IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

Lab-STICC

Generating LADs that make sense

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Roadmap

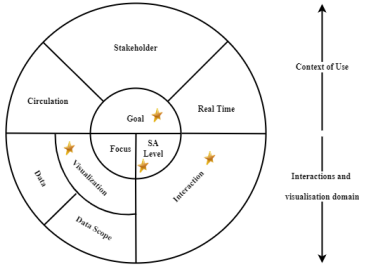
1. Context & Research questions
2. Theoretical framework
3. LADStudio
4. Evaluation study
5. Conclusion

Why Learning Analytics Dashboards (LADs) Design Matters

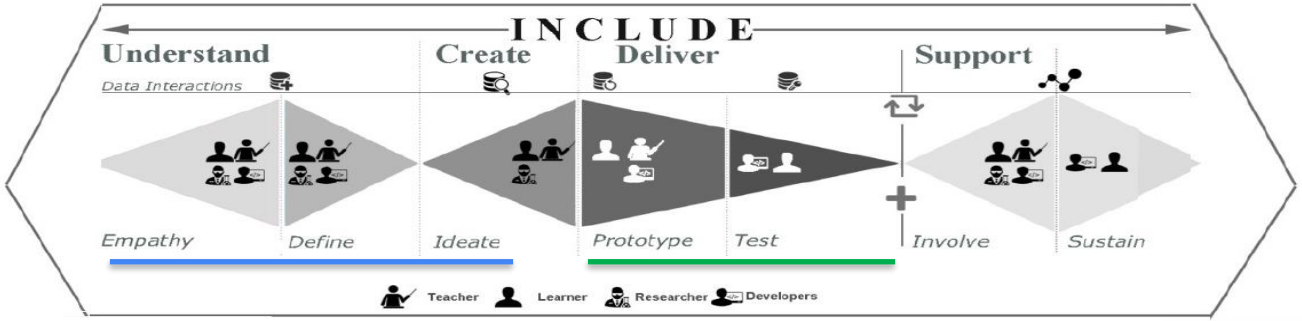
- LADs : visualize educational data resulting from LA process
- Well-designed LADs: effective to **awareness & decision-making**
  - sustain the learning process & improve its outcomes
- …but hard to design → Limited LAD adoption
  - little or no stakeholder involvement in the design process
    - inadequate addressing of their needs and expectations
    - insufficient support for their abilities e.g., visual literacy
  - poor understanding of the associated decision-making process: how the sensemaking with LADs occurs

Our aim : "A design methodology that addresses these factors for effective LADs"

Research project

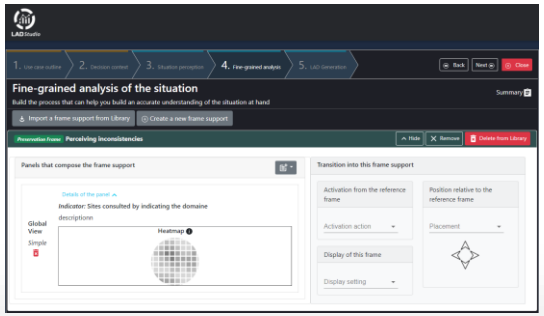


[Guiding Design](#)
Design Space
DEFLAD



(Prieto et al., 2018)

Ideation:
Codesign toolkit
PaDLAD



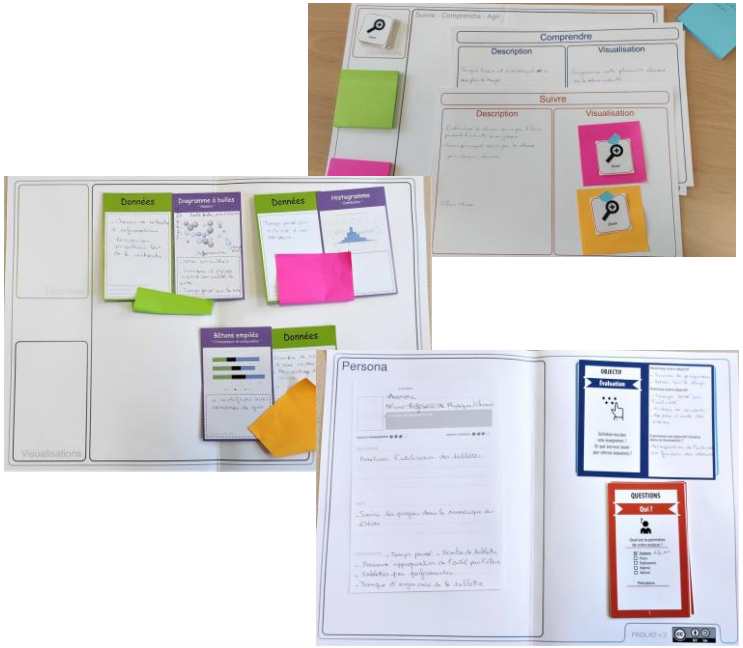
Prototyping:
Generating LADs that make sense

LADStudio

M. Sadallah. *Generating LADs that make sense*. CSEDU 2023

Current stage, in other words

From this:



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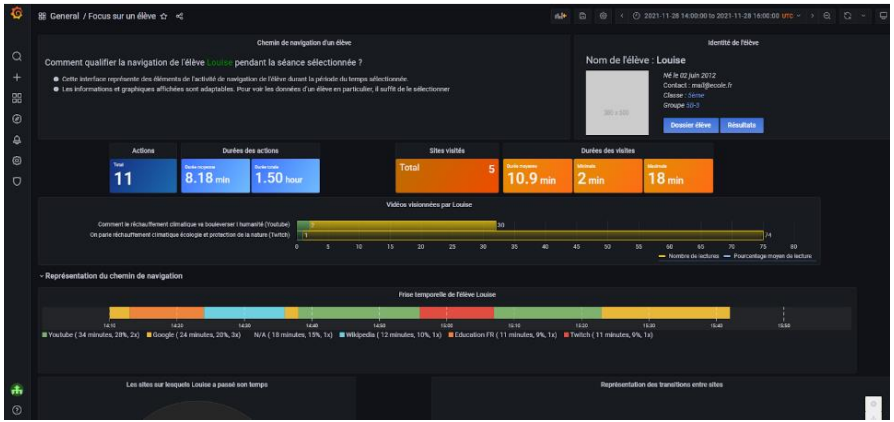


Research Questions

RQ1 How can the decision-making process be reflected on a LAD?

RQ2 How to support designers in translating design specifications into LADs, with explicit support for the decision-making process?

Making sense of LAD sensemaking

RQ1 How can the decision-making process be reflected on a LAD?

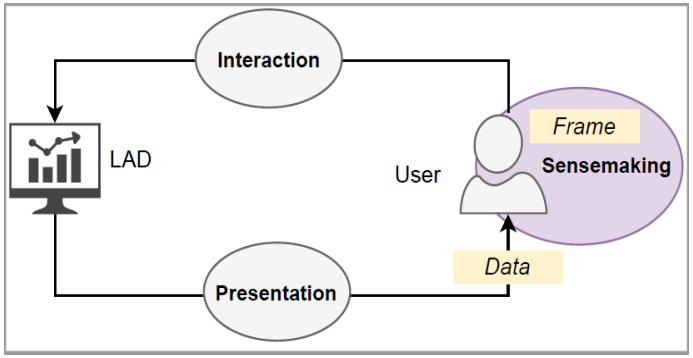
"Integrate the sensemaking dimension in LAD design"

- Sensemaking = process of creating meaning from complex data
- SM with LADs = process of interpreting data presented on the LAD and using it to inform and support decision-making

Making sense of LAD sensemaking

RQ1 How can the decision-making process be reflected on a LAD?

"Interaction-Sensemaking Loop"



Distributed cognition theory (Hutchins 1995)

- Sensemaking develops through perception and interaction

Data/Frame theory of SM (Klein 2006)

- LAD displays = Data
- Gained insight = frame

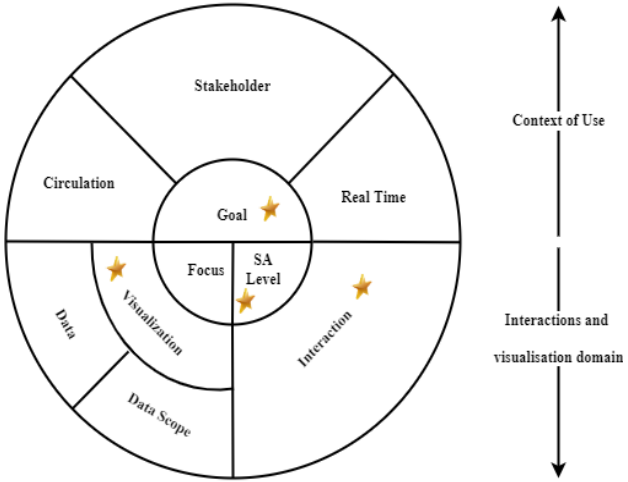
LAD design: adequate support needed for accurate frame construction (e.g., effective interaction and appropriate representations)

Making sense of LAD sensemaking

RQ1 How can the decision-making process be reflected on a LAD?

DEFLAD : LAD Design Framework, defining a refined design space

- Context of use
  - LAD goal, focus and targeted SA level
  - Stakeholders, timing and info circulation
- Interaction & visualization
  - Data & representation
  - Types of Interactions
- Explicit SM features at different levels *(★)*



Generative CoDesign Methodology

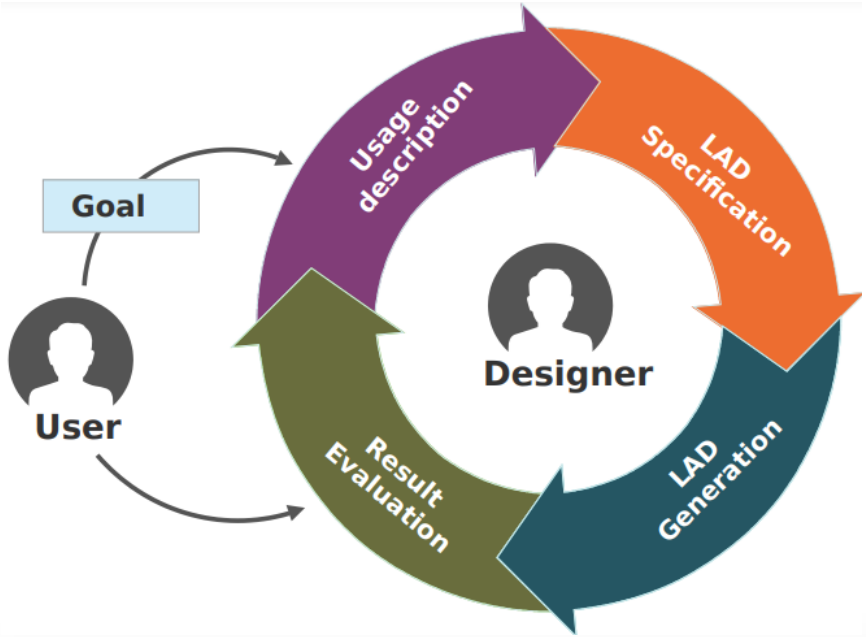
RQ2 Supporting designers in prototyping LADs with explicit SM processes?

A methodology to combine participatory design & generative design

- Participatory design
  - high levels of stakeholder involvement
  - stakeholders' needs, requirements and abilities
- Generative design
  - rapidly generate prototypes compliant with stakeholders' reqs and designer's specs
  - leveraging the computational power and efficiency

Generative CoDesign Methodology

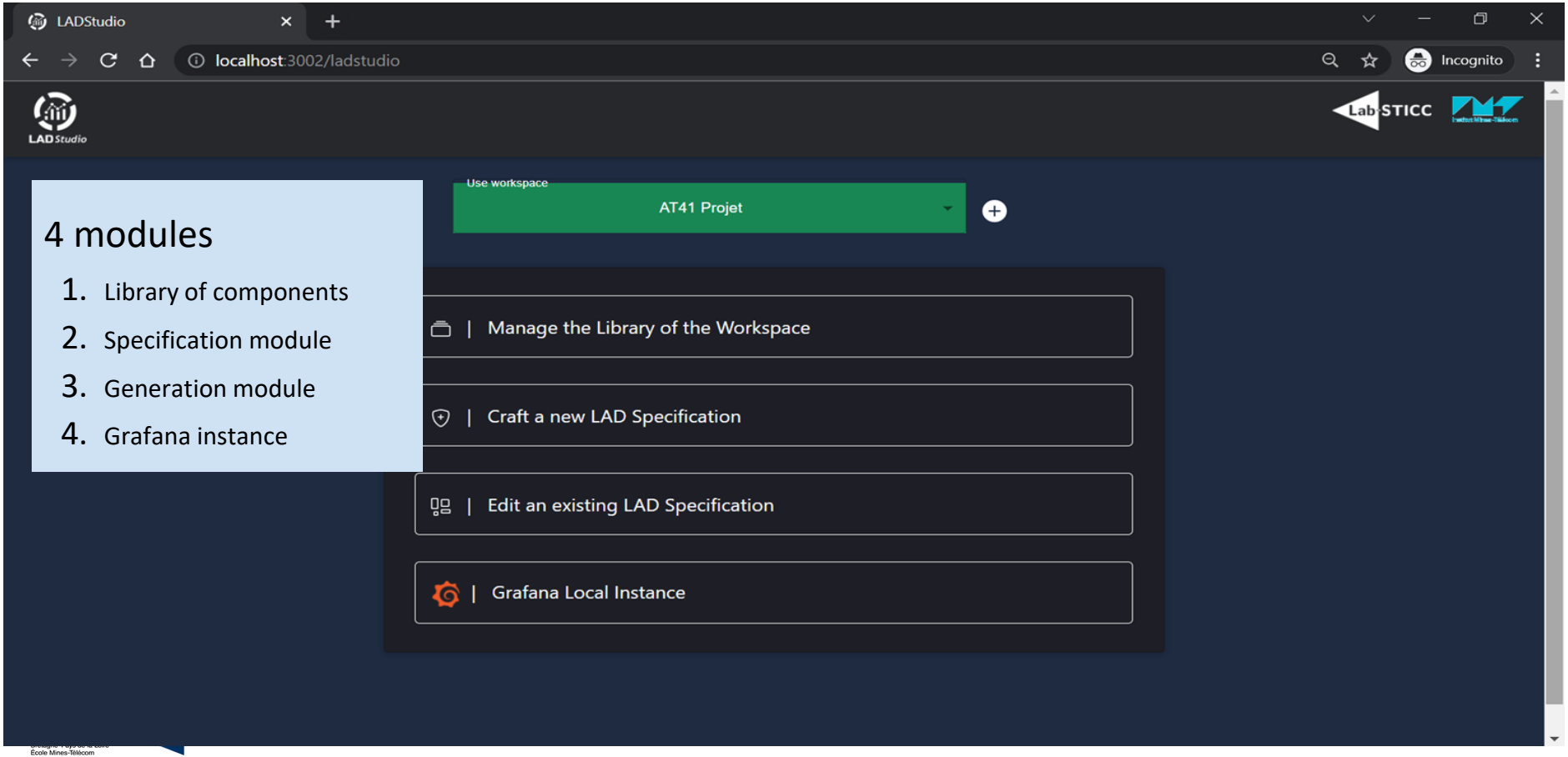
RQ2 Supporting designers in prototyping LADs with explicit SM processes?



Generative codesign methodology

- Clear and structured approach
- Encourage stakeholder involvement
- Comply with end-user needs
- Rapid prototyping

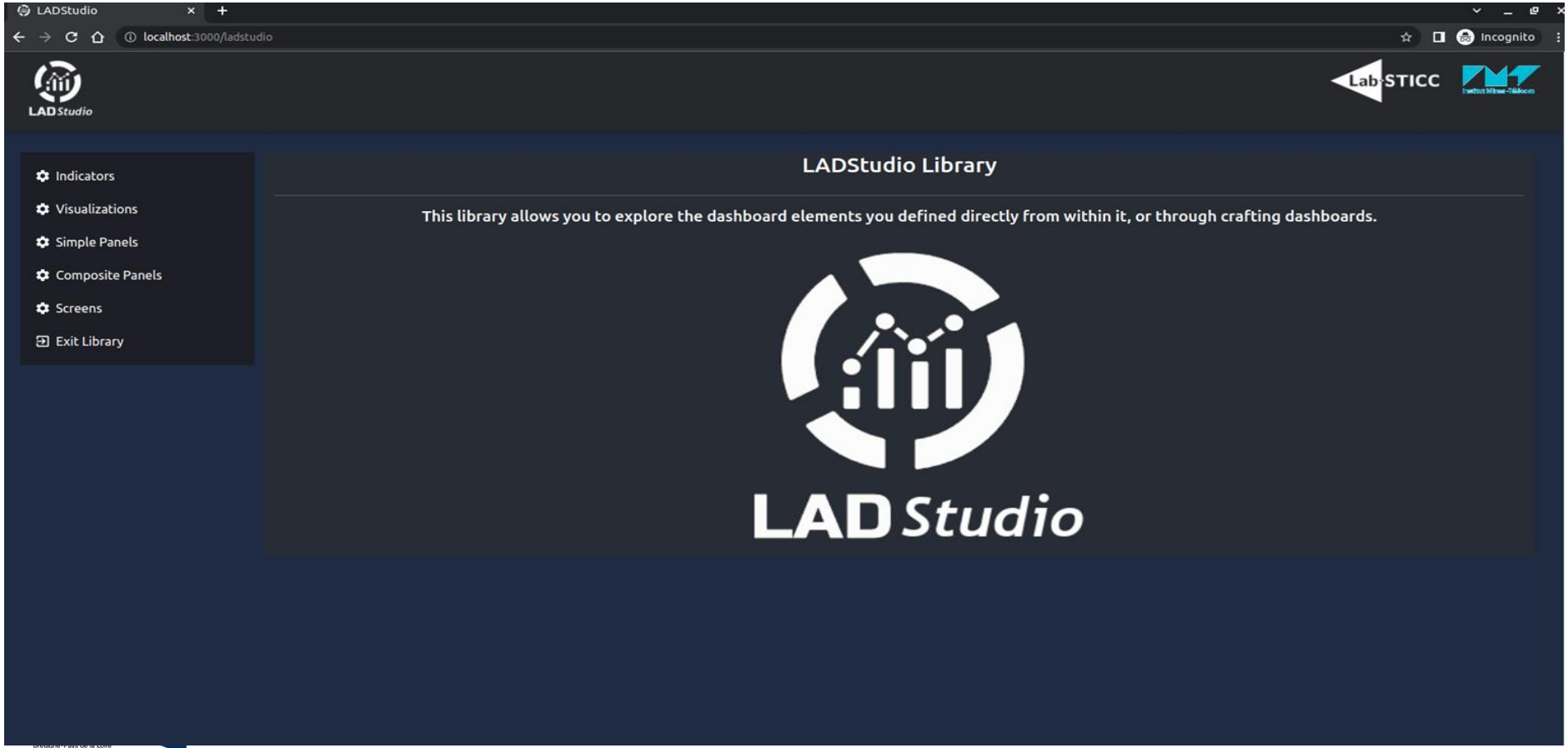
LADStudio, a tool for generating codesigned LADs



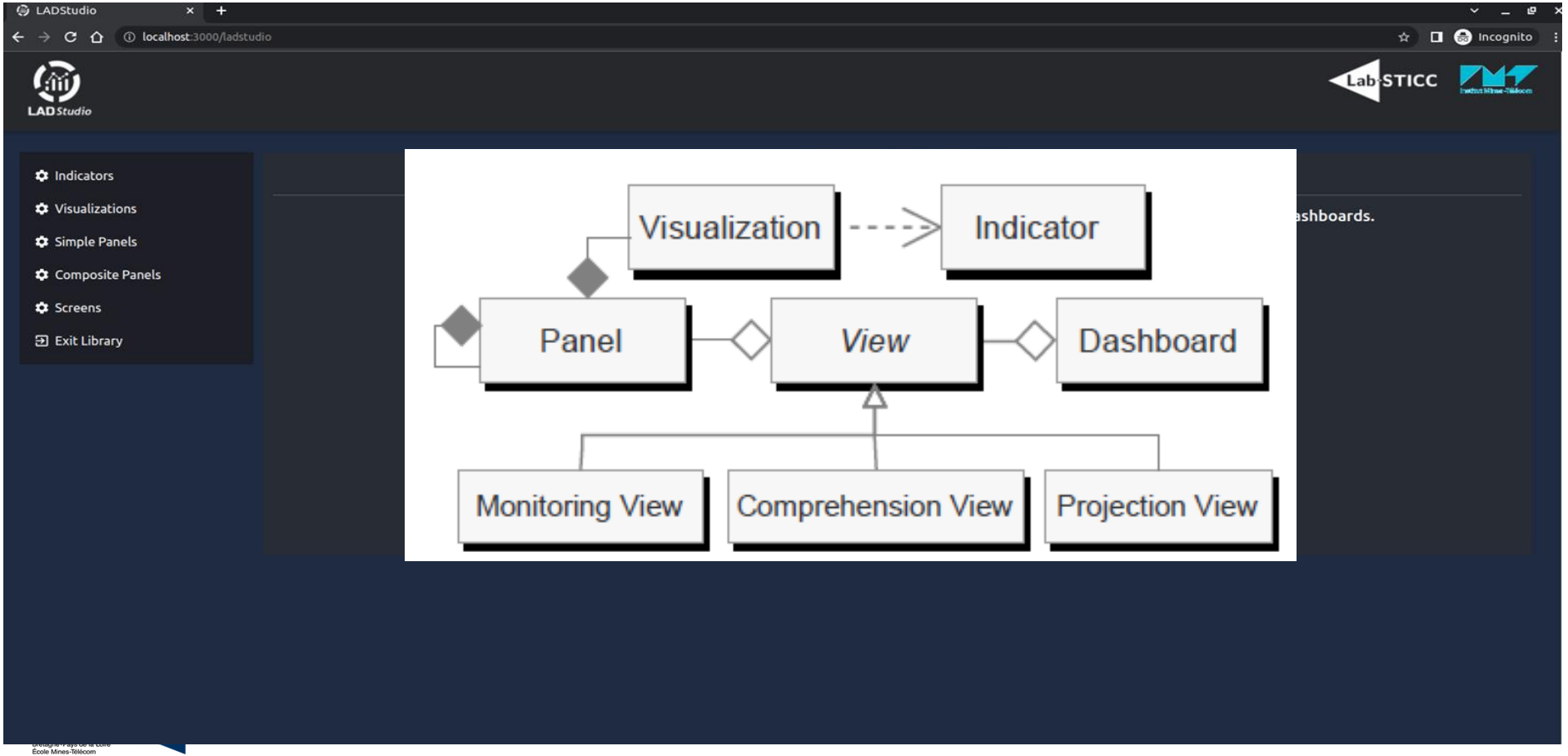
4 modules

1. Library of components
2. Specification module
3. Generation module
4. Grafana instance

LADStudio : library of components



LADStudio : library of components



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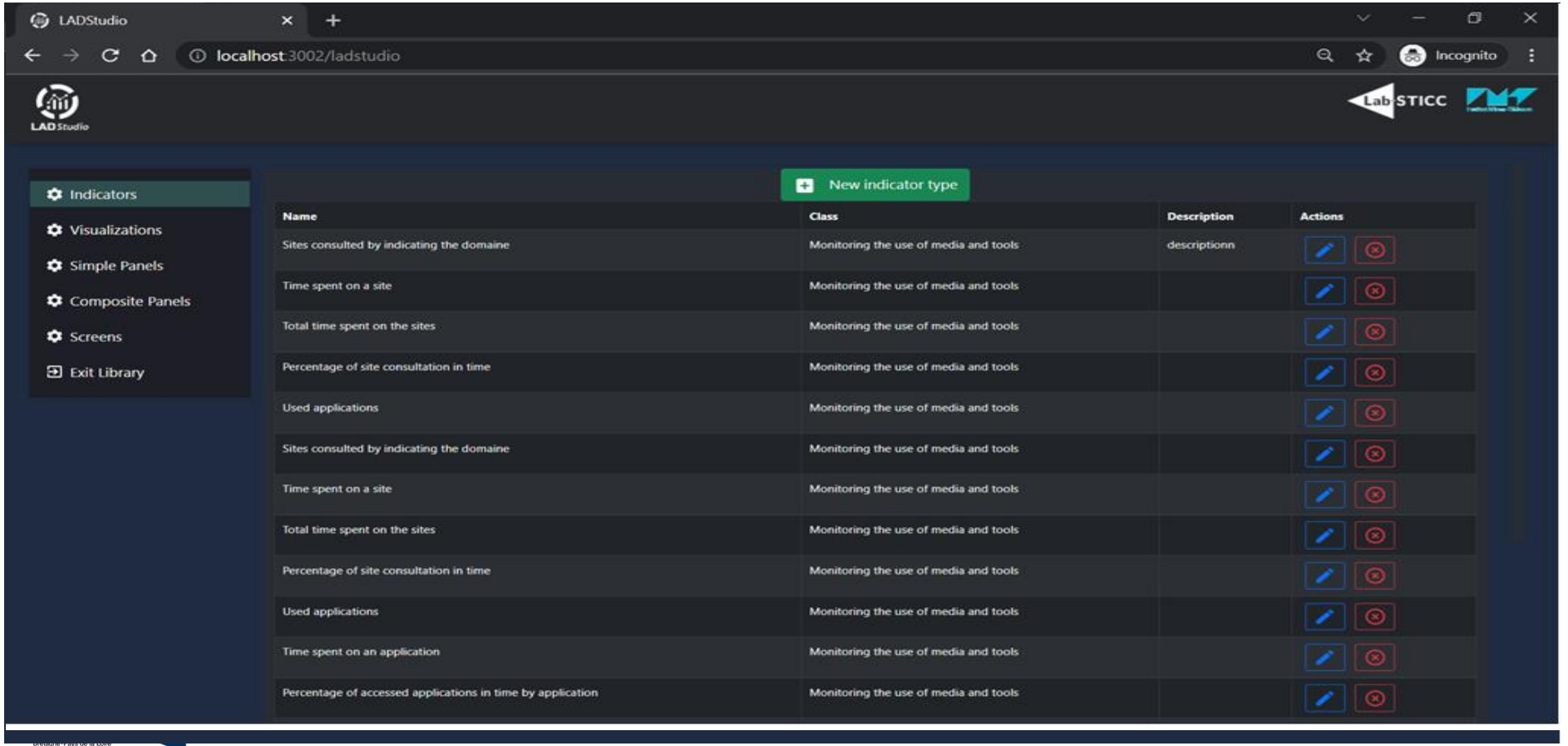

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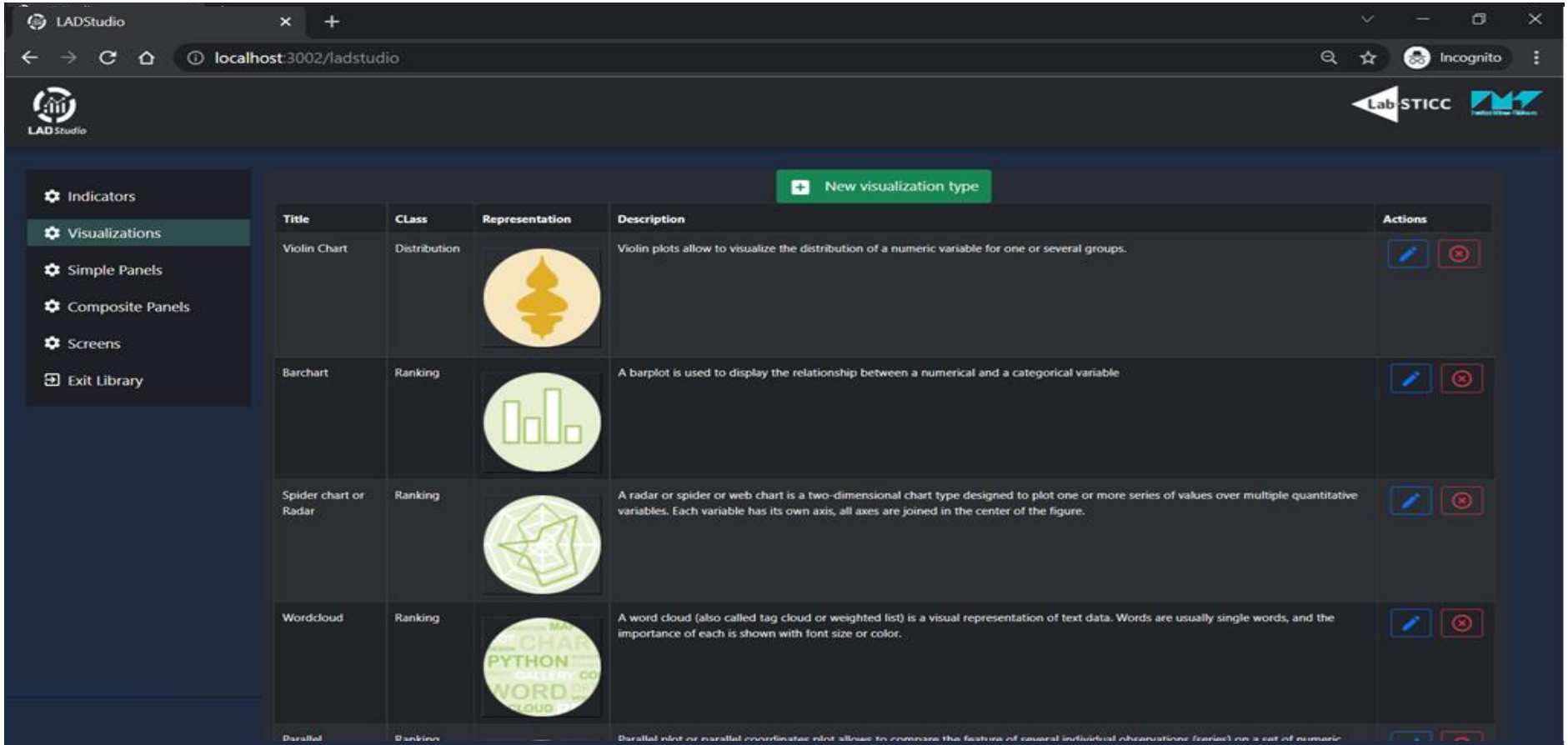

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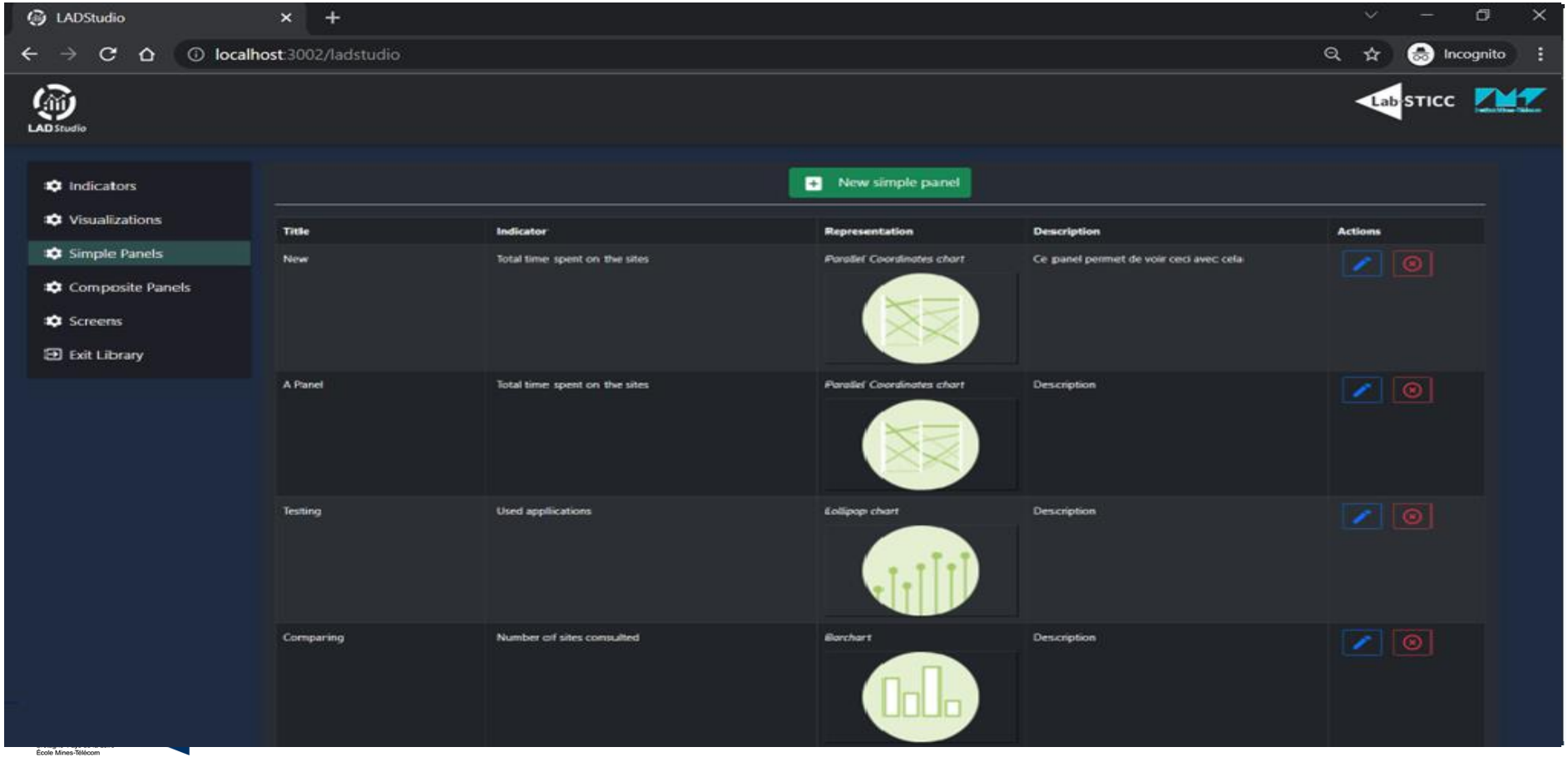
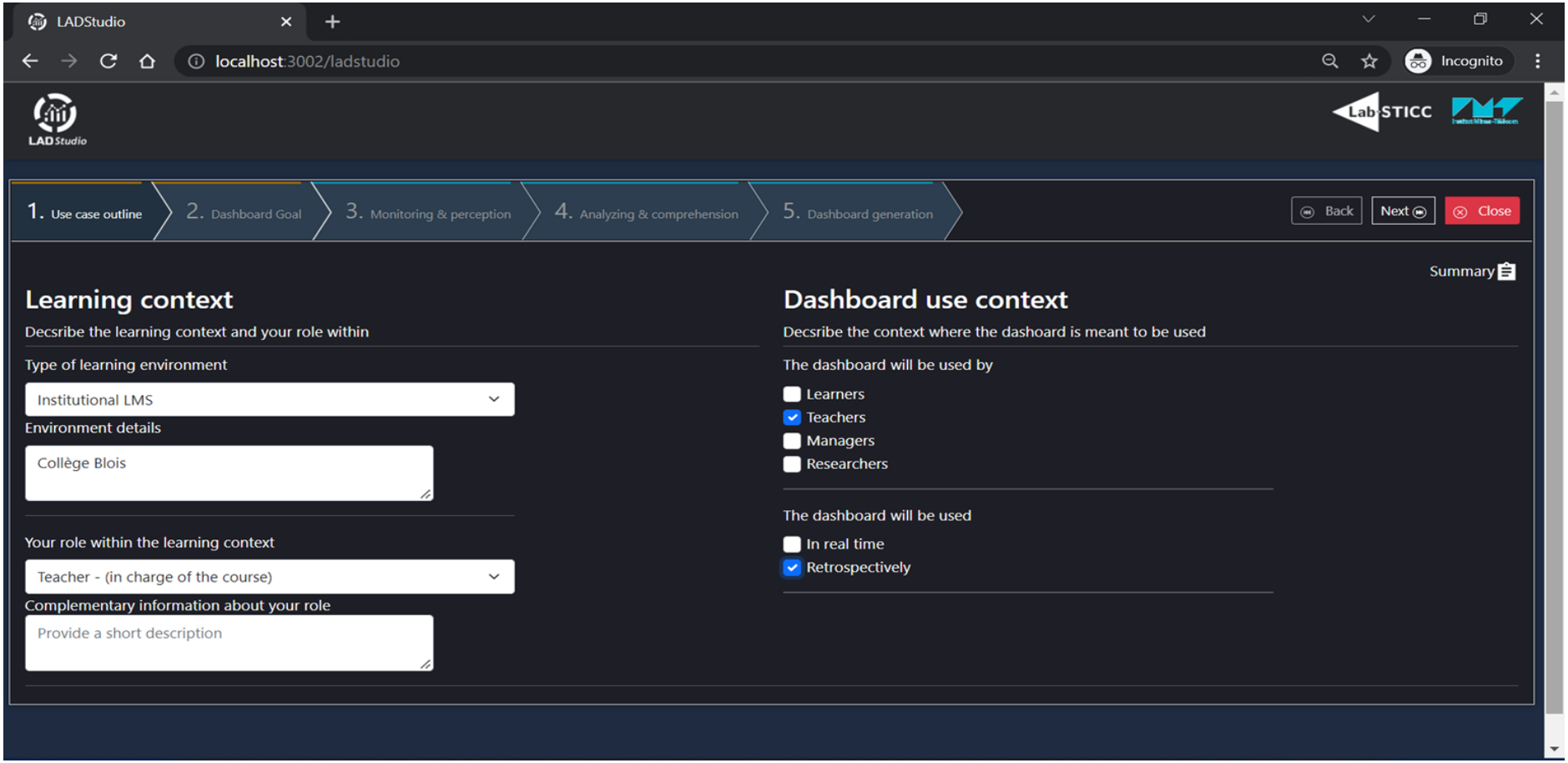


LADStudio : LAD specification & generation



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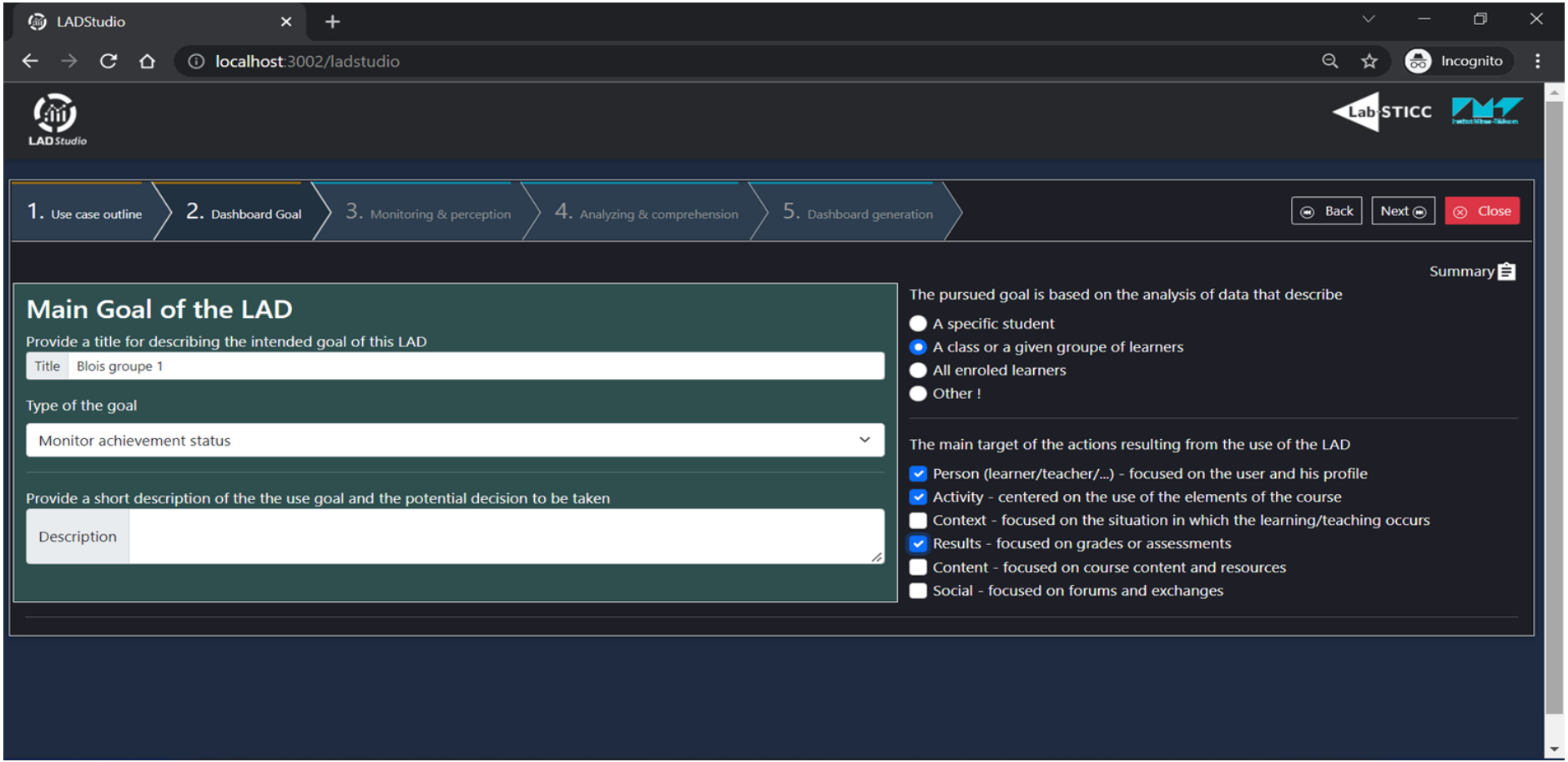

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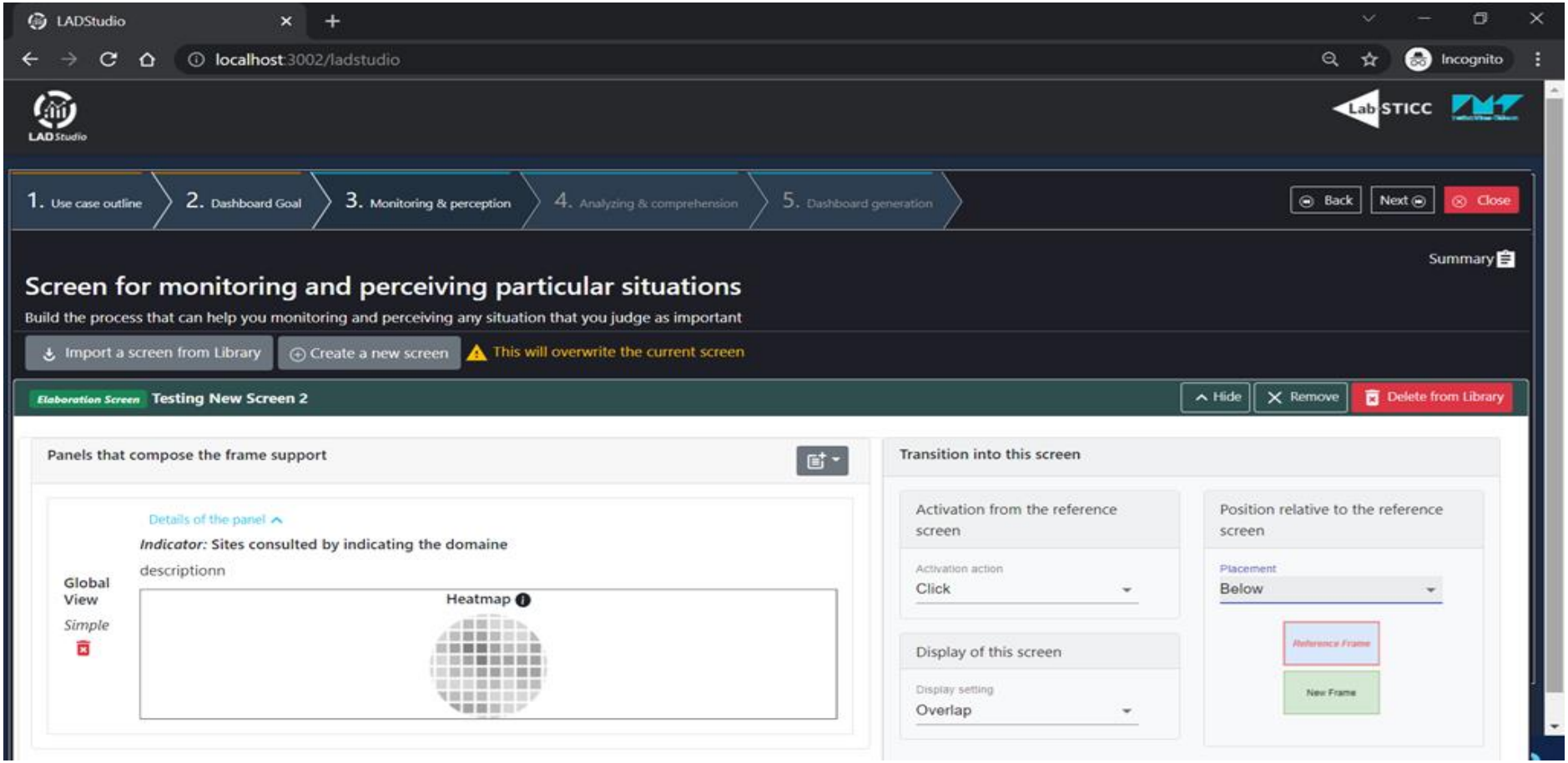
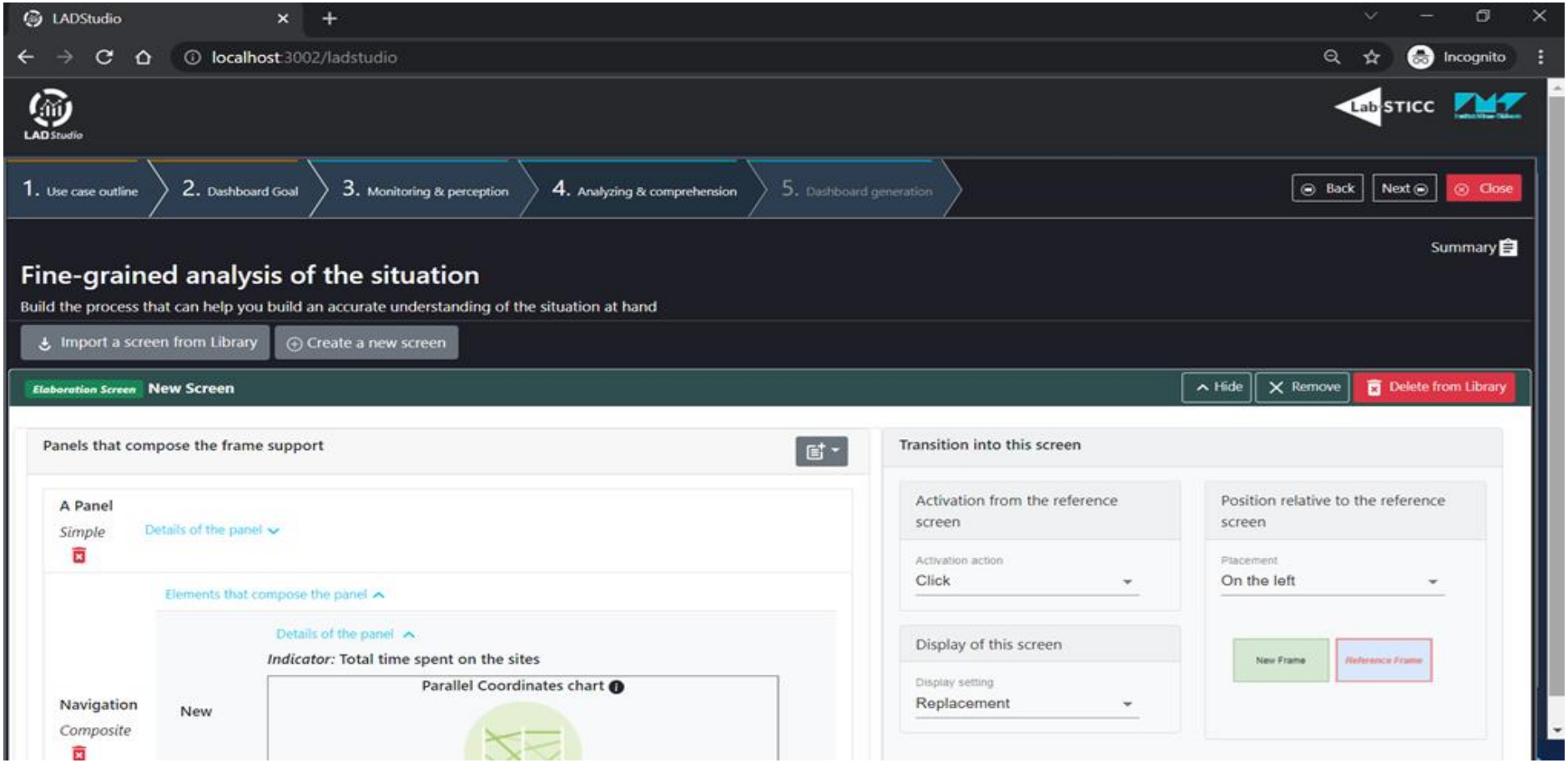


LADStudio : LAD specification & generation



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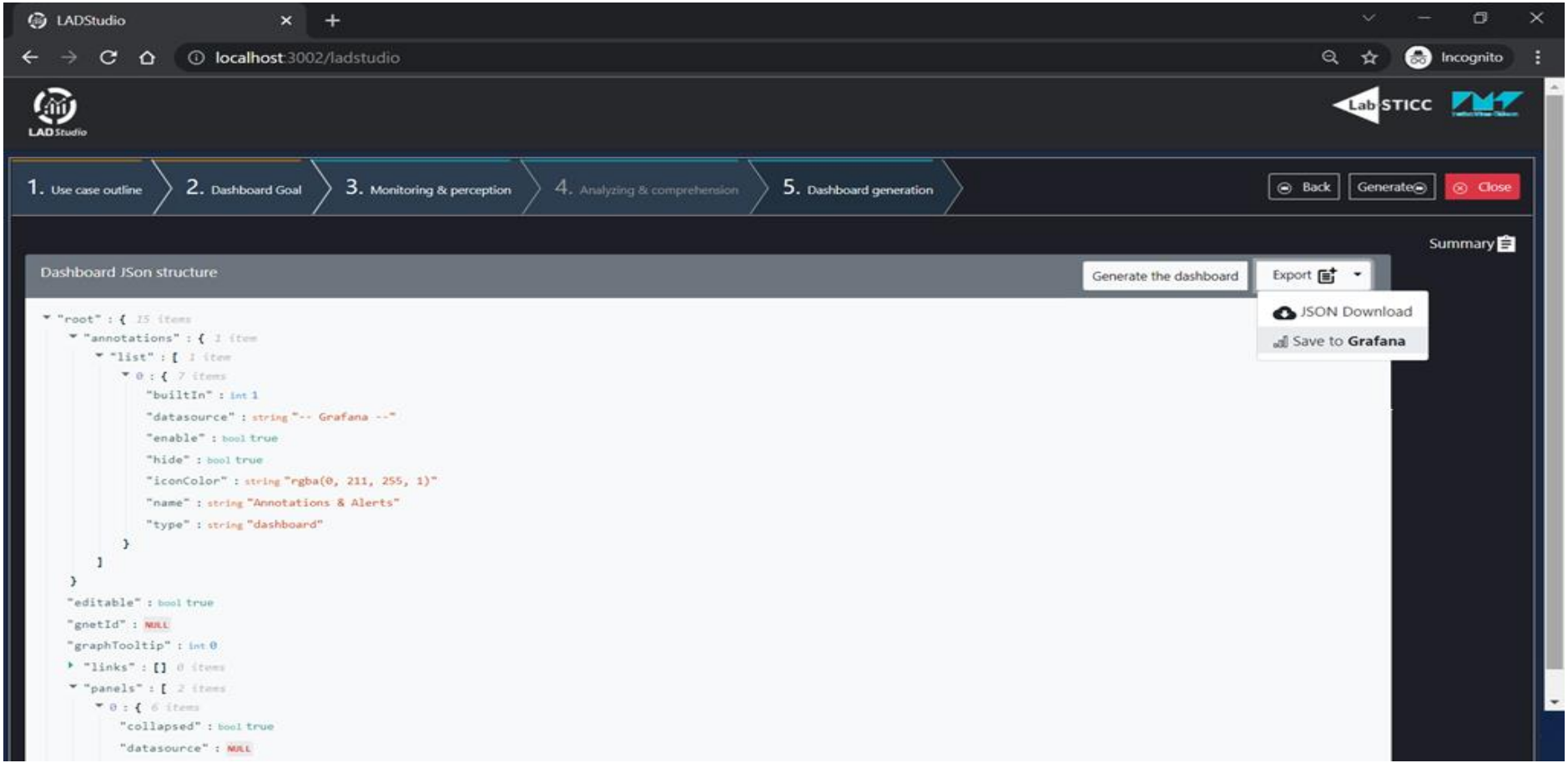

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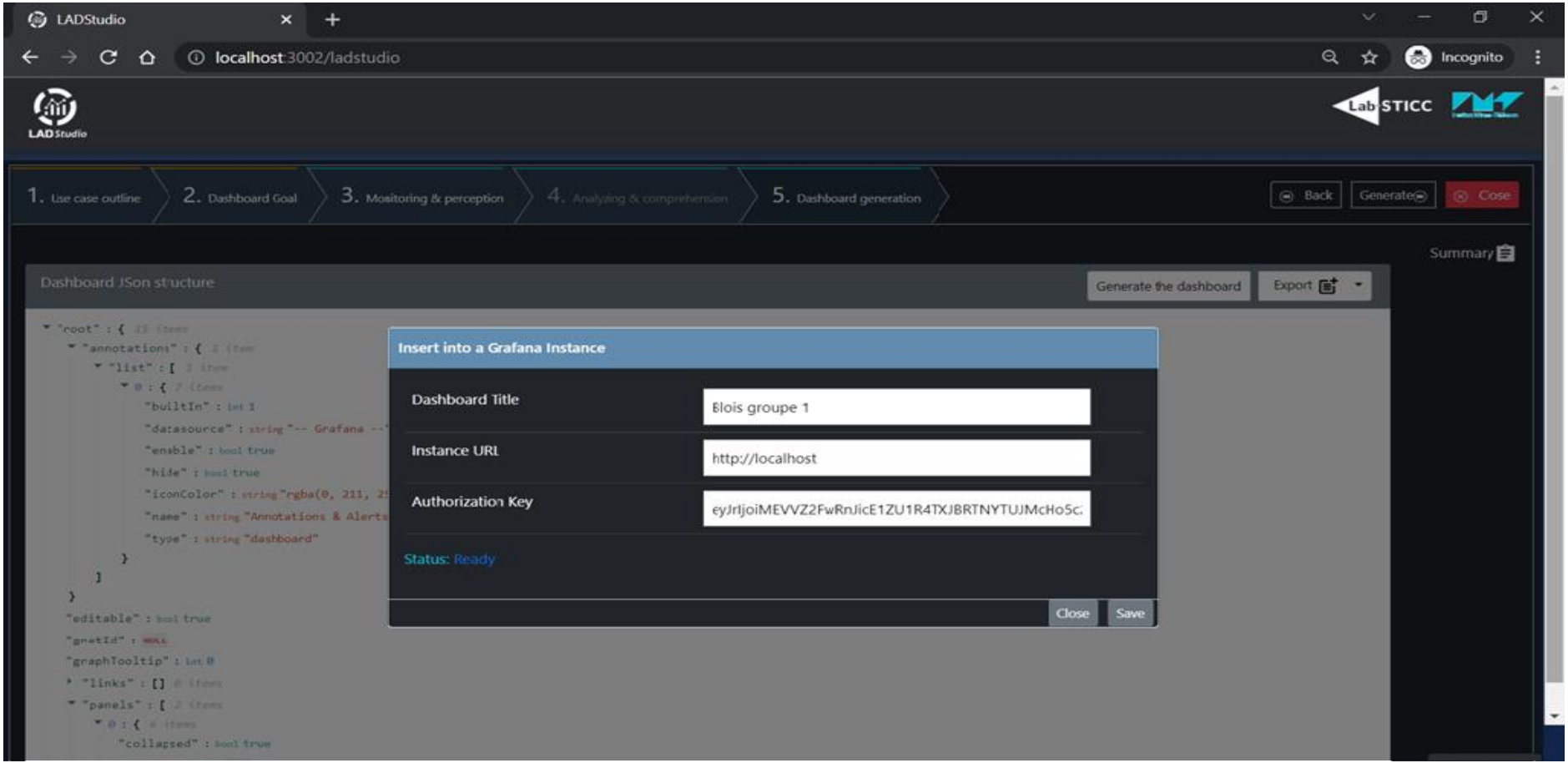

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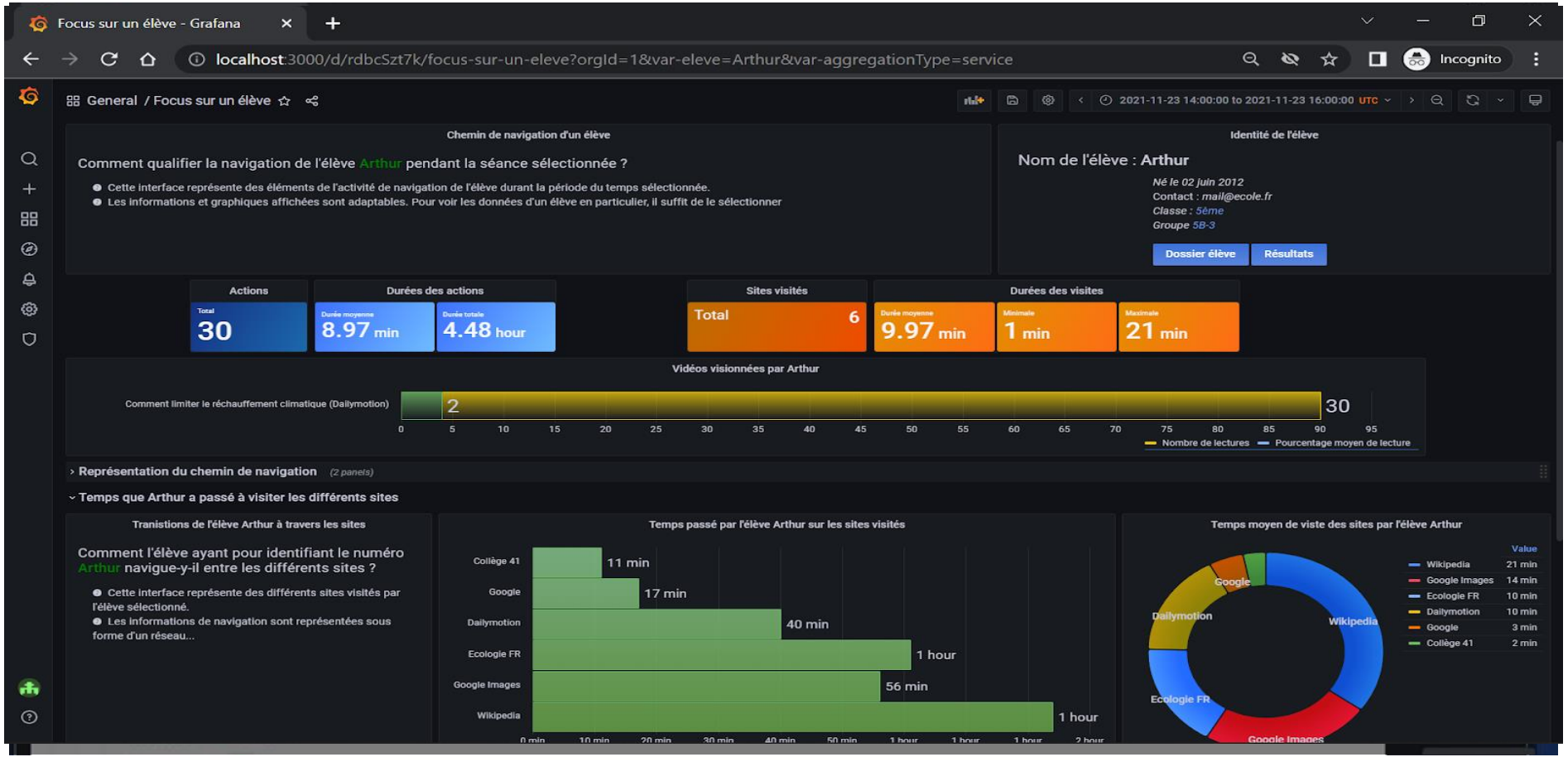


Qualitative evaluation study

- Evaluate usability and user experience of LADStudio
- 13 Participants: purposive sampling
  - Inclusion: experience with EdTools
  - Exclusion: unwillingness to participate
- Evaluation procedure
  - LADStudio demonstration
  - Independent experimentation
  - Collective codesign workshop
  - Questionnaire and open-ended questions
  - Duration: 2 hours

Variable	Category	n (%)
Gender	Male	8 (61.54)
	Female	5 (38.46)
Age	25–35	3 (23.08)
	36–45	7 (58.84)
	46–55	3 (23.08)
Staff	University Teacher	4 (30.77)
	Researcher	6 (46.15)
	Software developer	3 (23.08)

Evaluation study: instruments

- Usability evaluation
  - System Usability Scale (SUS) questionnaire
  - Reliable usability measure
- User Experience (UX) evaluation
  - User Experience Questionnaire (UEQ)
  - Valid tool for UX assessment
  - 26 items, 6 scales: *attractiveness, efficiency, perspicuity, dependability, stimulation, novelty*

Q1	I think I would like to be able to use LADStudio frequently
Q2	I found LADStudio unnecessarily complex
Q3	I thought LADStudio was easy to use
Q4	I think that I would need support to be able to use LADStudio
Q5	I found the various components of LADStudio were well integrated
Q6	I thought there was too much inconsistency in LADStudio
Q7	I would imagine that most people would learn to use LADStudio fairly quickly
Q8	I found LADStudio very cumbersome to use
Q9	I felt very confident using the LADStudio tool
Q10	I needed to learn a lot before I could use the LADStudio tool

Results: usability

SUS score: **71.15**
System usability rated as OK

Positive statements				Negative statements			
	A	N	D		A	N	D
Q1	9	2	2	Q2	0	1	12
Q3	10	2	1	Q4	7	3	3
Q5	11	1	1	Q6	0	0	13
Q7	2	4	7	Q8	1	0	12
Q9	10	3	0	Q10	3	6	4

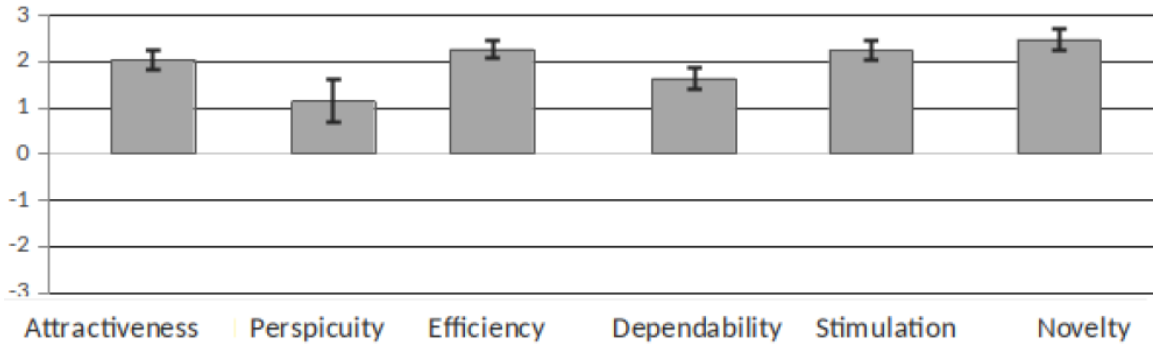
A: Agree or Strongly agree; N: Neither agree nor disagree; D: Disagree or Strongly disagree

- **Highest** scores
  - Q1: … able to use it frequently
  - Q3: … easy to use
  - Q5: …components well integrated
- **Lowest** scores
  - Q2: … unnecessarily complex
  - Q4: …need support
  - Q6: …too much inconsistency

Results: UX

UEQ score: **1.99**

Rating : **Good!**



- **Highest** score
  - novelty
  - efficiency
  - stimulation
- **Lowest** score
  - perspicuity

Results: Participants' Feedback

- Challenging at first but effective with practice
- Capable of creating useful and well-designed LADs
- Reasoning mirroring, support and guidance, at design

Improvement areas

- Challenging theoretical concepts
- Need design support ; lack of data/visual literacy

Discussion

- Usability & UX: satisfactory
- Encouraging feedback
- Some limitations
  - self-selection bias
  - small sample size restricts generalizability,
  - further investigation needed for LAD quality

Conclusion & outlook

- Efficient and involved LAD design methodology
  - participatory & generative
- LADStudio: functional prototypes from co-design specs
  - Success in innovative proposals and LAD adoption
- Next steps:
  - collect user and practitioner LAD proposals
  - address design adoption issues, and
  - share findings with the learning community.

Thank you for your attention!

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