

# Workshop: LA interventions based on multimodal dashboards

Online/Face2Face, XX/XX Month Year

# ISILA project

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



SOFIA UNIVERSITY  
ST. KLIMENT OHRIDSKI



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UNIVERSITY OF  
EASTERN FINLAND



universidad  
de león

# Workshop objective

Implement tracking student progress based on multimodal data

# Agenda

Duration	Time	Item
10'		Introduction and agenda
10'		Introduction to learning analytics
20'		Learning analytics tools in ISILA
10'		BREAK
15'		How to use multimodal data in teaching
15'		How to implement intervention methods in teaching
15'		How to use learning analytics dashboards to track students learning progress
15		General Ethical Guidelines to be considered
10'		Q&A and closing

# Facilitators

**XXXXX**

University of XXXXXX

**XXXXX**

University of XXXXXX

**XXXXX**

University of XXXXXX

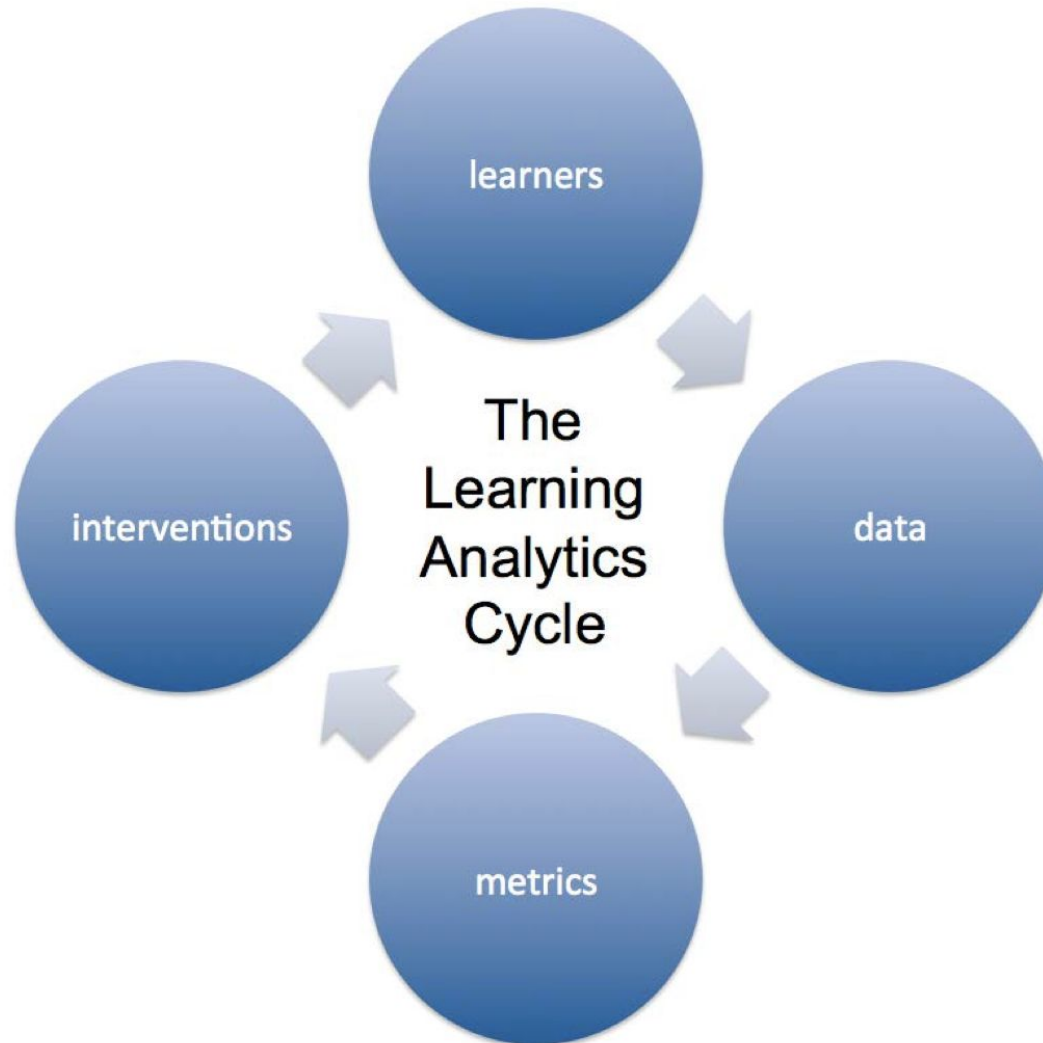
**XXXXX**

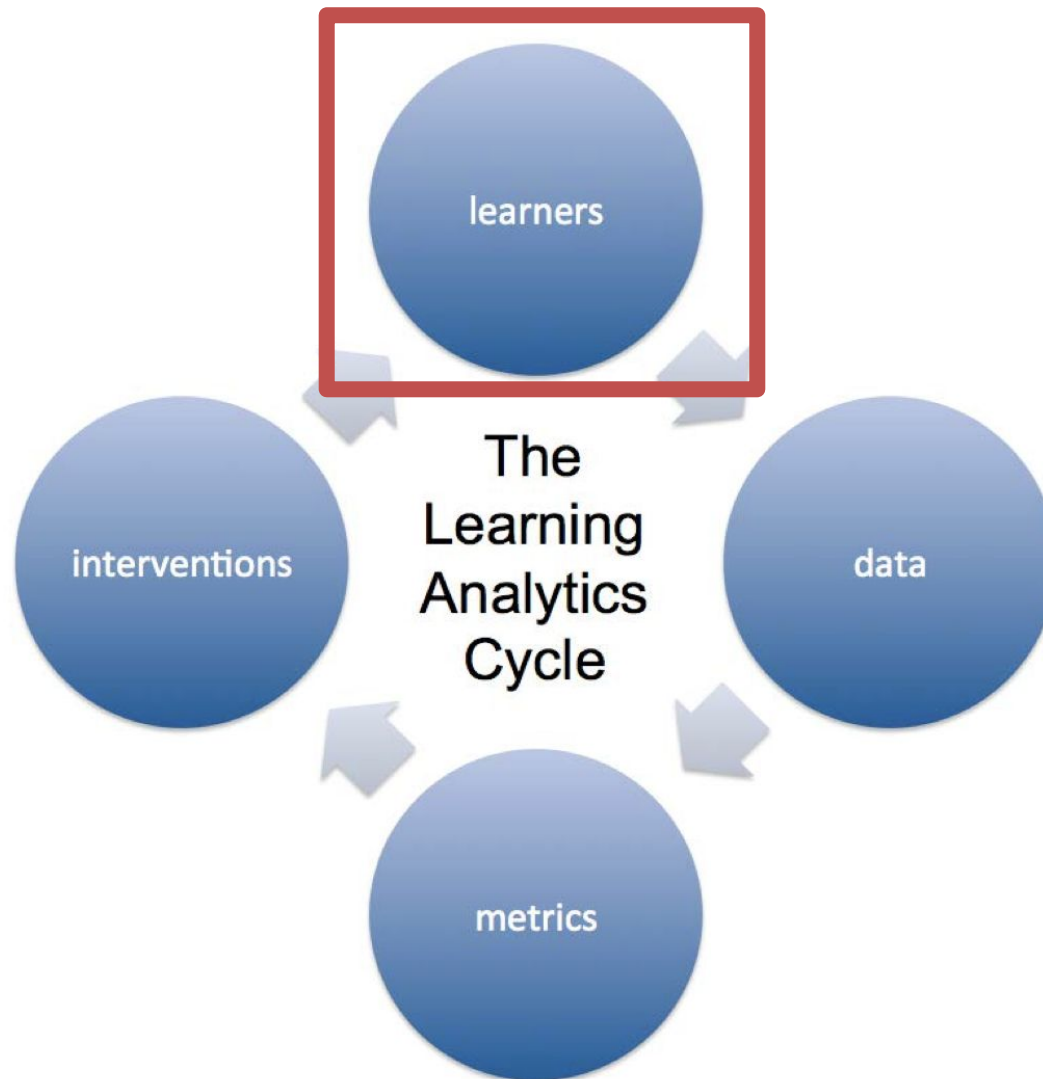
University of XXXXXX

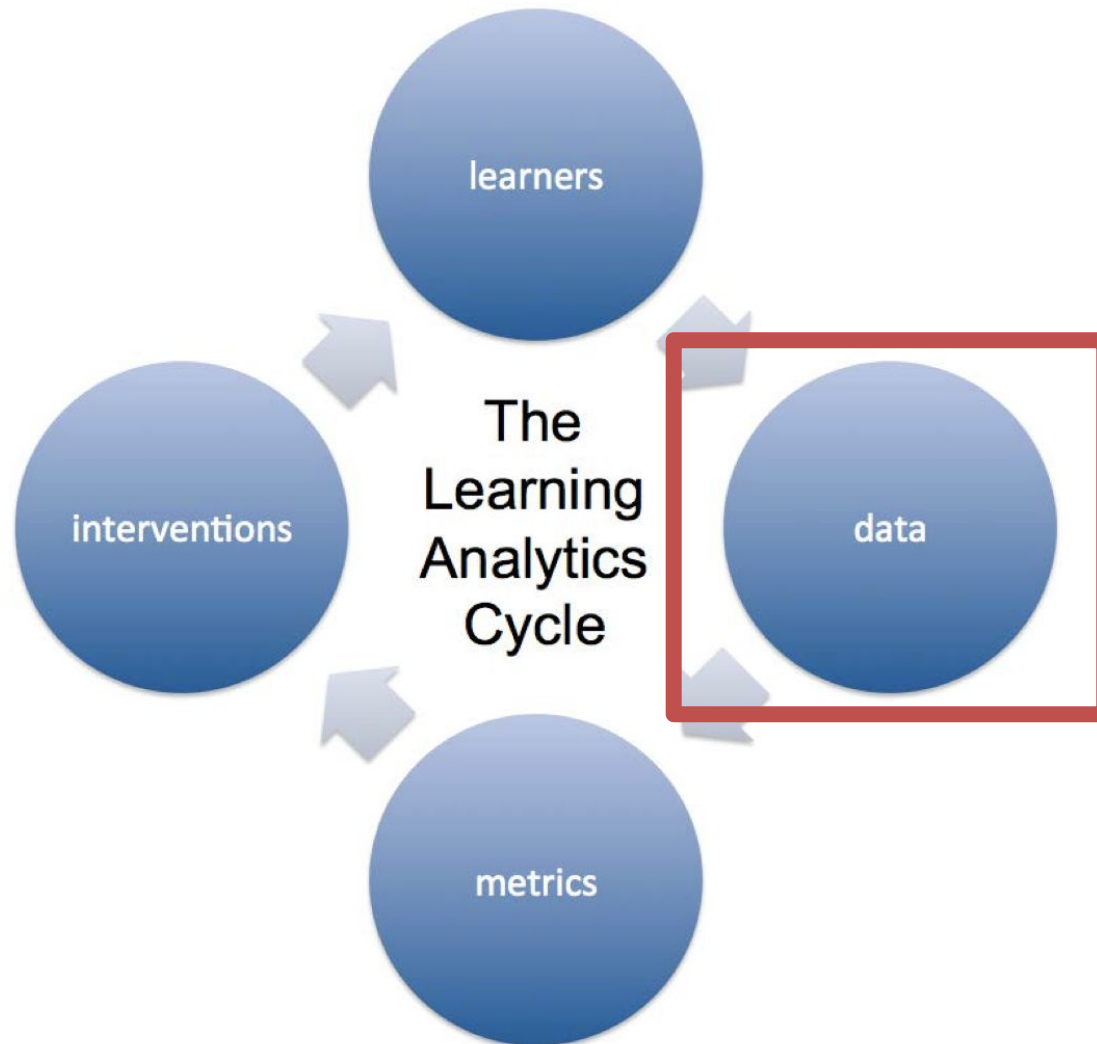
# A quick intro to learning analytics

# 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

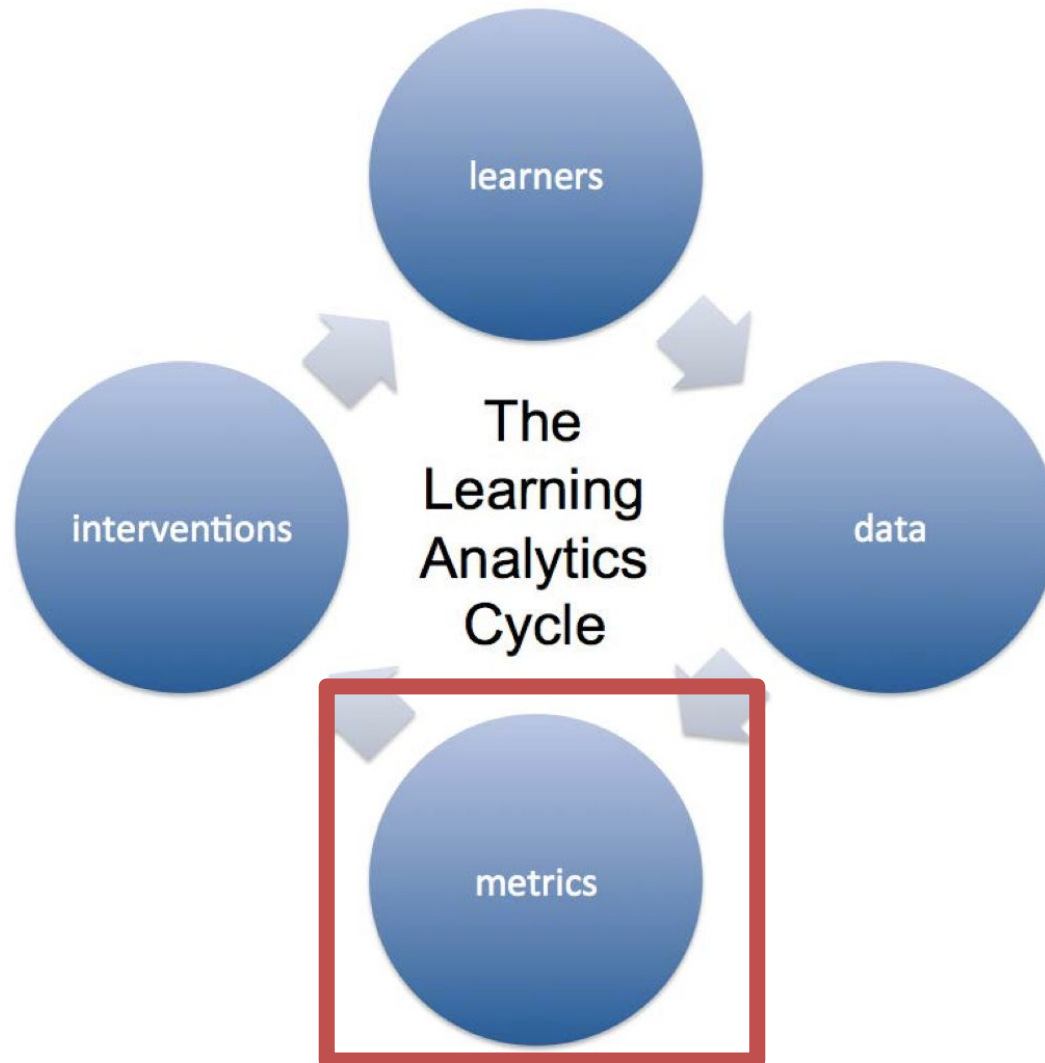
Self reported data

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?

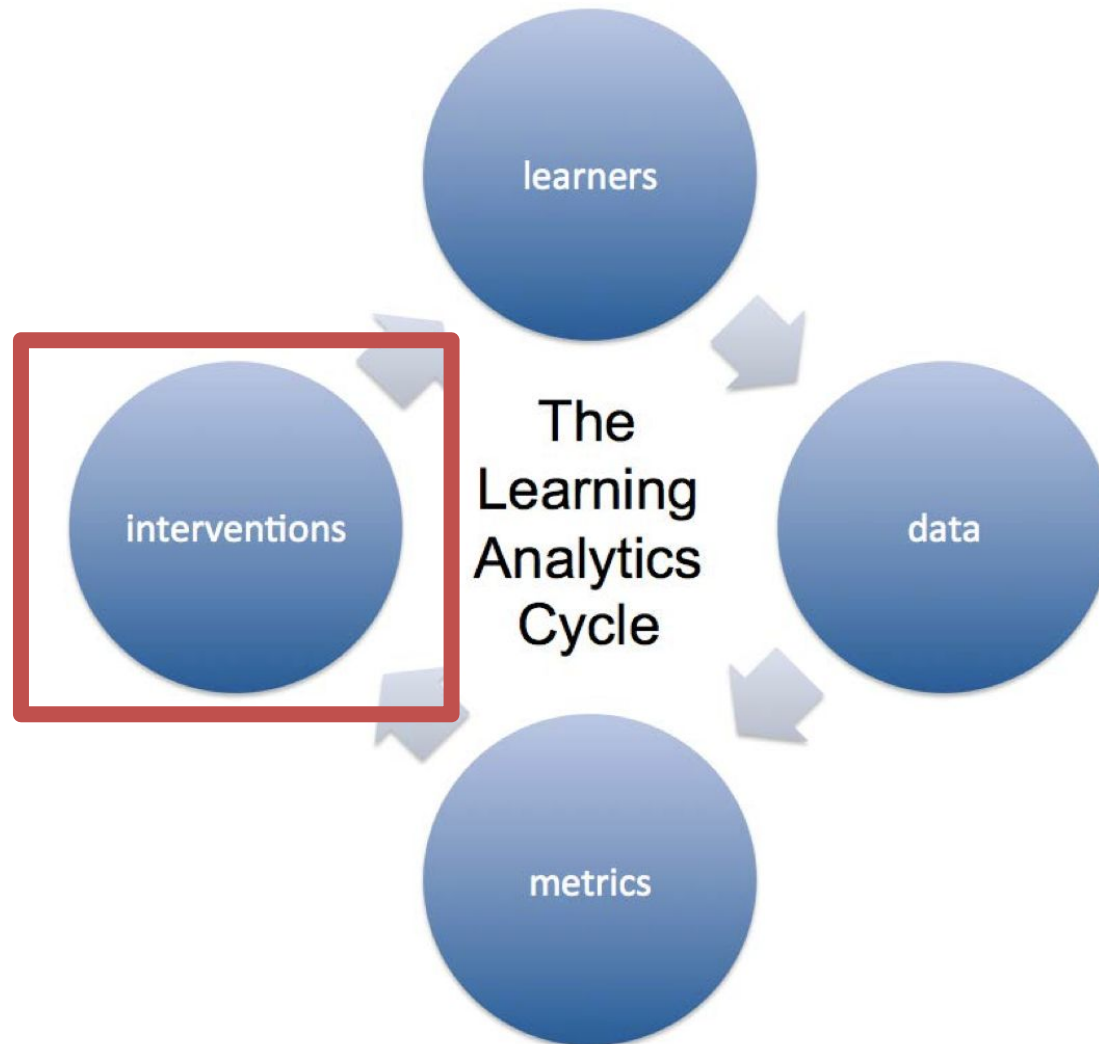
Does it measure what we want it to measure?

# Metrics considerations

What is the appropriate level of granularity for an indicator?

# Metrics considerations

What is the appropriate temporal dimension of an indicator?

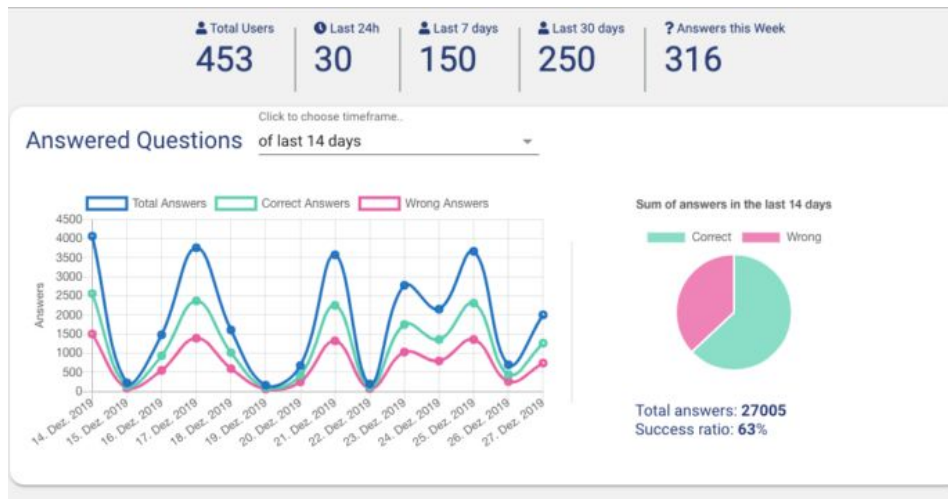


# Interventions

Learning analytics  
dashboards

# Interventions

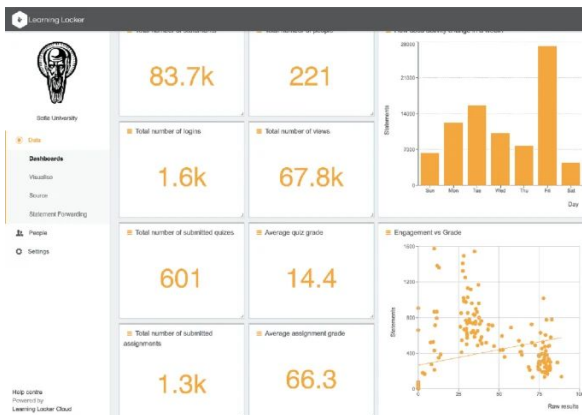
Learning analytics  
dashboards



# Interventions

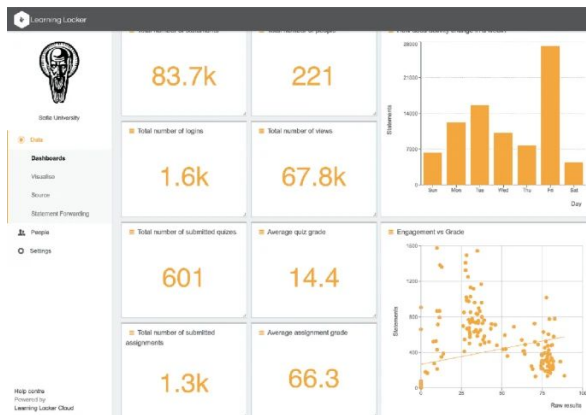
Learning analytics  
dashboards

LA-based pedagogical  
interventions



# Interventions

Learning analytics  
dashboards



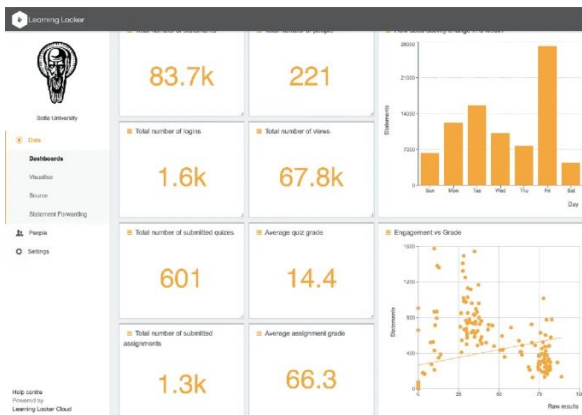
LA-based pedagogical  
interventions

face-to-face interventions

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

# 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

# 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



# Targets and measurement of LA interventions

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

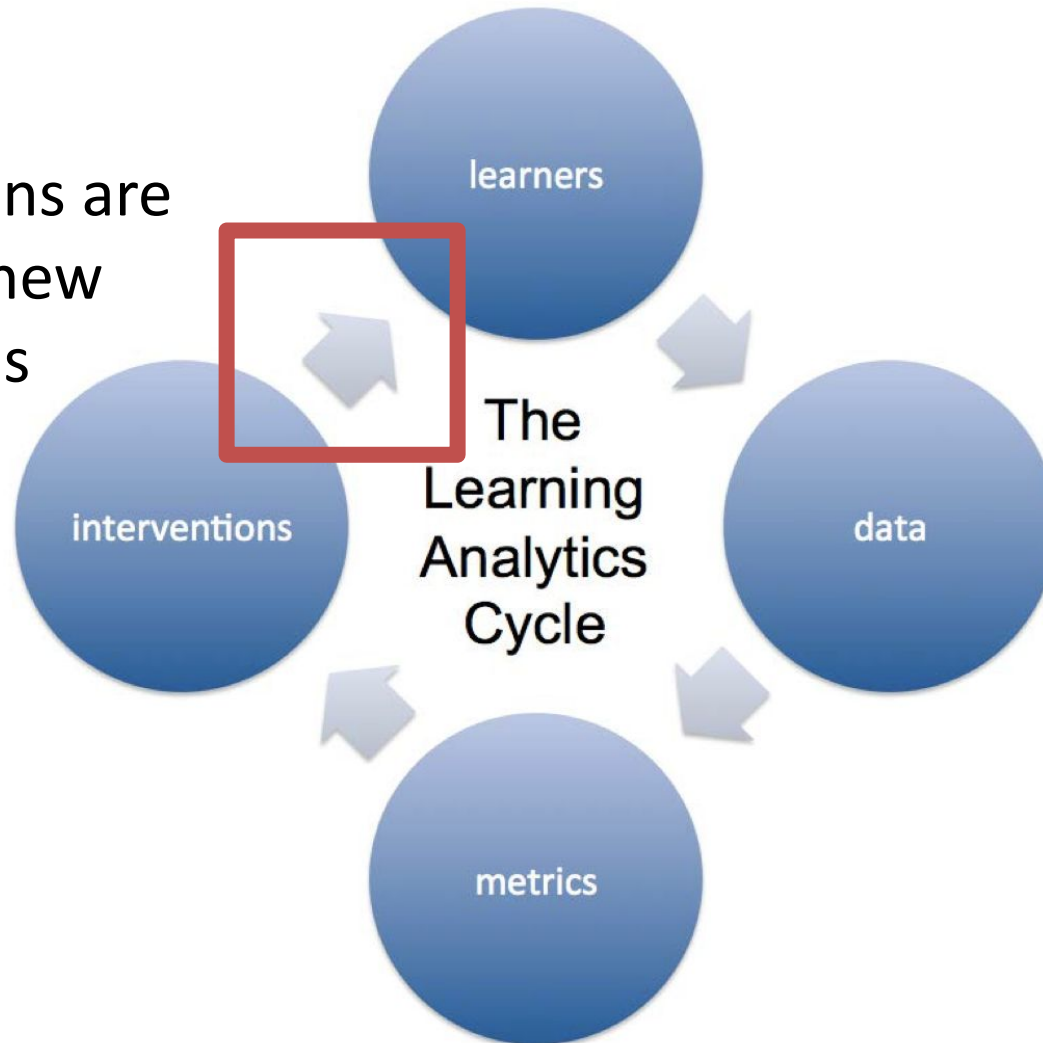
## Learning processes

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

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

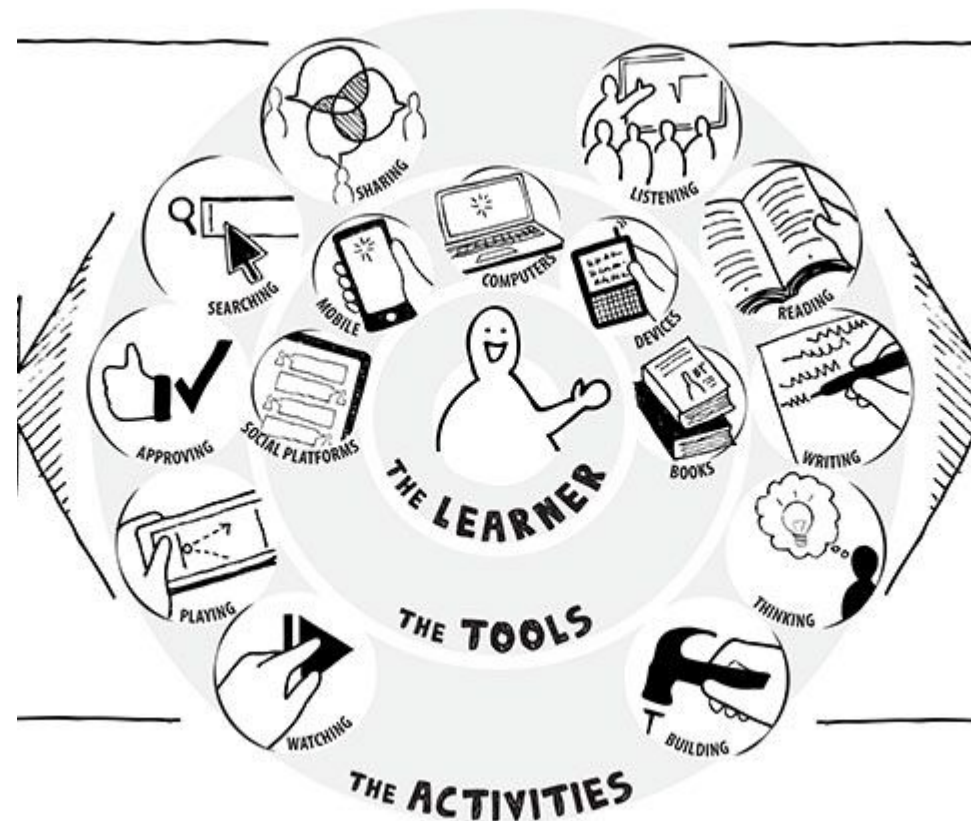
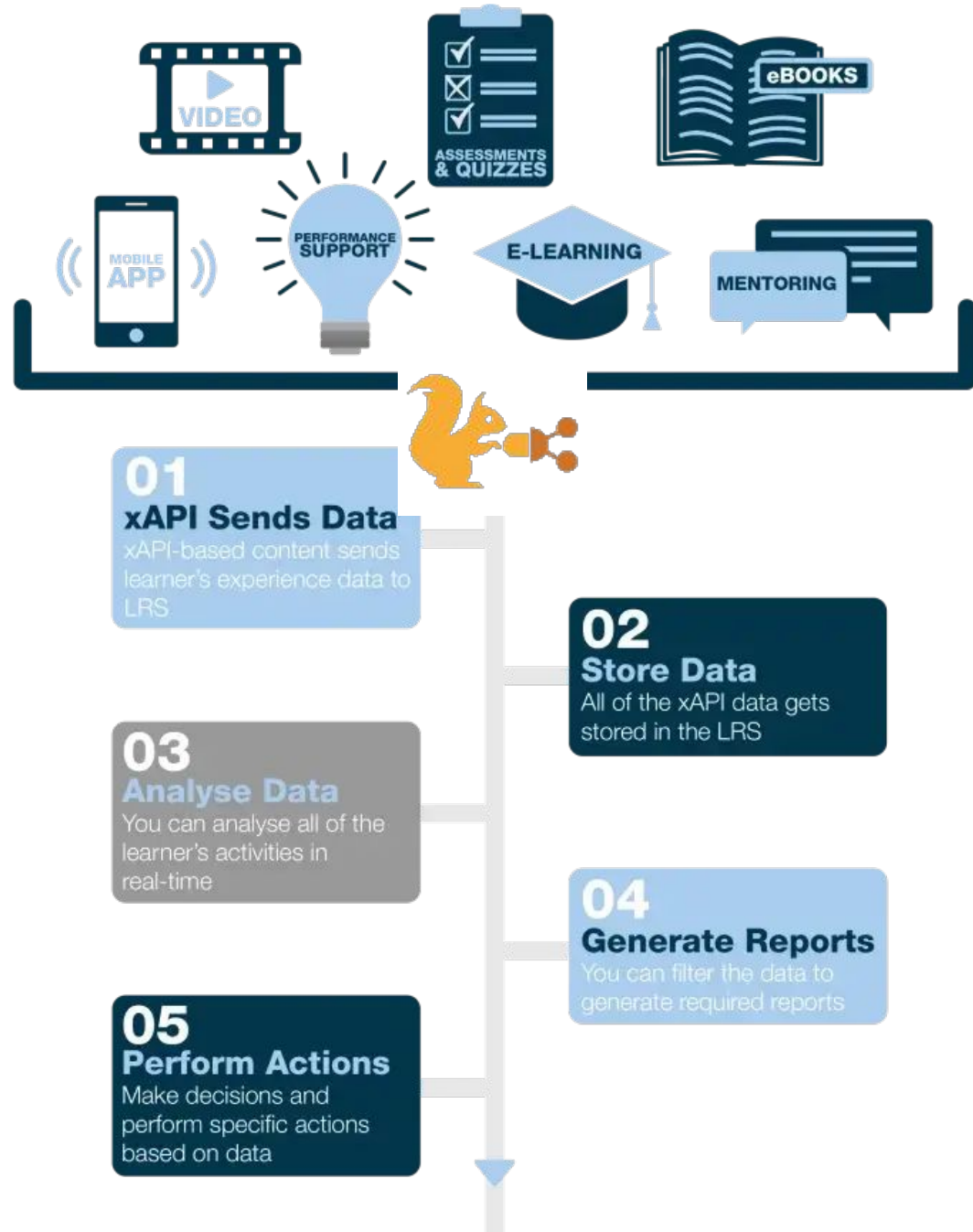


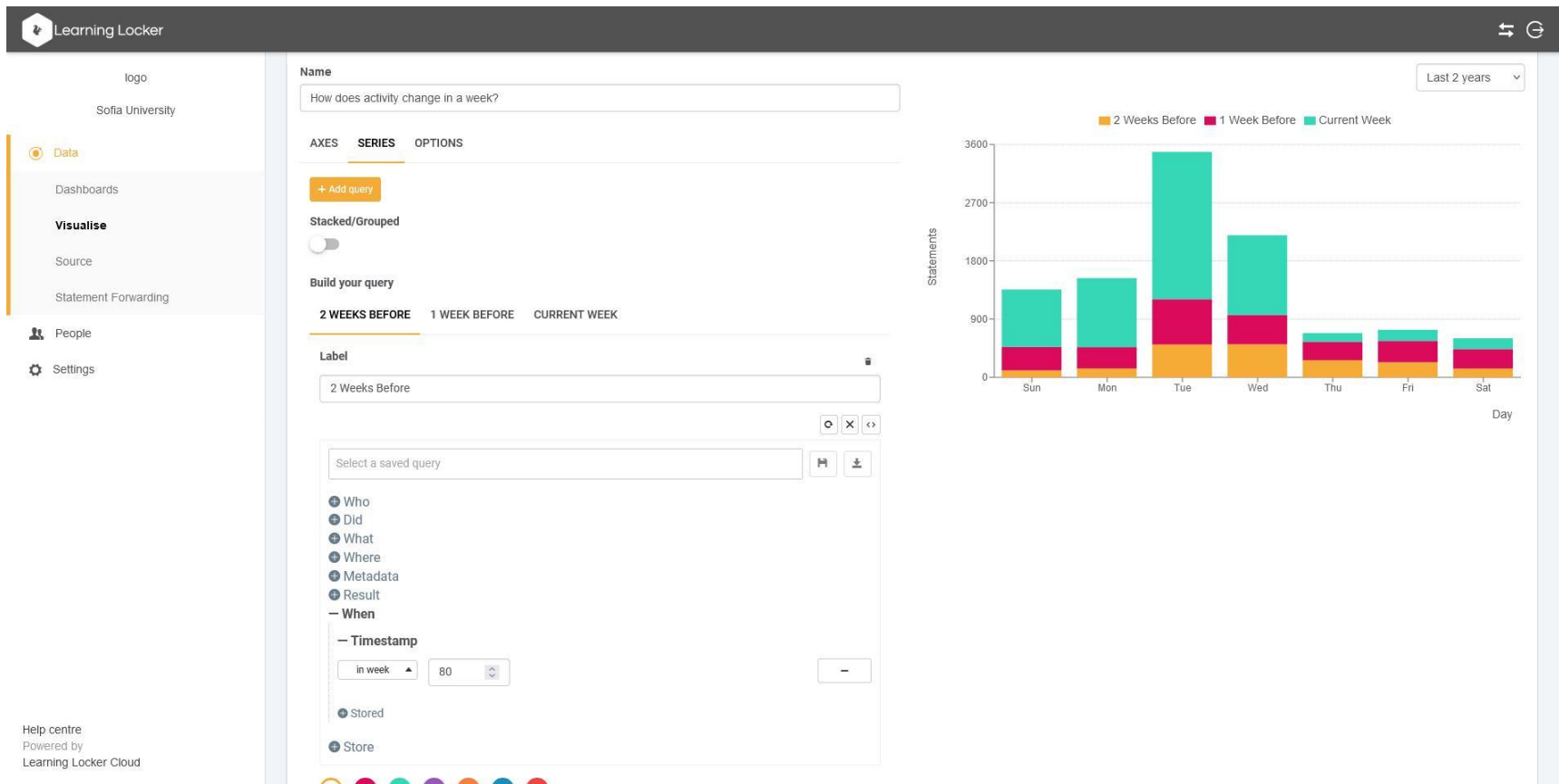
Image source: <https://xapi.com/overview/>



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



# Visual data exploration in Learning Locker



# 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!



# What we understand by multimodal data?

Data that is not coming from the LMS or necessarily from the institutional tools. E.g:

- External surveys
- Youtube videos tracking data
- Data about AI tools students use
- Instant messaging tools interactions among students

# Reflect and discuss: Do you use any multimodal data for training?

2' to think and share what multimodal data are you using in your training



# Main features of multimodal data

- Different data structures
- Different volume and speed of data
- Not always available
- This data could have different access policy than others (E.g: LMS vs Data in an instant messaging tool)

# How to use this data?

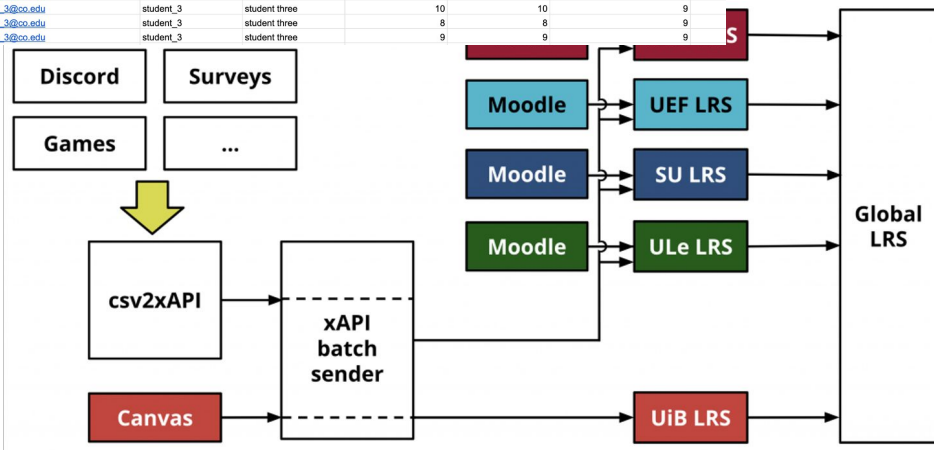


# Possible steps based on ILEDA's findings

- Check data availability
- Check data volume and speed
  - If necessary discard, group or adapt some data make them uniform
    - E.g: In a data stream consider the data at some specific moments, or average of the values.
- Check if data can be accessed or consent is required
- Adapt the data to something that can be analyzed
  - CSV2xAPI
  - It is necessary to think about how you later are going to filter and represent data
- Send it to a system in which you can explore it
  - LRS
- Visualize it in a dashboard

# Explore a data sample and how it is sent and represented

Timestamp	Email Address	Student number	Full name	I believe I can accomplish	I believe that my learning	I am keeping track of what I need to know
2023-09-11 08:58:18	student_1@co.edu	student_1	student one	10	10	8
2023-09-18 11:32:18	student_1@co.edu	student_1	student one	9	10	9
2023-10-25 10:02:31	student_1@co.edu	student_1	student one	10	10	10
2023-10-02 08:46:17	student_1@co.edu	student_1	student one	8	8	8
2023-10-09 15:22:56	student_1@co.edu	student_1	student one	9	8	9
2023-10-16 15:22:56	student_1@co.edu	student_1	student one	8	10	10
2023-10-23 15:22:56	student_1@co.edu	student_1	student one	9	10	9
2023-10-30 15:22:56	student_1@co.edu	student_1	student one	9	10	10
2023-09-11 08:58:18	student_2@co.edu	student_2	student two	7	8	8
2023-09-18 11:32:18	student_2@co.edu	student_2	student two	8	6	8
2023-10-25 10:02:31	student_2@co.edu	student_2	student two	7	7	6
2023-10-02 08:46:17	student_2@co.edu	student_2	student two	9	9	9
2023-10-09 15:22:56	student_2@co.edu	student_2	student two	10	10	10
2023-10-16 15:22:56	student_2@co.edu	student_2	student two	10	10	10
2023-10-23 15:22:56	student_2@co.edu	student_2	student two	9	10	10
2023-10-30 15:22:56	student_2@co.edu	student_2	student two	10	10	10
2023-09-11 08:58:18	student_3@co.edu	student_3	student three	9	10	10
2023-09-18 11:32:18	student_3@co.edu	student_3	student three	8	9	8
2023-10-25 10:02:31	student_3@co.edu	student_3	student three	10	10	8
2023-10-02 08:46:17	student_3@co.edu	student_3	student three	10	10	10
2023-10-09 15:22:56	student_3@co.edu	student_3	student three	8	8	5
2023-10-16 15:22:56	student_3@co.edu	student_3	student three	10	10	9
2023-10-23 15:22:56	student_3@co.edu	student_3	student three	8	8	9
2023-10-30 15:22:56	student_3@co.edu	student_3	student three	9	9	9



# How to implement intervention methods in teaching



## Plan the intervention

- You need to know why do you want to analyze
- What do you want to find out
- What data is available
  - Multimodal or regular data
  - How and when to collect the data
  - Should it be adapted
  - Should I ask for permission to access the data
- What decisions you would like to make
- Consider the type or types of intervention to do. E.g:
  - direct message, actionable feedback, categorisation of students, course redesign

# Prepare the data

- Collect the data
- Adapt it considering the activities developed to have similar metrics
- Store it using xAPI and a LRS

# Represent and analyze the data

- Represent it in several possible ways looking for the best possible solution



- Is this enough to make the chosen intervention?
  - If yes => Go with the next slide
  - If not => Go back two

## Proceed with the intervention

- Many based on feedback
  - Provide feedback and suggestions to the ones on risk
  - Provide feedback also to support the ones doing the things well
- Try to generate interaction, unidirectional feedback is not very useful
- Face to face feedback can be reported or even result in some type of agreement
- Interventions that mean changes in course design won't have an immediate effect

# Samples of interventions - Engagement Decrease

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the *Data Management Systems* course. Based on your activity in eLearn and the survey responses, we have noticed a significant decrease in your engagement since the beginning of the course.

We understand that challenges can arise during the semester, and we want to ensure that you have the support you need to succeed. If there are any difficulties—academic, personal, or technical—that may be affecting your progress, please know that we are here to help. We would love to discuss how we can support you, whether through study strategies, available resources, or guidance on course content.

If you'd like to talk, please reply to this email or contact your teacher directly. Your success in the course is important to us, and we are happy to assist in any way we can. You are definitely still in time to pass and succeed in your studies.

Looking forward to hearing from you.

Best  
The ISILA team

regards,

# Samples of interventions - Anxiety

Dear [NAME],

You are receiving this email as part of the ISILA project research study in the Data Management Systems course. We appreciate your dedication and engagement with the course materials. At the same time, we understand that you have reported experiencing high levels of anxiety, and we want to check in with you.

Balancing coursework and well-being can be challenging, and we want to ensure that you have access to the support and resources that may help. If you'd like to talk about any concerns—whether related to the course or general well-being—please feel free to reach out. We can discuss strategies for managing workload, study approaches, or direct you to additional resources that may be helpful.

You're doing great work, and your well-being is important to us. If you'd like, we can set up a time to chat—just reply to this email or contact your teacher directly.

Take care, and we're here if you need anything.

Best regards,

The ISILA team

# Samples of interventions - Specific Activities

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the *Social Network Analysis Course*. Based on your activity in eLearn and the survey responses in the first two weeks of the course, we have noticed you have not submitted your first assignment or completed the group project enrollment form [Here](#).

We understand that challenges can arise during the semester, and we want to ensure that you have the support you need to succeed. If there are any difficulties—academic, personal, or technical—that may be affecting your progress, please know that we are here to help. We would love to discuss how we can support you, whether through study strategies, available resources, or guidance on course content.

If you'd like to talk, please reply to this email or contact your teacher directly. Your success in the course is important to us, and we are happy to assist in any way we can. You are definitely still in time to pass and succeed in your studies.

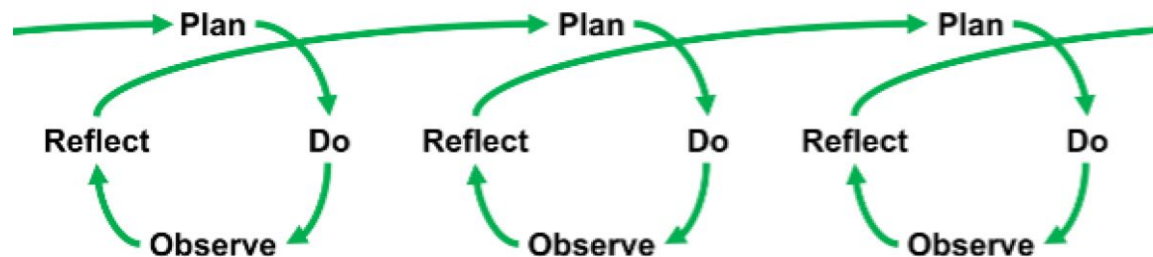
Looking forward to hearing from you.

## Some tips

- Performance of an intervention could depend on the data available and on how it can be understood
- Interaction teachers-students is essential
  - Try to increase responses rate by explaining the students its benefits
- Involve students through some kind of retribution (prices, grades, etc)
- Interventions not always have a positive effect, try again

# Do it yourself: Plan an intervention

5' to plan and share your potential intervention



# How to use learning analytics dashboards to track students learning progress



## Understanding the data

- You need to know what data is store and how it i stored
- You need to understand data structure
- You evaluate how useful this data can be
- Logs are just logs, it is necessary to build information from the data

## Curate and preprocess data

- To be represented data should be sent to the LRS
- Prepare data and map it with xAPI fields
  - Sometimes this is done directly (LMS)
  - Multimodal data usually requires using other tools (CSV2xAPI)
    - Map the csv fields

# Data selection and mapping

**ISI A csv2xAPI**

Import data Convert to xAPI Send to LRS

Choose CSV File

Browse... survey.csv

Upload complete

Select Columns to Transform: [Select All](#)

- Timestamp
- CourseId
- Course
- SurveyID
- Survey
- Verbid
- VerbName
- Name
- Email
- Motivation
- Engagement
- Metacognition
- Planning

Name column:

Question

Value column:

Answer

[Download](#) [Return to original](#)

[Transform to Long Format](#)

Show  entries Search:

Timestamp	CourseId	Course	SurveyID	Survey	Verbid	VerbName
2023-03-10 18:14:38	https://mylrs.es/courses/databases	Databases	https://mylrs.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answered
2023-03-10 18:14:38	https://mylrs.es/courses/databases	Databases	https://mylrs.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answer
2023-03-10 18:14:38	https://mylrs.es/courses/databases	Databases	https://mylrs.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answer
2023-03-10 18:14:38	https://mylrs.es/courses/databases	Databases	https://mylrs.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answer
2023-03-11 18:13:38	https://mylrs.es/courses/databases	Databases	https://mylrs.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answer

Showing 1 to 5 of 1,200 entries

Previous [1](#) [2](#) [3](#) [4](#) [5](#) ... [240](#)

**ISI A csv2xAPI**

Import data Convert to xAPI Send to LRS

Timestamp

Timestamp

Actor

Verb

Object

Result

Context

Activity parent id

SurveyID

Activity parent name

Survey

Context id

CourseId

Context name

Course

[Download](#) [Return to previous state](#) [Convert columns](#)

**Data to convert**

Show  entries Search:

Survey	Verbid	VerbName	Name	Email	Question	Answer
s.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answered	Person 1	person.1@uef.fi	Motivation 64
s.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answered	Person 1	person.1@uef.fi	Engagement 41
s.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answered	Person 1	person.1@uef.fi	Metacognition 91
s.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answered	Person 1	person.1@uef.fi	Planning 41
s.es/activities/srl	SRL	http://adinet.gov/expapi/verbs/answered	answered	Person 2	person.2@uef.fi	Motivation 67

Showing 1 to 5 of 1,200 entries

Previous [1](#) [2](#) [3](#) [4](#) [5](#) ... [240](#) Next

**Result**

# Sending data to the LRS (only in CSV2xAPI)

ISIA csv2xAPI

[Import data](#)
[Convert to xAPI](#)
[Send to LRS](#)

### LRS Auth

#### Endpoint:

#### Client name:

#### Client secret:

[Send to LRS](#)

### Server response


#### Sending the following statements

Show  entries

Search:

	result	context
<a href="#">auefirs.es/xapi/object/motivation</a> , "objectType": "Activity", "definition": "on"}}	{"response": "64"}	{"contextActivities": {"parent": {"id": "https://mylrs.es/activities/srl", "definition": {"name": "en": "SRL"}}, "grouping": {"id": "https://mylrs.es/courses/databases", "definition": {"name": "en": "Databases"}}}}
<a href="#">auefirs.es/xapi/object/engagement</a> , "objectType": "Activity", "definition": "nent"}}	{"response": "41"}	{"contextActivities": {"parent": {"id": "https://mylrs.es/activities/srl", "definition": {"name": "en": "SRL"}}, "grouping": {"id": "https://mylrs.es/courses/databases", "definition": {"name": "en": "Databases"}}}}
<a href="#">auefirs.es/xapi/object/metacognition</a> , "objectType": "Activity", "definition": "nition"}}	{"response": "91"}	{"contextActivities": {"parent": {"id": "https://mylrs.es/activities/srl", "definition": {"name": "en": "SRL"}}, "grouping": {"id": "https://mylrs.es/courses/databases", "definition": {"name": "en": "Databases"}}}}
<a href="#">auefirs.es/xapi/object/planning</a> , "objectType": "Activity", "definition": "i"}}	{"response": "41"}	{"contextActivities": {"parent": {"id": "https://mylrs.es/activities/srl", "definition": {"name": "en": "SRL"}}, "grouping": {"id": "https://mylrs.es/courses/databases", "definition": {"name": "en": "Databases"}}}}
<a href="#">auefirs.es/xapi/object/motivation</a> , "objectType": "Activity", "definition": "on"}}	{"response": "67"}	{"contextActivities": {"parent": {"id": "https://mylrs.es/activities/srl", "definition": {"name": "en": "SRL"}}, "grouping": {"id": "https://mylrs.es/courses/databases", "definition": {"name": "en": "Databases"}}}}

# Explore and understand the data in the LRS



ILEDA

- Data
- Dashboards
- Visualise
- Source**
- Statement Forwarding
- People
- Settings

Statements 📄

Explore 🏠 ✕ ⏪

Select a saved query 🏠 ⬇

- ⊕ Who
- ⊕ Did
- ⊕ What
- ⊕ Where
- ⊕ Metadata
- ⊕ Result
- ⊕ When
- ⊕ Store

▼ 9492d3b38e20b202d0b527bb69294cb140761626f971f1ca921323de8df6424f sent an hour ago

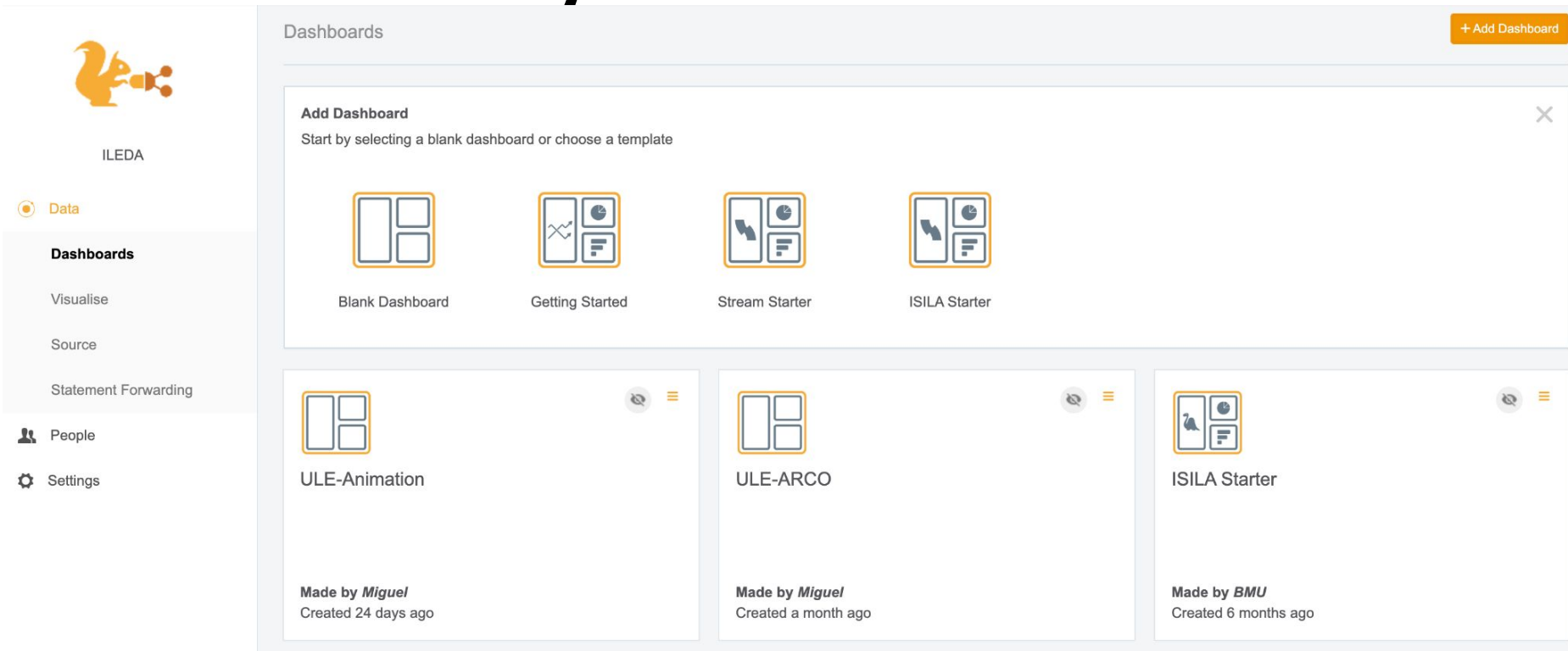
<http://example.com/discord/message/1428426321025040535>

```

{
  "stored": "2025-10-16T16:56:14.911Z",
  "priority": "MEDIUM",
  "active": true,
  "completedForwardingQueue": [],
  "failedForwardingLog": [],
  "client": "6463d9d23899915493ef0d84",
  "lrs_id": "6463d9d2389991b214ef0d83",
  "completedQueues": [
    "STATEMENT_QUERYBUILDERCACHE_QUEUE",
    "STATEMENT_FORWARDING_QUEUE",
    "STATEMENT_PERSON_QUEUE"
  ],
  "activities": [
    {
      "http://example.com/discord/message/1428426321025040535"
    }
  ],
  "hash": "a8136f305b6a0c4e800f12cc8a1e55b03bbd3233",
  "agents": [
    {
      "mailto:0e47b2e260cbb3bc21eae88dc0c8bc460c4aedf14ac268b6e874e6adb521baa2@anonymous"
    }
  ],
  "statement": {
    "authority": {
      "objectType": "Agent",
      "name": "UEF",
      "mbox": "mailto:hello@learninglocker.net"
    },
    "stored": "2025-10-16T16:56:14.911Z",
    "context": {
      "contextActivities": {
        "grouping": [
          {
            "id": "http://example.com/discord/guild/1415596674373652510".
          }
        ]
      }
    }
  }
}

```

# Build your own dashboard



The screenshot shows a web interface for building dashboards. On the left is a vertical sidebar with a logo of a squirrel and the text 'ILEDA'. Below the logo are menu items: 'Data', 'Dashboards', 'Visualise', 'Source', 'Statement Forwarding', 'People', and 'Settings'. The 'Dashboards' menu item is highlighted. The main content area is titled 'Dashboards' and has a '+ Add Dashboard' button in the top right corner. Below this is a modal window titled 'Add Dashboard' with a close button (X) in the top right. The modal contains the text 'Start by selecting a blank dashboard or choose a template' and four dashboard templates: 'Blank Dashboard', 'Getting Started', 'Stream Starter', and 'ISILA Starter'. Below the modal, three existing dashboards are displayed in a grid. Each dashboard card shows a preview icon, a title, and attribution information. The first card is 'ULE-Animation' by Miguel, created 24 days ago. The second is 'ULE-ARCO' by Miguel, created a month ago. The third is 'ISILA Starter' by BMU, created 6 months ago.

**ILEDA**

- Data
- Dashboards**
- Visualise
- Source
- Statement Forwarding
- People
- Settings

**Dashboards** + Add Dashboard

**Add Dashboard** ×

Start by selecting a blank dashboard or choose a template

- Blank Dashboard
- Getting Started
- Stream Starter
- ISILA Starter

**ULE-Animation** 🔄 ☰

Made by *Miguel*  
Created 24 days ago

**ULE-ARCO** 🔄 ☰

Made by *Miguel*  
Created a month ago




**ISILA Starter** 🔄 ☰

Made by *BMU*  
Created 6 months ago

# Define your representations

Add Visualisation Widgets ✕


Choose an option


-  [AC]: Feelings by student
-  [AC]: Effort and anxiety over time
-  [AC]: Effort vs Grades


Add new


▼ Pick a visualisation Made by Mig  
Created a few seconds ago


**Custom**


  
Bar


  
Correlation

  
Column


  
Line


  
Counter


  
Pie


  
Heatmap


**Templates**


  
What are the most popular learning experience activity types?


  
How many statements have been stored in the last 7 days?


  
How has activity changed over time?


  
What are the most popular verbs?


  
What are the most popular activities?


  
Who are the most active people?


  
How does activity change in a week?


  
Stream interactions vs engagement (last 7 days)


  
Stream comment count (last 7 days)


  
Stream learner interactions by date and verb (last 30 days)


  
Stream user engagement leaderboard (last 7 days)


  
Stream proportion of social interactions (last 7 days)


  
Stream activities with most comments (last 7 days)

  
Time spent (in minutes)

  
How does activity shift across the hours?

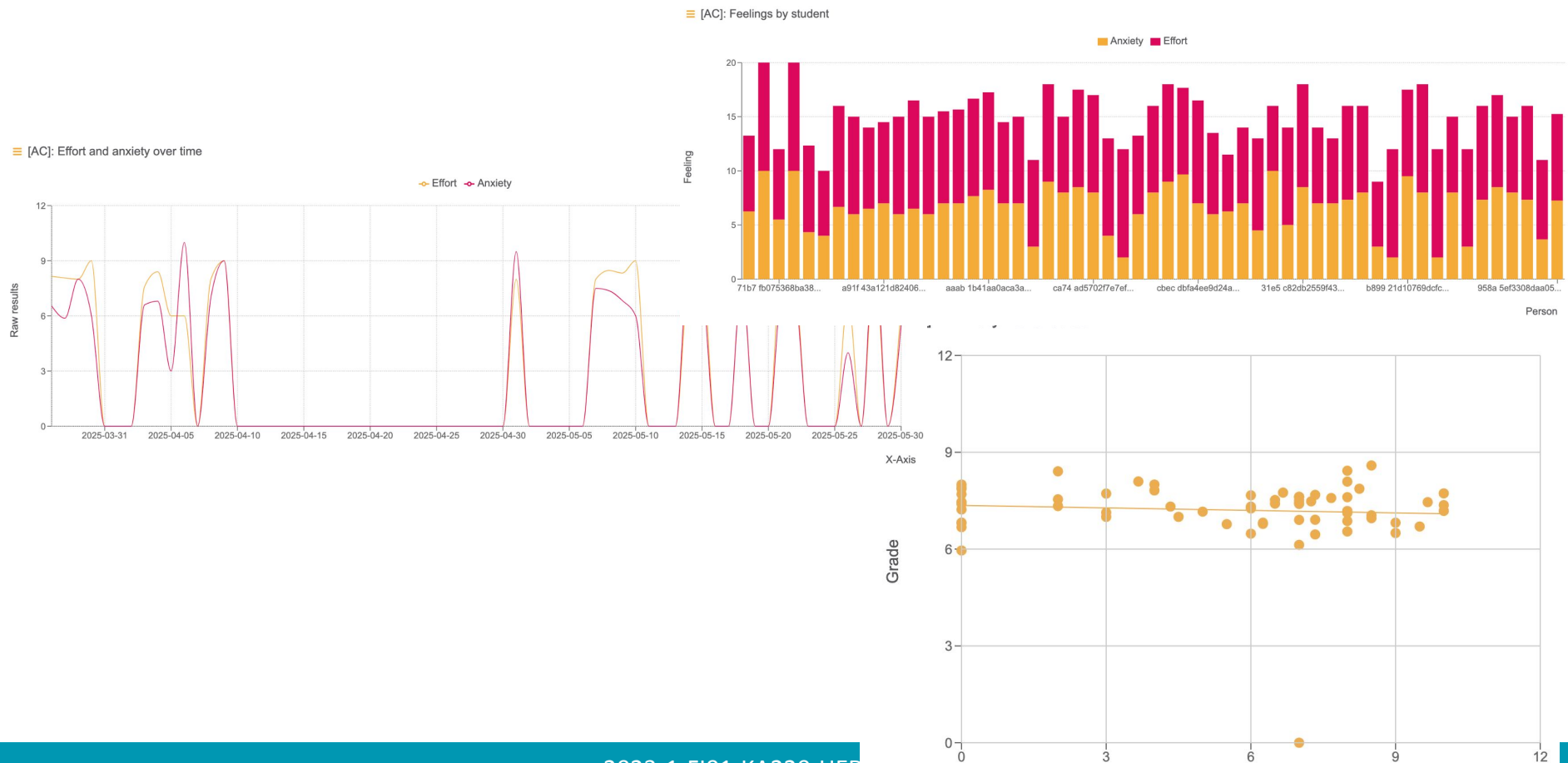
  
Statements vs Grades

  
Grades vs Time spent

  
Average Time Spent in Quiz Attempts

2023-1-FI01-KA220-HED-000159757

# Check you data and try again if necessary



# Do it yourself: Think about a representation and try it in our dummy dashboards



# General Ethical Guidelines to be considered



# General Facts

- Students must consent the use of their data
- Consent must be explicit and revokable
- Students who choose not to participate in the experiment will not be disadvantaged in any way and will have access to the same learning opportunities as the rest of their peers
- Students information will only be published with previous consent and in anonymous way

# Issues to consider

- It is necessary to show the students the potential benefits of the interventions
  - How students progress is analyzed
  - Intervention samples
- Engage them in other ways (rewards, extra points, ...)
- It is better to do an anonymize intervention (maybe post hoc) than doing none
- Explain also the benefits to the teachers

# Q & A

# Short survey

To be done



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# Thank you!