The devil in details:
Teaching as managing inter-discursive gaps

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Mathematics Education Colloquium
A teacher’s story


Einat Heyd-Metzuyanim
Einat’s after-school class of 13-year-old students
After a brief period of work with Dana, the teacher decided she is ‘clueless’, and also ‘learning disabled’.

Dana, Einat’s students, had considerable difficulties solving mathematical problems.

But then, something happened….
I started looking again [at all the] examples of Dana's 'cluelessness'.

And lo and behold, in none of them could I prove that Dana .... had no idea of what she was talking about.

But what was worse, I started seeing how I was missing.... significant teaching opportunities.

In dismissing Dana's suggestions ... as 'nonsense' or 'just guesses', I failed to notice that she actually had important ideas every now and then. ...

I thus committed one of the oldest teaching sins – I concentrated only on what Dana didn't know, and completely ignored what she did know.
But the ... graver consequences were that Dana learned from me, yet again, that her own thinking was irrelevant and unimportant.

Was it then a wonder that she continued to act ritually, hardly ever 'thinking for herself'? No one ever asked her, genuinely, to justify her claims according to her own set of rules.

She was taught over and over again that the only rules that 'counted' in this 'mathematical game' were those established by others. It was then that I realized I was part of Dana's problem, not part of her salvation.
A teacher’s story

“"I was part of Dana's problem not part of her salvation.”

What the teacher was doing mattered to Dana

but not in the way the teacher intended.

She was responsible for, at least,

- students’ learning
- their identities

she contributed undesirably

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MSU - devil in details - Sfard
In this talk:

I will ask: Why and how do teachers sometimes matter in unintended ways, against their better judgement?

I will claim: The devil is in our unacknowledged teaching routines.
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I will ask: Why and how do teachers sometimes matter in unintended ways, against their better judgement?

I will claim: The devil is in our unacknowledged teaching routines.

What are they? Where do they come from? How do they become the devil's favorite?

uncontrollable
sometimes too brief to be noticed
unacknowledged routines
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Plan

1. Teachers’ routines
What they are & where they come from

2. Pitfalls of routines
How helpful routines lead to unhelpful results

3. Controlling routines
against the unintended mattering
Plan

1. **Teachers’ routines**
   What they are & where they come from

2. **Pitfalls of routines**
   How teacher’s routines may lead to unintended results

3. **Controlling routines**
   against the unintended mattering
Routines

- defining routine
- facts about routines

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In most life situations, we know what to do – we are able to act in an immediate manner.
In most life situations, we know what to do – we are able to act in an immediate manner. Where does this ability come from?
When you **need to act**, what is it that makes you able to **decide on-the-spot** what to do?

Experience!!!

When you find yourself in a situation in which you feel obliged to act,
you tend to recall a past situation sufficiently similar to the present one to justify doing now what was done then.
When you **need to act**, what is it that makes you able to **decide on-the-spot** what to do?

Experience!!!

When you find yourselves in a **task-situation (TS)**, you tend to recall a **precedent**.
conclusions

- All you do in an immediate, competent way involves **replications** of your own or somebody else’s past actions

**Prediction & simulation**

- projecting past experience into future
- reproducing your past state
conclusions

- All we do in an immediate, competent way involves **replications** of one’s own or somebody else’s **past actions**

- The repetitions create **patterns of action** that is, **routines**
routine
is a pattern of action we recall in task-situation

What aspects of the precedent must be preserved?

What past way of acting can help in executing this task?

routine = task + procedure
A pattern of action we recall in task-situation is a routine. What must happen and how it can happen define the task and procedure, respectively.
routine

Is a pattern of action we recall in task-situation

- Depends on task-situation and the person

routine = task + procedure
Routines

defining routine

facts about routines
Facts about routines

- Routines are recursive constructs
Routines are recursive constructs - example
Problem-solving teacher-student interaction

Task: Make sure the student is able to solve this type of problem

- Pose a problem
- Evaluate the student’s ability to solve
- Accordingly, choose a routine (eliciting? telling?)
- Implement the chosen routine

Routine
Routine

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Routines are recursive constructs - example

Problem-solving teacher-student interaction

Task: Make sure the student is able to solve this type of problem

Pose a problem

Evaluate the student’s ability to solve

Accordingly, choose a routine (eliciting? telling?)

Implement the chosen routine

Observe & assess the student’s performance

Predict her future ability to cope

Routine
Facts about routines

- Routines are recursive constructs
- Routines come in different sizes
Routines come in different sizes

practice

lesson planning

managing classroom discussion

introducing new topic or concept

atomic routine

reacting to noise

preventing simultaneous talk

a confirmatory response
Routines come in different sizes

practice

these routines often remain unnoticed

In PD, we tend to care about the L or XL routines (practices).

We pay relatively little attention to the atomic

evaluating student’s answer

introducing new topic or concept

managing classroom discussion

reacting to noise

preventing simultaneous talk

lesson planning

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Facts about routines

- Routines are **recursive** constructs
- Routines come in **different sizes**
- Our routines constitute a tightly interconnected **system**
Facts about routines

Our **routines** are like our **routes**: they constitute a tightly interconnected, **fractal-like system**.
Facts about rout(in)es

Our routines are like our routes: they constitute a tightly interconnected, fractal-like system.
Facts about routines

- Routines are recursive constructs
- Routines come in different sizes
- Our routines constitute a tightly interconnected system
- The fact that we act in routinized ways does not preclude creativity
We build our actions from available routines

just like architects build original buildings from building blocks available in the market

Anna Sfard - Hans Freudenthal Medal 2007
Facts about routines

- Routines are *recursive* constructs
- Routines come in *different sizes*
- Our routines constitute a tightly interconnected *system*
- The fact that we act in routinized ways does not preclude *creativity*
- Routines are a *doubly-edged sword*
Routines, like our routes,

are **indispensable** for teaching

but may also be **dangerous**
Plan

1. Teachers’ routines
   What they are & where they come from

2. Pitfalls of routines
   How teacher’s routines may lead to unintended results

3. Controlling routines
   against the unintended mattering
Pitfalls of routines

- **of routines inception**
- **of recurring routines in task-situation**
- **of reconstructing other people’s routines on the basis of their performance**
Pitfalls of routines’ inception

Invent?

Do what you learned in PD

Emulate?
General Laws underlying our actions

The Law of Minimizing Effort (LoME): “If there are several ways of achieving the same goal, people will eventually gravitate to the least demanding course of action.."

(Daniel Kahneman)
Pitfalls of routines’ *inception*

emulating rather than active recalling or inventing

This happens mainly involuntarily

EXAMPLE: teachers’ well-known tendency for doing what their teachers did.
The Law of Minimizing Effort (LoME): “If there are several ways of achieving the same goal, people will eventually gravitate to the least demanding course of action..” (Daniel Kahneman)

The Law of maximizing Acceptability (LoMA): People tend to opt for what is expected to maximize social reward or minimize punishment.

Good → popular

Popular → good?
Pitfalls of routines’ inception

- **emulating** rather than active recalling or inventing

This happens mainly involuntarily

**EXAMPLE:** teachers’ well-known tendency for **doing what their teachers did.**

**PITFALL:** unknowingly, we may be emulating unhelpful routines.
Pitfalls

- of routines inception
- of recur-thing routines in task-situation
- of recon-structing other people’s routines on the basis of their performance
Recruiting a routine in a task-situation, TS

THE MECHANISM:
You do it in two steps, usually without our being aware of this

Subject to **LoME & LoMA**
Recruiting a routine in a task-situation, TS

**STEP 1:**
The choice of precedent-search-space (PSS)

For instance, PSS will be composed of only those past events that involved the same kind of objects/persons as the present TS.
Recruiting a routine in a task-situation, TS

**STEP 1:** The choice of precedent-search-space (PSS)

For instance, PSS will be composed of only those past events that involved the same kind of objects/persons as the present TS.

There is a set of relevant stories that are true for them all.
Routines are recursive constructs - example

Problem-solving in teacher-student interaction

Pose a problem

Evaluate the student’s ability to solve

Accordingly, choose a routine (eliciting? telling?)

Implement the chosen routine

Observe & assess the student’s performance

Predict her future ability to cope

“clueless” students

This kind of choice is often made with the help of grades of diagnoses (e.g. of “learning disability” or “giftedness”)

Evaluate the student’s ability to solve this type of problem

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Recruiting a routine in a task-situation, TS

**STEP 1:**
The choice of precedent-search-space (PSS)

**STEP 2:**
In that PSS, find past event that you see as the best fit for the present TS

For “clueless”: Telling rather than eliciting
Pitfalls of the routine’s recruitment

choosing PSS

Choosing by **wrong category identifiers** e.g.
by ethnicity, race, gender
SES, appearance, ....

- prejudice
- oppression
- injustice
- inequity
Pitfalls of the routine’s recruitment

Choosing by wrong category identifiers e.g. by ethnicity, race, gender SES, appearance, ....

PSS too wide

This choice is often made unconsciously, influenced by LoMA

- prejudice
- oppression
- injustice
- inequity

PSS too wide
Pitfalls of the routine’s recruitment

choosing PSS

Choosing by wrong category identifiers e.g. by ethnicity, race, gender SES, appearance, ....

PSS too wide

PSS too narrow
Recruiting a routine in a task-situation, TS

For instance, PSS will be composed of only those past events that involved the same kind of objects/persons as the present TS.

There is a set of relevant stories that are true for them all.

Your PSS will be restricted to past situations in which the discourse is the same as in those stories.

STEP 1: The choice of precedent-search-space (PSS)
Searching for a precedent in task-situation

Situated action cycle (Larry Barsalou)

Recognition of objects/persons

Recall of past situation with the same type of objects/persons

Simulation of the past state
Searching for a precedent in task-situation
(Situated action cycle, Larry Barsalou)

Situated action cycle
(Larry Barsalou)

Recognition of objects/persons
Recall of past situation with the same type of objects/persons
Simulation of the past state
– return to the past discourse

discursive stagnation
Pitfalls of the routine’s recruitment

**choosing PSS**

- Choosing by **wrong category identifiers** e.g.
  - by ethnicity, race, gender
  - SES, appearance, ....

- **PSS too wide**

- **PSS too narrow**

**choosing a precedent**

- **many procedures for one task**
‘Generosity’ of our routines’ system

Just as any city destination may be reached through different routes, so can any task be performed with the help of different routines.
Recruiting a routine in a task-situation, TS

**STEP 1:**
The choice of precedent-search-space (PSS)

**STEP 2:**
In that PSS, find past event that you see as the best fit for the present TS

What counts as “the best fit”?
Pitfalls of routines’ recruitment

choosing PSS

Choosing by **wrong category identifiers** e.g.
by ethnicity, race, gender
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PSS **too wide**

PSS **too narrow**

choosing a precedent

many procedures for one task

Because of the LoME, the least onerous routine is often chosen especially in the classroom, where on the spot decisions are needed

These most frequented routes may be shortcuts, good only for the specific task.
Pitfalls of the routine’s recruitment

choosing PSS

Choosing by **wrong category identifiers** e.g. by ethnicity, race, gender SES, appearance, ....

PSS **too wide**

PSS **too narrow**

choosing a precedent

many procedures for one task

Because of the LoLE, **the least onerous routine** is often chosen

"**the main road**"

**automated**
Pitfalls of the routine’s recruitment

choosing PSS

Neuroscientists:
This is how people learn

Establishing a rout(in)e means tuning and pruning: strengthening some neuronal connections (synapses) and removing other ones.

Plasticity of brain

choosing a precedent

many procedures for one task

Because of the LoLE, the least onerous routine is often chosen

“the main road”

Automated
The main pitfall of routinization

automated routines

involuntary

often used by the performer unconsciously

thus uncontrollable and resilient

The teacher’s automatic evaluative responses build students’ identity
Pitfalls

of routines inception

of recur-ritting routines in task-situation

of recon-structing other people’s routines on the basis of their performance
In the classroom, all the participants have to retrieve other participants’ routines from their performances.

Students **figure out** teacher’s task and **procedure** from her performances.

The teacher **reconstruct** students’ tasks and procedures from their performances.

What’s the task the kid had in mind?

What’s the task the teacher had in mid?
These guys performed a calculation with numbers they saw behind the bush.

**QUESTION TO YOU**

1. The task has a single correct solution.
2. When the solutions differ, at least one of them must be wrong.

Communicational gap
Teacher-student conversation

Teacher: So, what is? [writes $\frac{1}{3} \cdot 12$]
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Student: ......

Teacher: Try again, one third times twelve

Student: I think.... Don’t know...

Teacher: Once again, one third of twelve
Teacher: So, what is? [writes $\frac{1}{3} \cdot 12$]

Student: ...... 

Teacher: Try again, one third times twelve

Student: I think.... Don’t know...

Teacher: Once again, one third of twelve

Student: oh..... It’s four!
Teacher-student conversation

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Teacher-student conversation

He tries to multiply 12 by $\frac{1}{3}$, but is not yet skillful in the procedure.
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This word and symbol evoke **numerical discourse**
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This word evoked discourse on parts & wholes.
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**Teacher-student conversation**

**Numerical discourse**

**Discourse on parts & wholes**

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He tries to multiply 12 by 1/3, but is not yet skillful in the procedure. 

First, the teacher wanted me to do an “exercise”. This I don’t know. But now she asks what how much cookies I would end with if there were two other kids and 12 cookies altogether.
Plan

1. Teachers’ routines
   What they are & where they come from

2. Pitfalls of routines
   How teacher’s routines may lead to unintended results

3. Controlling routines
   against the unintended mattering
Teachers’ routines - summary

- Routines are routers created by walking.
- In building the routines we often reproduce patterns characteristic of our sociocultural niche.
- Many of them become automated.
Teacher’s automated routines

habitus

“...system of acquired dispositions...

society
written into the body,
into the biological individual"
Teacher’s automated routines

Teacher’s habitus

“...system of automated routines

teaching community
written into the body, into the biological individual"
Teachers’ routines - summary

- Routines are routers created by walking.
- In building the routines we often reproduce patterns characteristic of our sociocultural niche.
- Many of them become automated.
- Once created, our routines are difficult to change.
- The *imperceptible automated* routines are the most dangerous of all.
Teachers’ routines - summary

- Routines are routers created by walking.
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- Many become automated.
- Once created, our routines are difficult to change.
- The imperceptible automated routines are the most dangerous of all.
Teachers’ routines – how to improve them

Make ourselves aware of

(automated) routines

The pitfalls of these routines

mindfulness

research on learning
Teachers’ routines – how to improve them

Make ourselves aware of

(automated) routines

The pitfalls of these routines

Mindfulness

Research on learning

Improving the system

Eradicating the least helpful

New tools

Research on learning

Building new ones

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A small step for the teacher may be a huge step for the student.
Something to keep in mind

A small step for the teacher may be a huge step for the student.

No educational reform may succeed unless teachers take care of their atomic routines.