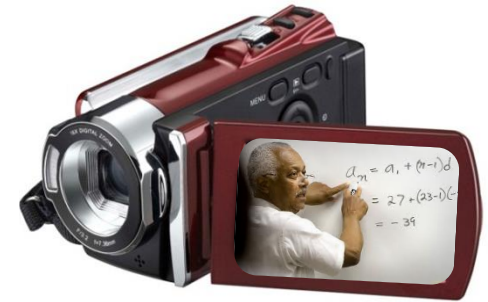


VIDEO-LM
framework



Findings

Why video?



- “Teachers benefit from opportunities to reflect on teaching with authentic representations of practice” (Sherin & van Es, 2009, p. 21)
- Video can introduce “the complexity and subtlety of classroom teaching as it occurs in real time” (Brophy, 2004, p. 287)
- “Because of the unique power of video to convey the complexity and atmosphere of human interactions, video case studies provide powerful opportunities for deep reflection” (Nemirovsky and Galvis, 2003, p. 68)



Outline



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Findings

The roles that the video plays in contemporary professional development of mathematics teachers



- Introducing new curricula, activities, pedagogical strategies, etc. (modeling exemplary practices)
- Using videotaped lessons as a source for feedback and self-evaluation (the teacher watches his/her own videotaped lesson with colleagues or instructors)
- Watching videotaped episodes in order to enhance teachers' understanding of students' mathematical thinking (guided discussion with focus on *noticing*)



Outline



Background



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framework



Findings

The VIDEO-LM project

(**V**iewing, **I**nvestigating and **D**iscussing
Environments **O**f **L**earning **M**athematics)

- Create a collection of videotaped lessons
- Use the lessons as “vicarious experiences” for other teachers, centering on how the filmed teacher demonstrates multifaceted elements of practice.
- Facilitate discussions that are teacher-centered



Outline



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Findings

Implementation:

Two forums of teachers have been experiencing watching and discussing videotaped mathematics lessons, and three more courses are currently held.



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Findings

The framework of analysis

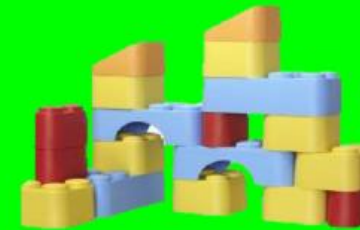
Mathematical and
meta-mathematical
ideas



Explicit and implicit
goals



Tasks and
activities



Dilemmas and
decision-making
processes



Beliefs about
mathematics
teaching



Interactions with
students



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Findings

The framework of analysis

Mathematical and
meta-mathematical
ideas



Given the topic of the lesson,
there is a range of relevant
concepts, procedures and ideas.

- What can we include in this “span of ideas”?
- Which of these ideas, or others, did the teacher bring forward in the lesson?
- Which meta-mathematical notions were evident within the lesson?



Outline



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Findings

Mathematical and
meta-mathematical
ideas



Example:



Episode from a calculus
lesson on inflection
points (נקודות פיתול)

11th grade

Advanced students



Outline



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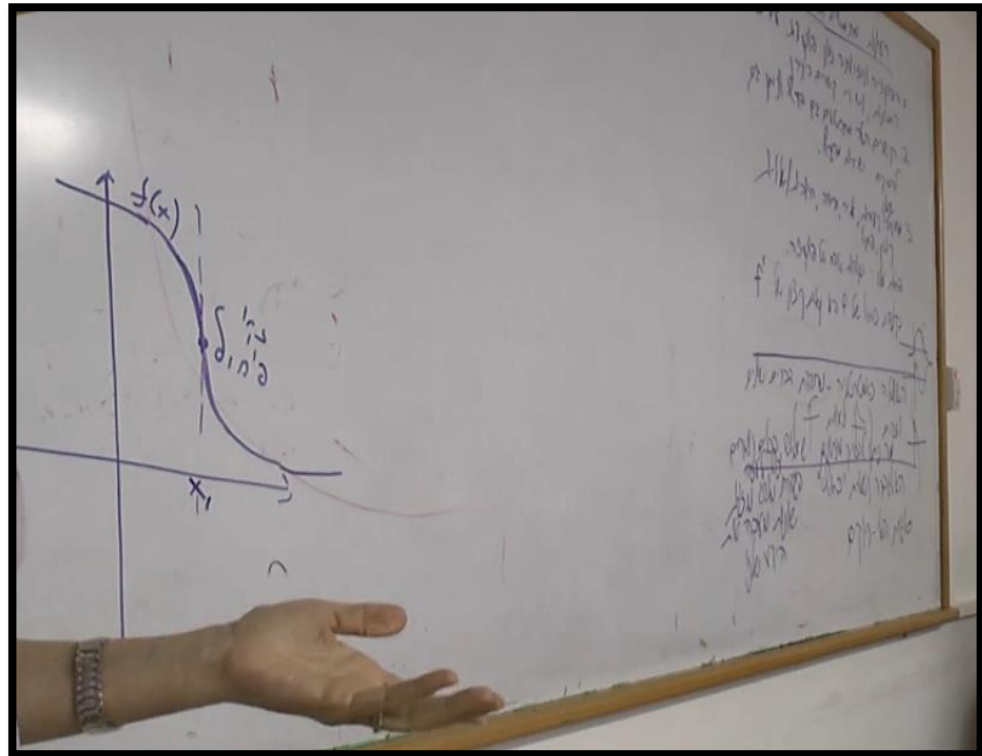


Findings

Mathematical and
meta-mathematical
ideas



What about an inflection point
where the first or the second
derivative do not exist?



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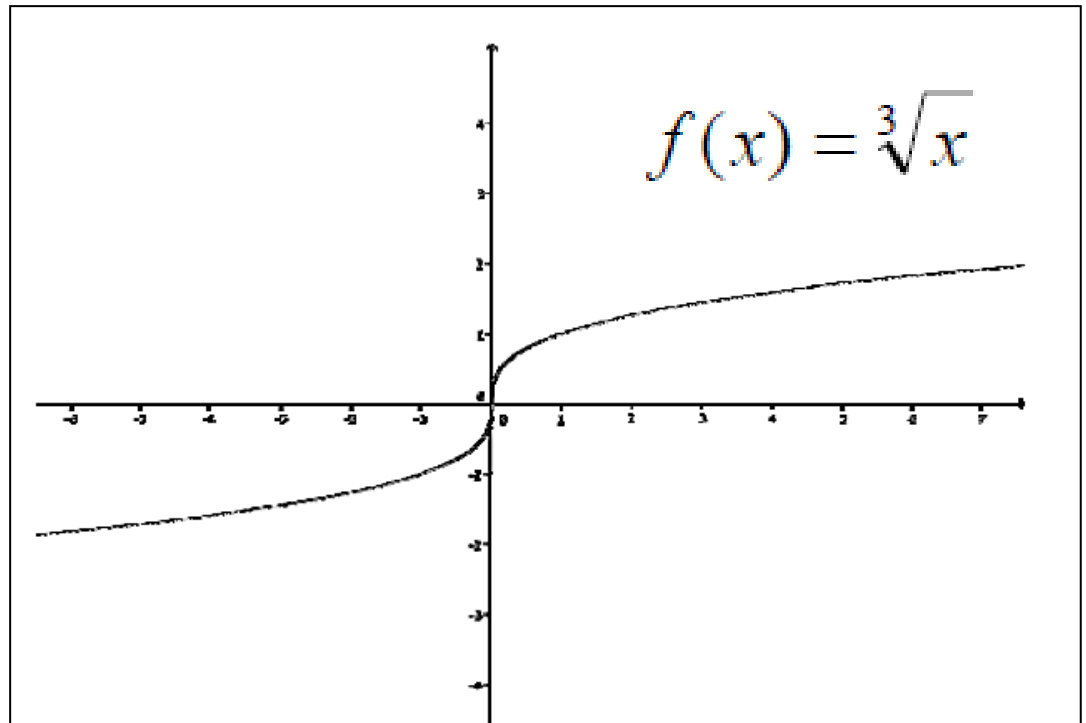
Findings

Mathematical and
meta-mathematical
ideas



f has an
inflection point
at $(0,0)$

A glimpse into the extensive
e-mail correspondence following
the video workshop:



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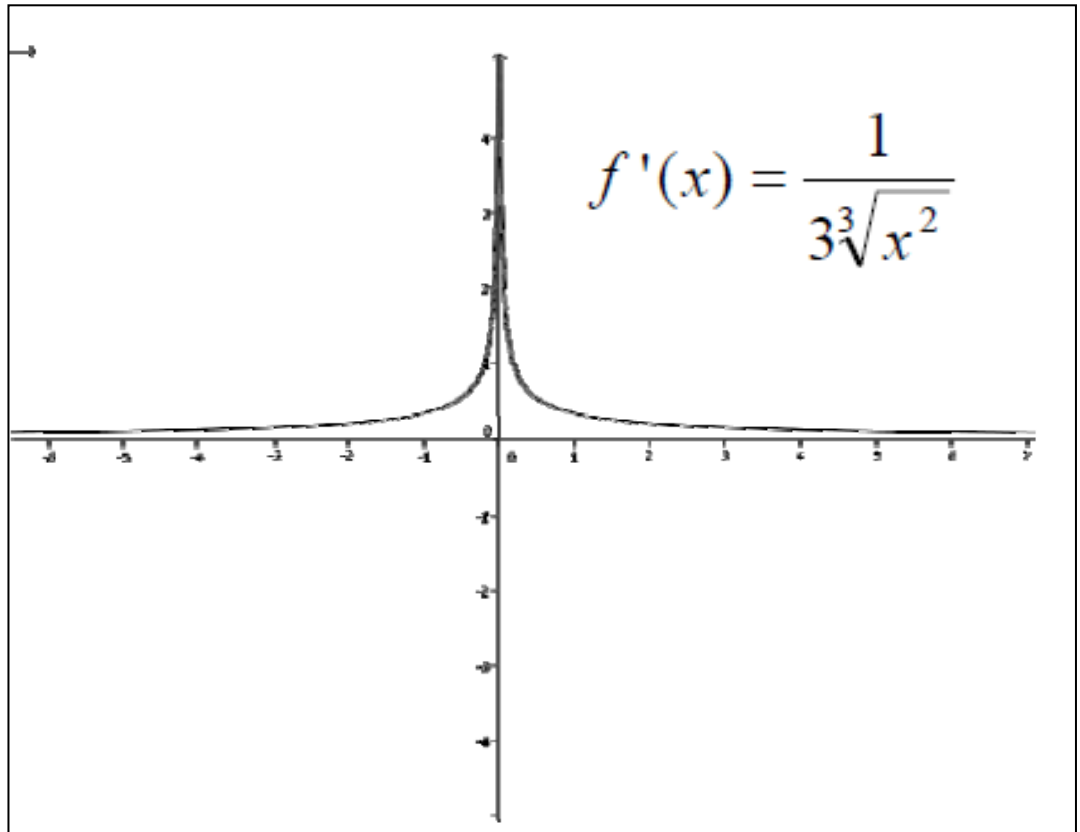


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Findings

Mathematical and
meta-mathematical
ideas



$f'(0)$ does not exist



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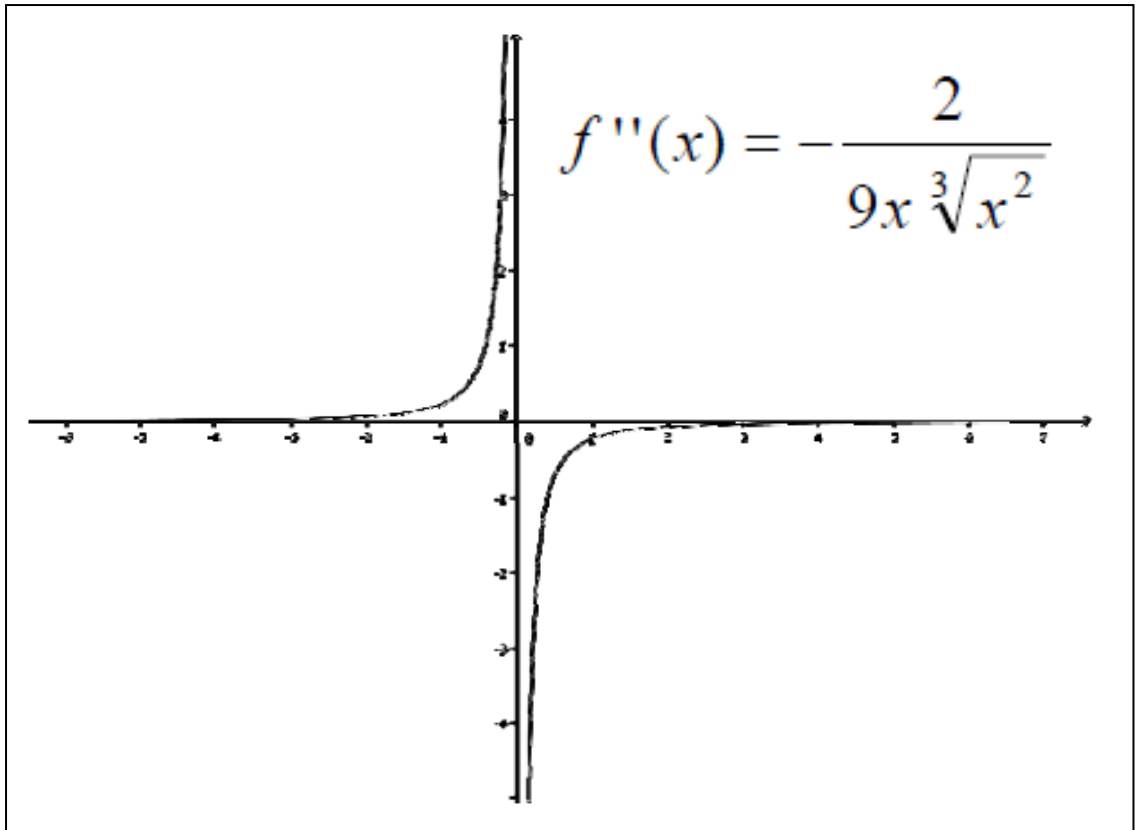


Findings

Mathematical and
meta-mathematical
ideas



$f''(0)$ does not exist



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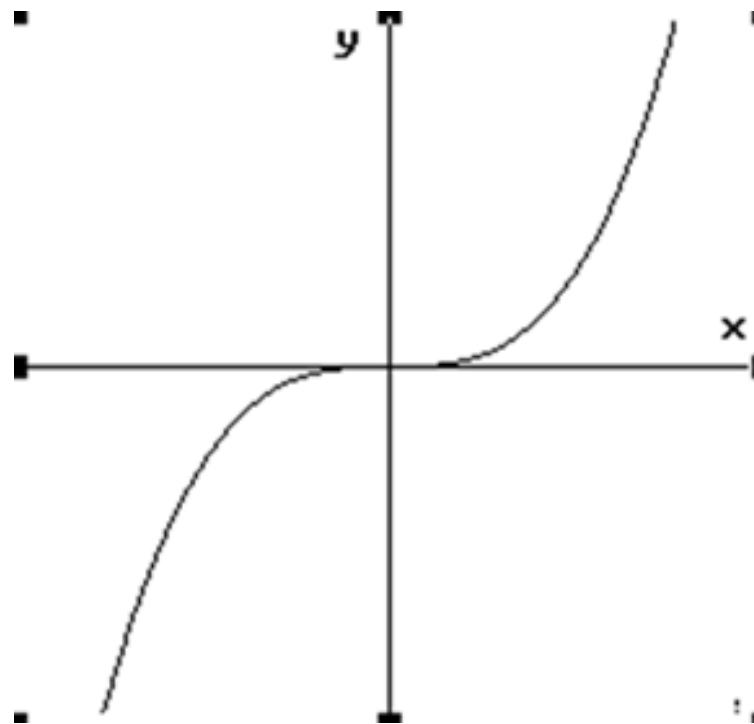


Findings

Mathematical and
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ideas



$$f(x) = x \cdot |x|$$



$$f'(0) = 0$$
$$f''(0) \text{ does not exist}$$



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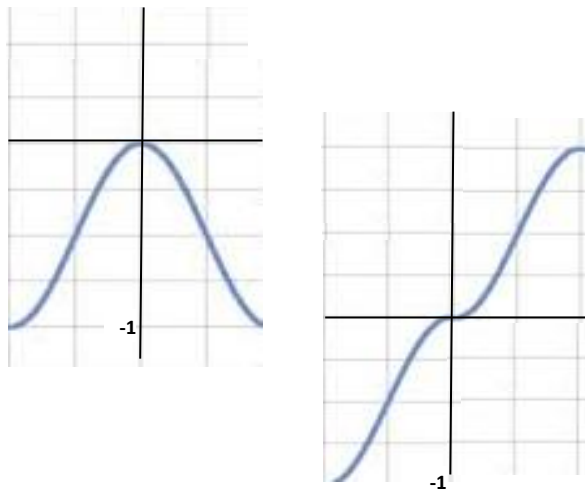


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Findings

Mathematical and
meta-mathematical
ideas



Generalization no.1 (incorrect):

The family of functions of the type

$$f(x) = x^n \cdot |x|$$

Where n is odd

Generalization no.2 (correct):

Any even function with

$f'(0) = 0$ and $f''(0) \neq 0$,

multiplied by $\text{sgn}(x)$

for example:

$$f(x) = (\cos x - 1) \cdot \text{sgn}(x)$$



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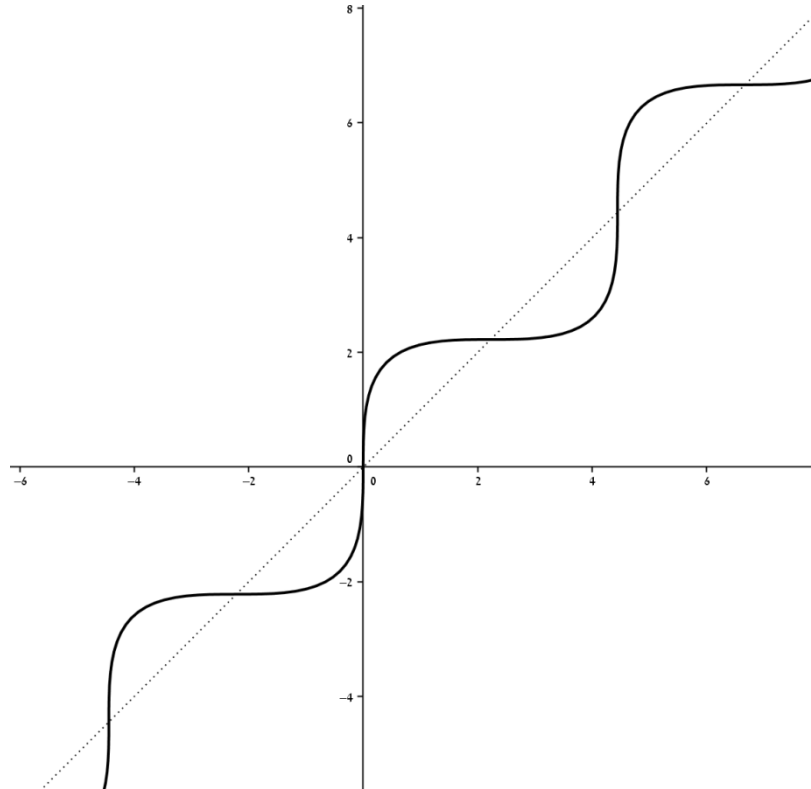


Findings

Mathematical and
meta-mathematical
ideas



$$f(x) = \sin(x) \text{ “turned” by } 45^\circ$$



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Findings

Mathematical and
meta-mathematical
ideas



Pedagogical insights and suggestions:

“We can introduce two tasks to
our advanced students,
following this discussion-

- 1) Find a function where an inflection point *is not* an extremum of the first derivative
- 2) Find a function where an inflection point x *is* an extremum of the first derivative but the argument $f''(x) = 0$ is false”



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Mathematical and
meta-mathematical
ideas



Pedagogical insights and suggestions:

“I think that everything we have seen so far shows that the correct definition of an inflection point is:

A point where the second derivative changes its sign, that is, there is an opposite sign in the neighborhoods before and after the point.

These following definitions are incorrect:

- 1) A point where the second derivative is zero*
- 2) A point where the first derivative has an extremum”*



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Pedagogical discussions:

Perhaps the teacher's decision to ignore such cases, and stick to the rule of characterizing inflection points by $f''(x) = 0$, is justified?

- Students may not be ready to grasp the correct definition, which requires advanced thinking.
- Functions such as $f(x) = x \cdot |x|$ and R-L derivatives are not included in the curriculum and the final exams.

When is it legitimate to “sacrifice” mathematical accuracy for the sake of our students’ best interests?



Outline



Background



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framework



Findings

The framework of analysis

Explicit and implicit goals



The rich span of mathematical ideas around a given topic enables various teachers' **choices** of the goals they wish to pursue within a lesson.

One of the reasons that lessons given by different teachers on the same topic do not resemble one another, is that these teachers derived different goals from the range of mathematical ideas relevant to the topic.



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Background



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Findings

Explicit and implicit goals



Exercise: Ascribing goals

What can be gained?

- Promoting the skill of articulating goals
- Enhancing awareness to the fact that there are alternative (sometimes even competing) goals to teaching a certain mathematical subject



Outline



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Findings

Explicit and implicit goals



Episode from a lesson
on the commutative
and associative laws

7th grade

Heterogeneous class

Example:



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Background



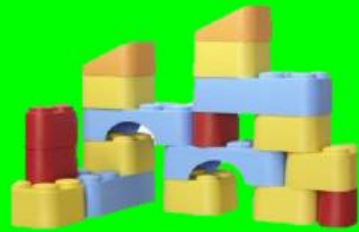
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framework



Findings

The framework of analysis

Tasks and activities



The means by which the teacher's goals are fulfilled.

The video enables teachers to watch a “task in action”, how it is implemented, the nuances in introducing it and how the teacher addresses the students' reactions.



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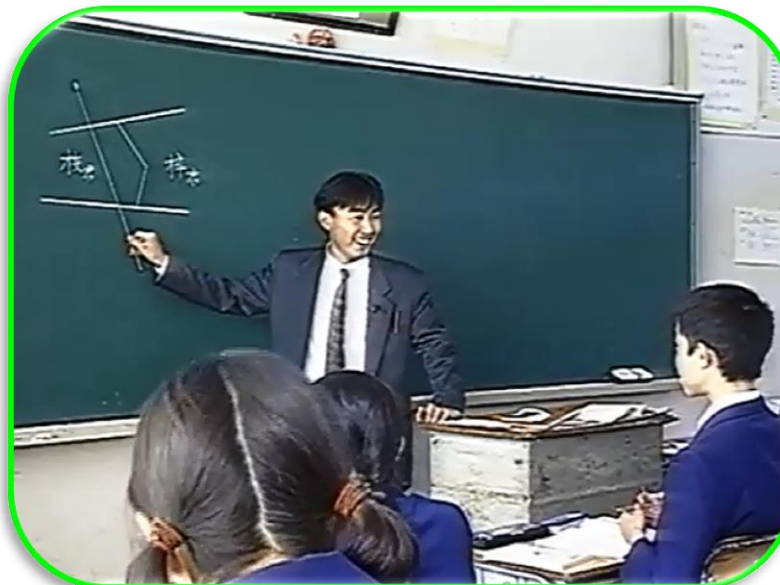
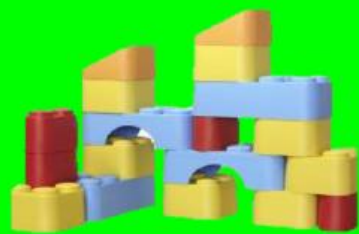


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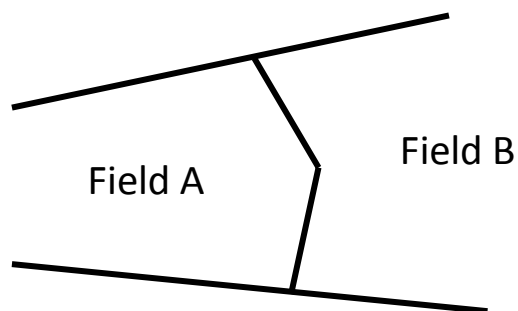
Findings

Tasks and activities



Example:

Junior high school geometry



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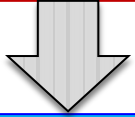


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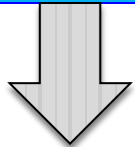


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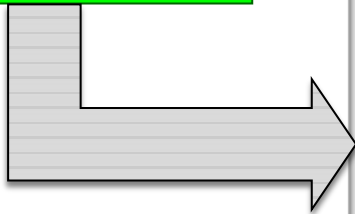
Mathematical ideas



goals



Tasks



The framework of analysis

Interactions with students



- Includes generic elements such as
- positive and negative feedbacks
 - listening to students
 - wait time
 - who gets permission to speak
 - etc.

But also how the teacher navigates the students' responses during the mathematical activity and poses subsequent questions.



Outline



Background



VIDEO-LM
framework



Findings

The framework of analysis

Dilemmas and
decision-making
processes



Discussing dilemmas and decisions of a videotaped teacher focuses on the alternatives that the teacher may have had, and their consequent tradeoffs.

Educated dilemma resolving rather than directing to a certain preferred way.



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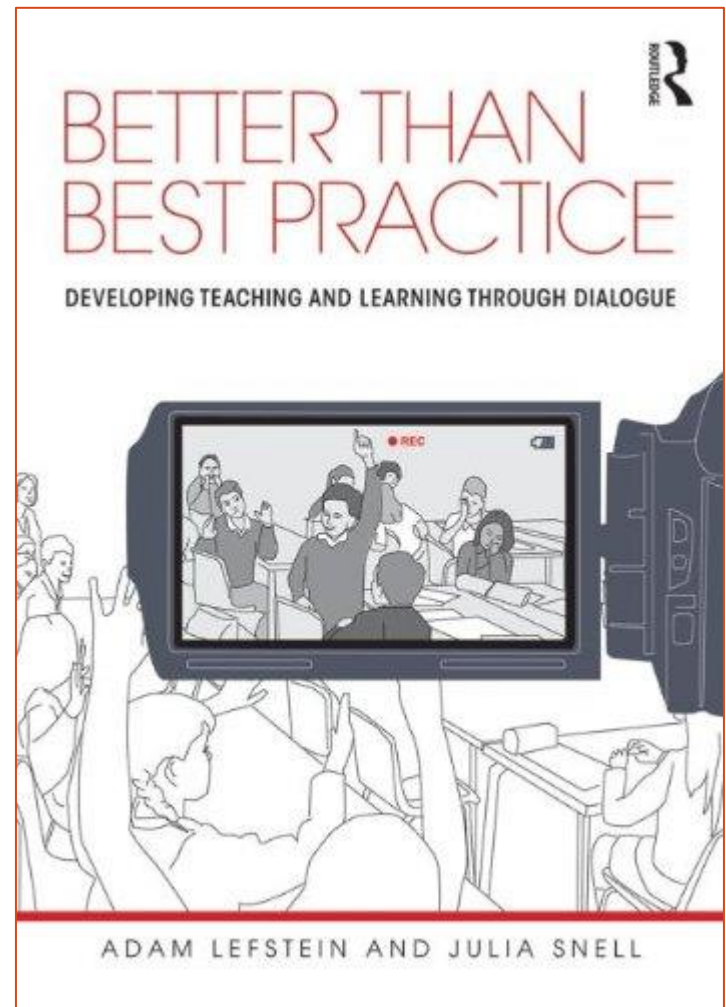


Findings

Dilemmas and decision-making processes



“We all teach fine, the point is to understand what you’re doing, why do you do it, and do you really agree with what you decided to do. If you agree, fine, but if you don’t – go and fix it! But be aware of what you did. I never thought about that”
(a participant in the summer course)



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Background



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Findings

The framework of analysis

Beliefs about
mathematics
teaching



Attention to questions such as

- What may be the filmed teacher's views about the nature of mathematics as a discipline?
- How does the teacher perceive his/her role?
- What may be his/her ideas about what “good mathematics teaching” is?
- What does s/he think about the students' role as learners?



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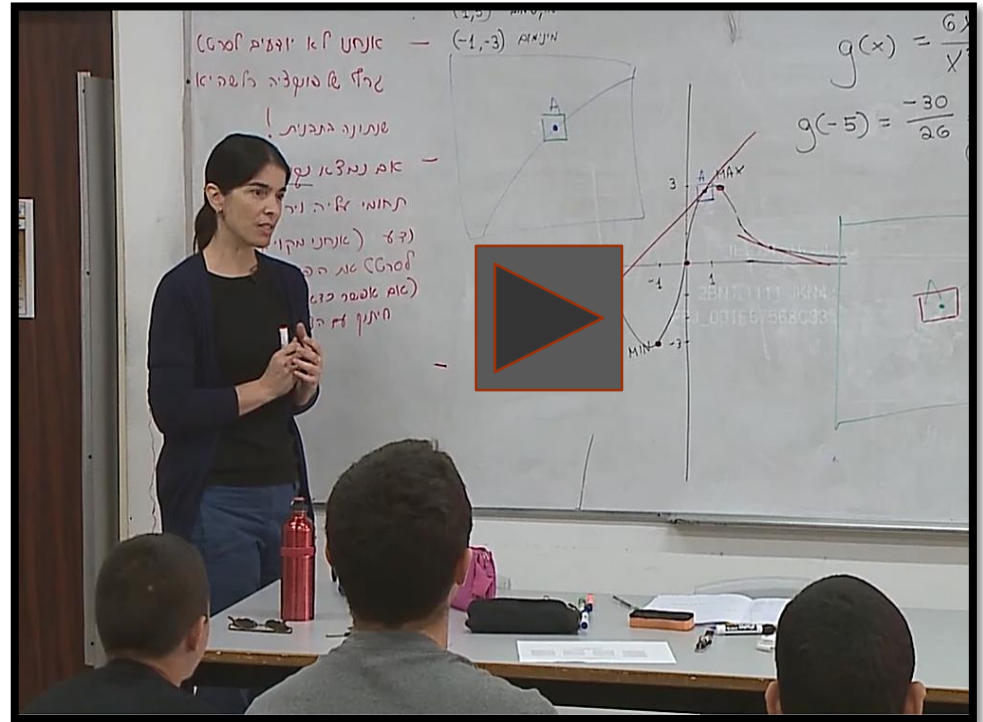
Findings

Beliefs about mathematics teaching



Example:

Episode from a lesson: Introduction to calculus
10th grade
Advanced students



Outline



Background



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framework



Findings

Preliminary findings

Implementation:

Two forums of teachers have been experiencing watching and discussing videotaped mathematics lessons, and three more courses are currently held.

Different modes of watching



Outline



Background



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Findings

- **Duration:** 28-30 hours and ongoing
- **Participants:** Secondary school math teachers
- **Data collection means:** Field notes during workshops, questionnaires administered at the end of course, video-documented discussions.



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Findings

What have we learned so far?

- Novelty of the video as a PD tool
- Teachers are intrigued and enthusiastic about the workshops, and keep high attendance and involvement
- Mathematical conversations are deep
- Change in participants' language:

I liked... I didn't like....
I would have expected her to...
At least she should have...
She didn't know how to explain...
The thing that was missing in the lesson was...



The teacher's goals are....
How else can this idea be presented?
She decided to do this because...



Outline



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Findings

Examples of teachers' comments

- “At first I related to the videos very differently. I tend to criticize what’s going on in the video and it’s hard for me to get away from that. It took time to understand what I can get from those videos”
- “I went through a process of how to watch and how to deeply think about what I’m watching”
- “I realized that when I watch lessons of new teachers in my staff of which I’m in charge, I actually criticize them instead of encouraging them to reflect”



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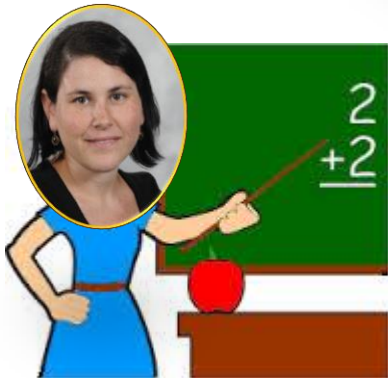


Findings

To conclude:



Many thanks to our great team:



Thank you!

The End



The image features the classic "The End" title card from Warner Bros. The words "The End" are written in a large, elegant, white cursive font. Below the text is the iconic Warner Bros. shield logo, which consists of a shield containing the letters "WB" and is flanked by two horizontal lines.