

The TELMA cross experiment

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Cross experiment: key ideas

- Experimenting “alien” ILE:
- Fixing/limiting some variable
- Young researcher’s fresh eyes
- A shared experimental plan

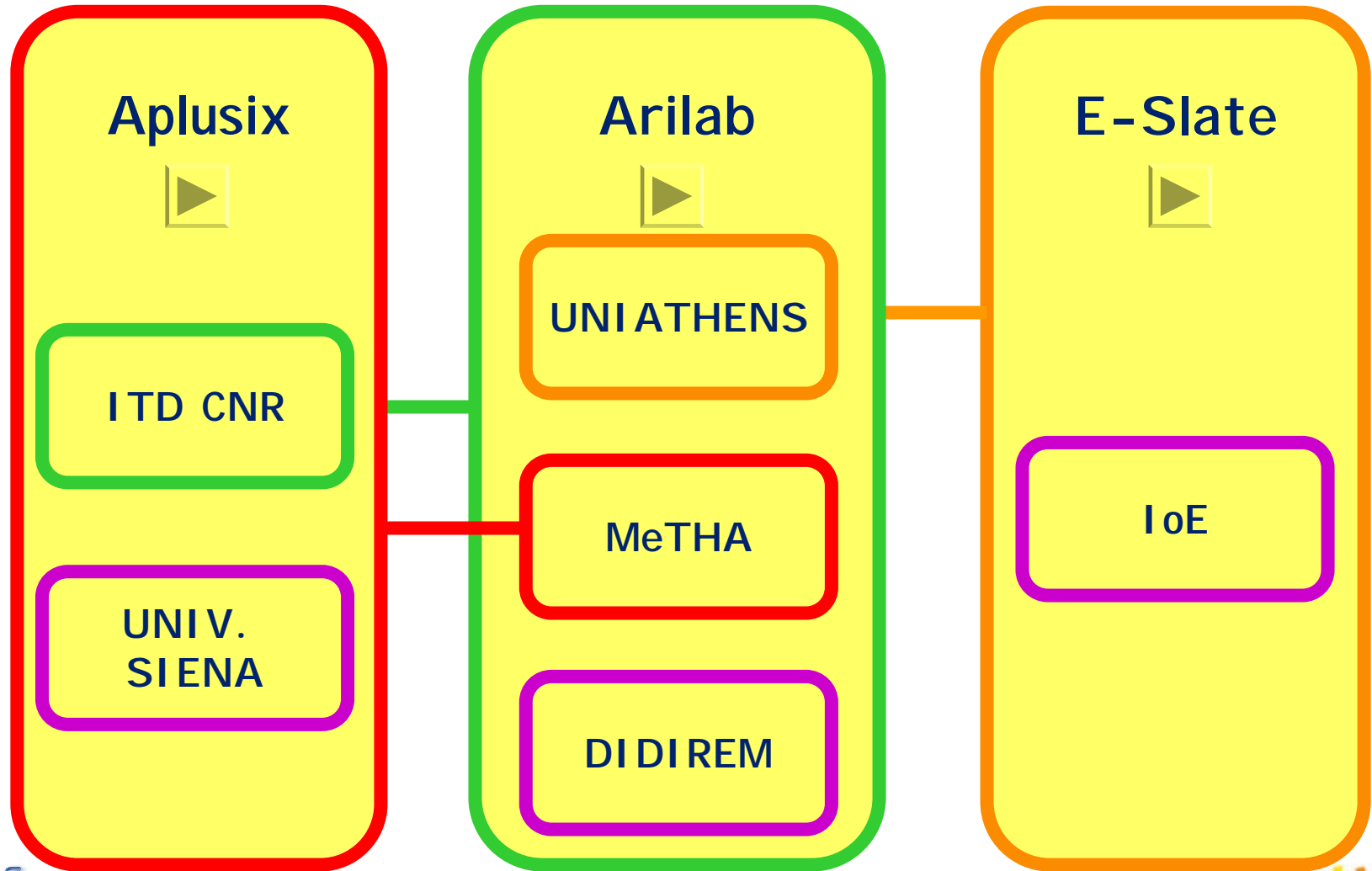


Experimenting “alien” ILEs

- Each team should experiment an ILE developed by another team
- Experimenting a tool in a context different from that of its conception (cultural, insitutional, rearch practice, school...)
- Implicit assumptions behind the design of a ILE might become explicit
- Exportability of ILE’s could be assessed and tested



Experimenting Alien ILEs



Fixing/limiting some variables

- Time (2 months at most)
- Age (11-13)
- Subject (fractions)



Young researcher's fresh eyes

- main actors of the activity: PhD students and young researchers
- Avoid rigid views and positions
- Foster (aiming at the future) a European/communitarian approach to research within the new generation of researchers
- Exploit the young researcher's willingness to collaborate, communicate, and put themselves into discussion

In this way we hoped to have a fertile terrain for the development of the experiment and of a shared perspective.



A shared Experimental plan?

What does it mean to have an experimental plane shared among a variety of teams belonging to different countries and cultures, and experimenting different ILEs?

Certainly we could not have *carbon copied* plans because of:

- differences in experimental contexts
- differences in research contexts, cultures and interests
- the employed ILEs were quite different one from each other

And we wanted to exploit the richness of teams' variety

Thus we decided to have a set of **local experiments** and to find a way to **amalgamate** them from the early phases of their designs to the latest phases of their analysis



A shared Experimental plan?

- Establish a shared space for comparisons
- Favour exchanges, dialogue, and mutual understanding
- Address a set of research questions relevant to each team
- Help each other during the design and development of the local experiment
- Conduct jointly analysis of the local experiments



A shared Experimental plan!

Set up a virtual community on the VDS

Joint construction of a “Guidelines” document



The Guidelines: start up

- 3 documents, providing a set of possible questions to be addressed (provided by experienced researchers):
 - Contexts (C. Kynigos)
 - Theoretical frameworks (M. Artigue)
 - Representations (C. Morgan)
- 5 questions from each document are chosen according to the following main criteria:
 - Relevance to teams's interest
 - Feasibility (time and age constrains, etc.)
- Each team is required to anticipate how it plans to answer the questions



	Theoretical frameworks	Representations	Contexts
Tool info + A priori			
A posteriori			
A priori + A posteriori			



Example 1: Context (A priori)

Which characteristics of the activities and tasks do you think they support the generation of meanings in a constructionist or experimental or even playful way?



Example 2: Theoretical Frameworks (A posteriori)

In your opinion, in which ways have your theoretical choices influenced:

- the analysis of the software and the identification of its didactic functionalities?
- the conception of the experiment?
- the choices of the data and their analysis?
- the results you obtain and the conclusions you draw from these?



Example 3: Representations (A priori + A posteriori)

What is the “distance” between the objects and the means of manipulating provided by the tool and those used in paper-and-pencil based work within the target domain?



Teams' tasks

Teams activities were regulated by tasks that were periodically assigned by the ITD, which in a rough chronological order consisted in:

- Choosing (or restricting the choice of) questions to be included in the guidelines
- Answering a priori questions
- Running the experiment
- Answering a-posteriori questions



Reflecting on teams' answers

The main tasks were interlaced with reflection tasks requiring the teams to:

- reflect on and highlight their main local results
- read other teams answers and comment on them within the perspective of highlighting possible general results of the cross experiment on the basis of a comparison of the conducted experiments



An example of reflection task

Reflecting on the modalities of employment (DF) of ILEs:

- *If you were to design a new experiment aiming at the same mathematical educational goal and employing the same ICT tool, which characteristics of the experiment would you keep unchanged?*
- *Which of these characteristics do you think, according to the theoretical framework you chose, are necessary conditions for the experiment to be successful?*



The guidelines as a research tool

The answers provided by the teams were made public to the group via the VDS and via e-mail exchanges, and were included in the *Guidelines* document which:

- provided research questions;
- established the when to address each question
- established common concerns to focus on when describing classroom experiments, on the basis of the definition of DF;
- gathered under the same document, the answers provided by each team to the chosen questions, in a format which could facilitate comparisons.



Reflecting on teams' experiments

The researchers participating to the cross experiment have been interviewed by other researchers at two different moments:

- After the design of the experiment, but before it was run
- After the experiment was run, and data was collected and analysed



Different typologies of local experiments

- Laboratory with few students
- Standard school context with whole classes of pupils
- conducted by researchers alone
- researches acting as and with teachers
- researchers only as observers
- Recovery activities
- New contents activities
-



New didactical functionalities

- Aplusix was conceived also as a tool for addressing standard school mathematics tasks concerning algebraic expressions: ex. computing, factorising, simplifying, etc.
- ITD researchers wanted to adopt it for open ended tasks concerning fractions



New didactical functionalities

$$\frac{13}{24}$$



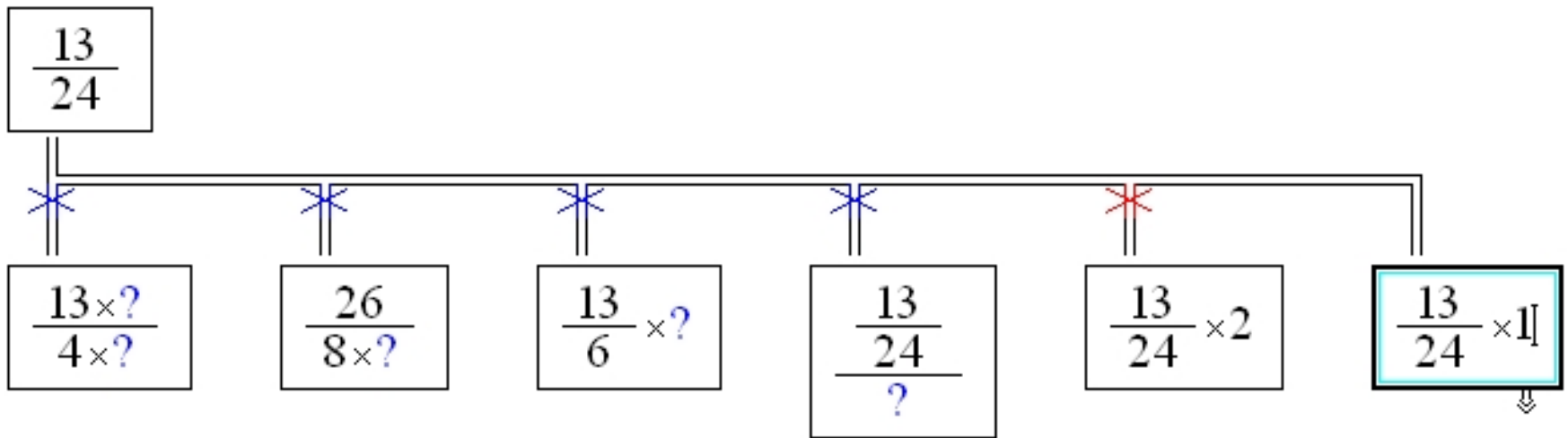
$$\frac{13 \times ?}{4 \times ?}$$

Expressions can be left incomplete



New didactical functionalities

TASK: complete the expressions, use the feedback to validate your work



This showing

- That the used tool (Aplusix) can be used in contexts and in ways quite different from those for which it has been conceived
- However this requires researchers/teachers to re-interpret it and adapt to specific situations



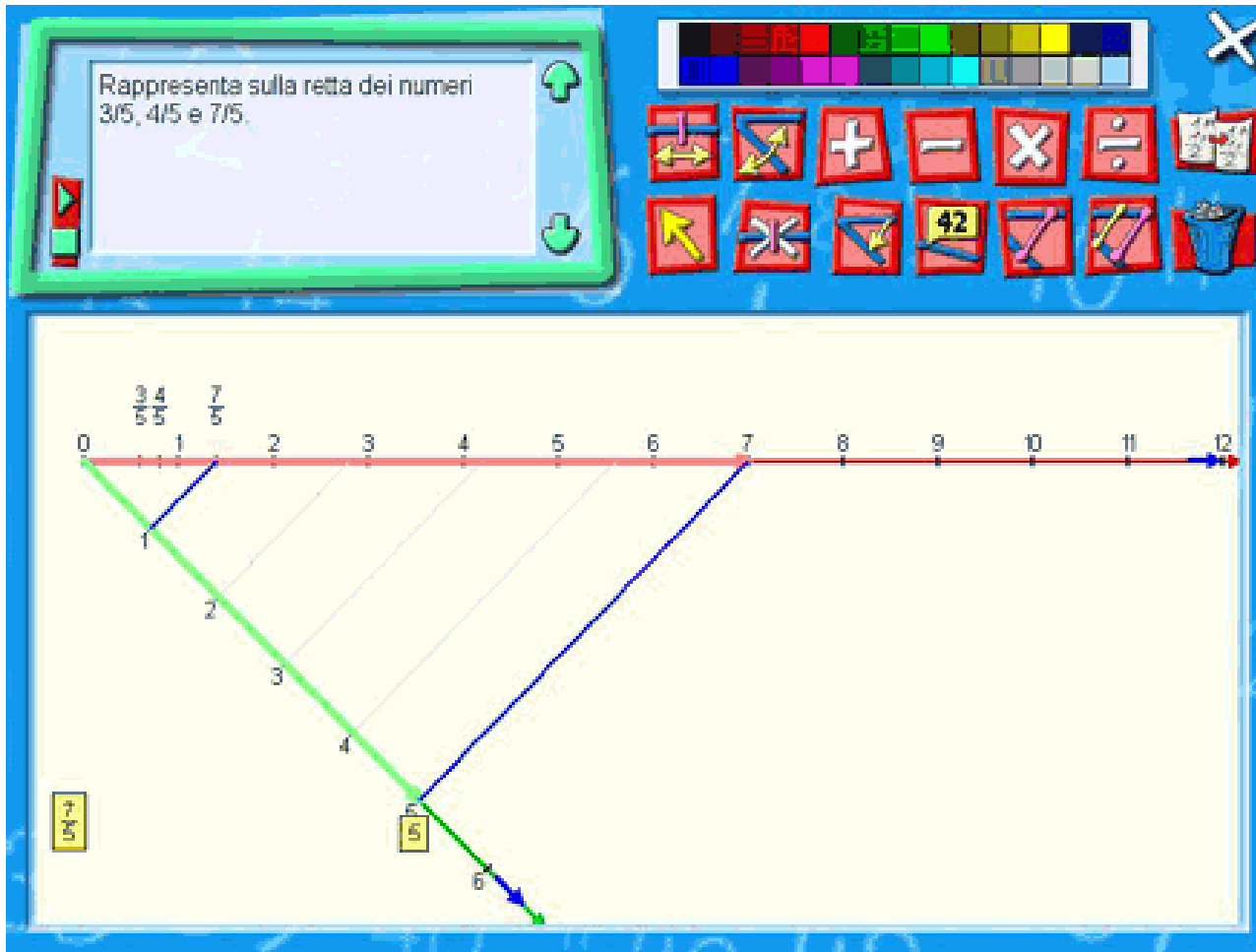
An example from cross experiment

The tool ARI-LAB 2 was experimented by both french teams (MeTAH and Univ. Paris 7) and by the greek team (NKUA).

The differences in cultural and institutional contexts resulted in differencies in how the tool has been employed.



ARI-LAB2 (Fraction Microworld)



Designed to support arithmetic activities

Uses “Thales’ theorem” to represent fractions

Different choices of employment of the fraction microworld

Even if the teams have compatible theoretical approaches (socio-constructivism background):

- University of Paris 7 team chose to not employ this microworld because of institutional considerations in this short term experiment.
- MeTAH team chose to employ the microworld as a “black box” but found this caused problems when pupils needed to make sense of feedbacks.



Different choices of employment of the fraction microworld

Even if the teams have compatible theoretical approaches (socio-constructivism background):

- NKUA team did not conceive the “black box” construction of fractions as problematic, even if pupils required for explanations, which how ever were supposed to be negotiated with the teacher, as suggested by their theoretical assumptions.



Thus with our cross experiment

- We had a chance to explore and point out how different factors influence/constrain research experiments, but also the exportability of tools to different contexts.
- Our examples on the one hand show that tools in general can be exported
- But on the other hand advise us on what kind of problems we may encounter



What theoretical frameworks don't say

- There seems to be a sort of gap between what a theoretical framework offers, and what is needed to put into practice (within a classroom experiment).
- Such a gap is at the core of the relationship between theoretical reflections and cases of practice, and it remains often implicit.



What theoretical frameworks don't say

- ITD and Siena teams both referred to Vygotskyian theories and used the same ILE, Aplusix
- But identified different educational goals



What theoretical frameworks don't say

- This resulted in two teaching experiments, both consistent with the respective theoretical frames, but deeply contrasting between them for:
 - the role of the teacher,
 - the kind of tasks given to pupils,
 - the validation of pupils' work,
 - the use and set up of the tool.



What theoretical frameworks don't say

- MeTAH and DIDIREM teams shared the same theoretical background: *Theory of Didactical Situations, Anthropological Approach to Didactics ...*
- and experimented the same ILE: AriLab2



What theoretical frameworks don't say

But their experiments differed for important aspects such as:

- who/what is responsible for validating pupils' work?
- Does validation emerge as a social product?
- Does it rest with the teacher?
- Or the opposite, does it rest with the ILE?
- Are pupils allowed/obliged/forbidden to use systems of representations other than those provided by AriLab2 (e.g. paper and pencil)?



Gains of the cross experiment

- Deeper understanding of each other's theoretical frameworks, researches, cultural influences, etc.
- Deeper understanding of each own theoretical frameworks, researches, cultural influences, etc.
- Insight on **adaptability of technological tools** to different theoretical frameworks, researches, cultural influences, etc.



The cross experiment methodology

