



Co-funded by  
the European Union

# Teacher training workshop

Online, 27/28 November 2024

# ISILA project

Improving the quality and sustainability of  
learning using early intervention methods  
based on learning analytics



SOFIA UNIVERSITY  
ST. KLIMENT OHRIDSKI



UNIVERSITETET I BERGEN



UNIVERSITY OF  
EASTERN FINLAND



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# Workshop objective

To familiarise you with the process of going  
from data,  
through learning analytics,  
to interventions

# Agenda

Duration	Time	Item
10'		Introduction and agenda
30'		Introduction to learning analytics
20'		Learning analytics tools in ISILA
10'		BREAK
30'		Worked example: <i>From data to interventions</i>
30'		Group work: <i>Designing interventions based on student data</i>
20'		Discussing results of exercise
10'		Q&A and closing

# Facilitators

**Ángel Hernández-García**  
Universidad Politécnica de  
Madrid

**Sonsoles Lopez Pernas**  
University of Eastern Finland

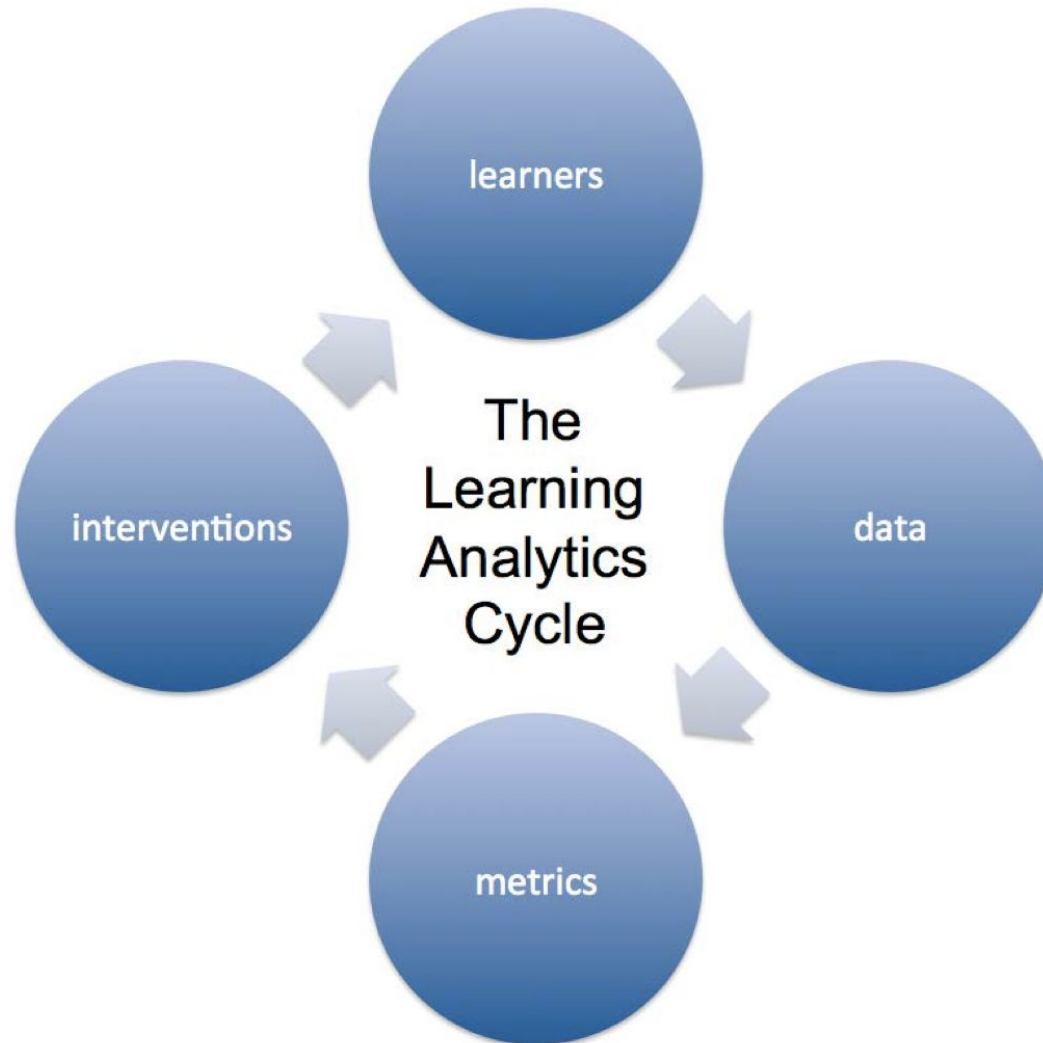
**Miguel Ángel Conde González**  
University of Leon

**Jelena Jovanovic**  
University of Bergen

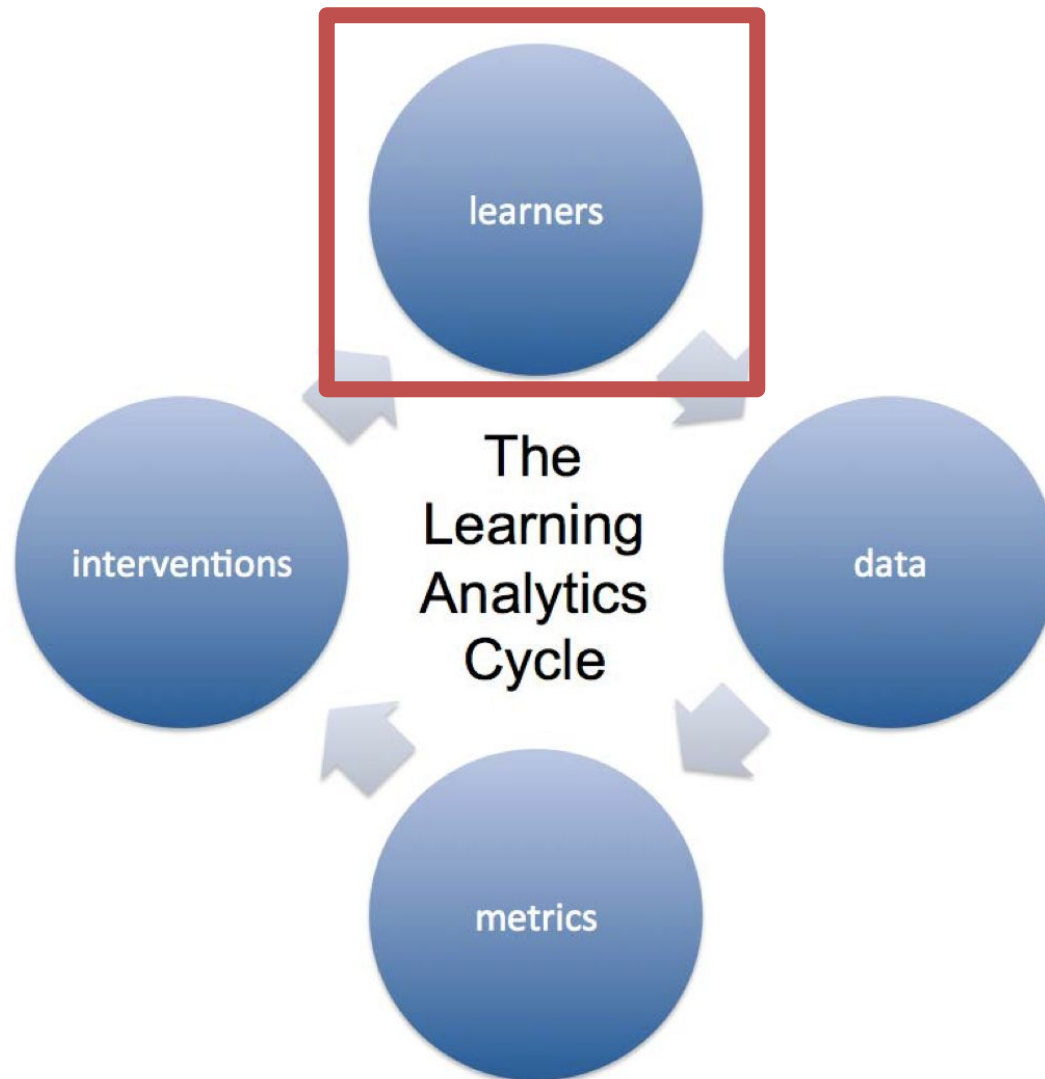
# A quick intro to learning analytics

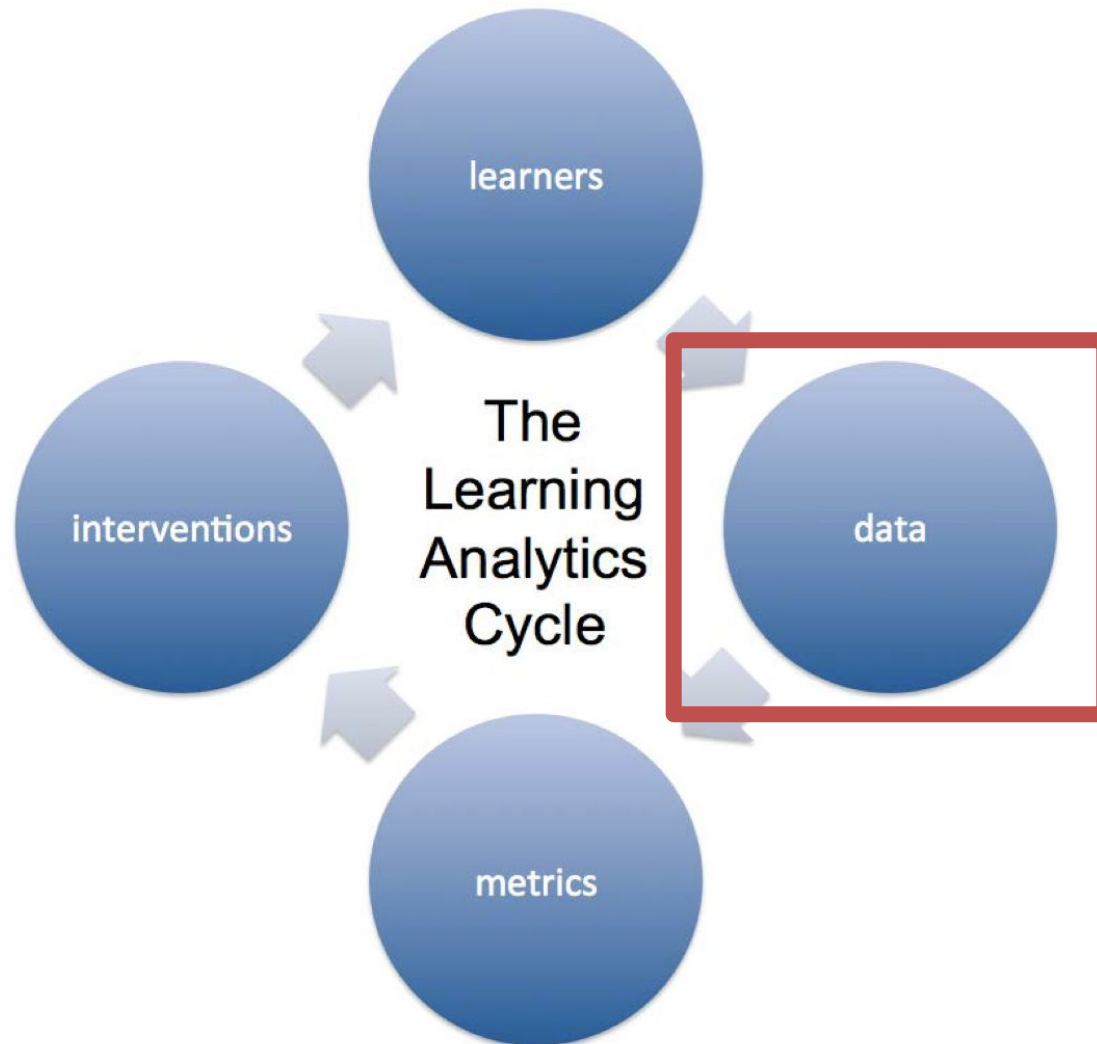
# Learning analytics

a field concerned with  
**collecting and analyzing learning-related data**  
to understand and support teaching and learning









# Main types of data

Digital traces of student learning behavior

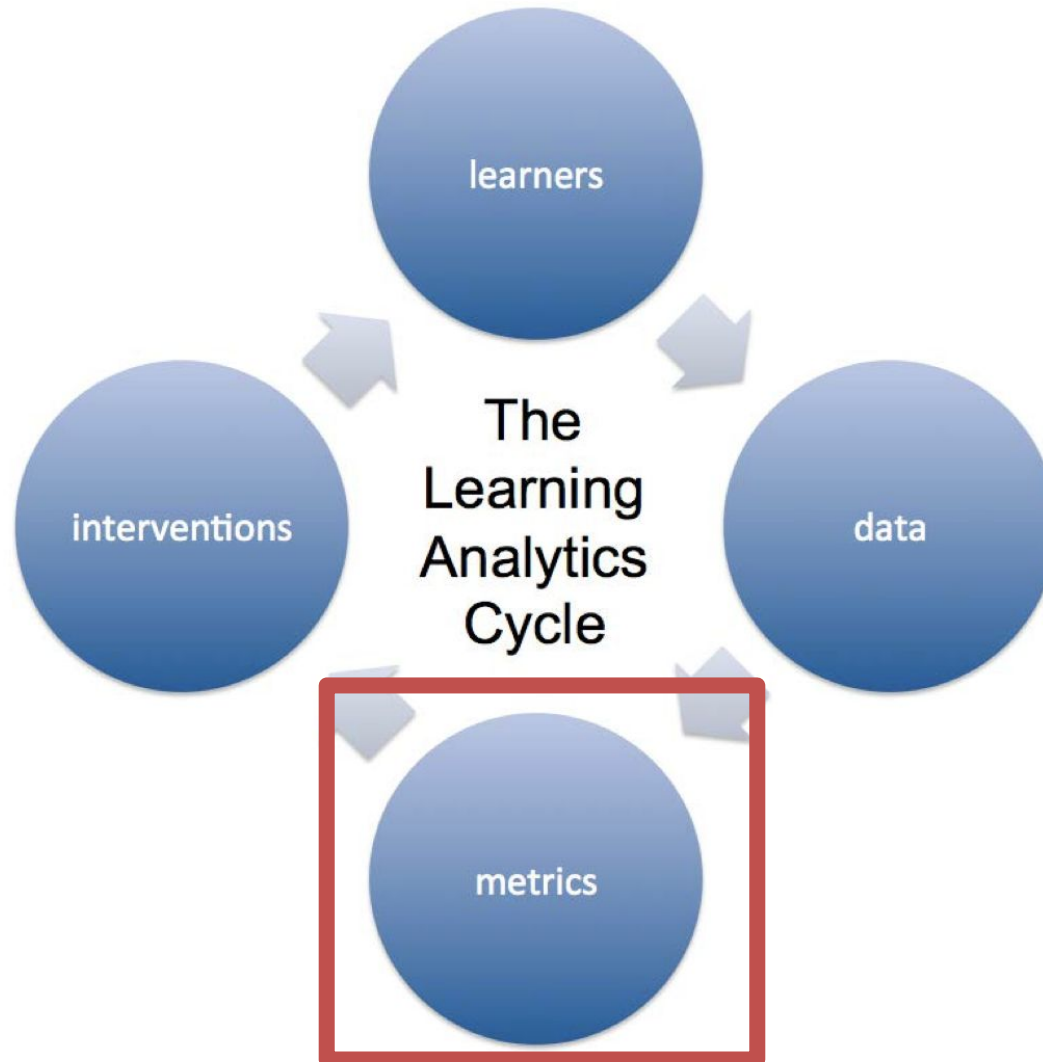
Self reported data

Student (co-)authored artefacts

# Integration of data from distinct sources

More comprehensive  
insights into the  
learning process

Increased trust in  
the insights derived  
from data



# Extracting insights from data

Data



Metrics  
(Indicators)



Learning-related  
construct

# Extracting insights from data

Data



Metrics  
(Indicators)



Learning-related  
construct

**LMS log data**

# Extracting insights from data

Data



Metrics  
(Indicators)



Learning-related  
construct

**LMS log data**

**Time spent in the LMS**  
**# of actions in the LMS**



# Extracting insights from data

Data



Metrics  
(Indicators)



Learning-related  
construct

**LMS log data**

**Time spent in the LMS  
# of actions in the LMS**

**Student  
engagement**

# Metrics considerations

Is an indicator relevant for the given LA objective?

# Metrics considerations

Is an indicator theoretically grounded?

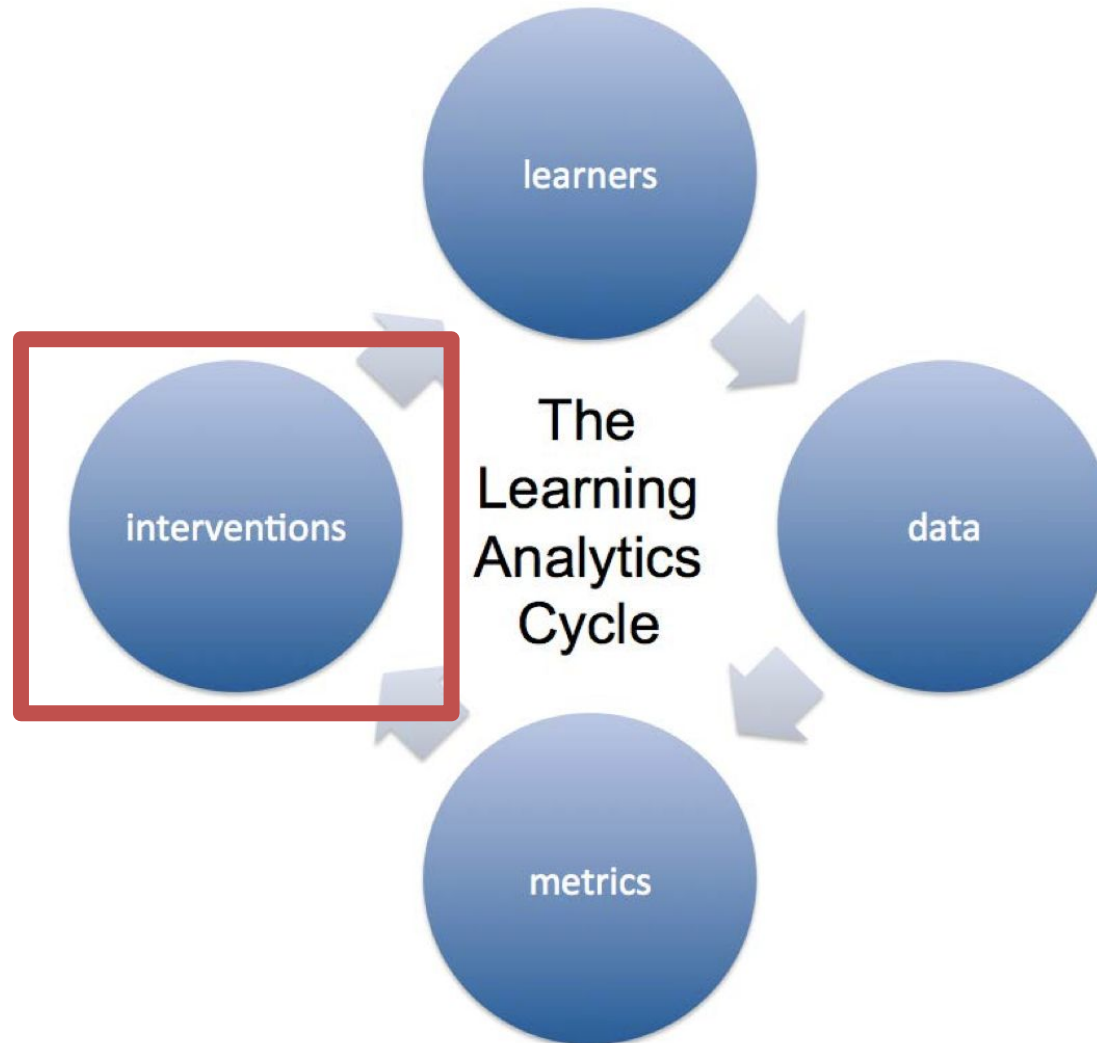
Does it measure what we want it to measure?

# Metrics considerations

What is the appropriate level of granularity for an indicator?

# Metrics considerations

What is the appropriate temporal dimension of an indicator?

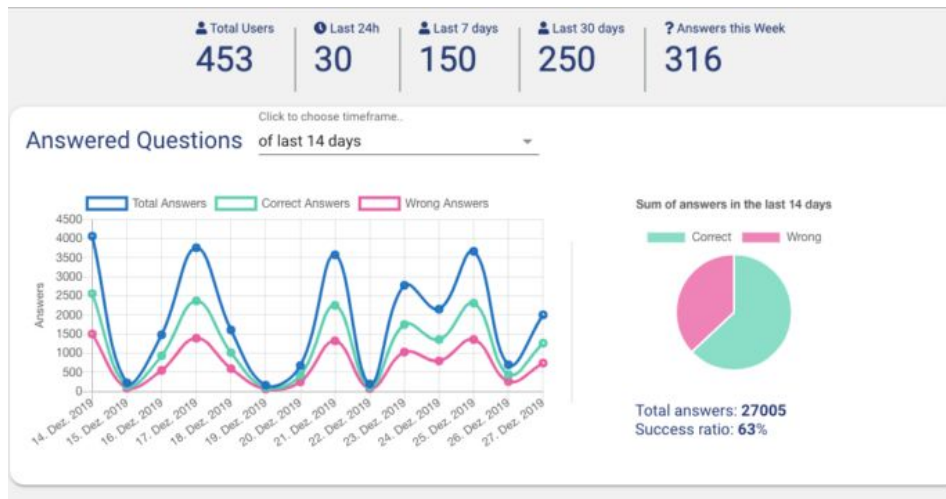


# Interventions

Learning analytics  
dashboards

# Interventions

Learning analytics  
dashboards

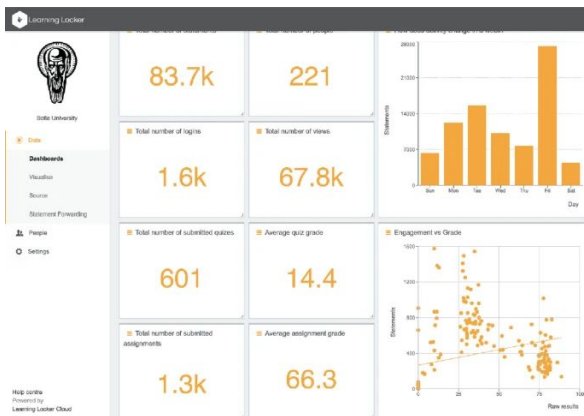




# Interventions

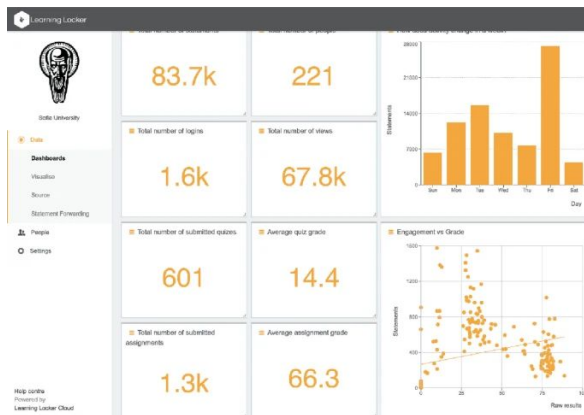
Learning analytics dashboards

LA-based pedagogical interventions



# Interventions

Learning analytics  
dashboards



LA-based pedagogical  
interventions

face-to-face interventions

e.g. instructors talking to individual students or  
changing how their classes are organised

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Learning analytics  
dashboards



LA-based pedagogical  
interventions

**face-to-face interventions**

e.g. instructors talking to individual students or changing how their classes are organised

**internet-based interventions**

e.g. email reminders, the provision of feedback, scaffolding, prompts, or recommendations

# Interventions

Learning analytics  
dashboards



LA-based pedagogical  
interventions

**face-to-face interventions**

e.g. instructors talking to individual students or changing how their classes are organised

**internet-based interventions**

e.g. email reminders, the provision of feedback, scaffolding, prompts, or recommendations

Mixed interventions

# Targets and measurement of LA interventions



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Learning  
environment

teacher awareness  
teacher productivity  
learning materials

Learning  
processes

Learning  
outcomes

# Targets and measurement of LA interventions

Learning  
environment

teacher awareness  
teacher productivity  
learning materials

Learning  
processes

learner awareness  
learner productivity  
self-regulated learning  
online activity  
engagement

Learning  
outcomes

# Targets and measurement of LA interventions

## Learning environment

teacher awareness  
teacher productivity  
learning materials

## Learning processes

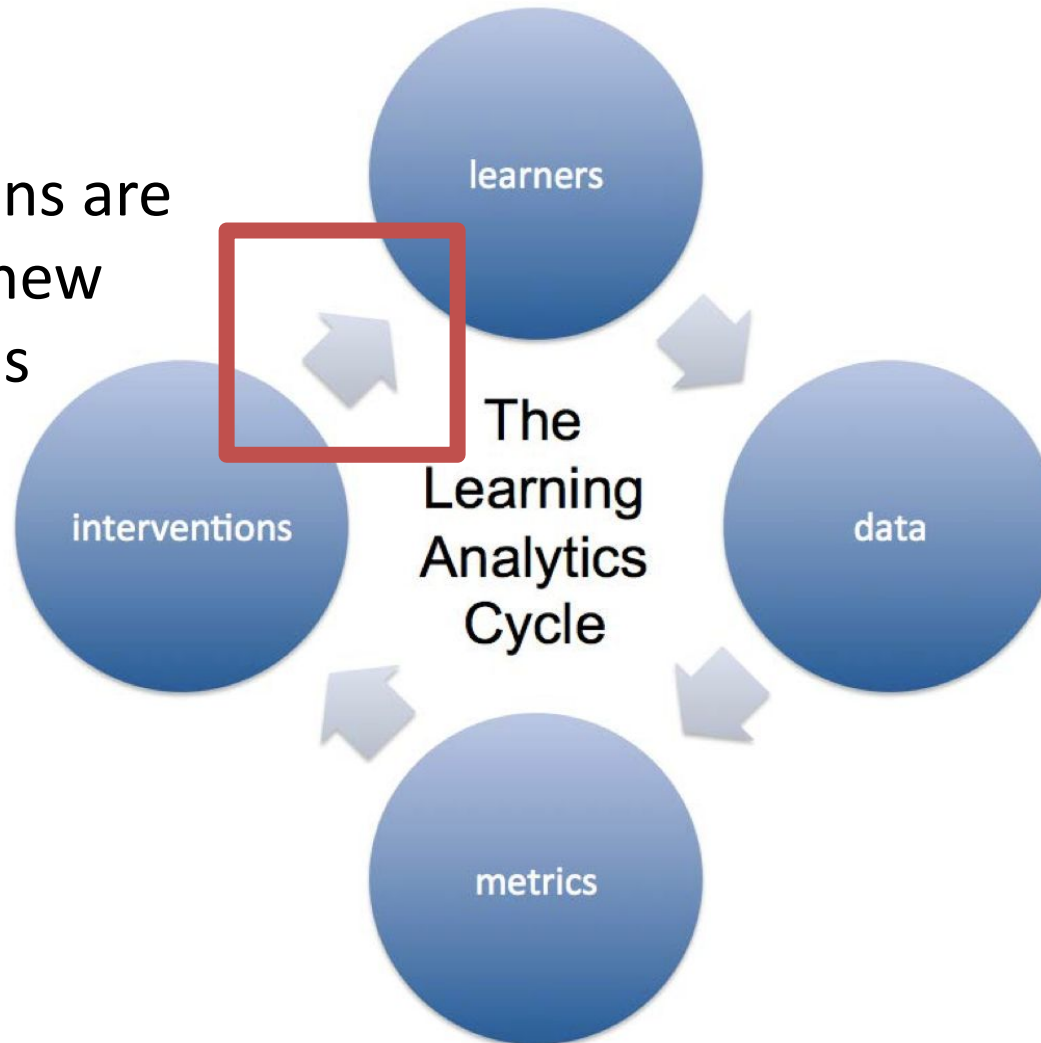
learner awareness  
learner productivity  
self-regulated learning  
online activity  
engagement

## Learning outcomes

knowledge and skills  
learning gains  
retention & drop-out rates



After  
interventions are  
applied, a new  
cycle begins



# Challenges

Student (data) privacy

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Collection of relevant data

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Choosing adequate data visualization methods

# Challenges

Student (data) privacy

Collection of relevant data

Choosing adequate data visualization methods

Proper data interpretation

# Challenges

Student (data) privacy

Collection of relevant data

Choosing adequate data visualization methods

Proper data interpretation

Choosing appropriate interventions

# Learning analytics tools in ISILA

# Learning Locker

An open source Learning Record Store for aggregating and analysing learning data

<https://github.com/LearningLocker>





# Learning Locker

Based on *xAPI open standard* for tool-agnostic representation of data about learning activities

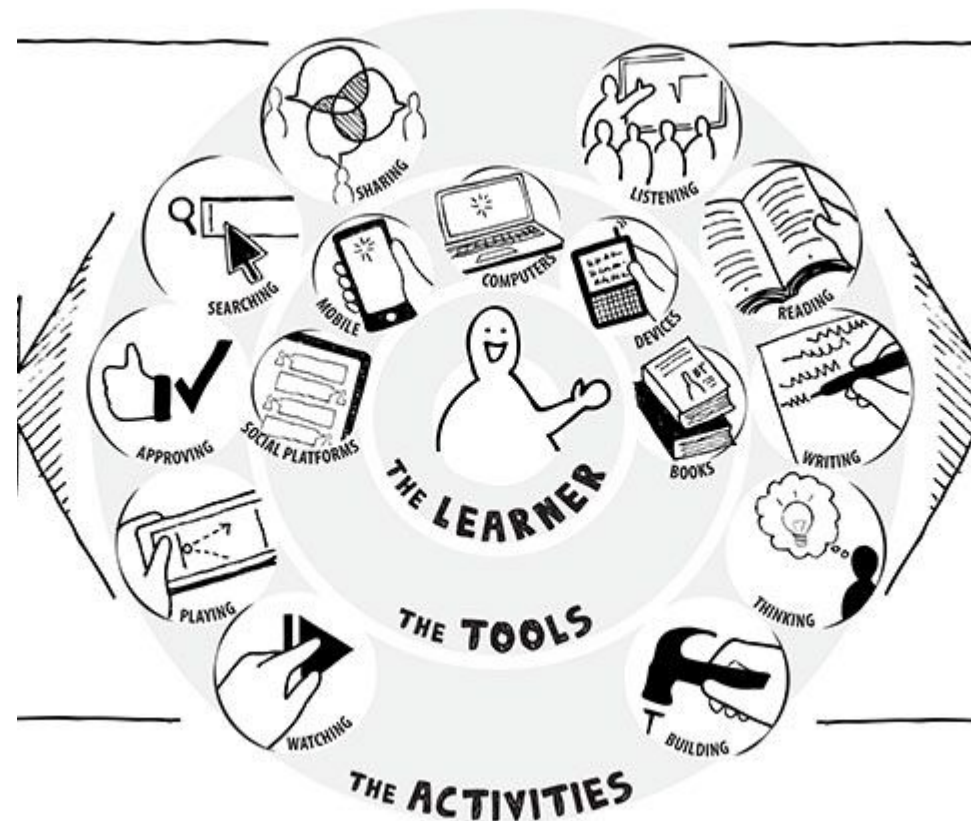


Image source: <https://xapi.com/overview/>



# The place and role of Learning Locker in data analysis pipeline



# Visual data exploration in Learning Locker

Learning Locker
↶ ↷

logo  
Sofia University

**Data**

Dashboards

**Visualise**

Source

Statement Forwarding

People

Settings

Help centre  
Powered by  
Learning Locker Cloud

**Name**  
How does activity change in a week?

**AXES SERIES OPTIONS**

+ Add query

**Stacked/Grouped**

**Build your query**

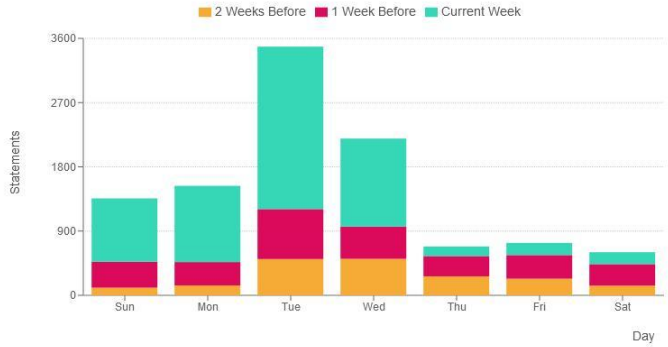
2 WEEKS BEFORE 1 WEEK BEFORE CURRENT WEEK

**Label**  
2 Weeks Before

Select a saved query

- Who
- Did
- What
- Where
- Metadata
- Result
- When
- Timestamp  
in week 80
- Stored
- Store

Last 2 years



Day	2 Weeks Before	1 Week Before	Current Week
Sun	~100	~200	~1000
Mon	~100	~200	~1000
Tue	~400	~500	~2000
Wed	~400	~400	~1000
Thu	~100	~200	~300
Fri	~100	~200	~300
Sat	~100	~200	~300

# The Concise Self-Regulated Learning (SRL) Survey

12 items (“I” statements) survey

Captures important SRL-related constructs:

goal setting

time management

effort regulation

motivation

help seeking

anxiety

feeling of belonging

meta-cognition

<b>Construct</b>	<b>Question statements</b>
Goal setting	<p>I planned my studies and set my learning goals</p> <p>I monitor and keep track of accomplishing the goals of my learning</p>
Effort regulation	<p>I have put enough effort into my learning/ tasks to accomplish them</p> <p>I am focused on performing my learning goals and resisting distractions</p>
Time management	<p>I am doing my studies in time and keeping with the deadlines</p>
Metacognition	<p>I learn from feedback or mistakes to improve my learning.</p> <p>I assess my performance or work in tasks in order to improve my skills</p>
Help seeking	<p>I seek help from teachers/friends/online when I need explanation or help with tasks</p>
Feeling of belonging	<p>I am having nice interactions and felt home within the school community today.</p>
Motivation	<p>I feel enthusiastic/motivated to learn, understand and get better grades.</p> <p>I enjoy my tasks and feel happy about my achievements / work / accomplishment.</p>
Anxiety	<p>I feel anxious/stressed working on learning tasks or assignments.</p>

Let's have a 10' break!

# Worked example: **From data to interventions**



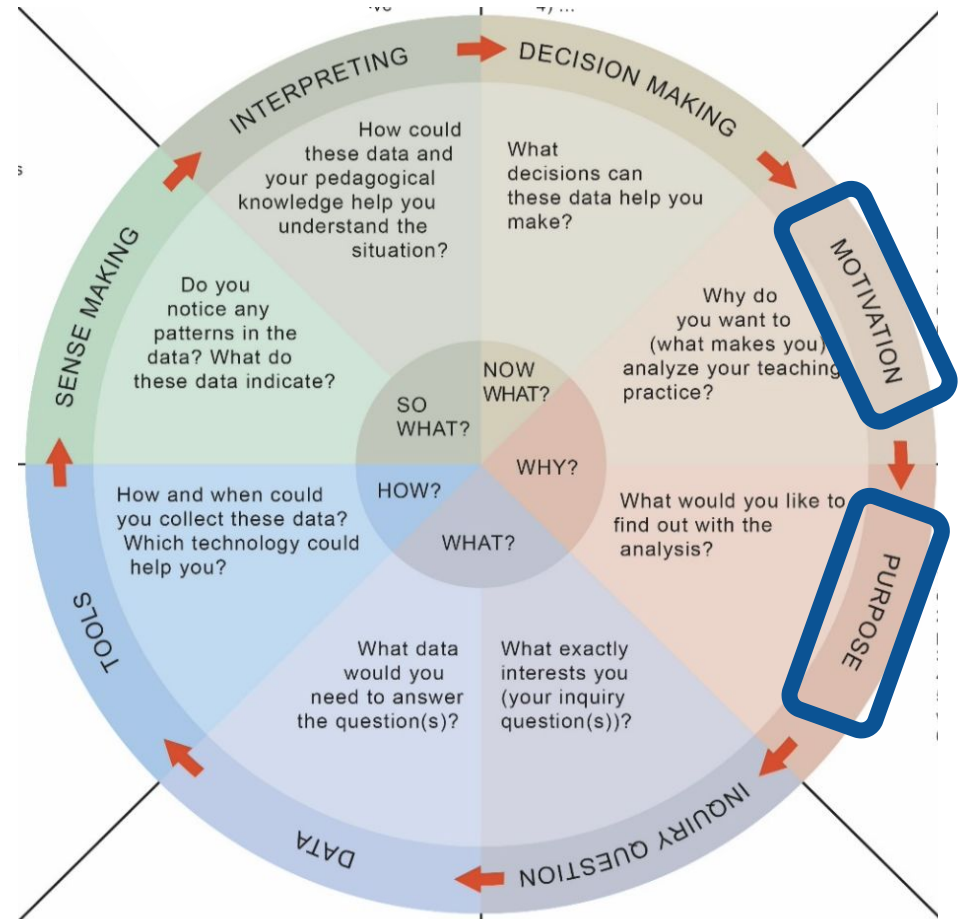


# Phase 1: WHY?



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Motivation	Purpose
Why do you want to (what makes you) analyze your teaching practice?	What would you like to find out with the analysis?
1) change in my context (new group of learners, change in course design or learning activities)	1) understand instructional change
2) student needs/perspective/development	2) evaluate my own performance
3) problems in teaching	3) monitor the progress
4) outward pressure	4) identify areas of need
5) professional development	5) support conversations with parents
6) ...	6) ....
+ any other reasons or options	

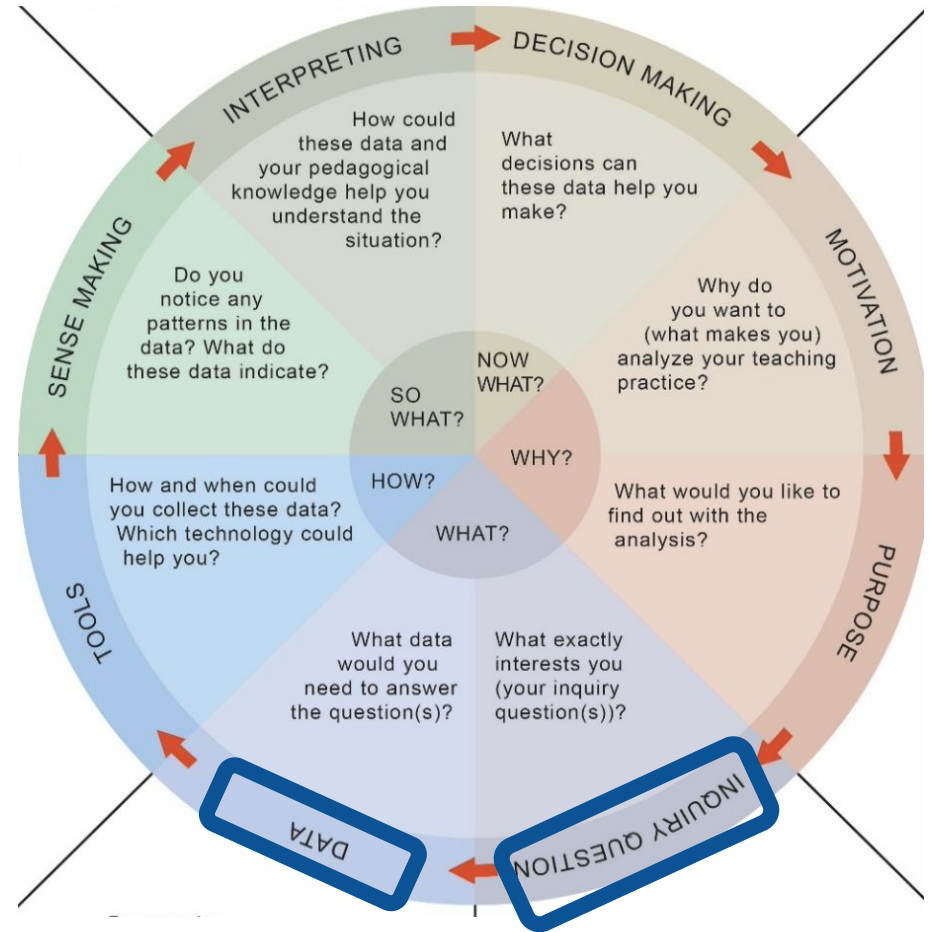


Inquiry Questions	Data needs
What exactly interests you?	What data would you need to answer the question(s)?
Write down 1-2 specific questions that you would like to get an answer to	<ol style="list-style-type: none"> <li>1) student work</li> <li>2) student feedback</li> <li>3) assessment data</li> <li>4) process data (activity logs)</li> <li>5) collaboration data</li> <li>6) student background data</li> <li>7) contextual data (curriculum, materials)</li> <li>8) ...</li> </ol>

# Phase 2: WHAT?



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## Data collection

How and when could you collect these data?

Which technology could help you?

1) data from electronic platforms

2) questionnaires or surveys

3) observation

4) conversations / interviews / discussions

5) exploring resources

6) sensor data

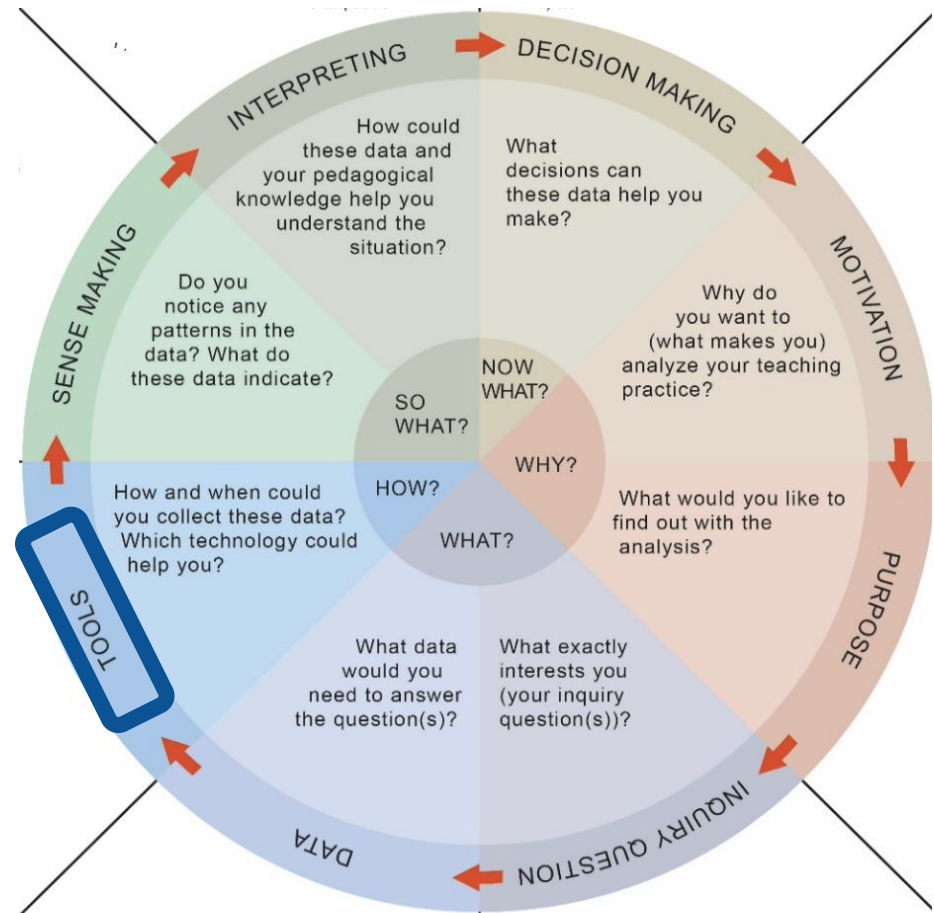
7) using apps

8) ...

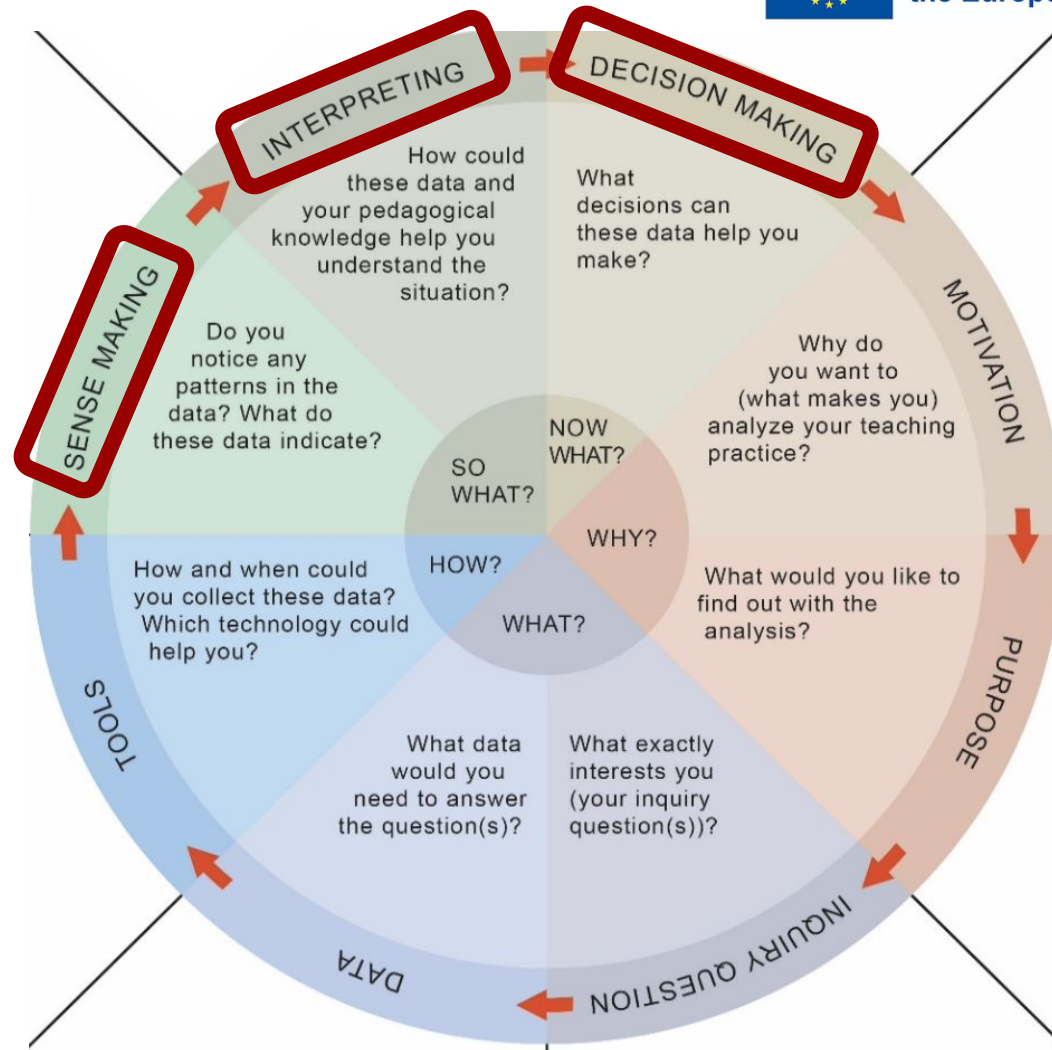
# Phase 2: HOW?



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# Focus of ISILA and this workshop





Sense making	Interpretation	Decision making
<p>Do you notice any patterns in the data? What do these data indicate? about:</p>	<p><i>How could these data and your pedagogical knowledge help you understand the situation?</i></p>	<p>What decisions can these data help you make?</p>
<ul style="list-style-type: none"> <li>1) knowledge of the students</li> <li>2) progress of the students</li> <li>3) engagement levels</li> <li>4) skills development of the students</li> <li>5) materials used and tasks employed</li> <li>6) recurring mistakes or difficulties</li> <li>7) your teaching</li> <li>8) reaching the curriculum goals</li> </ul>	<ul style="list-style-type: none"> <li>1) set and assess progress toward goals</li> <li>2) address individual or group needs</li> <li>3) evaluate effectiveness of practices</li> <li>4) assess whether student needs are met</li> <li>5) reallocate resources in reaction to outcomes</li> <li>6) enhance processes to improve outcomes</li> </ul>	<ul style="list-style-type: none"> <li>1) reflect on pedagogy</li> <li>2) wait-and-see</li> <li>3) take action, e.g., whole-class scaffolding, targeted scaffolding, and revising course design (adopt, adapt or reject a teaching method / material)</li> </ul>



# More intervention examples

The review of learning analytics intervention case studies by Wong & Li (2018)

23 distinct cases categorised into 4 kinds of interventions:

- direct message
- actionable feedback
- categorisation of students
- course redesign

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The review of learning analytics intervention case studies by Wong & Li (2018)

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- actionable feedback
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Example:

Student engagement with online  
activities, course topic focus



# Example: Context

- Graduate (master) course w/ flipped classroom design
- 75 enrolled students
- Activities: videos, self-assessment quizzes, assignments
- Several topics, in the domain of Advanced Data Management Systems, covered in the course

# Example: Inquiry questions

- How engaged the students are with the online activities available for the topic of ER diagrams?
- What is the dynamic of their engagement with distinct activities related to this course topic?
- How easy / difficult the self-assessment items (on the ER diagrams topic) are?

# Example: The available data

Data collected from the LMS about students' interactions with the course online learning activities:

- page views, including slides and lecture videos
- answering self-assessment items
- assignment submission

# Example: Sense making and interpreting

## Guiding questions:

Do you notice any pattern in the data? What do these data suggest?

How could these data and your pedagogical knowledge help you understand the situation?

# Example: Sense making and interpreting

ADMS: ER diagrams, number of students who watched the slides

67

ADMS: ER diagrams, number of students who completed self-assessment

63

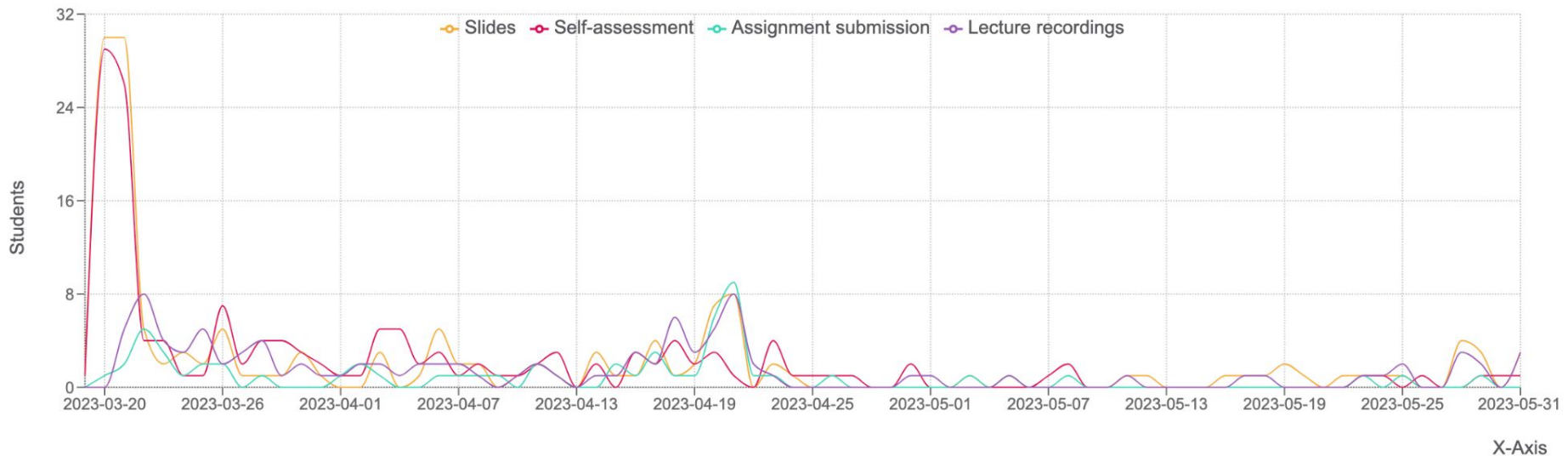
ADMS: ER diagrams, number of students who submitted assignment

57

ADMS: ER diagrams, number of students who watched the lecture recording

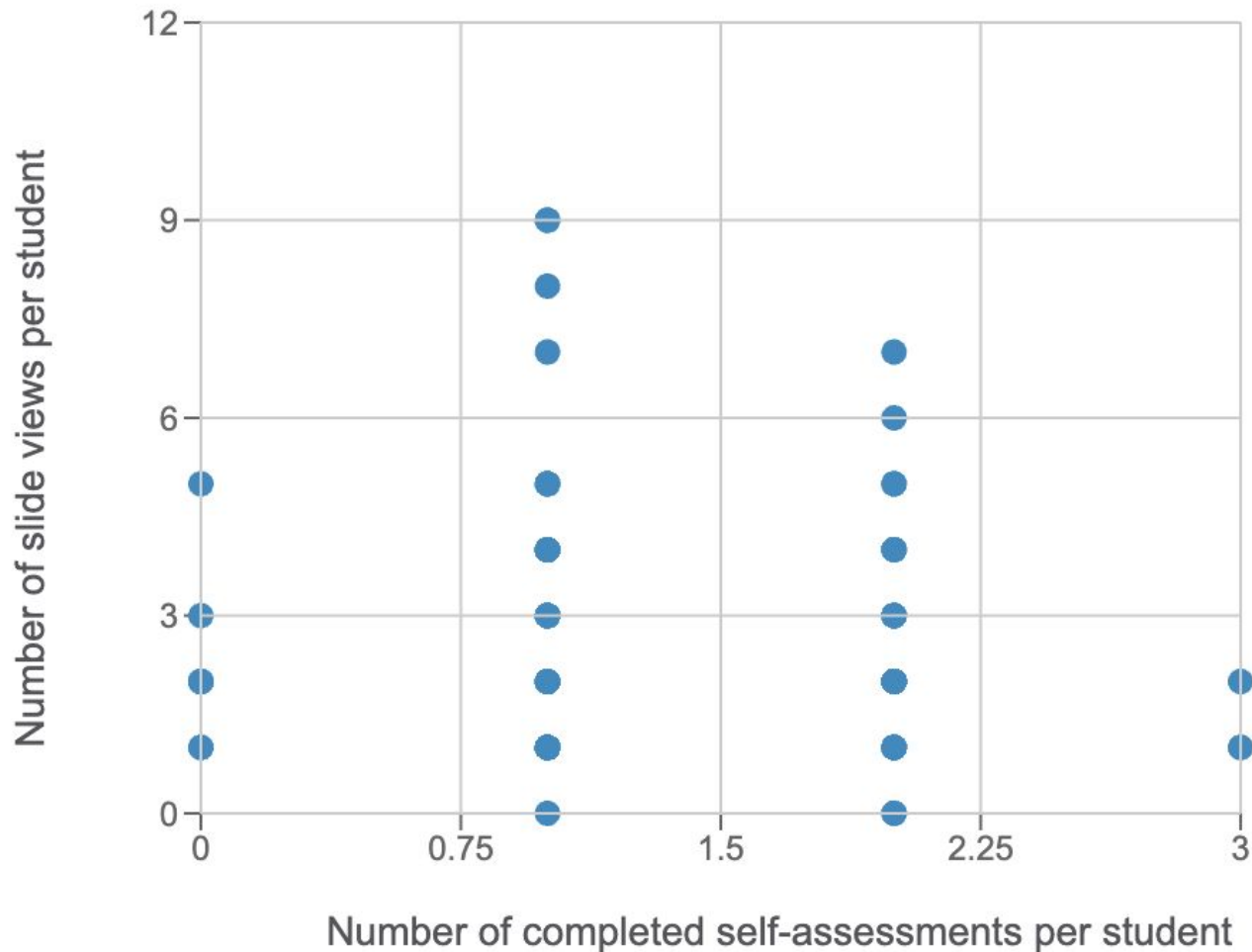
48

ADMS: ER diagrams timeline



# Example: Sense making and interpreting

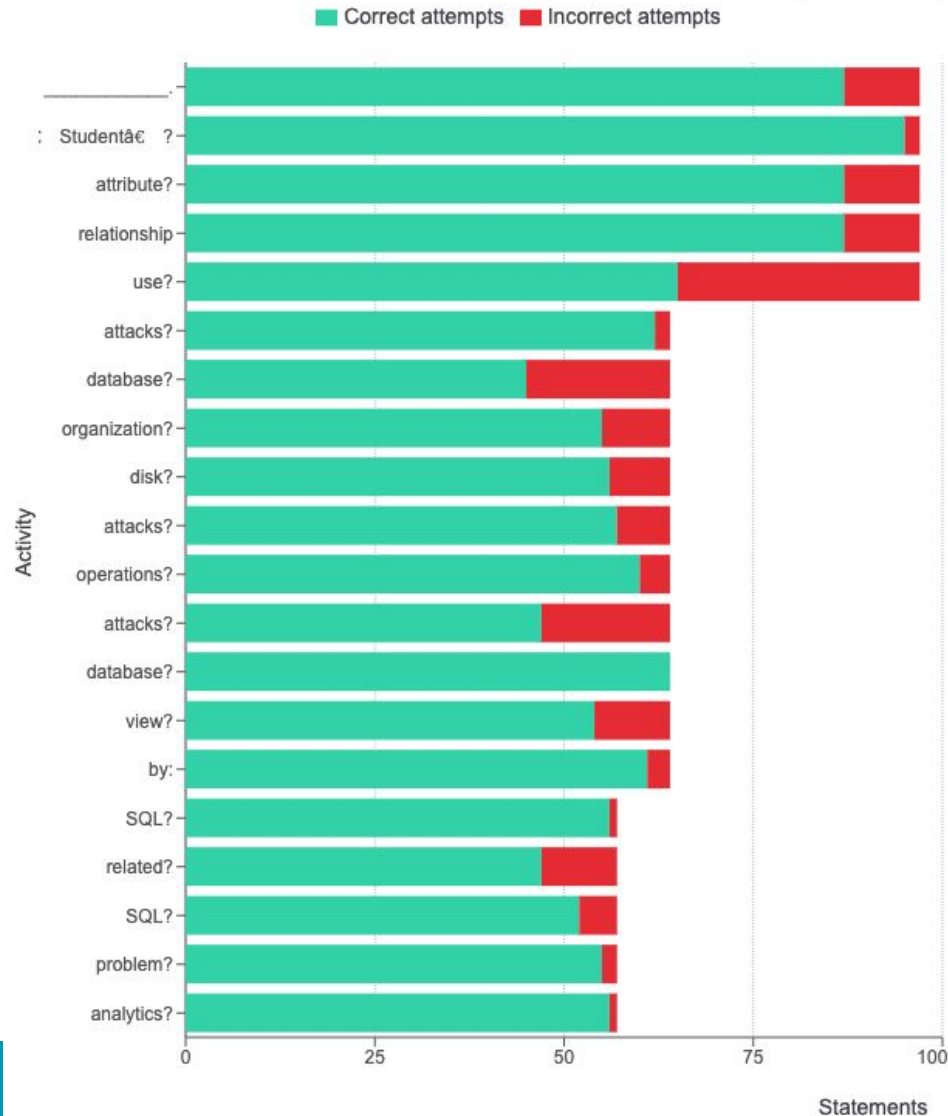
≡ ADMS: ER diagrams, slide views vs self-assessments



# Example: Sense making and interpreting

ADMS: ER diagrams, how easy self-assessment items are?

> NEXT



## Example: Decision Making

*What decisions can these data help you make?*

- Reach out to students who did not engage at all
- Reconsider the materials made available to students through slides
- Reconsider self-assessment items (too easy / difficult)



Group work:  
**Interpretation of student data and  
intervention design**

# Interpretation of student data and intervention design

**Goal:** Design potential interventions for the given course context and the given dashboard with course analytics

**Duration:** 30 minutes

**Task type:** Group work (break-out rooms)

**Output:** **Short presentation** (visualization interpretation > intervention)

# Student engagement with online activities throughout the course

# Course context

- Undergraduate blended course in Web programming
- 227 enrolled students
- Online materials: slides, games (practice), lecture recordings
- Assessment: one exercise each week, 2 assignments and the final exam

# Inquiry questions

- How engaged the students were with the online learning resources?
- If / how did the students' internal state (motivation, anxiety, enjoyment) change during the course?
- If / how did the students' time and effort management change during the course?
- If / how is the students' internal state associated with their use of online learning resources?

# The available data

- 1) Data collected from the LMS about students' interactions with the course online learning activities:
  - page views, including slides, games, and recorded lectures
  - assignment submission
- 1) Weekly survey data capturing different aspects of the students' self-regulation of learning

# Sense making and interpreting

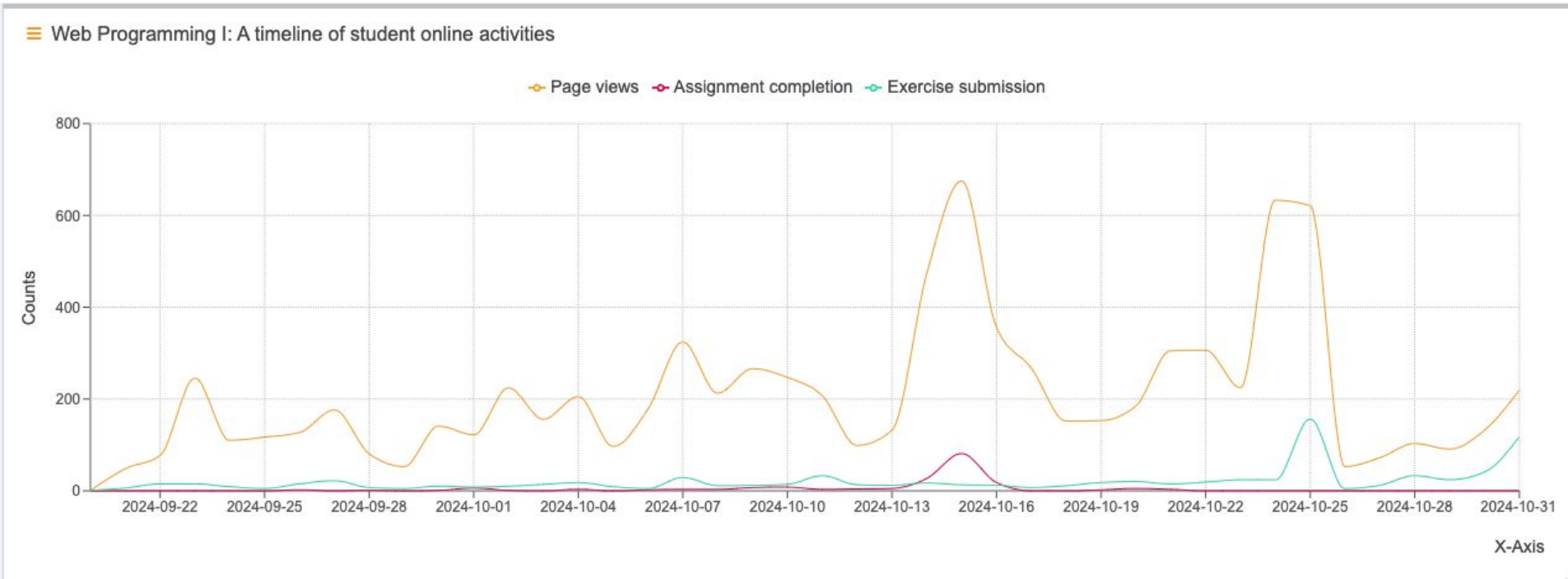
## Guiding questions:

**Do you notice any pattern in the data?  
What do these data suggest?**

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**What decisions can these data help you make?**

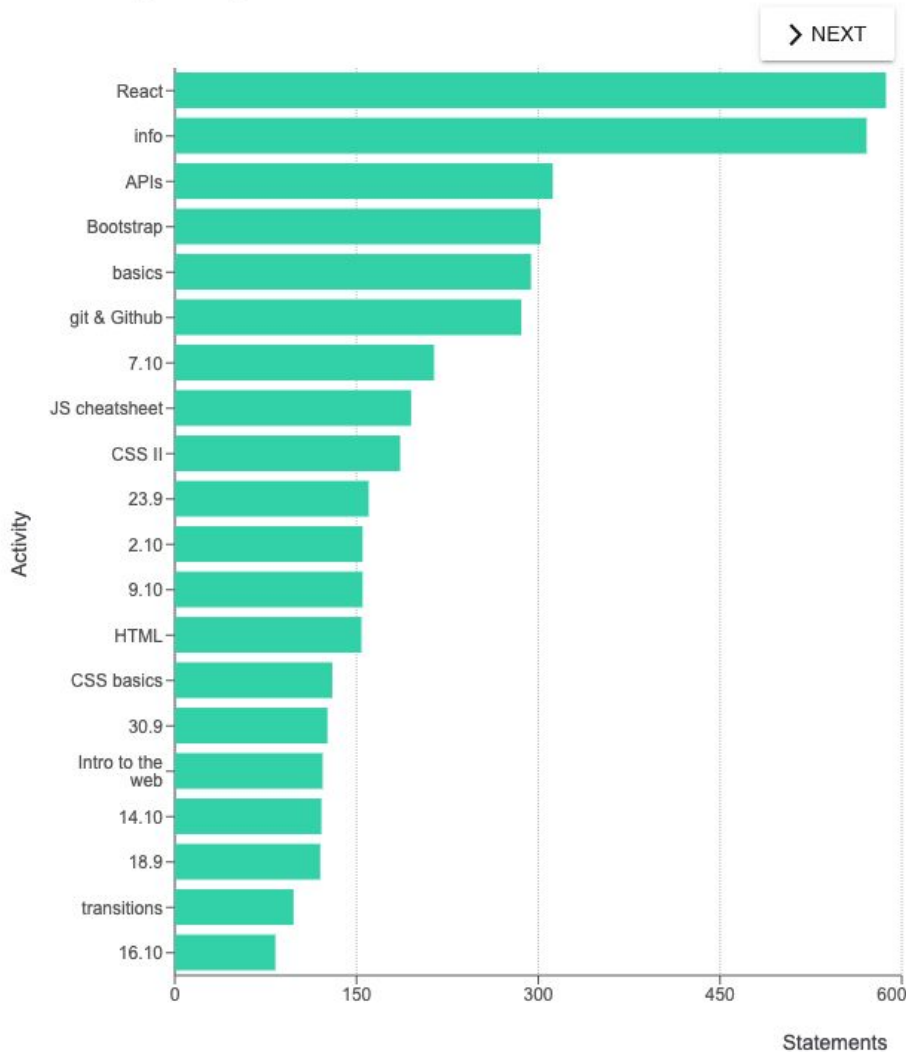
# Sense making and interpreting



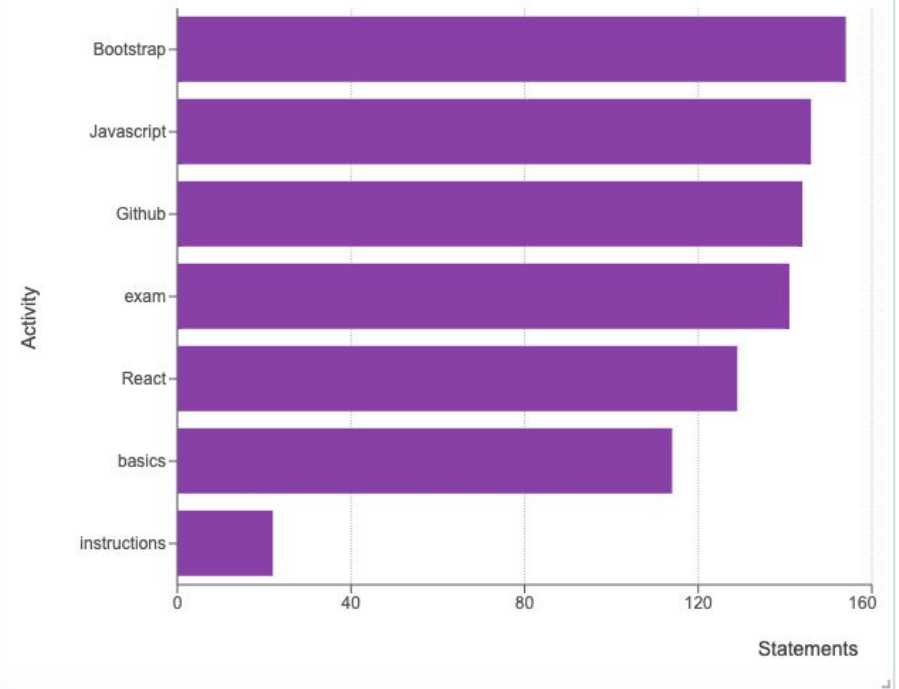


# Sense making and interpreting

Web Programming I: Resource view counts

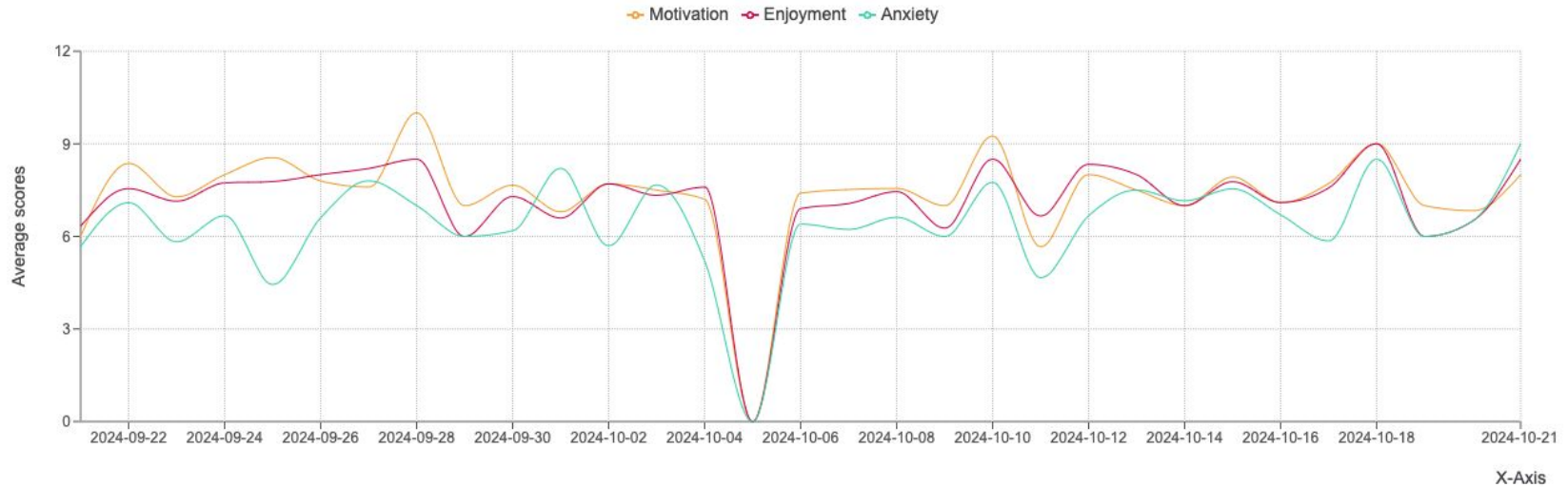


Web Programming I: Exercise submitted counts

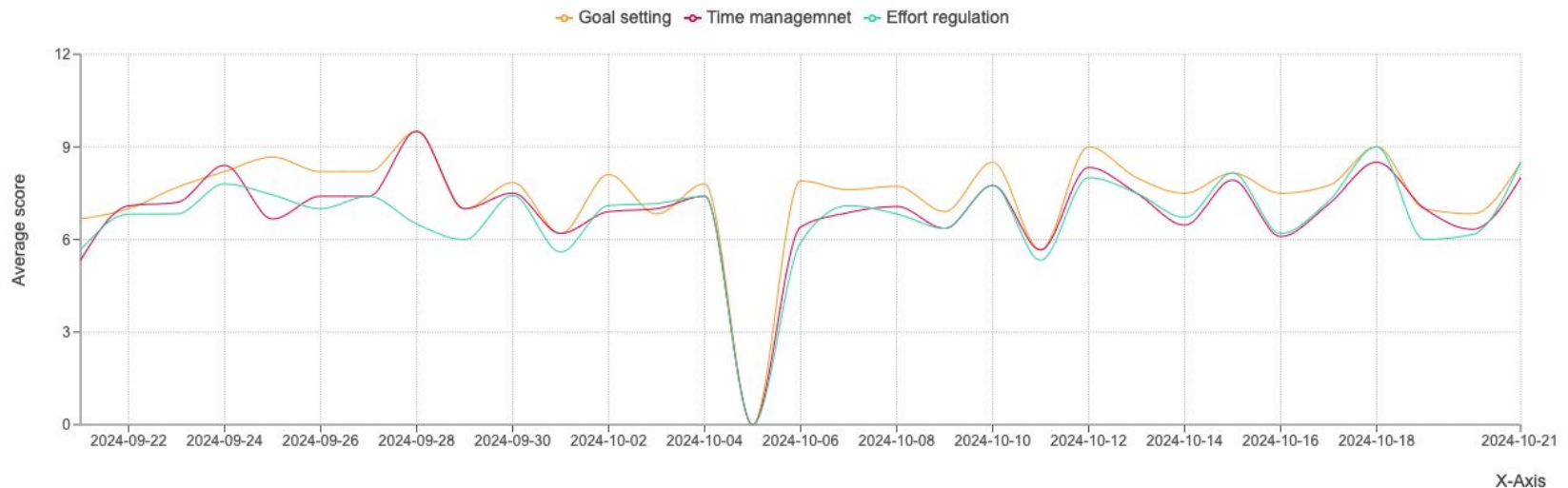


# Sense making and interpreting

Web Programming I: An overview of student self-reported motivation, enjoyment, and anxiety

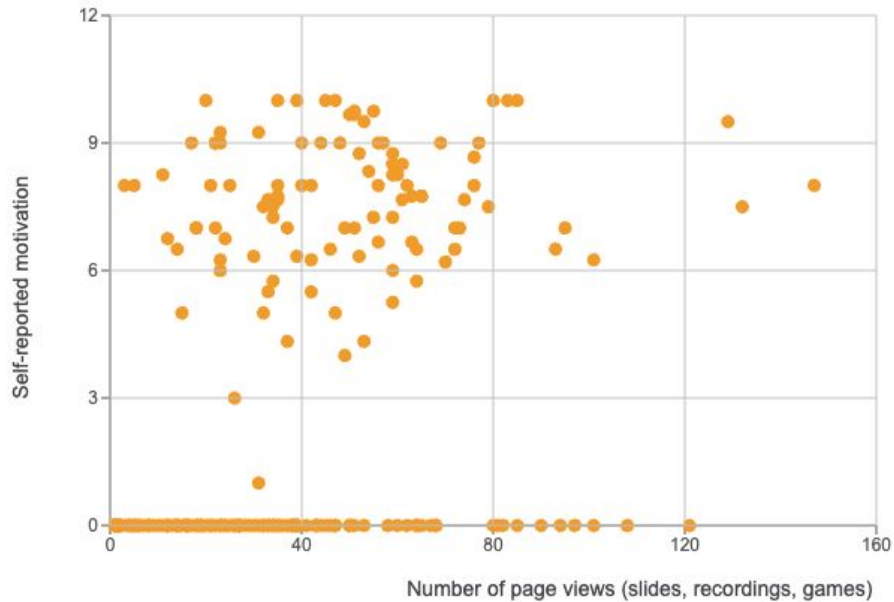


Web Programming I: A timeline of student self-reported goal setting, time and effort management

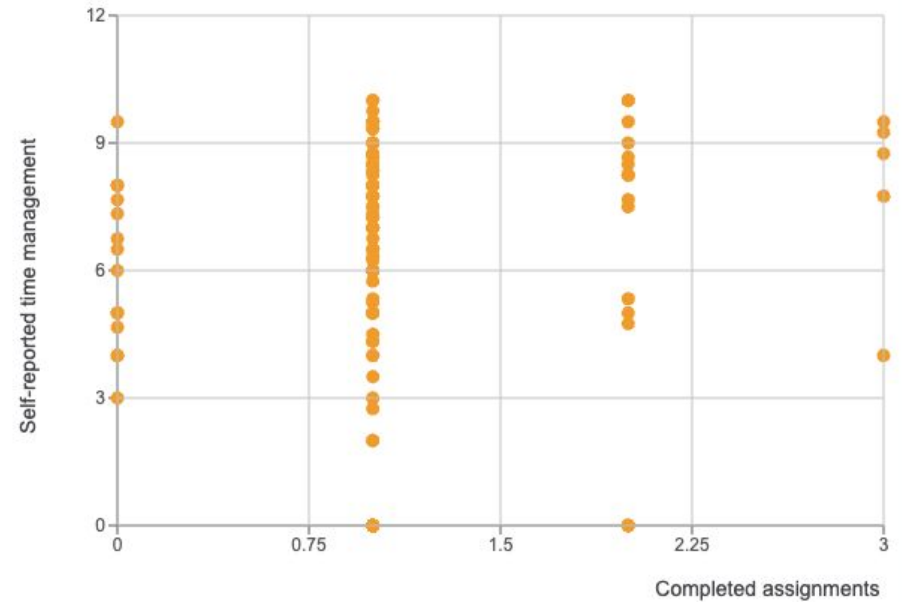


# Sense making and interpreting

Web Programming I: Views vs self-reported motivation



Web Programming I: Assessment completion vs (self-reported) time management



# Decision Making

*What decisions can these data help you make?*

- Explore ways to improve the materials on React as students seem to struggle with it
- Explore further peaks and plunges in motivation and time management to identify course elements associated with these points

# Group presentations

# Q & A

## Short survey

[https://docs.google.com/forms/d/e/1FAIpQLSco5UanaTzY1FceAqlaAYFHlY3r6N2nDB1DSnJzrsfd3Hrt\\_w/viewform](https://docs.google.com/forms/d/e/1FAIpQLSco5UanaTzY1FceAqlaAYFHlY3r6N2nDB1DSnJzrsfd3Hrt_w/viewform)



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# Thank you!