

# Expansive visibilization and double stimulation in the *pedagogical change laboratory*

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# Expansive visibilization and double stimulation in the *pedagogical change laboratory*

Doctoral research

Card-based co-design of technology-enhanced learning scenarios in a formative intervention based on the Change Laboratory methodology



## An ongoing educational challenge

The persistent challenge of digital technology integration (Abel et al., 2022; Albion & Tondeur, 2018; Lai et al., 2023)  $\Rightarrow$  calls for a "systemic approach" (Virkkunen & Newnham, 2013, p. 62)

Integrating digital technology requires a **re-mediation** (Griffin & Cole, 1984; Kaptelinin, 2015) of teaching and learning : **integration of new artifacts modifies "the mediational structure"** (Engeström, 1994, p. 45) **of *teaching|learning* activity** (Hauge, 2014).

Digital technology integration should be viewed as **a transformation problem rather than an implementation one** (Engeström, 2009).



What training modalities are most likely to support teachers in the practical transformation (Sannino et al., 2016) of their activity while integrating digital technologies and practices into *teaching|learning*?

## An ongoing educational challenge

### Two approaches

- **Formative intervention** (Engeström, 2011; Virkkunen & Newnham, 2013)  
Collectives create a new concept for their activity system in order to provide solutions to issues encountered in their work context.
- **The Learning by Design approach** (Kelly et al., 2019; Koehler & Mishra, 2005; Koh et al., 2017; Voogt et al., 2016; Yeh et al., 2021)  
Teachers collaboratively design technology-enhanced learning (TEL) scenarios and are intended to develop their Technological Pedagogical and Content Knowledge (TPACK).



Teachers' developmental trajectory during a formative intervention called the *pedagogical change laboratory* (PCL), which bridges CHAT interventionist methodology with Learning by Design (LBD).

# Investigating teachers' developmental trajectory during the *pedagogical change laboratory* (PCL)



## Conceptual approach

Theoretical foundations  
of the *pedagogical change laboratory* (PCL)



## Methodology

The design of the  
*pedagogical change laboratory* (PCL) and  
research methodology



## Results

Main findings



## Discussion

Highlights

## Theoretical foundations of the *pedagogical change laboratory* (PCL)

Two theoretical principles from CHAT.

Same epistemological principles as the Change Laboratory (Sannino & Engeström, 2017): the *theory of expansive learning* (Engeström, 2015) and the *principle of double stimulation* (Sannino, 2015, 2020).

- Teachers *recognize and analyze their problematic situation*, both at the *action and systemic levels* (Engeström, 2018; Virkkunen & Newnham, 2013), with the goal of *breaking out of it* and concretely changing their practices (Sannino & Engeström, 2017).
- It aims *to facilitate teachers' transformative agency* (Sannino, 2020).

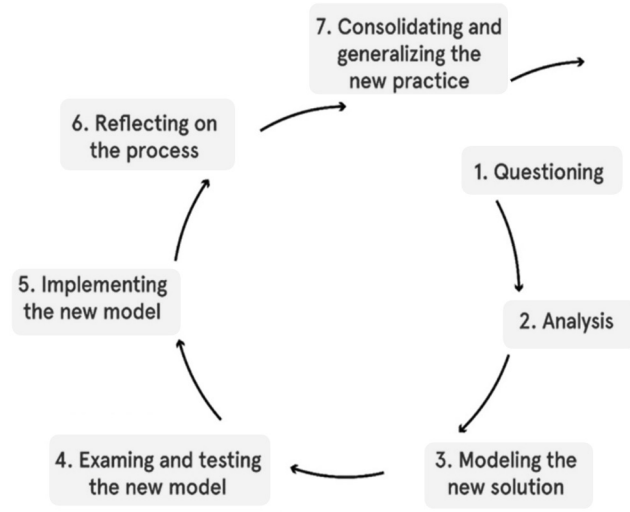
## Theoretical foundations of the *pedagogical change laboratory* (PCL)

❖ The *theory of expansive learning* (Engeström, 2015)

*Expansive visibilization* (Engeström, 2018): “making troubles, contradictions, future visions, and novel solutions [...] visible, so that the practitioners could transform their activity in conceptually mastered and practical” (p. 198).

**Figure 1.**

*Sequence of Learning Actions in an Expansive Learning Cycle, adapted from Engeström and Sannino (2010).*

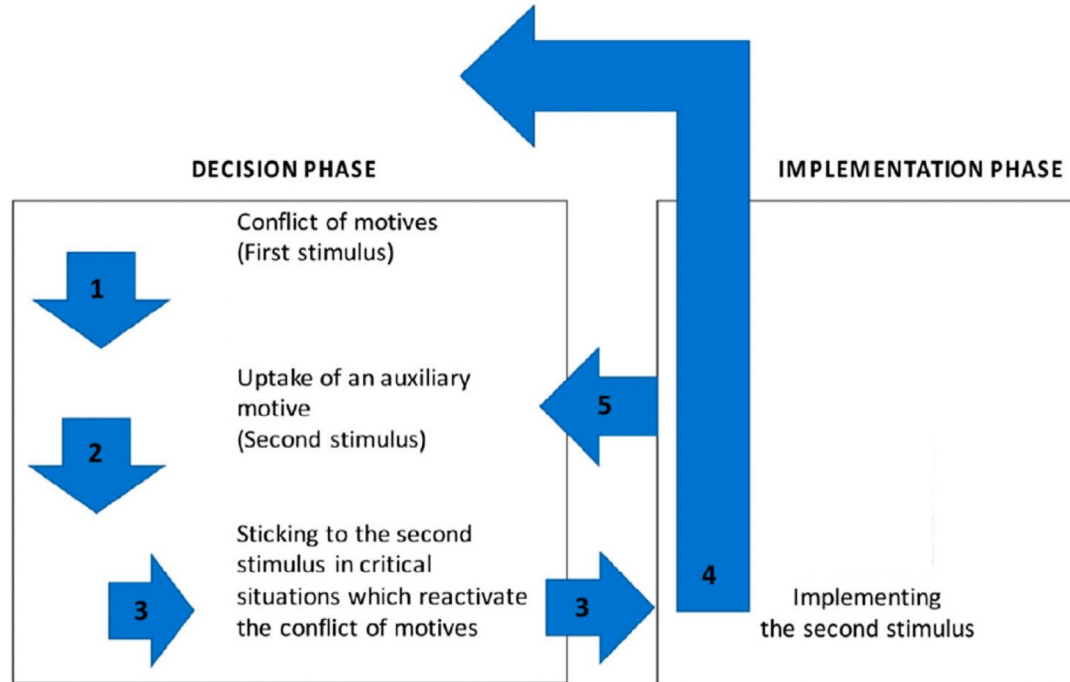


## Theoretical foundations of the *pedagogical change laboratory* (PCL)

- ❖ Transformative agency by double stimulation (TADS) (Sannino, 2020)

Figure 2.

*TADS model : Transformative Agency by Double Stimulation. The source is from Sannino et al. (2021).*





## Theoretical foundations of the *pedagogical change laboratory* (PCL)

Two theoretical principles from the TPACK conceptual framework.

### Learning by Design (LBD)

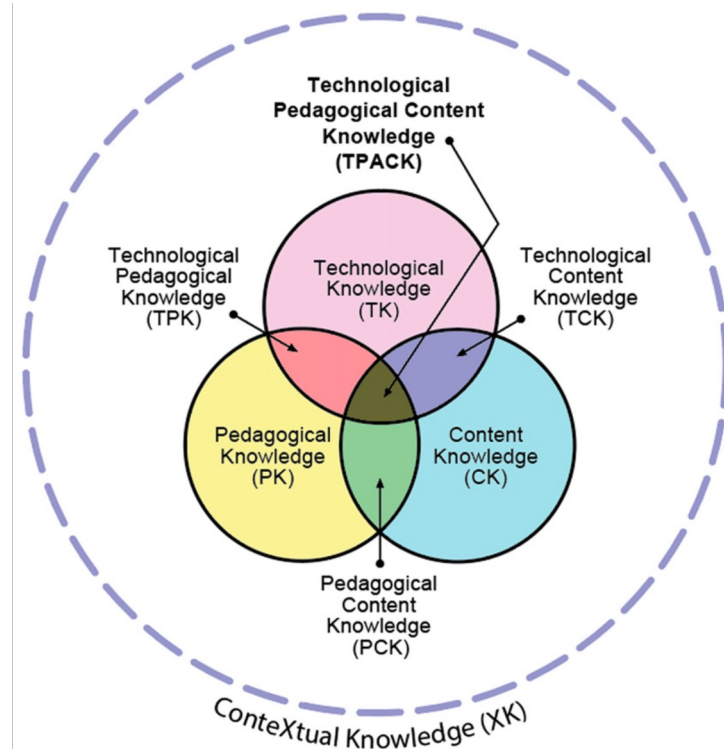
- engages teachers in **collaborative design** and requires them to **actively learn to blend their understanding of technology, teaching methods, and subject matter** in order to create engaging learning experiences tailored to the specific parameters of their context (Koehler & Mishra, 2008).
- **develops teachers' competences for technology integration** (Yeh et al., 2021) and fosters **teachers' development of Technological Pedagogical Content Knowledge** (Voogt et al., 2016; Warr & Mishra, 2023)

“a complex, situated, and integrated body of knowledge” (Yeh et al., 2021, p. 2).

TPACK : “the basis of effective teaching with technology” (Koehler & Mishra, 2008, p. 18).

**Figure 3.**

*TPACK Framework. The source is from Punya (2019).*



## Teachers' developmental trajectory during the PCL through the lens of TADS and TPACK

RQ1. What TADS instances can be observed during the *pedagogical change laboratory* (PCL)?

RQ2. What TPACK instances can be observed during the PCL?

RQ3. Are there any relationships between TADS and TPACK instances that can be observed?



Four lower (11-14 y) and upper secondary (15-17 y) teachers of French



French international school in Switzerland  
that follows the curricula of the French Ministry of Education

Teachers' intentions expressed during the preparation phase :



To address didactic and pedagogical issues related to teaching patrimonial literature

Taking full advantage of the digital technologies at their disposal



Object of the transformational process : (activity of) *teaching|learning* French literature

## The design of the *pedagogical change laboratory* (PCL)

*Pedagogical change laboratory* (PCL) as a **variation of the Change Laboratory** (Engeström, 2011) that does not strictly replicate the traditional methodology.



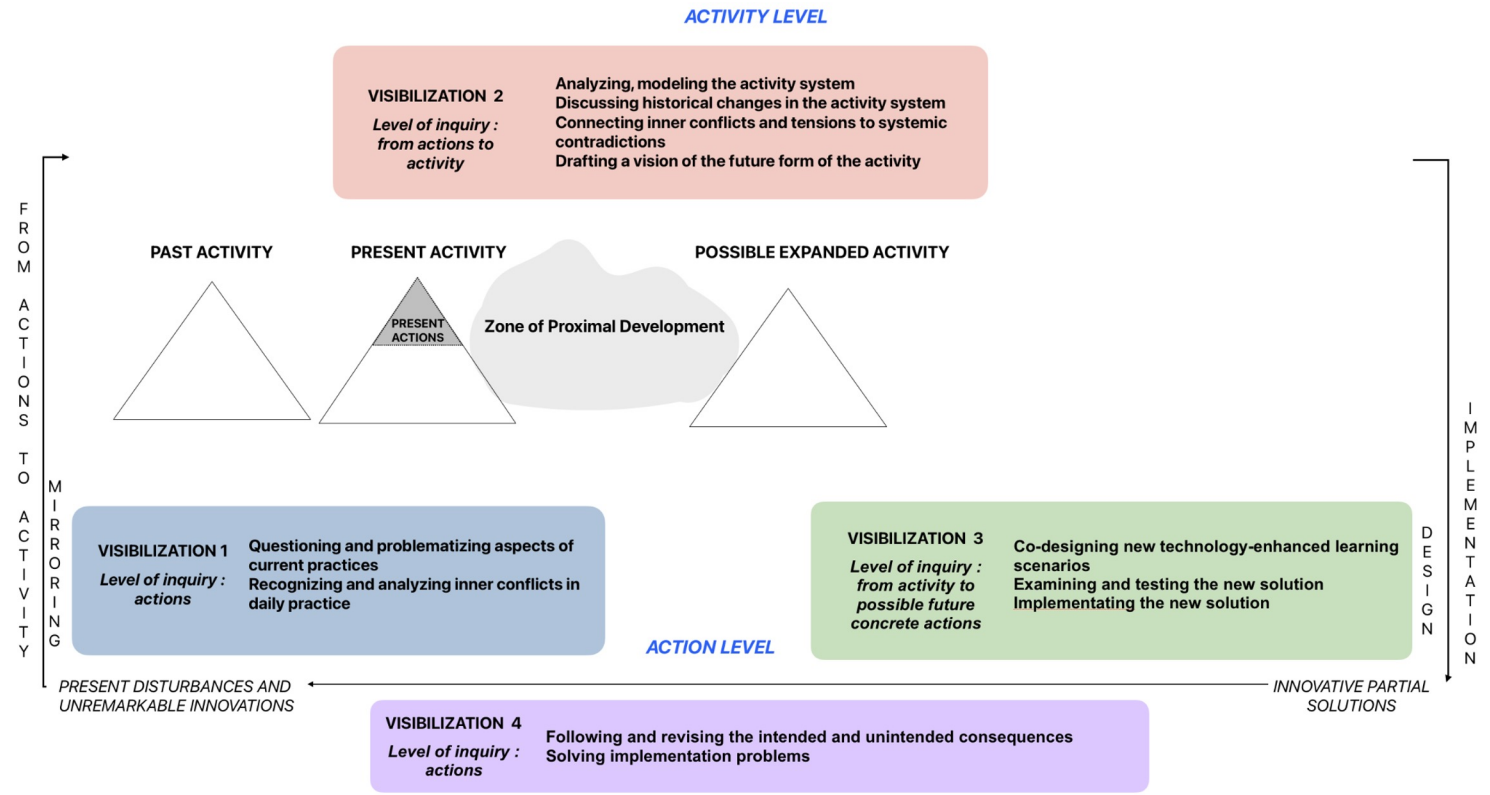
A **different time format** to fit the ecological requirements of *these* in-service teachers in *this* school



Specifically **designed through an ecological approach** aiming that teachers can take full **advantage of the digital technologies** available in their environment.

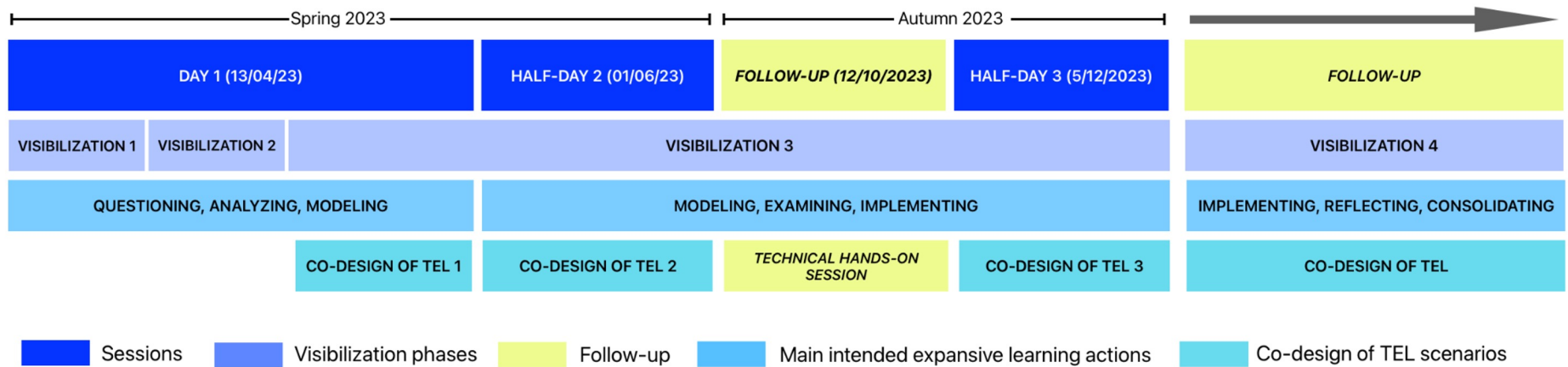
# The design of the pedagogical change laboratory (PCL)

**Figure 4.**  
*Visibilization Phases in the pedagogical change laboratory, adapted from Engeström (2018).*



# The design of the pedagogical change laboratory (PCL)

Figure 5.  
Temporal Representation of the Sessions and Methodological Stages of the PCL.



## Data Collection and Stepwise Procedures of Analysis

Sessions recorded and manually transcribed verbatim : 53035 words.

Data analysis : three phases

- TADS instances
- TPACK instances
- Relationships between TADS and TPACK instances

Mixed methods

Incorporating quantitative aspects into data analysis and result presentation to supplement the qualitative results



### ❖ Identifying TADS instances

TADS model translated into four steps (Sannino et al., 2021).

Step 1: Expressions of **conflicts of motives**.

Step 2: Adoption of an “**instrumental solution**” (Engeström et al., 2014, p.122) **to the conflicts of motives**, a **second stimulus** understood as a **forward-oriented anchor**, a **stable platform** to move forward (Sannino, 2020).

Step 3: **Sticking to the second stimulus**. When teachers project themselves into future implementation and refer to the concrete implementation of the second stimulus, committing themselves “to undertake specific transformative actions” (Sannino et al., 2021, p. 1619).

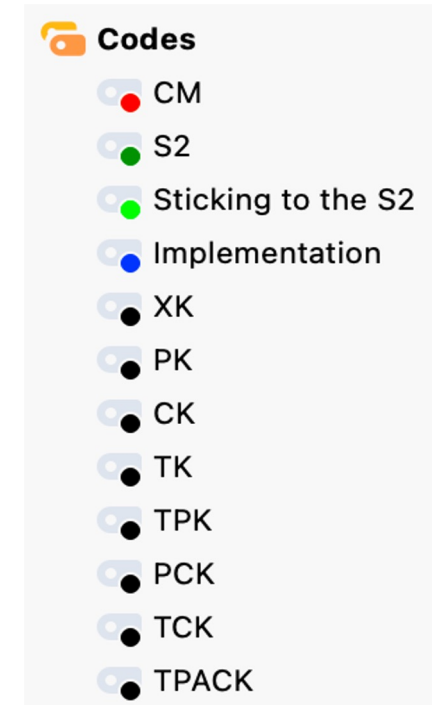
Step 4: **Implementation**. When the second stimulus is implemented through **concrete material achievements and concrete new solutions and practices** (Sannino et al., 2021).

### ❖ Identifying TPACK instances

"coding and counting approach to data analysis"  
(Yeh et al., 2021, p. 10)

**Coding scheme** based on the **eight TPACK knowledge constructs** :  
Contextual Knowledge (XK), Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Knowledge (TK), Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK) and TPACK (Technological Pedagogical Content Knowledge).

**Figure 6.**  
*Coding Scheme Screenshot.*



## Data Collection and Stepwise Procedures of Analysis

- ❖ Identifying relationships between TADS and TPACK instances

Intersections of codes in the segments corresponding to:

**TADS instances** : conflicts of motives, second stimulus, sticking to the second stimulus, implementation.

**Three TPACK instances** : Contextual Knowledge (XK), Pedagogical Content Knowledge (PCK), TPACK (Technological Pedagogical Content Knowledge).

Overlaps of codes have been analyzed.

### Three clarifications

Because TPACK constructs overlap, it is customary to code only what directly corresponds to the element itself.

The unitization strategy (Campbell et al., 2013) focused on meaning units : some coded segments consisted of only a few words, whereas others included numerous speaking turns.

This study does not consider the fourth visibilization phase, which primarily concerns the follow-up.

## RQ.1: What TADS instances can be observed during the *pedagogical change laboratory* (PCL)?

Macro-analysis at the level of the entire intervention (Morselli, 2021)

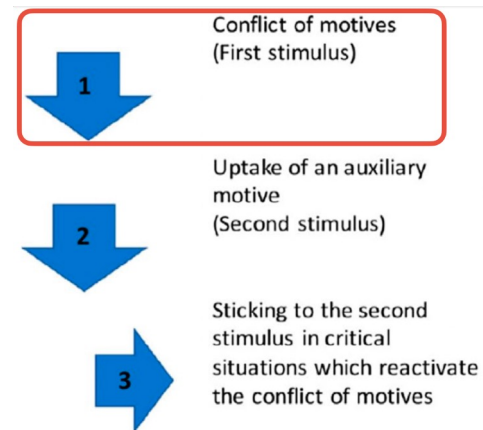
### Decision phase

- Step 1

**First stimulus** emerged during visibilization 1 and 2.

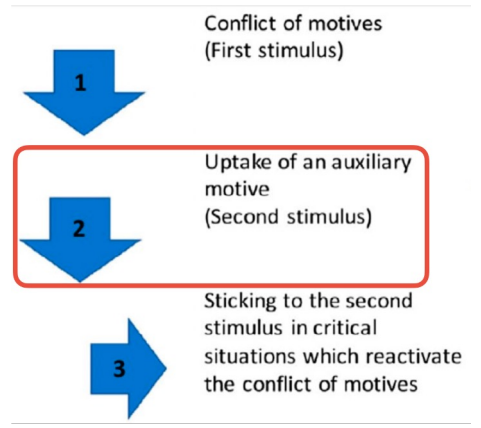
Problematic situation: **students' disinterest in learning French literature**

**Central conflict of motives** : the desire to transmit the pleasure of literature VS the need to prepare their students for exams in accordance with national programs.



# RQ.1: What TADS instances can be observed during the *pedagogical change laboratory* (PCL) L?

- Step 2



Visibilization 2.

Future direction to resolve the conflict of motives :  
reconciling the pleasure of *teaching|learning* literature with the requirements of the national curricula.

Visibilization 3.

Second stimulus: a new technology-enhanced learning scenario.

Figure 7.

*Rendez-vous: A Second Stimulus based on Five Principles*

**Rendez-Vous**

**Main aim :** to change students' attitudes toward school reading so that they become engaged and enjoy learning literature.

**1st principle:**  
A digital reading log for each secondary student

**2nd principle:**  
Student's *rendez-vous* with their reading log

**3rd principle:**  
Student's *rendez-vous* with their readership community

**4th principle:**  
Student's *rendez-vous* with their personal reading

**5th principle:**  
Sustainable *rendez-vous*

## RQ.1: What TADS instances can be observed during the *pedagogical change laboratory* (PCL)?

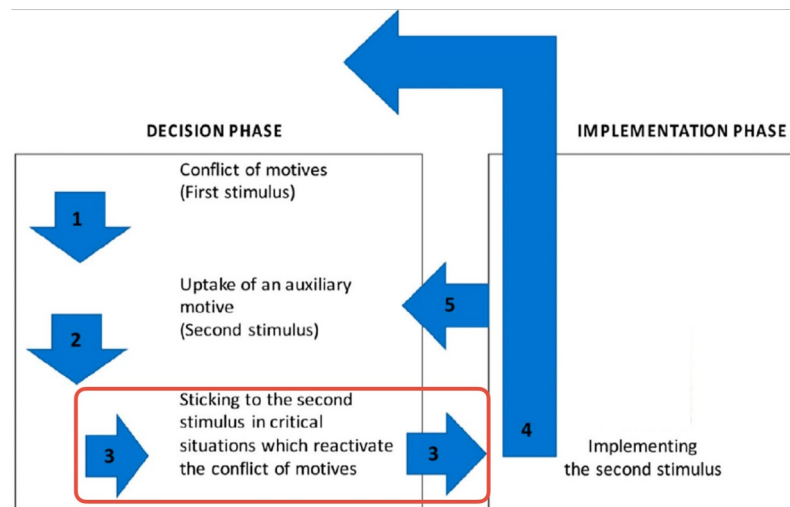
- Step 3

At the end of each co-design session

Teachers discussed the concrete implementation of the *Rendez-vous*.

Real conflict of stimuli (Sannino, 2016)

Observed at the beginning of the co-design session 4, just before teachers implemented some principles of the *Rendez-vous* in their third scenario.



## RQ.1: What TADS instances can be observed during the *pedagogical change laboratory* (PCL)?

### Implementation phase

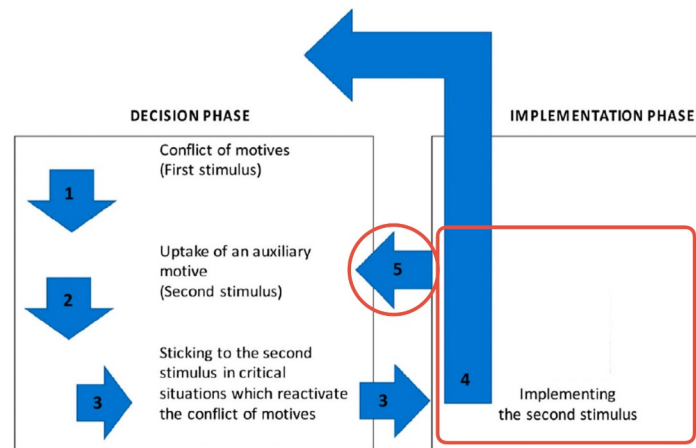
- Steps 4-5
- **Objectification** (Engeström et al., 2023): teachers designed a concrete material product in the form of a digital reading log

→ **Implementing the principles of the *Rendez-vous***:

Teachers designed two new TEL scenarios for different key stage levels.



The implementation required a **chain of double stimulation** (Engeström & Sannino, 2013; Virkkunen & Newnham, 2013).

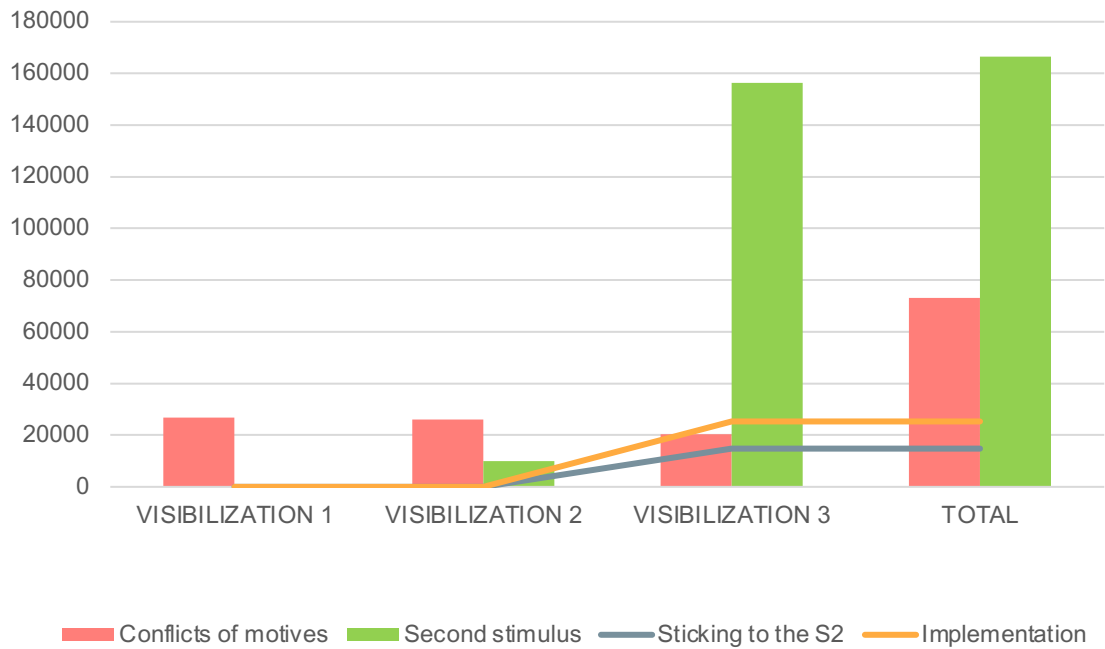




# RQ.1: What TADS instances can be observed during the pedagogical change laboratory (PCL)?

Figure 8.

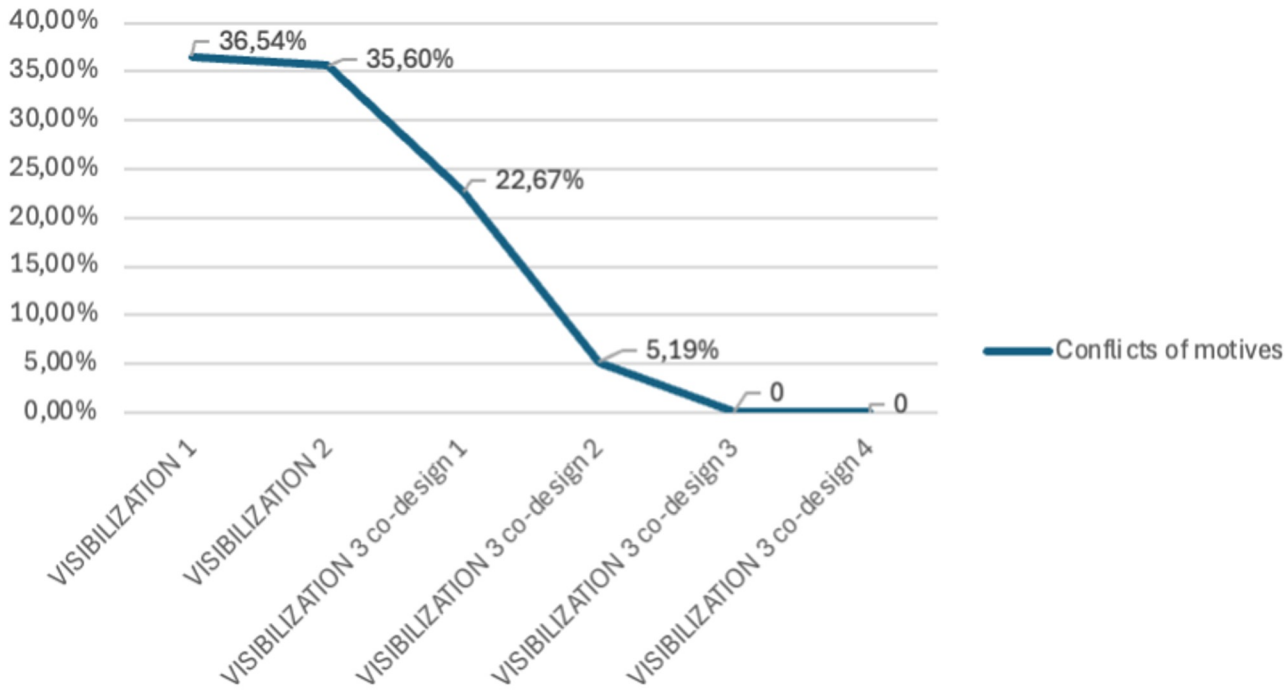
*Distribution of four TADS Instances across the Visibilization Phases (coded characters).*



# RQ.1: What TADS instances can be observed during the pedagogical change laboratory (PCL)?

Figure 9.

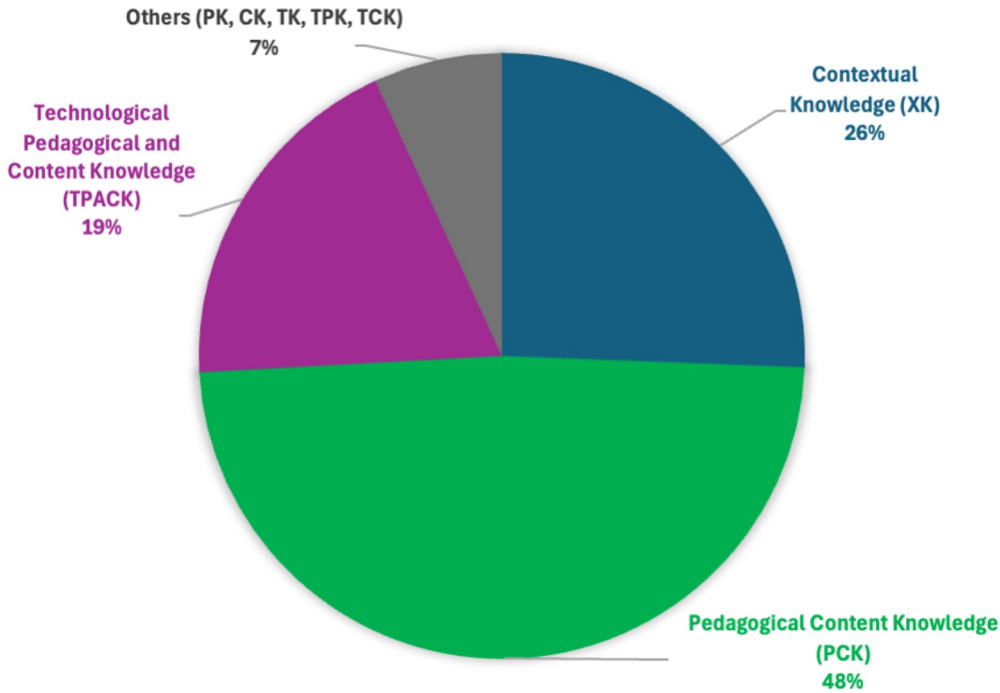
*Distribution of Conflicts of Motives across the Visibilization Phases and Co-design Sessions.*



# RQ.2: What TPACK instances can be observed during the *pedagogical change laboratory (PCL)*?

**Figure 10.**

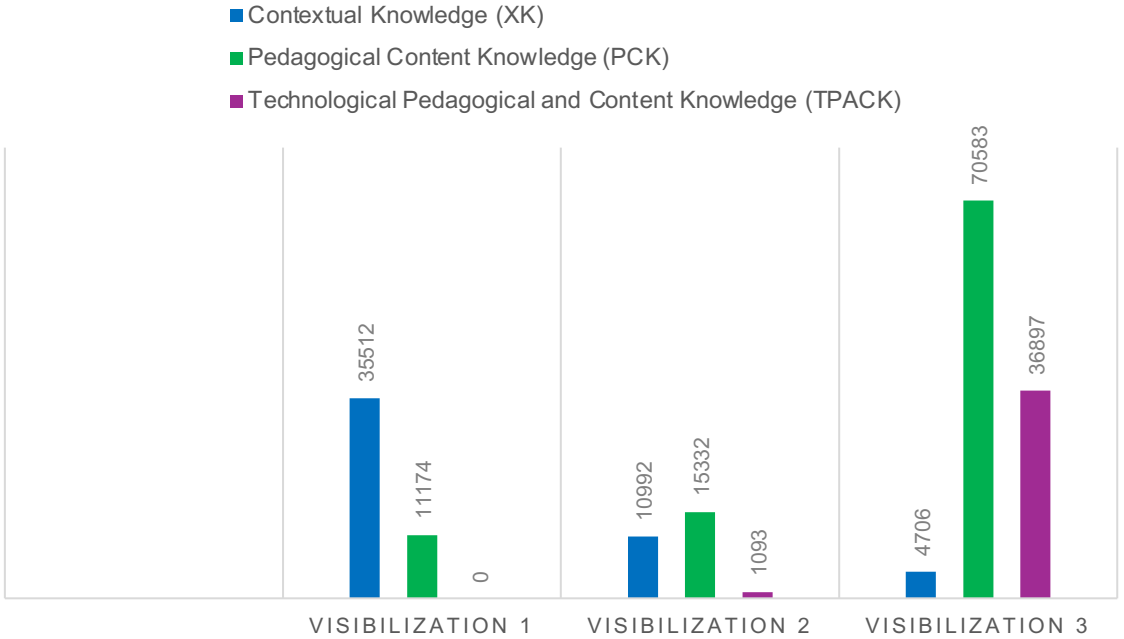
*Distribution of TPACK Instances in the PCL.*



# RQ.2: What TPACK instances can be observed during the pedagogical change laboratory (PCL)?

**Figure 11.**

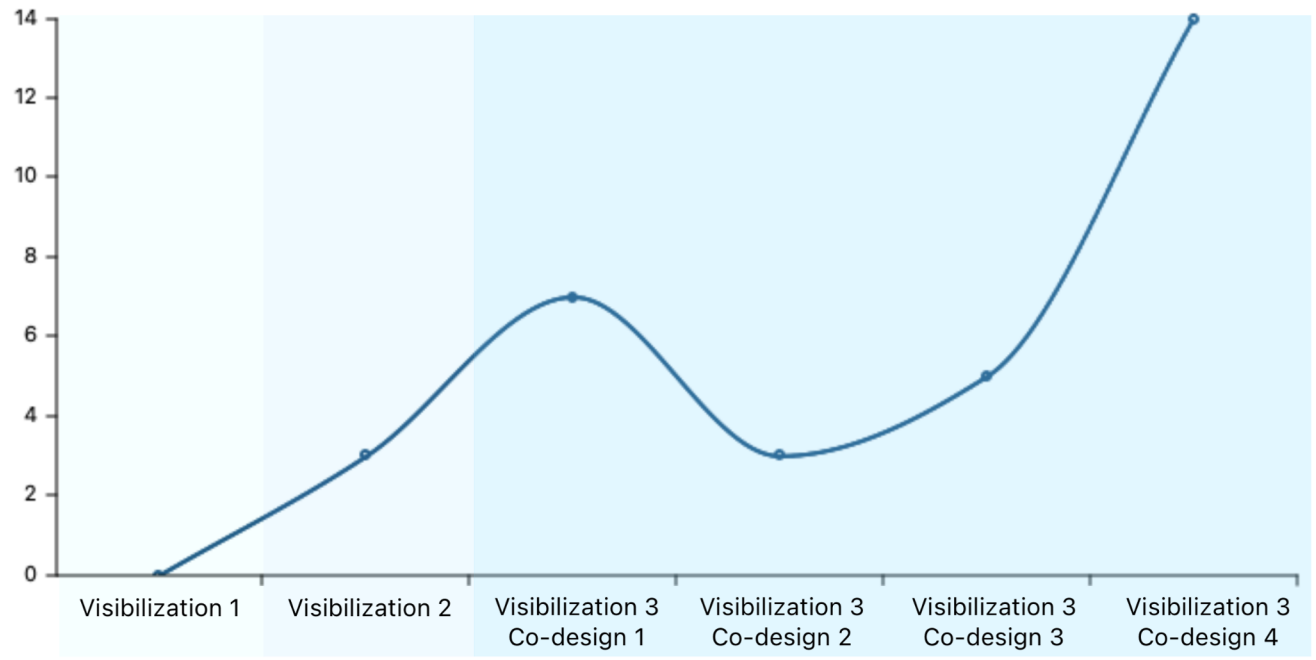
*Distribution of Contextual Knowledge (XK), Pedagogical Content Knowledge (PCK) and Technological Pedagogical Content Knowledge (TPACK) across the Vizibilisation Phases (coded characters).*



# RQ.2: What TPACK instances can be observed during the pedagogical change laboratory (PCL)?







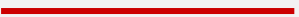
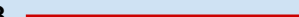
**Figure 12.**

*Evolution of Technological Pedagogical Content Knowledge (TPACK) instances according to Visibilization Phases and Co-design Sessions (coded segments).*



### RQ.3: Can we observe relationships between TADS and TPACK instances?

**Table 1.**  
*Intersections between TADS Instances and three TPACK Instances (XK, PCK, TPACK): Frequency of their Co-occurrence (number of coded segments).*

	Contextual Knowledge (XK)	Pedagogical Content Knowledge (PCK)	TPACK (Technological Pedagogical and Content Knowledge)
Conflicts of motives 	23 	29 	3
Second stimulus 	16	62 	28 
Sticking to the S2	0	3	0
Implementation 	6	11	23 

### RQ.3: Can we observe relationships between TADS and TPACK instances?

**Table 2.**  
*Intersections between TADS Instances and three TPACK Instances (XK, PCK, TPACK) according to the Visibilization Phases (percentages).*

	Visibilization 1-2	Visibilization 3
Conflicts of motives/Contextual Knowledge (XK)	<b>95,65%</b>	4,35%
Conflicts of motives/Pedagogical Content Knowledge (PCK)	<b>62,07%</b>	<b>37,93%</b>
Second stimulus/Pedagogical Content Knowledge (PCK)	12,90%	<b>87,10%</b>
Second stimulus/Technological Pedagogical Content Knowledge (TPACK)	7,14%	<b>92,86%</b>
Implementation/Technological Pedagogical Content Knowledge (TPACK)	0,00%	<b>100%</b>

## An evolution in the mobilization of TPACK that follows TADS dynamics and movement

1. **Conflicts of motives** frequently co-occur with the mobilization of **Contextual Knowledge (XK)** in visibilizations 1 and 2.

In visibilizations 1 and 2, conflicts of motives are linked to the progressive elucidation of the problematic situation based on an analysis of daily practice and systemic contradictions.

In CHAT, “activity itself is the context” (Nardi, 1996, p. 73).

⇒ CHAT methodology, based on the double stimulation principle and expansive learning, appears then to facilitate the mobilization of Contextual Knowledge (XK).

### *Implications for practice*

CHAT, which provides methodological tools for systemic analysis and transformation, may offer the opportunity to design formative interventions where teachers can mobilize and draw on their Contextual Knowledge (XK) to effectively integrate digital technologies into *teaching|learning* while transforming their practices.



## An evolution in the mobilization of TPACK that follows TADS dynamics and movement

2. Conflicts of motives frequently co-occur with the mobilization of Pedagogical Content Knowledge (PCK) across the visibilization phases.

Teachers' central conflict of motives : the desire to transmit the pleasure of literature VS the need to prepare their students for exams in accordance with national programs.

Conflicts of motives based on didactic concerns: drivers for transformation in the *pedagogical change laboratory* (PCL), not the digital technologies.

→ confirmed by the many intersections identified between the Second stimulus and Pedagogical Content knowledge (PCK).

### *Implications for practice*

Adopting a CHAT methodology may allow to put digital technologies at the service of teaching and learning as the object of teachers' activity rather than taking a techno-centric approach to technology integration. This view is well aligned with the TPACK conceptual framework, which is technology agnostic (Mishra et al., 2023, p. 239).

## An evolution in the mobilization of TPACK that follows TADS dynamics and movement

3. Technological Pedagogical Content Knowledge (TPACK) mostly co-occurs with Second stimulus and implementation steps.

Second stimulus (*Rendez-vous*):

Composite (Engeström et al., 2023) and high level of abstraction.

Implementation ⇒ Chain of second stimuli (new TEL scenarios) ⇒ TPACK knowledge increased significantly during the steps 4 and 5 of the TADS model.

⇒ This appears to have not only strengthened teachers' "understanding of the problem and capacity to take further actions" (Sannino, 2020, p. 3), but also encouraged them to mobilize increasingly more of their TPACK knowledge.

### *Implications for practice*

In order to support teachers in practical transformation (Sannino et al., 2016) of teaching and learning while mobilizing their TPACK knowledge, the combination of CHAT methodology and Learning By Design may prove to be a promising path for teachers' professional development.

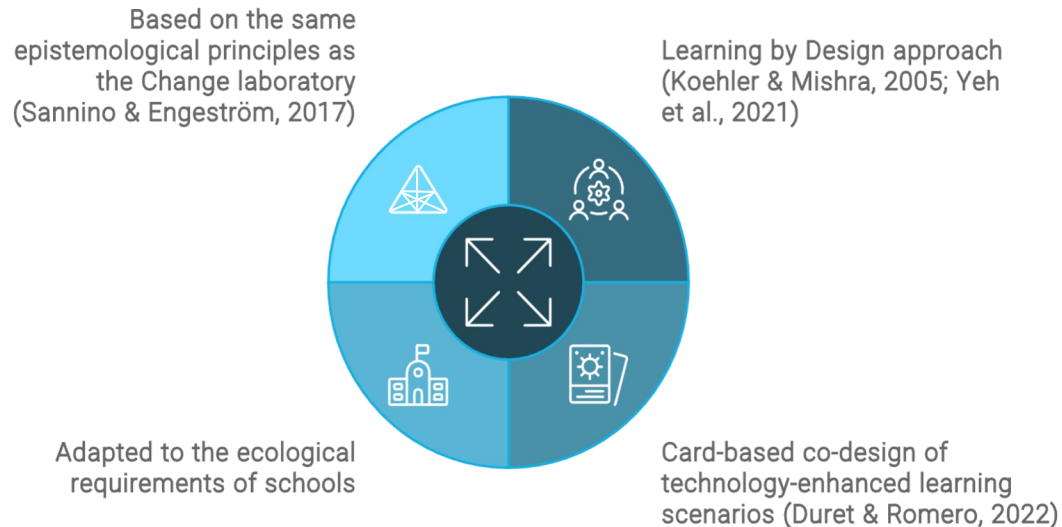
- ❖ Importance of double stimulation in structuring Change laboratory interventions (Morselli & Sannino, 2021)
  - ⇒ This study tends to show that in CHAT formative interventions, **double stimulation can also support teachers' TPACK while transforming their practices.**
  
- ❖ Further research will be needed to confirm the *pedagogical change laboratory's* relevance to teacher professional development.
  - ⇒ This study will continue as part of the doctoral research by **examining expansive learning actions and their relationship to TADS and TPACK instances.**

## The *pedagogical change laboratory*

The *pedagogical change laboratory* could serve as a formative intervention, enabling teachers to transform their practices while taking into account the digital technologies available in their environment to support the transformation of *teaching|learning* activity.

### Figure 13.

*The Four Features of the Pedagogical Change Laboratory.*



**Thank you** for your attention.

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