

# Using Learning Analytics Dashboards to Explore Student Performance and Engagement Across Educational Levels

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# Biography



Nebrija University, Madrid, Spain

Scientific Researcher

Jan. 2017 – Jan. 2019



Linnaeus University, Växjö, Sweden

Doctoral candidate and researcher - PhD, Computer & Data Science

Aug. 2019 – Dec. 2024



Radboud University, Nijmegen, Gelderland, Netherlands

Visiting Scholar

Apr. 2022 – May. 2022



Autonomous University of Madrid, Madrid, Spain

Visiting Scholar

Oct. 2023 – Nov. 2023



University of Valladolid, Valladolid, Spain

Postdoctoral researcher – GENIELearn project

Mar. 2025 – Present

# Problem Definition & Motivation

*Learning Analytics (LA): “the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs”*

DOI: [10.1145/2330601.2330661](https://doi.org/10.1145/2330601.2330661)

*Learning Analytics Dashboards (LAD): “a single display that aggregates different indicators about learner(s), learning process(es), and/or learning context(s) into one or multiple visualizations”*

DOI: [10.1109/TLT.2016.2599522](https://doi.org/10.1109/TLT.2016.2599522)

## Challenges:

1. Variety of Visualization & Machine Learning(ML) Methods
2. Research Gaps in the Context of Study
3. Data Management
4. Requirements

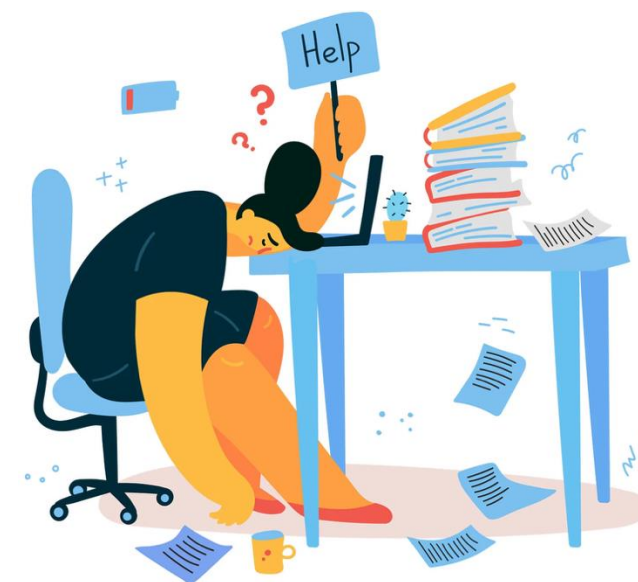


Photo by [Getty Images](#)

# Research Questions

**RQ1:** How can visualization techniques be optimized to enhance teachers' understanding and decision-making when analyzing educational data?

**RQ2:** What design principles should guide the development of interoperable Learning Analytics Dashboards across different educational platforms and levels?

# Methodological Approach

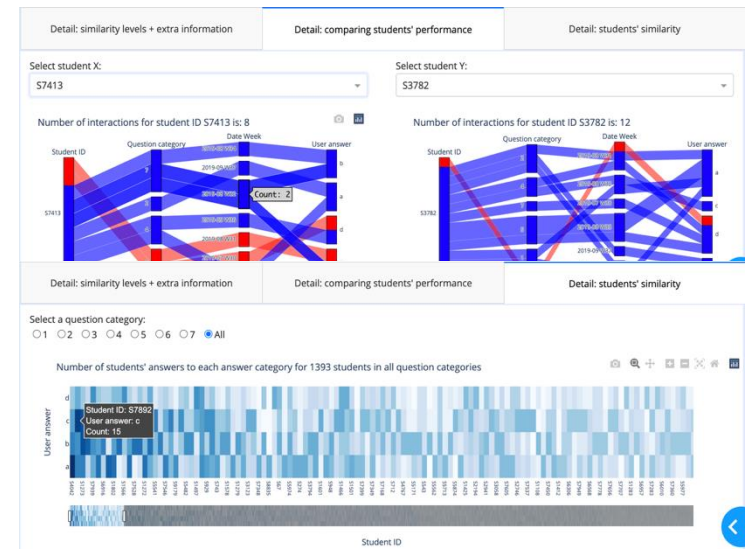
1. Exploring various visualization & ML techniques
2. *Scoping review ([Link](#))*
3. *Technical solution for data management ([Link](#))*
4. Human-Centered Design (HCD) approach for co-designing LADs
5. Scenario-based framework to ensure user transparency in development of Multiple Learning Analytics Dashboards (MLADs)

“Overview first, zoom and filter, then details on demand”

DOI: [10.1109/VL.1996.545307](https://doi.org/10.1109/VL.1996.545307)



Ref. [1]



Ref. [2]

# SBGTool V2.0

## SIMILARITY-BASED GROUPING TOOL (SBGTOOL)

Choose a class name:

Class #1

LEARN MORE

RESET

**C** Detail

| Student ID | Date Week   | Date       | Subject number | User answer | Correct answer | Result    | Ans. DUR |
|------------|-------------|------------|----------------|-------------|----------------|-----------|----------|
| S11        | 2019-09-W36 | 2019-09-10 | 4              | a           | a              | Correct   | 0.489    |
| S11        | 2019-10-W40 | 2019-10-12 | 2              | c           | c              | Correct   | 0.3      |
| S11        | 2019-08-W34 | 2019-08-31 | 2              | c           | c              | Correct   | 0.3      |
| S11        | 2019-10-W42 | 2019-10-22 | 2              | c           | c              | Correct   | 0.317    |
| S11        | 2019-10-W41 | 2019-10-18 | 5              | d           | d              | Correct   | 0.667    |
| S11        | 2019-11-W45 | 2019-11-13 | 5              | d           | a              | Incorrect | 0.55     |
| S11        | 2019-09-W35 | 2019-09-06 | 4              | b           | a              | Incorrect | 0.517    |
| S11        | 2019-09-W38 | 2019-09-24 | 5              | a           | a              | Correct   | 0.283    |
| S11        | 2019-09-W38 | 2019-09-23 | 5              | b           | d              | Incorrect | 0.383    |
| S11        | 2019-10-W40 | 2019-10-10 | 2              | c           | b              | Incorrect | 0.367    |
| S11        | 2019-09-W35 | 2019-09-11 | 6              | a           | a              | Correct   | 0.171    |
| S11        | 2019-09-W38 | 2019-09-23 | 5              | c           | a              | Incorrect | 1.033    |
| S11        | 2019-10-W39 | 2019-10-04 | 5              | d           | b              | Incorrect | 0.483    |

Result: 70.47% Correct, 29.53% Incorrect

Ease & difficulty of different subjects (%)

| Subject number | Ease (%) | Difficulty (%) |
|----------------|----------|----------------|
| 1              | 77.1%    | 22.9%          |
| 2              | 28.7%    | 71.3%          |
| 3              | 26.2%    | 73.8%          |
| 4              | 29.7%    | 70.3%          |
| 5              | 35.3%    | 64.6%          |
| 6              | 26.7%    | 73.3%          |
| 7              | 30.6%    | 69.3%          |

**A** Key Metrics

No. STU: 182, No. QNS: 1232, No. Ans A: 356, No. Ans B: 405, No. Ans C: 345, No. Ans D: 252, No. Correct: 957, No. Incorrect: 401

**B** Overview

Number of student's answers and correct answers in different weeks of using the digital learning tool

2019-07 W26: Total: 101, Correct: 60, Incorrect: 41

**C** Students' performance, Students' engagement, Comparison

Select a feature: Student ID, Date, Day, Hour, Subject

Students with different levels of performance

Performance (%) vs Student IDs

Level: Accurate, Very high, High, Low, Very low

Students' performance, Students' engagement, Comparison

Select a feature: Student ID, Date, Day, Hour, Subject

Number of correct/incorrect answers per date

Students' performance, Students' engagement, Comparison

Select student ID X: 5622, Select student ID Y: 5119

Number of interactions for student ID 5622 is: 29, Number of interactions for student ID 5119 is: 20

Students' performance, Students' engagement, Comparison

Select a subject number: 01, 02, 03, 04, 05, 06, 07, All

Number of answers in all subjects for 182 students

Ref. [3]

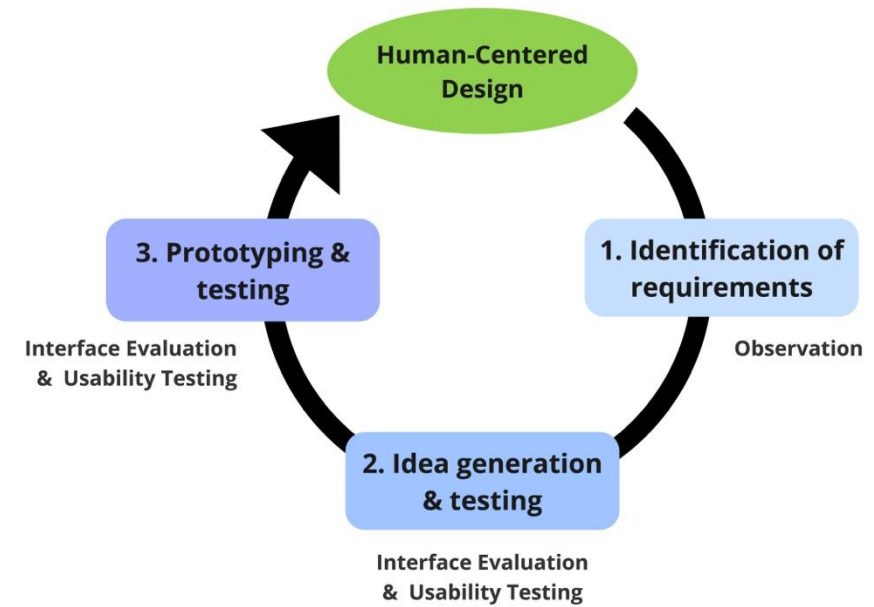


# Three-Step Human-Centered Design Approach

Human-centered design: “approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors and usability knowledge and techniques”

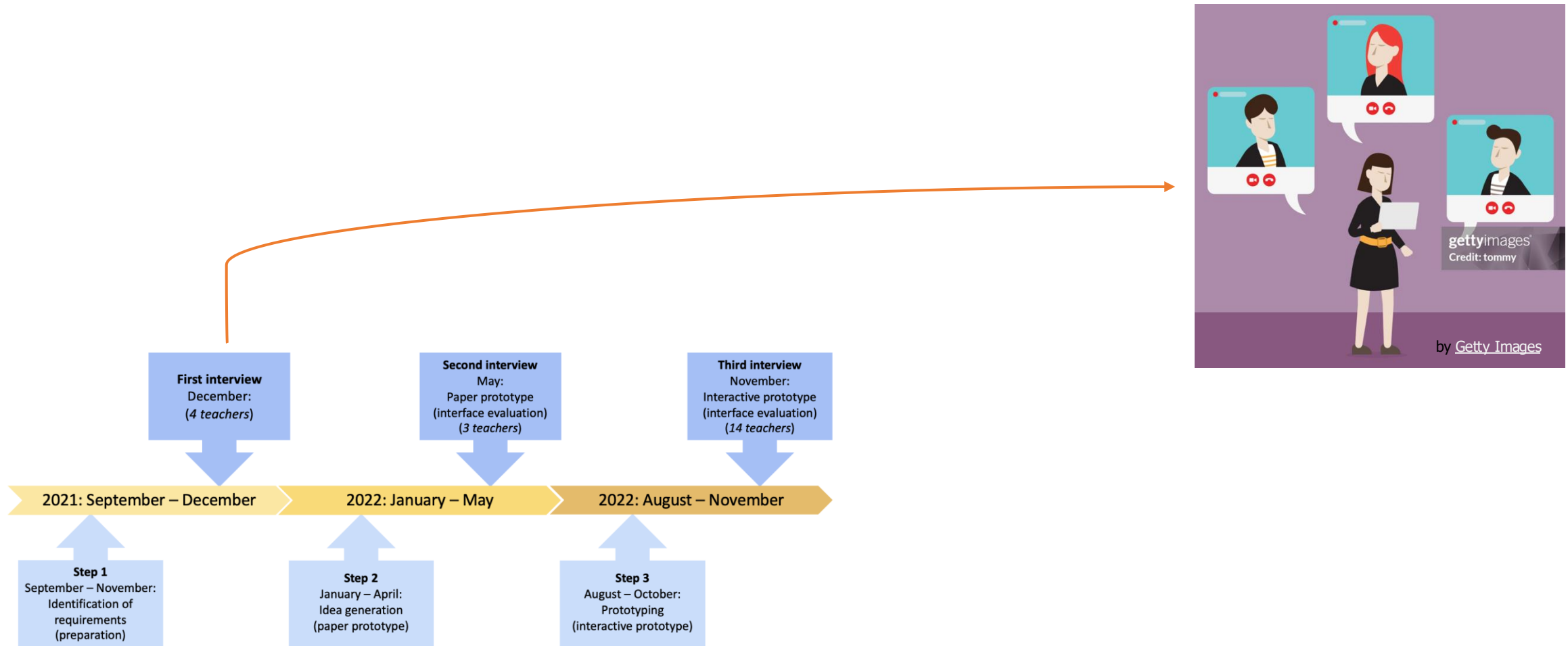
DOI: [10.2752/175630614X14056185480186](https://doi.org/10.2752/175630614X14056185480186)

## Methodology (a three-step HCD approach):

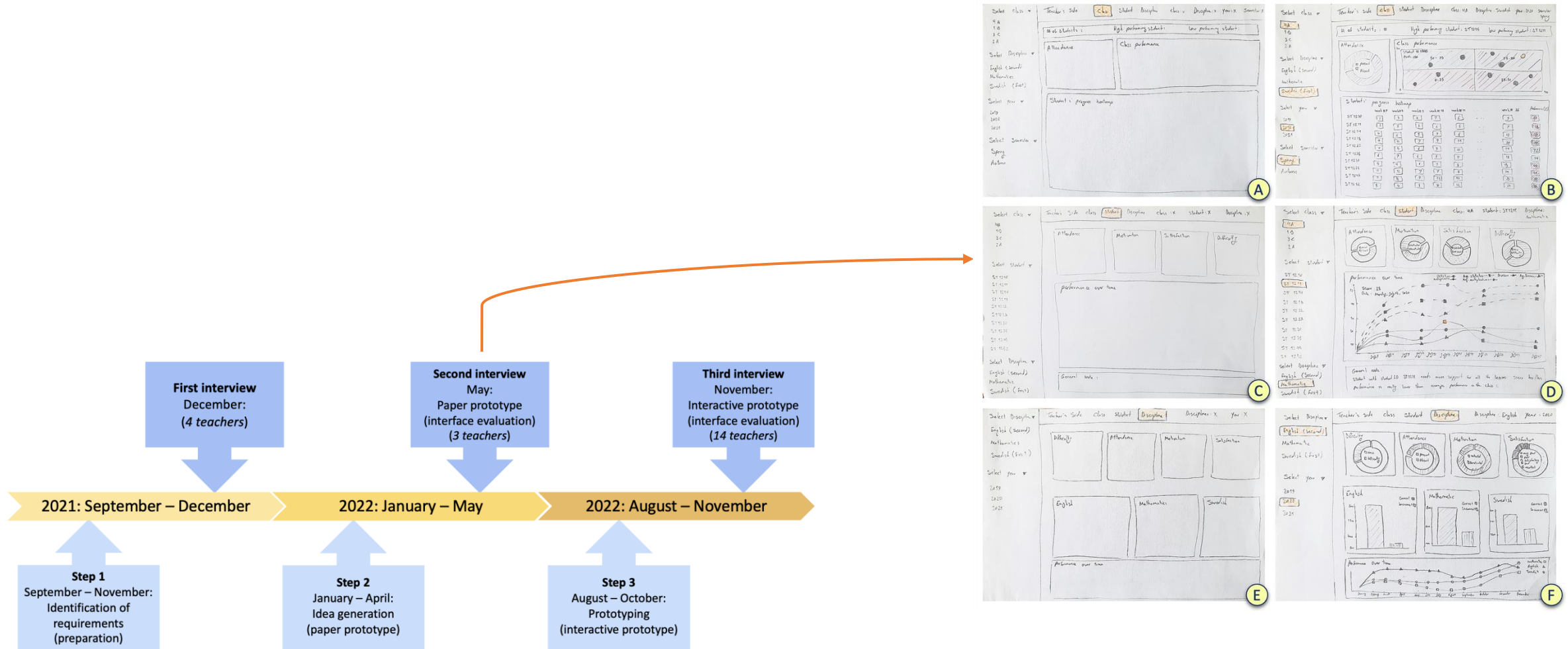


Ref. [4]

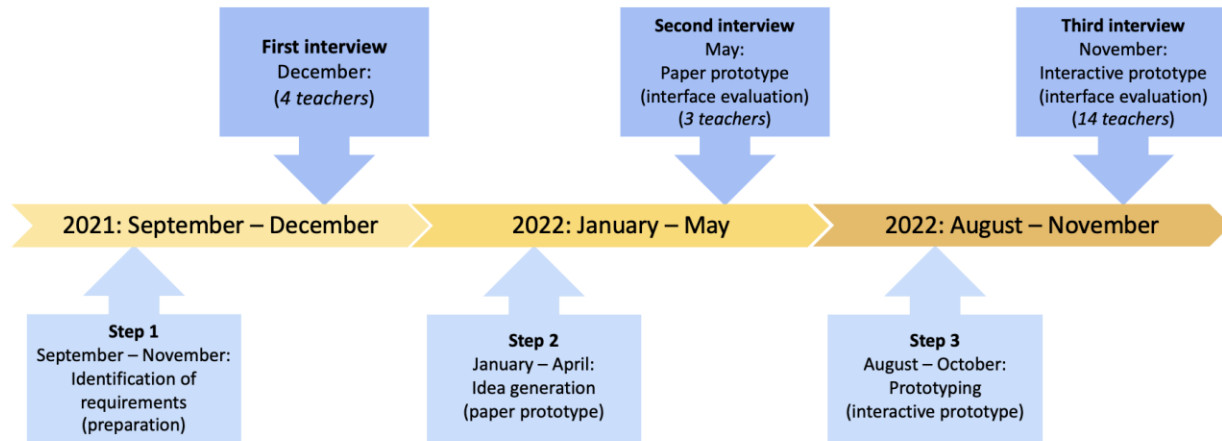
# Three-Step Human-Centered Design Approach: Step 1



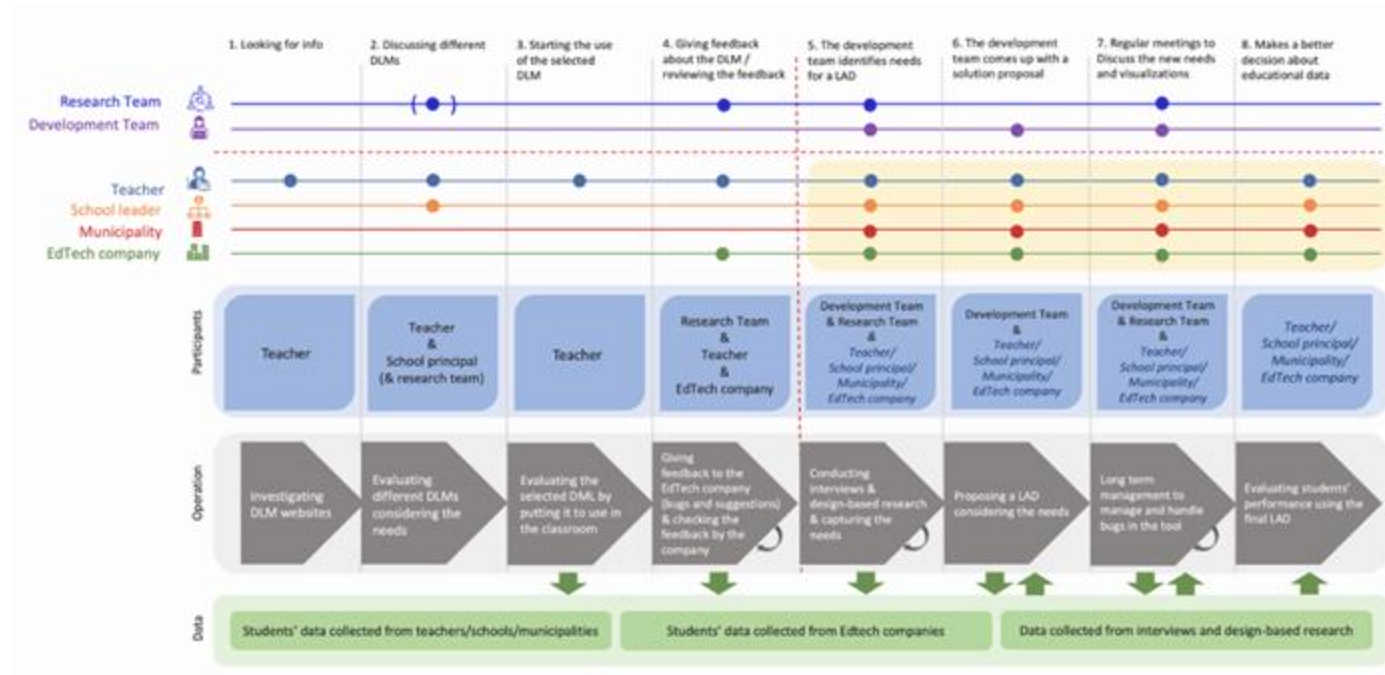
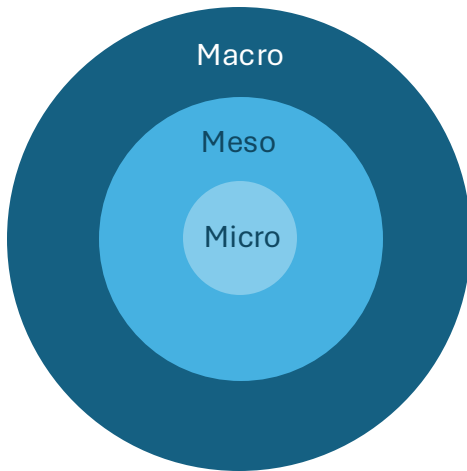
# Three-Step Human-Centered Design Approach: Step 2



# Three-Step Human-Centered Design Approach: Step 3



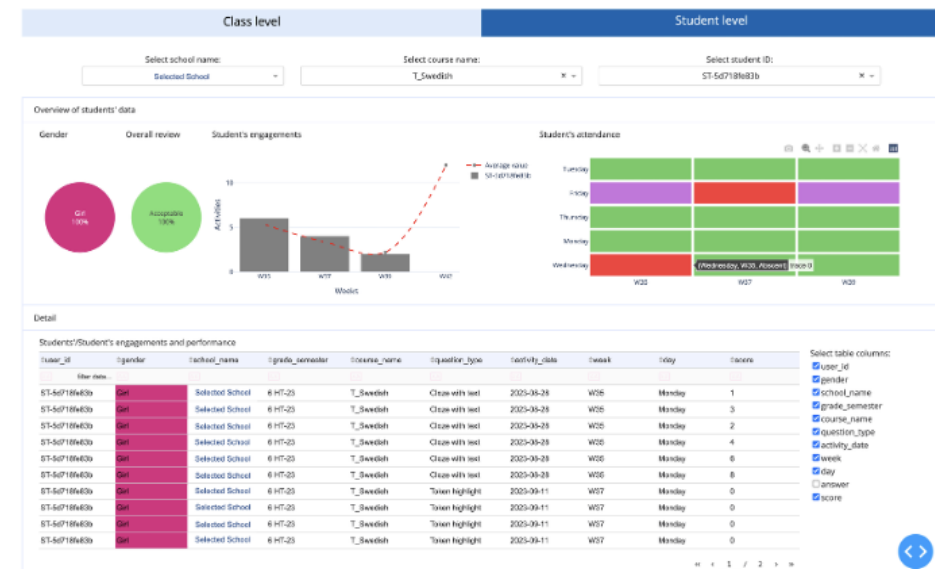
# Scenario-Based Framework (MLADs)



Ref. [5, 6]

# Scenario-Based Framework (MLADs)

## Teacher LAD (Micro Level):



Ref. [6]

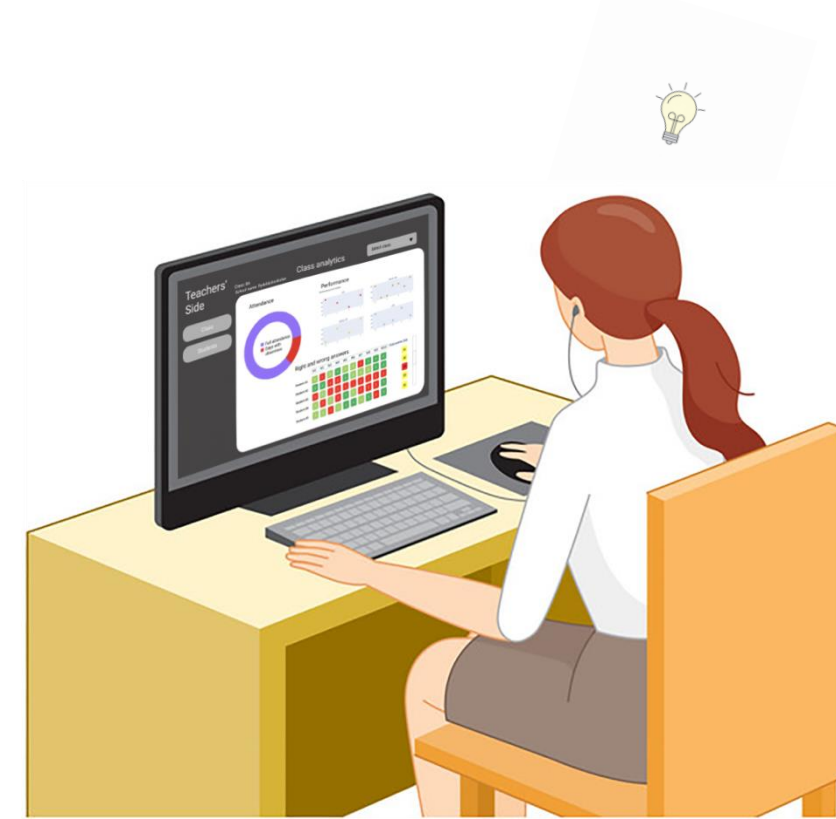
# Design-Based Research

Design-Based Research: “a systematic yet adaptable methodology designed to enhance educational practices through iterative analysis, design, development, and implementation. This involves collaboration between researchers and practitioners in real-world settings, ultimately leading to the formulation of contextually-sensitive design principles and theories”

DOI: [10.1007/BF02504682](https://doi.org/10.1007/BF02504682)

## A Design-Based Research approach:

1. Identification of requirements
2. Idea generation & testing
3. Intervention, evaluation & testing of the solution
4. Development & implementation



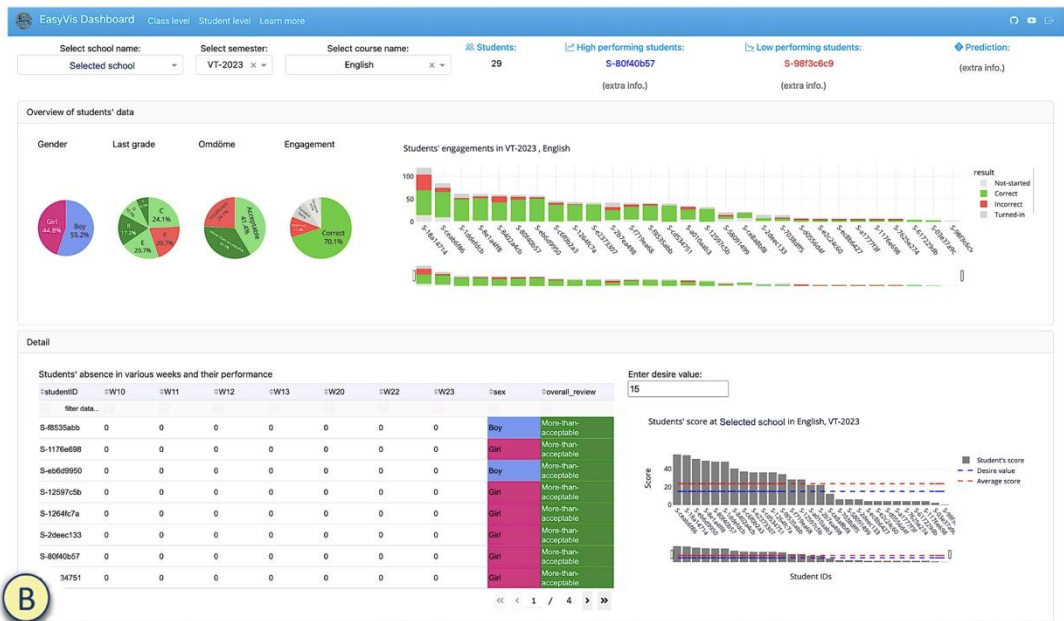


## Teacher LAD (Micro Level):

### EasyVis Dashboard

EasyVis is a web-based Visual Learning Analytics (VLA) tool for teachers that combines data from student activities, attendance, and grades to give a complete picture of student involvement, performance, and attendance. Using EasyVis allows teachers to monitor students' learning progress and activities, aiding them in making informed decisions.

A



B

Please log in to continue:

Enter your username

Enter your password

Login



C



# Limitations, Challenges and Contribution

## Limitations

- Teachers used purchased DLMs without clear understanding.
- Apprehension among IT and educational managers regarding data sharing.

## Challenges

- Teachers' feedback on the DLMs was not promptly attended by providers
- Obtaining student data took around three years due to GDPR regulations.
- Accessing data on a weekly basis was challenging.
- Conducting empirical studies progressed slowly due to busy schedules.

## Overall Contribution

Improves educational technology by enhancing data visualization that can be used for pedagogical decision-making to possibly aid academic results and engagement.

# What is Next?

A simple MLADs targeting various stakeholders...



# Publications

1. Mohseni, Z., Martins, R.M., Masiello, I. (2021). SAVis : a Learning Analytics Dashboard with Interactive Visualization and Machine Learning. *Nordic Learning Analytics (Summer) Institute 2021, Stockholm*.
2. Mohseni, Z., Martins, R.M., Masiello, I. (2021). SBGTool : Similarity-Based Grouping Tool for Students' Learning Outcomes. *Proceedings of the 2021 Swedish Workshop on Data Science (SweDS), IEEE*.
3. Mohseni, Z., Martins, R.M., Masiello, I. (2022). SBGTool v2.0: An Empirical Study on a Similarity-Based Grouping Tool for Students' Learning Outcomes. *Data*. 7 (7).
4. Mohseni, Z., Masiello, I., Martins, R.M. (2023). Co-Developing an Easy-to-Use Learning Analytics Dashboard for Teachers in Primary/Secondary Education : A Human-Centered Design Approach. *Education Sciences*. 13 (12).
5. Mohseni, Z., Masiello, I., Martins, R.M. (2023). Towards a Teacher-Oriented Framework of Visual Learning Analytics by Scenario-Based Development. *DCECTEL 2023 Doctoral Consortium of ECTEL, Aveiro, Portugal, 4-8 September 2023*. 12-17.
6. Mohseni, Z., and Masiello, I. (2025) Towards a Scenario-Based Framework for Developing Multiple Learning Analytics Dashboards. *Under review*.
7. Mohseni, Z., and Masiello, I. (2025) Co-designing, Developing, and Implementing Multiple Learning Analytics Dashboards for Data-Driven Decision-Making in Education: A Design-Based Research Approach. *Accepted*.

# Thank you for your attention!!!

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