Plenary Panel

Mathematics and other disciplines: epistemological issues and their impact on teaching practices at tertiary level
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Laura Branchetti
(Chair of the panel)
The speakers

Epistemological and institutional perspectives

Our questions
Ricardo Karam

History of Physics and Physics education

University of Copenhagen (DK)
Felix Ho

Chemistry education

University of Uppsala (SW)
Frank Feudel

Mathematics & Economics education

Humboldt-University of Berlin (D)
Noemí Ruiz Munzón

Modelling

Escola Universitària Salesiana de Sarrià
TecnoCampus
Structure of the panel

Presentations
Discussion
Q&A sessions
General discussion
Epistemological Perspectives

- **P** (PERSPECTIVES)
  - **HISTORICAL EPISTEMOLOGICAL**
    - Interesting historical cases of interplay maths & physics
  - **C** (RESOURCE FRAMEWORK & EP. FRAMING)
    - Modeling cycles?
    - Students’ reasoning
  - **E** (AXIOMATIC)
    - Assumptions
    - Mathematical practices with different models
  - **M** (REFERENCE EP. MODEL)
    - Epistemological analysis of the emergence, roles and relationships between disciplines

- **INSTITUTIONS**
- **KNOWLEDGE**
- **DISCIPLINES**
- **STUDENTS**
Epistemological perspectives

PERSPECTIVES

HISTORICAL EPISTEMOLOGICAL
- INTERESTING HISTORICAL CASES OF INTERPLAY MATHS & PHYSICS

RESOURCE FRAMEWORK & EP. FRAMING
- MODELING CYCLES?
- STUDENTS’ REASONING

AXIOMATIC
- ASSUMPTIONS
- MATHEMATICAL PRACTICES WITH DIFFERENT MODELS

REFERENCE EP. MODEL
- EPistemological ANALYSIS OF THE EMERGENCE, ROLES AND RELATIONSHIPS BETWEEN DISCIPLINES

KNOWLEDGE
- DISCIPLINES
- INSTITUTIONS
- STUDENTS
To what extent do the epistemological issues at stake influence the teaching at tertiary level?

First guiding question
To what extent does the institutional "disciplinarization" of knowledge allow to address the complex epistemological relationships between mathematics and other disciplines in teaching?

Second guiding question
**QUESTION 1**
To what extent is it possible and realistic to design math service courses to teach "prerequisites" for other disciplines? If so, what should students possibly acquire/learn in such courses? Is there something missing in this approach?

**QUESTION 2**
From a didactical perspective, are there differences between teaching mathematical modelling and integrating mathematical practices into modelling for other disciplines or professional fields? If so, what are the main differences?

**QUESTION 3**
How can mathematics as a discipline and mathematical practices from other disciplines be integrated in students’ math courses to provide meaningful learning opportunities? Who should be responsible for this integration at the institutional level?
Discussion
Boundary zones

Boundary people
Need to question the modelling cycle
Mathematics does not directly model the Reality (whatever it means..); disciplines provide intermediate models /resources
The institutional "disciplinarization" of knowledge can hide the complexity of students' reasoning.

but

disciplines provide epistemological criteria to validate reasonings and teachers play a crucial role ("truth is not validity", models have always assumptions!)
1. **Questioning the assumptions** and "breaking the models" in the other disciplines or in inquiry practices

2. **Prerequisites**: toolbox, resources?

Prototypical examples of problems to have more resources & skills to creatively adapt to new problems (examples, prototypes) and not adapt the new problems to the resources!
Within the "other-disciplinary" courses

Co-evolution (avoid before/after) (as Tzanakis, 2016)

Modelling in new infrastructures (?)

Prerequisites or "postrequisites": manage new resources needed during the activity on both sides (Math&Others)
Teachers' expertise developed thanks to research in interdisciplinary educational research.

**Inspirations**

- Teachers' expertise developed thanks to research in interdisciplinary educational research.

**Co-teaching**

(different disciplines/fields)

**Prerequisites or "postrequisites":** consequences on institutional infrastructures and knowledge organization/presentation.
Not more mathematical contents but a different kind of interdisciplinary contextualized modelling practices + "metareasonings"

**Pedagogical values of examples** (overcoming trivial relationships)

**Metacognitive + Meaning making, interpretation**

**Modelling** as a new epistemological tool

**More awareness of assumptions of models**

MORE MATHS?
Avoid to fill their box with things you hope they will use, but they will never use!
Q&A sessions
General discussion

QUESTION 1
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