

Presentation given for **SURF**, Netherland

A participatory design process for learning analytics dashboards

Madjid Sadallah*

Jean-Marie Gilliot

Nov. 14, 2022

madjid.sadallah@imt-atlantique.fr



Learning analytics dashboards (LADs)

Visualization tools that combine into single displays different indicators related to the learner(s), the learning process(es) and/or the learning context(s) using one or more visualizations (Schwendimann et al. 2017)

Purpose: report back insights

- gained from a learning analytics process
 - derived from student data
 - to a wide range of educational stakeholders
 - to make sound and timely decisions which significantly impact the learning process



LAD: why a limited adoption

“LAD usage: an increasing interest BUT a **limited adoption**”

- (1) Design principles: scarcity of studies
- (2) LADs sometimes impose assumptions that do not meet the users' needs
- (3) Users often lack experience with LADs and have limited data literacy
- (4) Associated decision-making processes: little knowledge of the associated processes of sensemaking, insight-seeking and decision-making

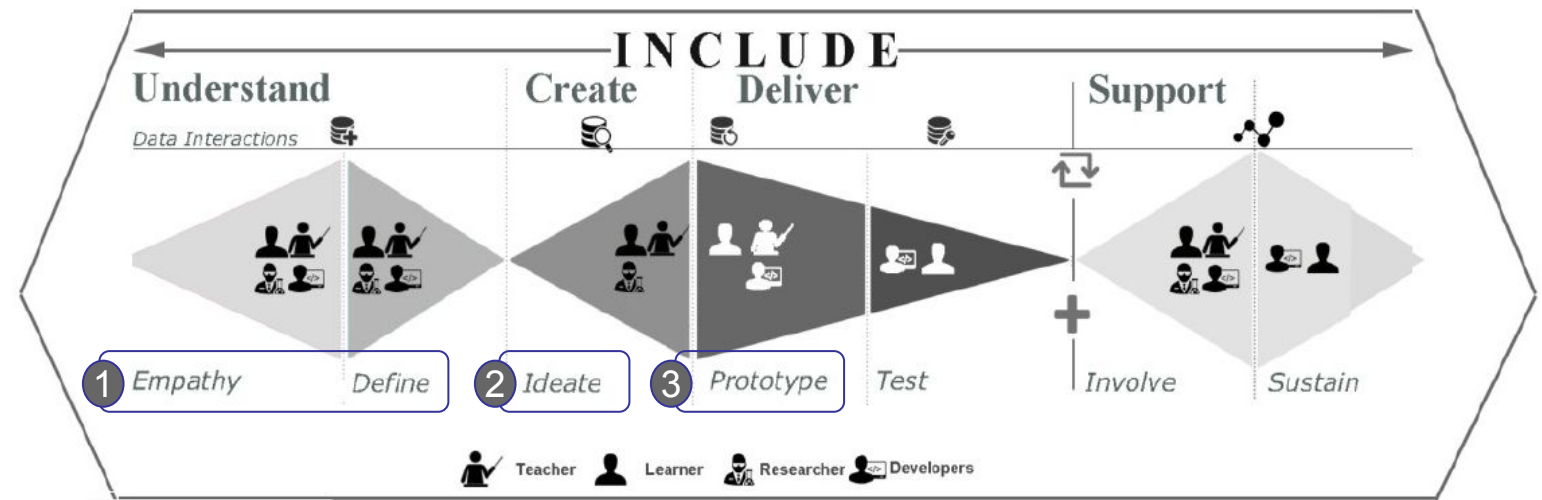
Research: the success of LADs (**acceptance** and **adoption**) depends largely on the degree of stakeholder involvement during the design phase

--> User-Centered Design (UCD) - Human-Centered Learning Analytics (HCLA)

LAD design: towards a participatory approach

LAD codesign: "an approach where learners, educators, institutions, researchers, developers and designers are all included across different stages of the design process, from exploration to actual implementation" (Prieto-Alvarez, et al. 2018)

1. Meetings with researchers, university teachers & instructional designers
2. PaDLAD: a card-based toolkit for ideation
3. LADStudio: a dashboard prototyping tool



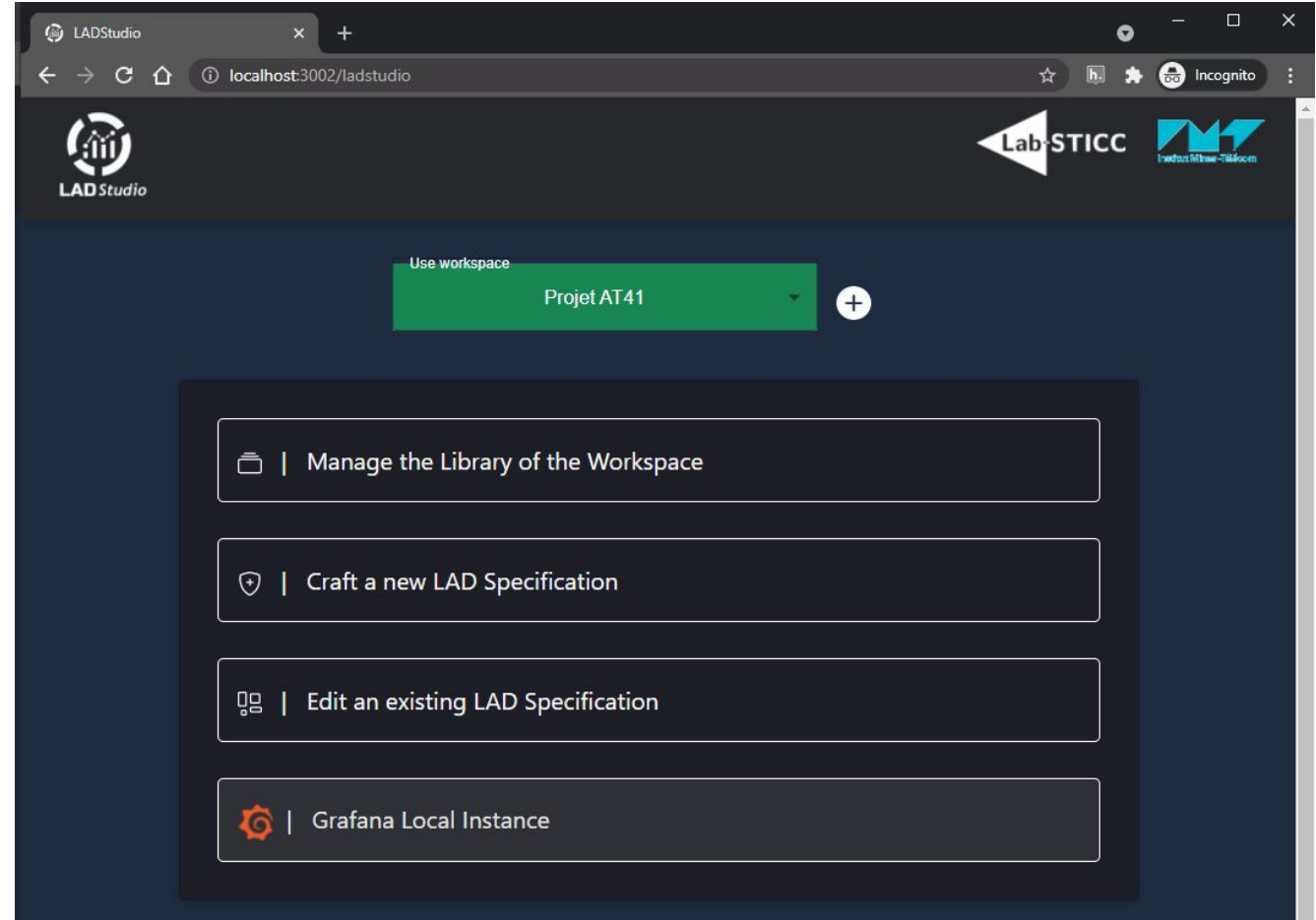
Interaction codesign process and roles for LA (Prieto-Alvarez, et al. 2018)

PaDLAD

&

LADStudio

5



PaDLAD: theoretical foundations

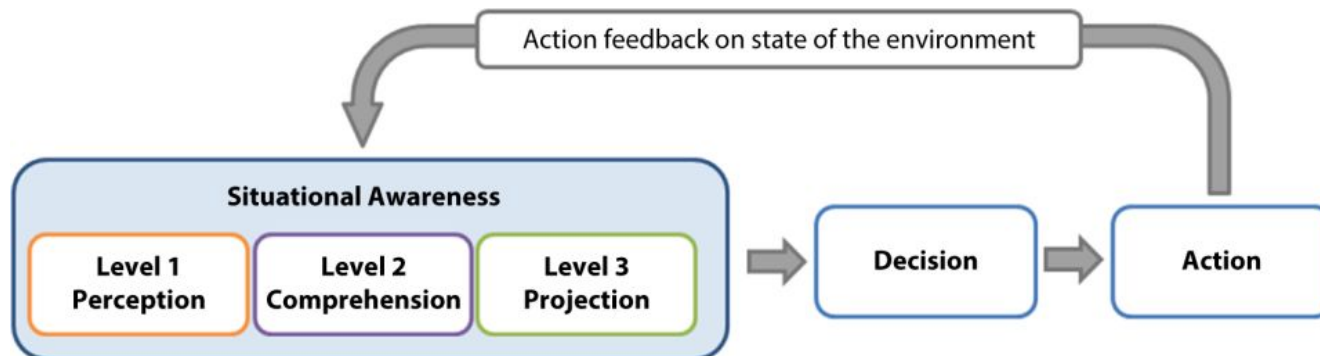
A refined design space

Dimension	Elements	Values
Who ?	Stakeholder	Governance, Institution, Curriculum, Teacher/tutor, Learner
	Circulation	Public, Organizational, Social, Individual
When?	Real-time	Y/N
Why?	Focus	Learning Process (cognitive, outcome-oriented, process-oriented, behavioral, meta-cognitive, social)
		Management (people, resources, activities, experience)
	Situation Awareness Level	Perception (or monitoring, or awareness), Comprehension (or analysis, reflection), Projection (or prediction), Action (or decision, intervention, feedback, assessment)
What?	Data	List of relevant data
	Data scope	Classroom, Learning Management Systems, Curriculum, Profile, Other
HoW	Visualization	Type of diagram
	Interaction	Zoom, Filter, Details-on-Demand, Relate, History, Extract

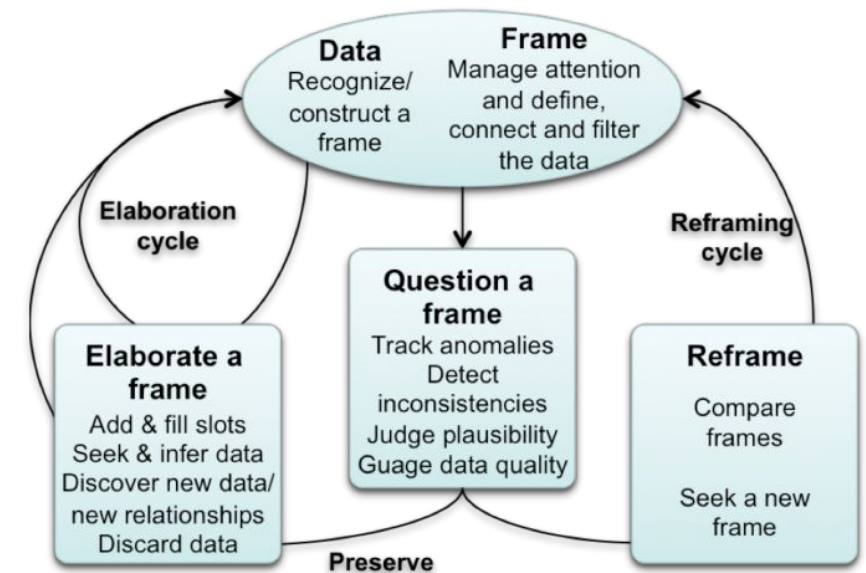
PaDLAD: theoretical foundations

Decision-making: ability to observe the environment, and to understand it (*situational awareness*) by making sense of the observations (*sensemaking*)

Situational Awareness Model of Endsley (1995)



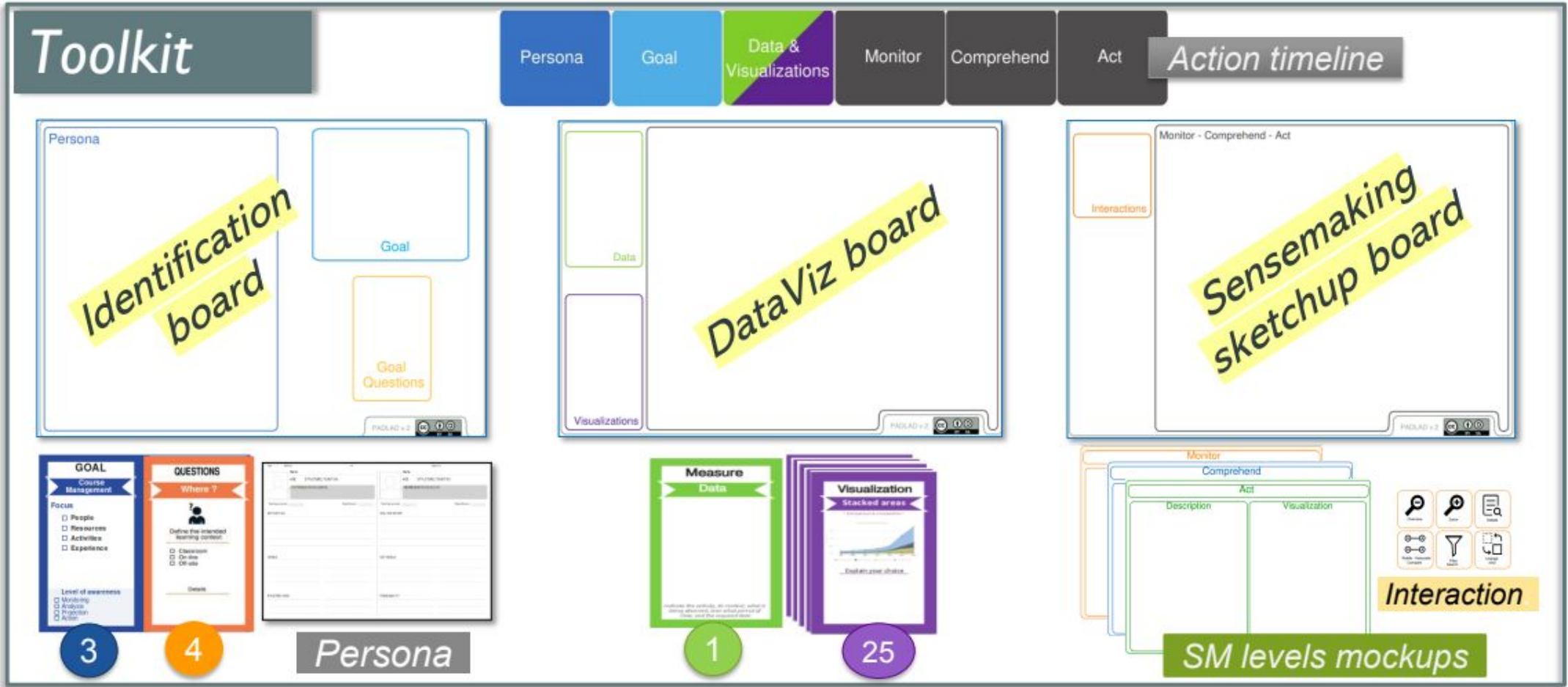
Sensemaking Data/Frame Model (Klein 2007)



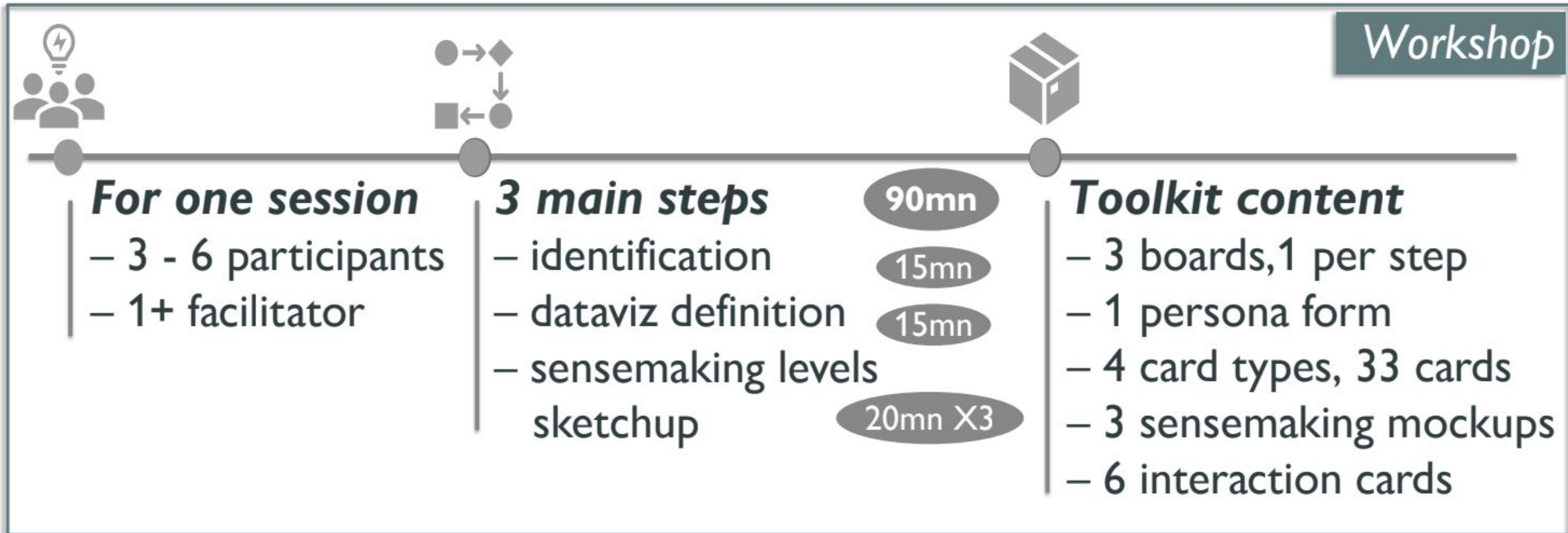
PaDLAD goals, in practice

- Collaboratory answer
 - ◇ For whom are we designing the LAD?
 - ◇ What is its purpose?
 - ◇ In what context will it be used?
 - ◇ With what data? What visualizations?
 - ◇ What is the usage scenario for decision making

PaDLAD toolkit



PaDLAD in practice



Identification board

Context identification

15mn

- Negotiate a goal
- Describe the persona
- Define the use context

GOAL
Course Management

Name your goal

Provide more details

Focus

- People
- Resources
- Activities
- Experience

Level of awareness

- Monitoring
- Analysis
- Projection
- Action

How does this goal fit into the course design?

GOAL
Learning Progress

Name your goal

Provide more details

Focus

- Performance
- Outcome
- Process
- Organization
- Behavior
- Social

Level of awareness

- Monitoring
- Analysis
- Projection
- Action

How does this goal fit into the course design?

GOAL

Name your goal

Provide more details

Level of awareness

- Monitoring
- Analysis
- Projection
- Action

How does this goal fit into the course design?

Name

STRUCTURE FUNCTION

REPRESENTATIVE QUOTE

TEACHING METHOD

TELEPHONE

MOBILITY

GOALS

PERSONALITY

QUESTIONS
Where?

Define the intended learning context

- Classroom
- On-line
- Off-site

Details

QUESTIONS
Who?

What is the scope of the analysis

- Students
- Profession
- Institution
- Regional
- National

Details

QUESTIONS
How?

Is the dashboard shared?

- Yes
- No
- Yes, partially

If yes, with who?

Details

QUESTIONS
When?

The use of the dashboard is

- In real-time
- A posteriori

How long does the observation take place?

- One session
- One week
- One month
- One semester
- One year
- The whole schooling

Details

Identification board

Persona

Date: / / Made by: For: Version no.:

Name

AGE STRUCTURE, FUNCTION

REPRESENTATIVE QUOTE

Teaching expertise ○○○○
Digital fluency ○○○○

MOTIVATION

GOALS

FRUSTRATIONS

GOAL

Learning Progress

Focus

- Performance
- Outcome
- Process
- Organization
- Behavior
- Social

Level of awareness

- Monitoring
- Analysis
- Projection
- Action

Name your goal

Provide more details

How does this goal fit into the course design?

Goal

AUDIENCE

User(s)

What is the audience of the dashboard

- Students
- Teacher
- Curriculum
- Institution

Details

Context

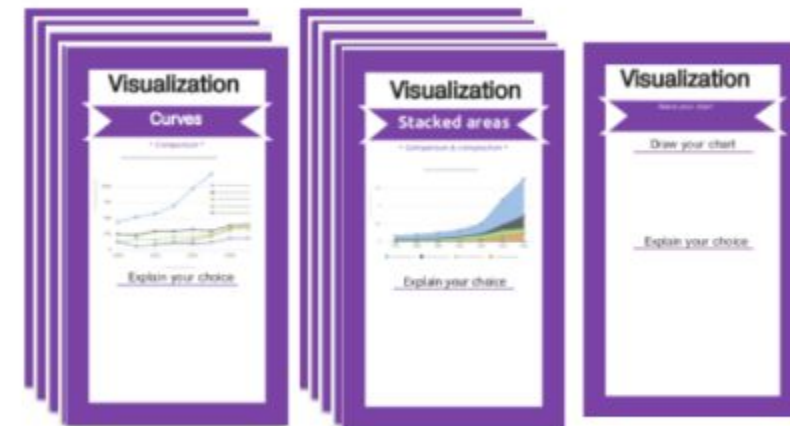
PADLAD

DataViz board

DataViz definition

15mn

- Determine data to use
- Form dataviz tuples by associating data to visual representations



DataViz board

Measure Data

Indicate the activity, its context, what is being observed, over what period of time, and the required data

Data

Visualization Curves

Curves

Explain your choice

Measure Data

Indicate the activity, its context, what is being observed, over what period of time, and the required data

Visualization Stacked bars

* Composition & comparison *

Explain your choice

Visualization Stacked bars

* Composition & comparison *

Explain your choice

Visualization Bubble chart

* Relation *

Explain your choice

Measure Data

Indicate the activity, its context, what is being observed, over what period of time, and the required data

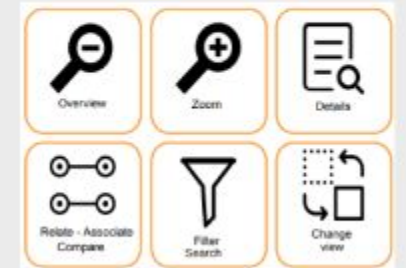
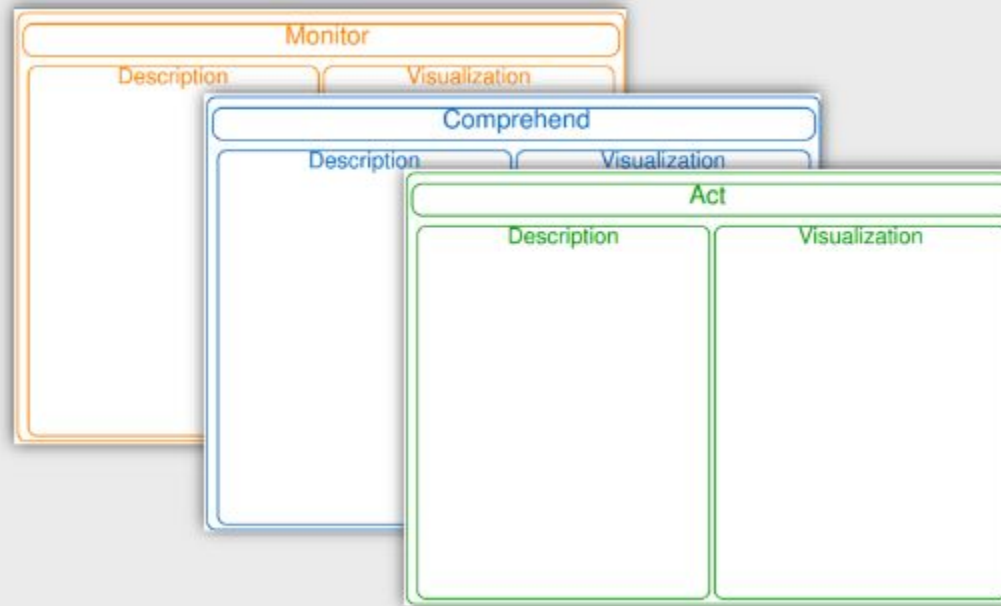
PADLAD CC BY SA

Sketching board

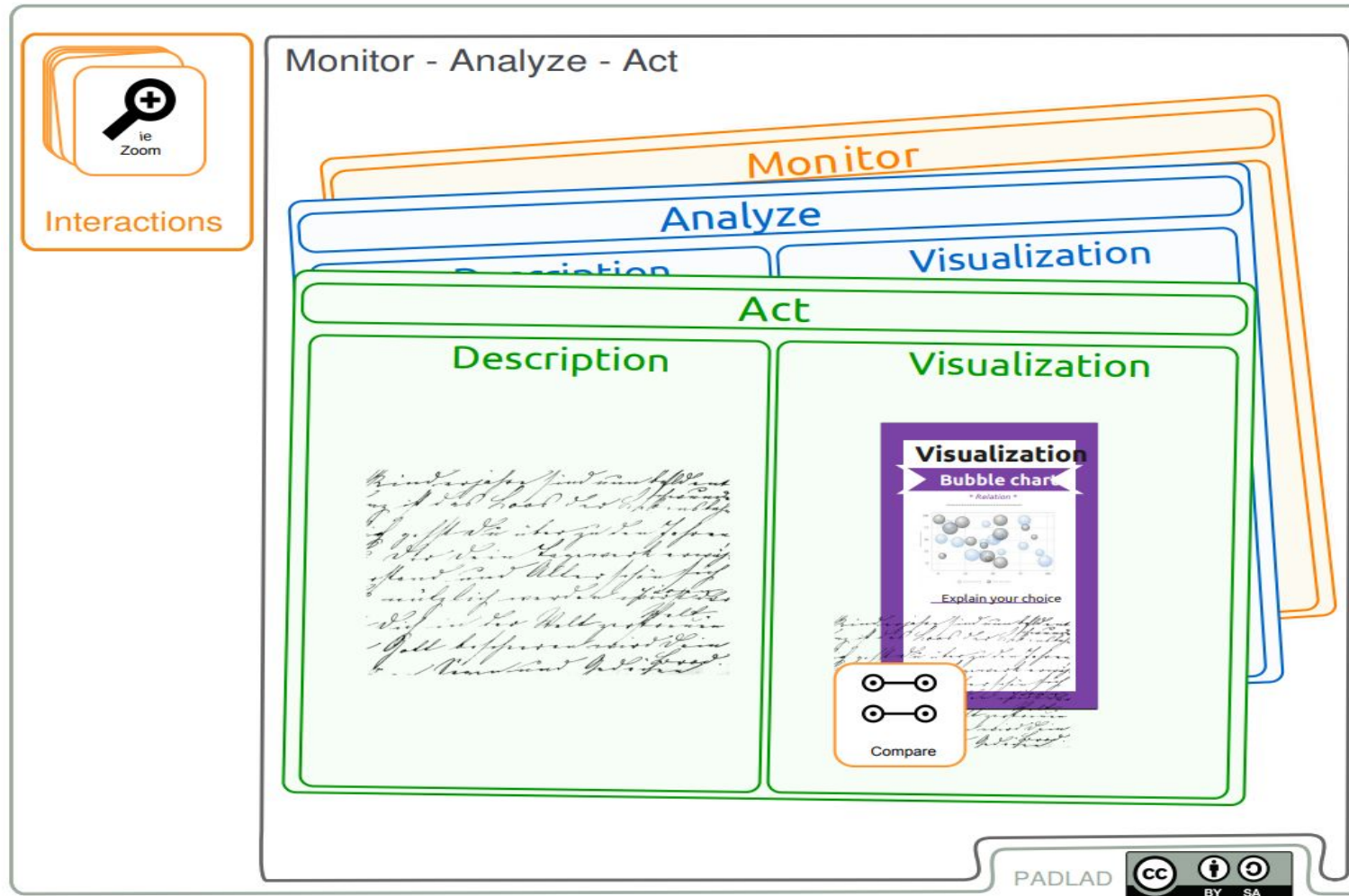
Sensemaking levels sketchup

20mn X3

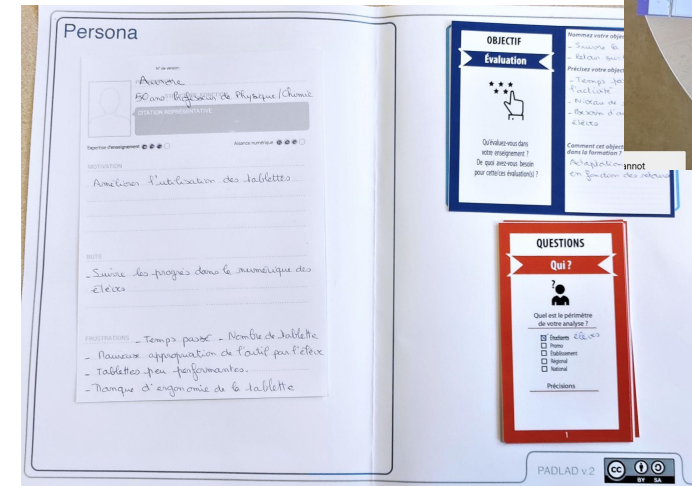
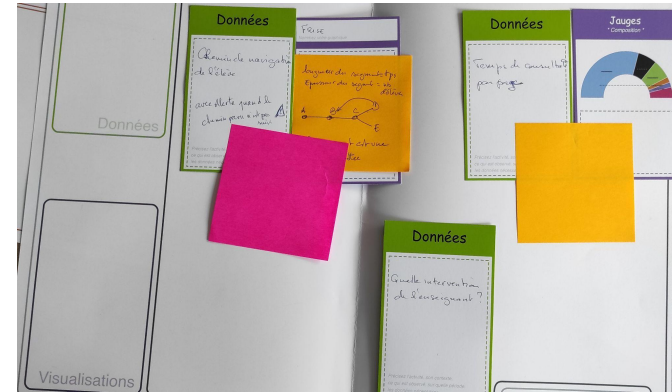
- Associate dataviz tuples to SM levels: *Monitor* – *Comprehend* – *Act*
- Add interaction options



Sketching board



PaDLAD workshops



PaDLAD evaluation: 15 participants

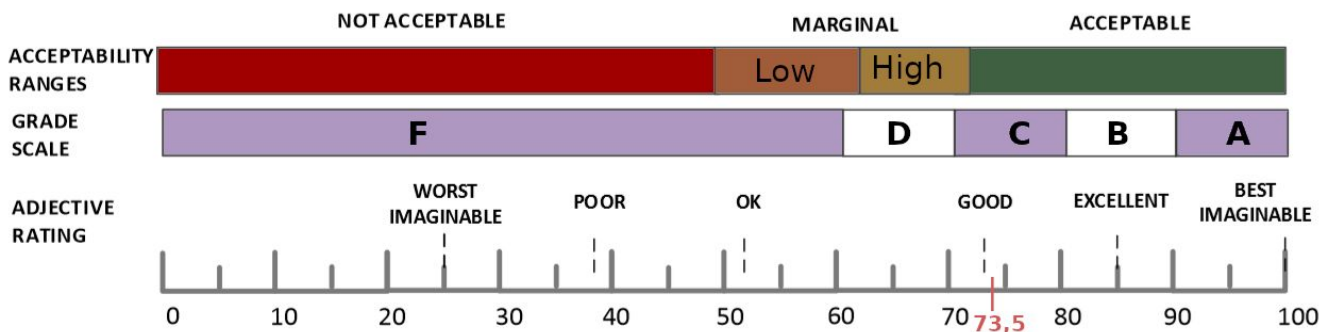
Usability

- ◆ *System Usability Scale (SUS)*
- ◆ Average SUS score: 73.5
- ◆ Acceptability Range: *High*
- ◆ Grade Scale level: *category C*
- ◆ Adjective Rating: *Good category.*



Supporting creativity, commitment and collaboration

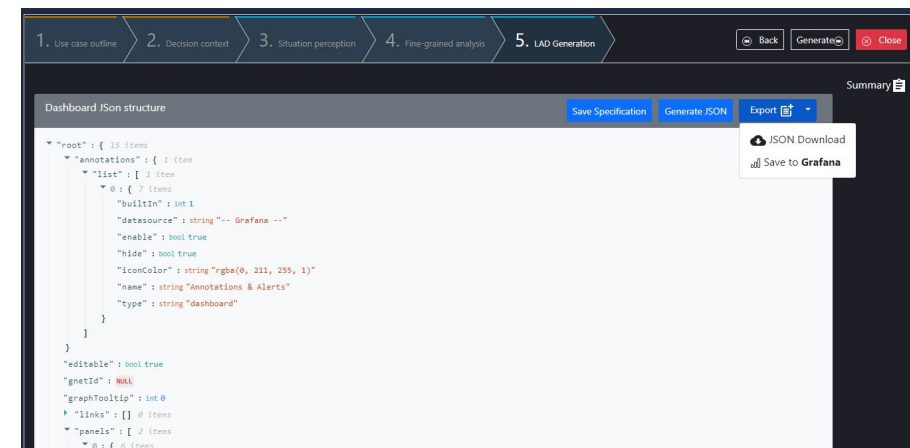
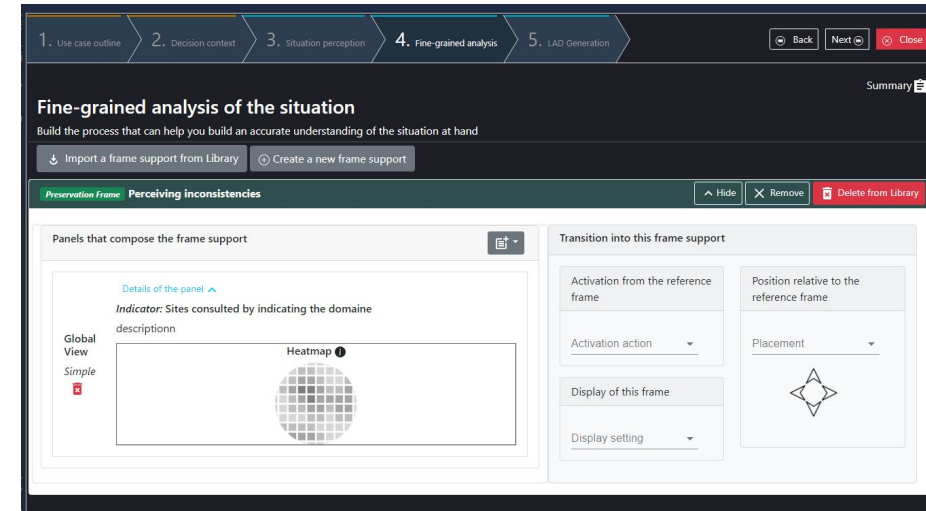
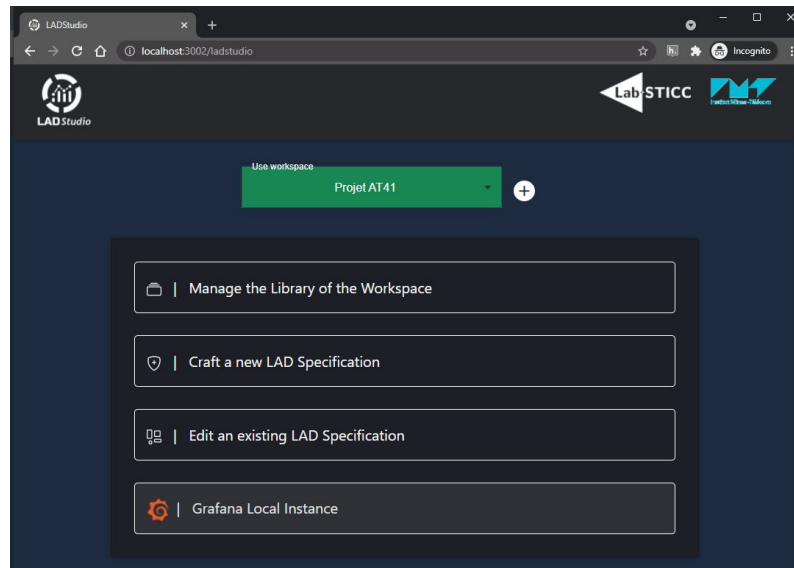
- ◆ *Self-Report Level of Participation Survey*
- ◆ CD activities: Planning & org., Creative design, Priority-setting, Negotiation, and Reflection and evaluation
- ◆ Scale: 1 = passive , 2 = information sharing, 3 = engagement and mobilization, **4 = collaboration, and 5 = empowerment**



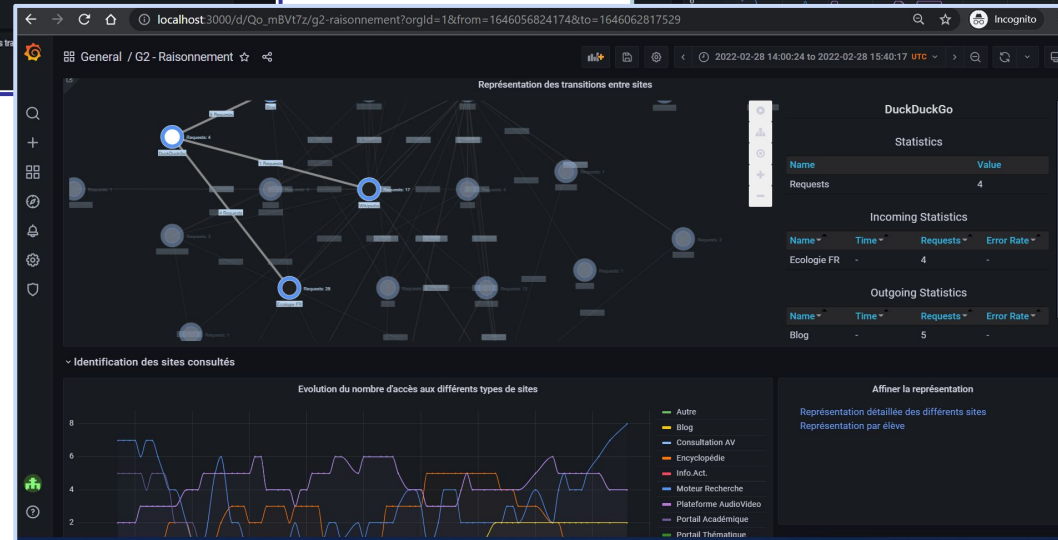
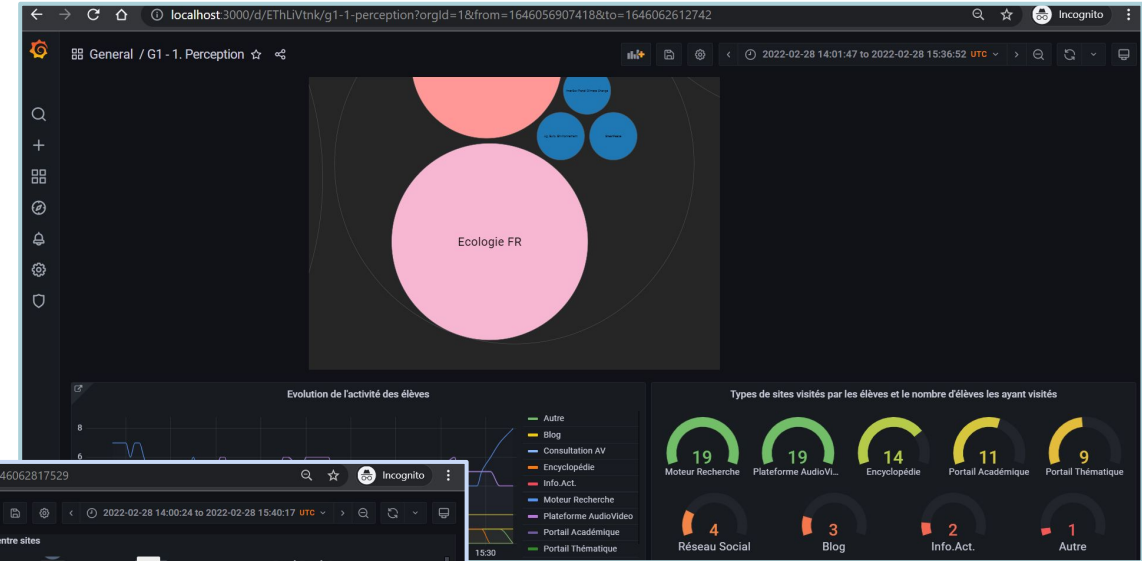
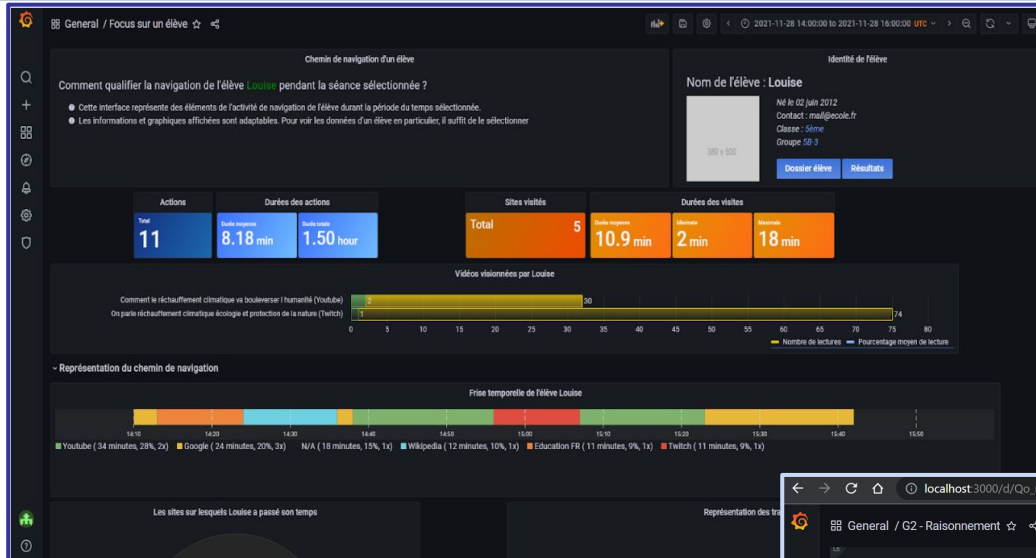
LADStudio: from sketches to prototypes



LADStudio: dashboard specification



LADStudio: generated Grafana LADs



Conclusion

Lessons learnt

- 1) Participatory approaches foster adoption by teachers of LA innovations
- 2) Ideation tools like PaDLAD are useful when they promote a precise description and decomposition of the intended goals
- 3) Sensemaking dimension is pivotal in the construction of relevant dashboards

Next

- PaDLAD is currently under test in university
 - ◆ ePaDLAD to be implemented next year
- LADStudio is in beta-stage. Ongoing development
 - ◆ First tests with teachers and instructional designers in mid-january

Thank you for your attention



Interested in using the PaDLAD toolkit for LAD codesign?

 <https://padlad.github.io/Participatory-Design-ToolkitV2>



or contact one of the co-authors