PANEL
"Integration of Theory and Practice and/or/versus (Evidence-Based) Research as a Service to Practice"

"Intégration de la théorie et des pratiques et/ou/versus recherches empiriques au service des pratiques"

Theory and Practice as a dialectical relationship: an example from the FaSMEd Project

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CIEAEM Restricted Meeting – Prague, July 22-23, 2016

Theory and Practice as a dialectical relationship

Theory

Practice
Theory and Practice as a dialectical relationship

[P, M, Q]

Radford, 2008

Theory can be seen as a way of producing understandings and ways of action based on:

- A system, P, of basic principles, which includes implicit views and explicit statements that delineate the frontier of what will be the universe of discourse and the adopted research perspective.
- A methodology, M, which includes techniques of data collection and data-interpretation as supported by P.
- A set, Q, of paradigmatic research questions: templates or schemas that generate specific questions as new interpretations arise or as the principles are deepened, expanded or modified.

Theory and Practice as a dialectical relationship: an example from the FaSMEd Project

Improving Progress for Lower Achievers through Formative Assessment in Science and Mathematics Education

Principles:
- Formative Assessment is a suitable method for enhancing students’ learning in math and science
- (New) technologies can support students and teachers in this respect
Theory and Practice as a **dialectical relationship:**
an example from the FaSMEd Project

**Formative assessment strategies:**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Where the learner is going?</th>
<th>Where the learner is right now?</th>
<th>How to get there?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clarifying learning intentions and criteria for success</td>
<td>Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding</td>
<td>Providing feedback that moves learners forward</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Peer</th>
<th>Understanding and sharing learning intentions and criteria for success</th>
<th>Activating students as instructional resources for one another</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Learner</th>
<th>Understanding learning intentions and criteria for success</th>
<th>Activating students as the owners of their own learning</th>
</tr>
</thead>
</table>

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Theory and Practice as a **dialectical relationship:**
an example from the FaSMEd Project

**Formative assessment strategies:**

<table>
<thead>
<tr>
<th>Où les élèves doivent aller?</th>
<th>Où les élèves en sont?</th>
<th>Comment y aller?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professeur</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Groupe classe</th>
<th>Comprendre et partager les intentions d’apprentissage et les critères de réussite</th>
<th>Mettre les actions et les productions de chacun à disposition des autres.</th>
</tr>
</thead>
</table>

|-------|----------------------------------------------------------------|------------------|
Theory and Practice as a **dialectical relationship**: an example from the FaSMEd Project

Improving Progress for Lower Achievers through **Formative Assessment in Science and Mathematics Education**

**Methodology**
- Design-based research

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An Example from the FaSMEd Project

Improving Progress for Lower Achievers through **Formative Assessment in Science and Mathematics Education**

**Methodology**
- **Design-based research**: a formative approach in which a product or process is envisaged, designed, developed and refined through cycles of enactment, observation, analysis and redesign, with systematic feedback from practice.
Theory and Practice as a **dialectical relationship**: an example from the FaSMEd Project

Improving Progress for Lower Achievers through **Formative Assessment in Science and Mathematics Education**

**Research Question:**
- How can technology be used in order to foster formative assessment classroom practices in ways that allow teachers to respond to the emerging needs of low achieving learners in mathematics and science so that they are better motivated in their learning of these important subjects?

At a local level: Torino Unit

**Additional Principles:**
- Formative Assessment may be fruitfully linked to argumentation processes in order to foster mathematical thinking

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Cusi, Morselli & Sabena (in print)
Theory and Practice as a dialectical relationship: an example from the FaSMEd Project

• At a local level: Torino Unit

Additional Principles:
• During class activities, and in particular in formative assessment activities, it is important to enable students to make their thinking visible (Collins, Brown and Newmann 1989) and share it with the teacher and the classmates.


Theory and Practice as a dialectical relationship: an example from the FaSMEd Project

• At a local level: Torino Unit

Methodology
• Group-works + classroom discussions
• Use of connected-classroom technology
A typical FaSMEd Lesson

SHARING AND DISCUSSING

A quick zoom during the teaching-experiment

- Grade V
- During the group-work phase, students faced the following task:

Between two plants, two parking lots can be placed, as in the following drawings:

![Diagram of parking lots between plants]

How many parking slots, if there are 37 plants?

From The Unit “Sequences as functions” – ArAI Project
A quick zoom during the teaching-experiment

- Almost all groups found the correct result (72 parking slots), but following different reasoning paths, with different arguments.

- The teacher-researcher (Annalisa Cusi) is coordinating the classroom discussion and projecting the students’ answers.
- They are now discussing the formula $37 \times 2 - 2$, and Annalisa asks for a justification: why did they do $37 \times 2 - 2$?

- Sofia begins to explain:

  Video 1

A quick zoom during the teaching-experiment

Transcript

- Sofia: In my opinion it is right to do times 2 minus 2 because if... there are all the trees that...between two trees there are two parking lots, but between the first and the last...between the first and the last one there are not two parking lots.

- Annalisa: would you like to come at the whiteboard, so you explain with the drawing, which may be easier?
A quick zoom during the teaching-experiment

- Sofia begins to explain, and the teacher asks her to come at the blackboard.

Principle
- enabling students to make their thinking visible and share it with the teacher and the classmates.

Theory guided practice...
...Annalisa was at the same time researcher and teacher!

A quick zoom during the teaching-experiment

- Sofia agrees to come at the whiteboard to explain her idea:

Video 2
A quick zoom during the teaching-experiment

Transcript

• **Annalisa**: let's take one of these drawings and let's reason on it.

• **Sofia**: because... in between these two, for instance, there is a... a parking lot, but between the first and the last one, here and here, there is not parking lot, so minus 2.

For the discussion

How would you (as teachers) react to Sofia's explanation?

Is your answer guided by your experience?
your theoretical principles?
...

• **Sofia**: because... in between these two, for instance, there is a... a parking lot, but between the first and the last one, here and here, there is not parking lot, so minus 2.
Thank you
Merci

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FaSMEd

Coda 1_Practice – How Annalisa did react

- **Annalisa**: Ah! Vittorio you want to intervene: I see your hand up.
- So, Sofia was saying: Between the first one and the last one there is no parking lot, so I have to take away 2!

- Amplifying a piece of Sofia’s argument, so to make her thinking visible and share it with the classmates
- Focusing student’s attention on the **wrong warrant** of the argument
- Activating students as resources for one another
Coda 2_Research – Taking another “regard”

- **Sofia:** because...in between these two, for instance, there is a...a parking lot, but between the first and the last one, here and here, there is not parking lot, so minus 2

- **Annalisa:** Ah! Vittorio you want to intervene, I see your hand up. So. Sofia was saying: Between the first one and the last one there is no parking lot, so I have to take away 2!

Coda 2_Research – Taking another “regard”

Even if the main focus of design was on the role of verbal and written resources (words, drawings, tables, graphs), looking at the actual practice also gestures and embodied acts come to the front as important resources for Formative Assessment practices.
Even if the main focus of design was on the role of verbal and written resources (words, drawings, tables, graphs), looking at the actual practice also gestures and embodied acts come to the front as important resources for Formative Assessment processes in the classroom.

New Research Question
- How can gestures be exploited by the teacher as resources for Formative Assessment processes in the classroom?

Theory and Practice as a dialectical relationship

...a never ending story