FaSMEd case studies from France

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French context

- Different schools involved from grade 4 to 10
- 5 clusters of schools (17 teachers) in Maths, in Science and in Maths&Science (teachers working together around a common topic, co-animated lessons, ...)
- Connected classroom technologies: tablets, student response system, IWB ...
Case study context

• Upper secondary level
• Grade 9 tablet classroom
• NetSupport School, Maple TA, IWB
• Mathematics sequence on linear functions
• Competences to be acquired:
  - Calculating/detecting images
  - Calculating/detecting inverse images
  - Recognising a linear function
  - Shifting from the graphical frame to the algebraic frame and vice versa
• Moment of the learning sequence: third quiz on these competences
Theoretical framework: Theory of Didactic Situations in Mathematics

Brousseau (2004)
Theoretical framework: Instrumental Genesis and Orchestration

Trouche (2004)

The term *instrumental orchestration* points out the necessity (for a given institution – a teacher in her/his class, for example) of external steering of students’ instrumental genesis.

An *instrumental orchestration* is defined by didactic configurations (i.e., the layout of the artefacts available in the environment, with one layout for each stage of the mathematical treatment) and by exploitation modes of these configurations.
Methodology and Data collection

- **Logbook**: document filled in by the tablet classroom mathematics teacher all year long
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- **Observation grid**: important points to reflect upon before and after the observation

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**FaSMEEd observation grid**

If the lesson is part of a learning sequence, write what happened before and what is planned after.

Before the lesson, a short *a priori* analysis:
- Prerequisites.
- Objective(s).
- Class organisation (tools, technology, individual or collective work, ...).
- Expected difficulties for students, regarding the scientific content at stake and the particular class organisation.
  - How to identify students with any difficulties?
  - What is planned to overcome these difficulties?

After the lesson:
- Short comment on the lesson.
- Write down unexpected events
  - According to you, what was the cause?
  - How did you react?
  - Do you plan to come back on these difficulties in the next lessons?
Methodology and Data collection

- **Logbook**: document filled in by the tablet classroom mathematics teacher all year long
- **Observation grid**: important points to reflect upon before and after the observation
- **Classroom observations**: videos, photos, audios, teacher’s report and notes
- **Discussions and meetings**
- **Interviews** with teacher and students
A low achiever working on the question:
*The curve below represents a linear function.*
*The image of 9 is -2.*
True or false?
Analysis at the student’s level
Analysis at the student’s level

E: Activating student as the owner of his own learning
Analysis at the student’s level

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Analysis at the student’s level

E : Activating student as the owner of his own learning
Analysis at the student’s level

Devolution is at the base of this dynamics

Confronted to his material *milieu* (given by the teacher) the student reflects on the mathematical situation thanks to the knowledge and the technology at his disposal.
Analysis at the student’s level

Dynamics within the cube determinates the FA process with technology

Towards other levels of FA process
Towards other functionalities of technology
Towards class and teacher
Dynamics within the cube determinates the FA process with technology

Within each cuboid
Didactic situations can be analysed according to the mutual relationships between knowledge, student, teacher and technology
Analysis at the teacher’s level

Dynamics toward the teacher’s plane

Depending on the students’ performance, teacher may adapt his teaching and provide feedback to students

T: I don’t know, if I’m going to take it into account or not. The idea is that I would like to mark it. If I realise that it doesn’t work... I don’t know...
I’m going to see what’s going on.... At least I’ll know that you don’t succeed here. You can skip it if you don’t know what to do.

B : Engeneering effective classroom discussions and other learning tasks
C : Providing feedback that moves learners forward
Dynamics toward the teacher’s plane

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Analysis at the teacher’s level

Dynamics within the teacher’s plane

Teacher can adapt technology relatively to the FA levels and goals.

- Net Support School + IWB: Sending & Sharing
- Maple TA: Processing & Analysing
- Providing students with interactive environments
Final remarks

Analysis at the micro-level shows that
- The cube gives pictures of the classroom landscape at a certain moment
- The **study of the dynamics** within the cube describes the process of FA with technology

Analysis at the macro-level can be also done in relation with teachers’ **professional development**
- Within teachers-researchers team
- Following the FA development over time in the classrooms
- FA can be formative also for teachers
- Necessitating a new framework, for us **Meta-Didactical Transposition model** (Arzarello *et al.*, 2014; Aldon *et al.*, 2013)