



Pilot Course Curriculum and Intervention Plan for Distributed Systems (BMU)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Table of Content

1	General course information>	4
2	Motivation and purpose (Why)	4
3	Defining more precisely what to explore (What)	5
4	Data collection strategy (How)	6
5	Data analysis and interpretation (So What)	7
6	Interventions plan (Now What)	7

1 General course information

Course name	Distributed Systems
Institution	Belgrade Metropolitan University (BMU)
Course level	Undergraduate
Teaching model	Hybrid – face to face teaching with online resources and assignments
Course learning objectives	• Understand the concepts of distributed systems • Master communication protocols TCP/IP, UDP, and middleware. • Understand the concepts of coordination and consistency in distributed systems • Understand fault tolerance and reliability • Understand security principles in distributed systems. • Apply concepts of distributed systems in the real world • Evaluate system performance • Master awareness of emerging trends in distributed systems.

2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	• Gain insights into student engagement and progress in mastering distributed systems concepts and techniques. • Improve student engagement in the course and their learning. • Investigate the evolution of students' self-regulation throughout the course?

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	• Which activities students find engaging? • How student engagement correlates with learning outcomes? • How students progress through assignments and projects? • How much students engage in course activities? • What is the evolution of students’ self-regulation throughout the course?
Data sources	• Engagement with the lectures • Exercise/assignment submission and grades • SRL weekly survey • Discord conversation data

4 Data collection strategy (How)

Data sources		• Learning Management System (LMS) • Quizzes and assignments • Discord student discussions • SRL surveys	
Data aggregation		Data will be collected in xAPI format and integrated into Learning Locker either directly from the LMS plugin or through the csv2xAPI tool developed within the ISILA project	
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Introduction to distributed systems	• Slides and teaching materials for the topics: - o Computer networks - o Centralized, decentralized and distributed systems - o Designing distributed systems - o Common mistakes when designing distributed systems • Self-assessment quizzes • Exercises for understanding needed software and environment for developing distributed applications • Homework assignment 1	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
2	Distributed systems architecture	• Slides and teaching materials for the topics: - o Architecture styles of distributed systems	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades

		- o Middleware in distributed systems - o Layered distributed systems - o Symmetrical architectures - o Hybrid architectures • Self-assessment quizzes • Exercises in Python • Homework assignment 2 • Discord discussion about assignment 2	• Discord student discussion
3	Processes and threads	• Slides and teaching materials for the topics: - o Processes - o Threads - o Multithreading in distributed systems • Self-assessment quizzes • Exercises in Python • Homework assignment 3 • Discord discussion about assignment 3	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
4	Virtualization	• Slides and teaching materials for the topics: - o Principles of virtualization - o Containers - o Virtual machines vs containers - o Applying virtual machines in distributed systems • Self-assessment quizzes • Exercises in virtualization software • Homework assignment 4 • Discord discussion about assignment 4	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
5	Clients servers and	• Slides and teaching materials for the topics:	• Interaction with teaching materials in the course LMS

		- o Networked user interfaces - o Virtual environments - o Client software - o Server design - o Object servers • Self-assessment quizzes • Exercises in Python • Homework assignment 5 • Discord discussion about assignment 5	• Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
6	Communication in distributed systems	• Slides and teaching materials for the topics: - o Basics of communication in distributed systems - o RPC - o Message-based communication - o Multicast communication • Self-assessment quizzes • Exercises for distributed systems development • Homework assignment 6 • Discord discussion about assignment 6	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
7	Coordination in distributed systems	• Slides and teaching materials for the topics: - o Clock synchronization - o Logical clocks - o Mutual exclusion - o Election algorithms - o Coordination algorithms • Self-assessment quizzes • Exercises for distributed systems development • Homework assignment 7 • Discord discussion about assignment 7	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion

8	Names, identifiers and addresses	• Slides and teaching materials for the topics: - o Simple naming - o Structured naming - o Attribute-based naming - o Networking with named data • Self-assessment quizzes • Exercises for distributed systems development • Homework assignment 8 • Discord discussion about assignment 8	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
9	Consistence in distributed systems	• Slides and teaching materials for the topics: - o Consistence models - o Data-based models - o Client-based models - o Consistence protocols • Self-assessment quizzes • Exercises for distributed systems development • Homework assignment 9 • Discord discussion about assignment 9	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
10	Replication in distributed systems	• Slides and teaching materials for the topics: - o Replication - o Managing replication - o Replication and content storage - o Content distribution - o Content management - o Caching and replication in the Web • Self-assessment quizzes • Exercises for distributed systems development t	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion

		• Homework assignment 10 • Discord discussion about assignment 10	
11	Fault tolerance in distributed systems	• Slides and teaching materials for the topics: ◦ Basic fault tolerance concepts ◦ Fault models ◦ Fault masking ◦ Fault tolerance • Self-assessment quizzes • Exercises for distributed systems development • Homework assignment 11 • Discord discussion about assignment 11	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
12	Reliable communication in distributed systems	• Slides and teaching materials for the topics: ◦ Reliable client-server communication ◦ Point-to-point communication ◦ Reliable group communication ◦ Distributed commit ◦ Rollback • Self-assessment quizzes • Exercises for distributed systems development • Homework assignment 12 • Discord discussion about assignment 12	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
13	Security in distributed systems	• Slides and teaching materials for the topic: ◦ Cryptography ◦ Authentication ◦ Trust in distributed systems ◦ Authorization • Self-assessment quizzes	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion

		• Exercises for distributed systems development • Homework assignment 13 • Discord discussion about assignment 13	
14	Intro to Java enterprise edition	• Slides and teaching materials for the topic: - o Introduction to servlets - o Servlet creation - o Servlet lifecycle - o Servlets and sessions - o Asynchronous servlets • Self-assessment quizzes • Exercises for distributed systems development • Homework assignment 14 • Discord discussion about assignment 14	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Project grades • Discord student discussion
15	Intro to blockchain technology	• Slides and teaching materials for the topic: - o Blockchain technologies - o Distributed ledgers - o Consensus mechanisms • Self-assessment quizzes • Exercises for distributed systems development • Homework assignment 15 • Course project assignment • Discord discussion about the project	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Project grades • Discord student discussion

5 Data analysis and interpretation (So What)

Sense making and interpretation context	Use dashboards to visualize engagement levels. Analyze correlations between activities and outcomes. Identify students that are in the bottom quartile of activity and self-regulation. Compare results with course goals and prior expectations.
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6 Interventions plan (Now What)

Potential interventions	Face-to-face interventions: - devote more time to the topic/assignment, - arrange additional learning activities, - address challenges, - extend deadlines if students are struggling. Internet-based interventions: - email class-wide reminders, - recommendations, - personalized email offering 1-to-1 tutorial or additional support, - share additional resources on Discord. Content adjustments: - revise content or format for topics with low engagement (e.g., simplify lecture slides, add examples).
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Pilot Course Curriculum and Intervention Plan for Fundamentals of Web Development (BMU)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Author(s)	Miroslava Raspopović Milić, BMU
With contributions by:	
Revised by:	Sonsoles López-Pernas, UEF

Table of Content

1	General course information>	4
2	Motivation and purpose (Why)	4
3	Defining more precisely what to explore (What)	5
4	Data collection strategy (How)	6
5	Data analysis and interpretation (So What)	7
6	Interventions plan (Now What)	7

1 General course information

Course name	Fundamentals of Web Development
Institution	Belgrade Metropolitan University (BMU)
Course level	Undergraduate
Teaching model	Hybrid – face to face teaching with online resources and assignments
Course learning objectives	• Understand the basics of web technologies • Differentiate between client-side and server-side programming • Apply HTML elements for structuring web pages • Use CSS for styling and layout positioning • Develop interactive web pages using JavaScript • Implement object-oriented concepts in JavaScript • Work with JSON and jQuery • Apply SEO optimization techniques

2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	• Gain insights into student engagement and progress in mastering web development concepts and techniques. • Improve student engagement in the course and their learning. • Investigate the evolution of students' self-regulation throughout the course?

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	• Which activities students find engaging? • How student engagement correlates with learning outcomes? • How students progress through assignments and projects? • How much students engage in course activities? • What is the evolution of students’ self-regulation throughout the course?
Data sources	• Engagement with the lectures • Exercise/assignment submission and grades • SRL weekly survey • Discord conversation data

4 Data collection strategy (How)

Data sources	• Learning Management System (LMS) • Quizzes and assignments • Discord student discussions • SRL surveys		
Data aggregation	Data will be collected in xAPI format and integrated into Learning Locker either directly from the LMS plugin or through the csv2xAPI tool developed within the ISILA project		
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Fundamentals of web technologies	• Slides and teaching materials for the topics: ◦ Internet and WWW ◦ URI, URL, URN ◦ HTTP ◦ Web technologies: HTML, CSS, Javascript ◦ Client-side programming ◦ Server-side programming ◦ Responsive design • Self-assessment quizzes • Exercises for understanding request/response method of HTTP • Homework assignment 1	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
2	Basic HTML elements	• Slides and teaching materials for the topics: ◦ Steps in Website Development ◦ HTML Document Structure ◦ HTML Elements	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades

		- o HTML Attributes - o HTML Headings - o HTML Paragraphs - o HTML Styles - o HTML Formatting - o HTML Comments - o HTML Colors - o HTML Links - o HTML Head • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 2 • Discord discussion about assignment 2	• Discord student discussion
3	Structuring web pages with HTML	• Slides and teaching materials for the topics: - o HTML Images – Map, Background, Favicon - o HTML Tables - o HTML Lists - o HTML Layout - o HTML Forms - o HTML Symbols • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 3 • Discord discussion about assignment 3	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
4	HTML classes and identifiers	• Slides and teaching materials for the topics: - o HTML block/inline - o HTML class - o HTML id - o HTML iframes - o HTML responsive • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 4 • Discord discussion about assignment 4	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion

5	HTML and CSS	• Slides and teaching materials for the topics: ◦ User interface design ◦ Why use CSS? ◦ HTML and CSS ◦ CSS document structure ◦ CSS syntax ◦ CSS colors ◦ CSS text formatting (Text, Font, Icons, Lists) • Self-assessment quizzes • Exercises for CSS development • Homework assignment 5 • Discord discussion about assignment 5	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
6	CSS	• Slides and teaching materials for the topics: ◦ CSS padding ◦ CSS border ◦ CSS margins ◦ CSS box model ◦ CSS table formatting • Self-assessment quizzes • Exercises for CSS development • Homework assignment 6 • Discord discussion about assignment 6	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
7	CSS: Elements positioning	• Slides and teaching materials for the topics: ◦ CSS Positioning ◦ CSS Layout • Self-assessment quizzes • Exercises for CSS development • Homework assignment 7 • Discord discussion about assignment 7	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
8	Advanced CSS	• Slides and teaching materials for the topics:	• Interaction with teaching materials in the course LMS • Filling out SRL survey

		- o CSS transformation (2D, 3D) - o Responsive CSS - o Bootstrap • Self-assessment quizzes • Exercises for CSS development • Homework assignment 8 • Discord discussion about assignment 8	• Assignment submissions • Assignment grades • Discord student discussion
9	Introduction to JavaScript	• Slides and teaching materials for the topics: - o What is JavaScript - o Adding JavaScript to an HTML page - o Syntax rules - o Statements - o Variables - o Data types - o Operators - o Conditional statements - o Loops - o Functions • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 9 • Discord discussion about assignment 9	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
10	JavaScript objects and arrays	• Slides and teaching materials for the topics: - o Arrays - o Objects • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 10 • Discord discussion about assignment 10	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
11	JavaScript OOP	• Slides and teaching materials for the topics: - o Methods - o Classes	• Interaction with teaching materials in the course LMS • Filling out SRL survey

		- o Objects - o Constructors - o Encapsulation - o Polymorphism - o Inheritance • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 11 • Discord discussion about assignment 11	• Assignment submissions • Assignment grades • Discord student discussion
12	DOM manipulation and events	• Slides and teaching materials for the topics: - o Document Structure - o Finding Elements - o Creating Nodes - o Positioning - o Events - o Form Validation • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 12 • Discord discussion about assignment 12	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
13	JS JSON	• Slides and teaching materials for the topic: - o JS JSON • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 13 • Discord discussion about assignment 13	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion
14	JQuery	• Slides and teaching materials for the topic: - o JQuery • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 14	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Project grades

		• Discord discussion about assignment 14	• Discord student discussion
15	SEO optimization	• Slides and teaching materials for the topic: - o SEO optimization • Self-assessment quizzes • Exercises for HTML web development • Homework assignment 15 • Course project assignment • Discord discussion about the project	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Project grades • Discord student discussion

5 Data analysis and interpretation (So What)

Sense making and interpretation context	Use dashboards to visualize engagement levels. Analyze correlations between activities and outcomes. Identify students that are in the bottom quartile of activity and self-regulation. Compare results with course goals and prior expectations.
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6 Interventions plan (Now What)

Potential interventions	Face-to-face interventions: - devote more time to the topic/assignment, - arrange additional learning activities, - address challenges, - extend deadlines if students are struggling. Internet-based interventions: - email class-wide reminders, - recommendations, - personalized email offering 1-to-1 tutorial or additional support, - share additional resources on Discord. Content adjustments: - revise content or format for topics with low engagement (e.g., simplify lecture slides, add examples).
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Pilot Course Curriculum and Intervention Plan for Object-oriented programming I (BMU)

**“Improving the quality and sustainability of
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on learning analytics”**

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Author(s)	Jovana Jović, BMU
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1	General course information>	4
2	Motivation and purpose (Why)	4
3	Defining more precisely what to explore (What)	5
4	Data collection strategy (How)	6
5	Data analysis and interpretation (So What)	7
6	Interventions plan (Now What)	7

1 General course information

Course name	Object-oriented programming I
Institution	Belgrade Metropolitan University (BMU)
Course level	Undergraduate
Teaching model	Hybrid – face to face teaching with online resources and assignments
Course learning objectives	• Mastery of basic methods of procedural programming in Java • Understanding, writing, and using methods (subprograms) in Java • Understanding and applying object-oriented programming concepts using Java • Understanding and working with arrays • Storing data in text and binary files • Ability to create simpler programs in Java

2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	• Gain insights into student engagement and progress in mastering Java programming concepts and techniques, including procedural and object-oriented programming. • Improve student understanding and application of Java methods, arrays, and file handling. • Investigate the evolution of students' problem-solving and programming skills throughout the course. • Explore how students apply theoretical concepts to create simple yet functional Java programs.

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	• Which activities do students find most engaging when learning Java programming? • How does student engagement correlate with their mastery of procedural and object-oriented programming concepts in Java? • How do students progress through coding assignments, exercises, and projects in Java? • To what extent do students actively engage with course activities related to methods, arrays, and file handling? • What is the evolution of students' self-regulation and problem-solving skills as they advance through the Java programming course?
Data sources	• Engagement with the lectures • Exercise/assignment submission and grades • SRL weekly survey • Discord conversation data

4 Data collection strategy (How)

Data sources		• Learning Management System (LMS) • Quizzes and assignments • Discord student discussions • SRL surveys	
Data aggregation		Data will be collected in xAPI format and integrated into Learning Locker either directly from the LMS plugin or through the csv2xAPI tool developed within the ISILA project	
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Introduction to Java	• Slides and teaching materials for the topics: - o Specification of the Java programming language - o A simple program in Java - o Creating, compiling, and executing programs - o Programming style and documentation - o Programming errors - o Developing Java programs using NetBeans/IntelliJ • Exercises for compiling and executing programs • Individual practice: Practice tasks • Test 1	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
2	Elementary Programming in Java	• Slides and teaching materials for the topics: - o Reading input from the console - o Identifiers and variables - o Assignment statements and expressions - o Naming constants, naming conventions - o Numeric data types and operations - o Numeric constants - o JShell tool for command-line execution - o Solving expressions and operator precedence	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades

		- o Case study: Determining the current time - o Extended assignment operators - o Increment and decrement operators - o Numeric type conversions - o Software development process - o Case study: Counting monetary units - o Common errors and pitfalls • Exercises for sample Java programs • Individual practice: Practice tasks • Test 2	
3	Selections	• Slides and teaching materials for the topics: - o Logical data types, values, and expressions - o if-else statements - o Common errors and pitfalls - o Generating random numbers - o Case study: Calculating Body Mass Index (BMI) - o Case study: Tax calculation - o Logical operators - o Two computer science case studies - o switch statements - o Conditional operators - o Debugging - o Video demonstrations, examples, and self-assessment tests • Exercises for selections in Java programs • Individual practice: Practice tasks • Homework assignment 1 • Test 3	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
4	Mathematical Functions, Symbols, and Strings	• Slides and teaching materials for the topics: - o Common mathematical functions - o char data type for symbols and operations - o String class - o Case study: Guessing a birthday - o Case study: Converting a hexadecimal digit - o Case study: Revising the lottery program - o Formatting console output - o Video demonstrations, examples, and self-assessment tests • Exercises for mathematical, functions, symbols and strings in Java programs	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades

		• Individual practice: Practice tasks • Test 4	
5	Loops	• Slides and teaching materials for the topics: - o Introduction to loops - o while loop - o Case study: Guessing numbers - o Strategies for loop design - o Controlling loops by limiting values - o do-while loop - o for loop - o Choosing the right loop - o Nested loops - o Minimizing numerical errors - o Keywords: break and continue - o Case studies - o Video demonstrations, examples, and self-assessment tests • Exercises for loops in Java programs • Individual practice: Practice tasks • Test 5	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
6	Methods	• Slides and teaching materials for the topics: - o Defining methods - o Calling methods - o void vs. methods returning values - o Passing arguments by value - o Modular programming - o Case study: Hexadecimal-to-decimal conversion - o Method overloading - o Variable scope - o Case study: Generating random characters - o Method abstraction and incremental refinement - o Implementation details - o Video demonstrations, examples, and self-assessment tests • Exercises for methods in Java programs • Individual practice: Practice tasks • Homework assignment 2 • Test 6	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
7	Single-Dimensional Arrays	• Slides and teaching materials for the topics: - o Basics of arrays - o Case study: Analyzing numbers - o Case study: Deck of cards - o Copying arrays	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Discord student discussion

		- o Passing arrays to methods - o Case study: Counting letter occurrences - o Variable-length argument lists - o Searching arrays - o Sorting arrays - o Array class - o Command-line arguments - o Video demonstrations, examples, and self-assessment tests • Exercises for single-dimension array in Java programs • Individual practice: Practice tasks • Test 7 • Essay 1 • Discord discussion essay 1	
8	Multi-Dimensional Arrays	• Slides and teaching materials for the topics: - o Basics of multi-dimensional arrays - o Processing two-dimensional arrays - o Passing two-dimensional arrays to methods - o Case study: Grading a multiple-choice test - o Case study: Finding the closest pair - o Case study: Sudoku - o Multi-dimensional arrays - o Video demonstrations, examples, and self-assessment tests • Exercises for multi-dimension array in Java programs • Individual practice: Practice tasks • Test 8	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
9	Objects and Classes	• Slides and teaching materials for the topics: - o Defining classes for objects - o Constructing objects using constructors - o Accessing objects through reference variables - o Using classes from the Java library - o Static variables, constants, and methods - o Visibility modifiers - o Encapsulation of data fields - o Passing objects to methods - o Arrays of objects - o Immutable objects and classes, and their scope - o this reference	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades

		- o Video demonstrations, examples, and self-assessment tests • Exercises for object and classes in Java programs • Individual practice: Practice tasks • Homework assignment 3 • Test 9	
10	Object-Oriented Thinking	• Slides and teaching materials for the topics: - o Abstraction and encapsulation of classes - o Thinking in objects - o Class relationships - o Case study: Designing the Course class - o Case study: Designing a class for stacks - o Handling primitive data types as objects - o Automatic type conversion - o Classes BigInteger and BigDecimal - o String class - o StringBuilder and StringBuffer classes - o Video demonstrations, examples, and self-assessment tests • Exercises for object oriented thinking in Java programs • Individual practice: Practice tasks • Test 10	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
11	Inheritance and Polymorphism	• Slides and teaching materials for the topics: - o Superclasses and subclasses - o Using the super keyword - o Method overriding - o Polymorphism - o Dynamic binding - o Object conversion and the instanceof operator - o The equal() method for objects - o ArrayList class - o Useful methods for lists - o Case study: Custom stack class - o Protected data and methods - o Preventing extension and overriding - o Video demonstrations, examples, and self-assessment tests • Exercises for inheritance and polymorphism in Java programs • Individual practice: Practice tasks • Test 11	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades

12	Working with Exceptions and Input/Output of Textual Data	• Slides and teaching materials for the topics: ◦ Working with exceptions ◦ Types of exceptions ◦ Throwing, declaring, and catching exceptions ◦ Using exceptions ◦ Defining custom exception classes ◦ File class ◦ Files for reading and writing textual data ◦ Reading data from the web ◦ Case study: Web scraper ◦ Video demonstrations, examples, and self-assessment tests • Exercises for exceptions in Java programs • Individual practice: Practice tasks • Homework assignment 4 • Test 12	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
13	Abstract Classes and Interfaces	• Slides and teaching materials for the topics: ◦ Abstract classes ◦ Case study: Abstract number class ◦ Case study: Calendar and Gregorian calendar ◦ Interfaces ◦ Comparable interface ◦ Clonable interface ◦ Interfaces vs. abstract classes ◦ Case study: Rational class ◦ Guidelines for class design ◦ Video demonstrations, examples, and self-assessment tests • Exercises for exceptions in Java programs • Individual practice: Practice tasks • Test 13	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades
14	Input and Output of Binary Data	• Slides and teaching materials for the topics: ◦ How to manage text I/O in Java? ◦ Text I/O vs. binary I/O ◦ Binary I/O classes ◦ Case study: Copying files ◦ Object input and output ◦ Files with random access ◦ Video demonstrations, examples, and self-assessment tests • Exercises for exceptions in Java programs • Individual practice: Practice tasks	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades

		• Test 14	
15	Testing with JUnit	• Slides and teaching materials for the topics: - o Basics of JUnit - o Using JUnit in NetBeans - o Test programs • Exercises for exceptions in Java programs • Individual practice: Practice tasks • Homework assignment 5 • Test 15 • Course project assignment • Project • Discord discussion about the project • Discord discussion about the essay 2	• Interaction with teaching materials in the course LMS • Filling out SRL survey • Assignment submissions • Assignment grades • Project grades • Discord student discussion

5 Data analysis and interpretation (So What)

Sense making and interpretation context	Use dashboards to visualize student engagement levels in Java programming activities. Analyze correlations between course activities (e.g., coding exercises, case studies, and tests) and student performance outcomes. Identify students in the bottom quartile based on activity completion, self-regulation, and programming skills. Compare student results with established course goals (e.g., mastering Java concepts) and prior performance expectations.
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6 Interventions plan (Now What)

Potential interventions	Face-to-face interventions: - devote more time to the topic/assignment, - arrange additional learning activities, - address challenges, - extend deadlines if students are struggling. Internet-based interventions: - email class-wide reminders, - recommendations, - personalized email offering 1-to-1 tutorial or additional support, - share additional resources on Discord. Content adjustments: - revise content or format for topics with low engagement (e.g., simplify lecture slides, add examples).
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Pilot Course Curriculum and Intervention Plan for Digital Design and Multimedia (SU)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Table of Content

1	General course information>	4
2	Motivation and purpose (Why)	4
3	Defining more precisely what to explore (What)	5
4	Data collection strategy (How)	6
5	Data analysis and interpretation (So What)	7
6	Interventions plan (Now What)	7

1 General course information

Course name	Digital Design and Multimedia – Digital Media
Institution	Sofia University
Course level	Undergraduate
Teaching model	In-person
Course learning objectives	The digital design and multimedia (Digital Media) course is elective for all students. It includes almost all different media and modality in a coherent combination. The course focuses on equipping students with the creative, technical, and conceptual skills needed to design and create engaging digital content and multimedia experiences. Learning objectives: 1. Understand the Foundations of Digital Design - Grasp the basic principles of design, including color theory, typography, layout, balance, and composition. - Explore the history and evolution of digital media and its role in communication. - Understand visual storytelling and its impact on user engagement. 2. Learn Multimedia Tools and Software - Gain proficiency in industry-standard design software, such as Adobe Photoshop, Illustrator, InDesign, Premiere Pro, After Effects, and others. - Learn to use tools for creating 2D and 3D graphics, animations, and interactive media. - Explore web design tools (e.g., Figma, Adobe XD) for creating user interfaces and interactive prototypes. 3. Master Digital Media Production Techniques - Develop skills in digital image editing, vector graphic creation, and layout design. - Learn video editing, motion graphics, and audio production for multimedia projects. - Understand file formats, resolution, and optimization for different platforms (e.g., web, mobile, print). 4. Create and Edit Multimedia Content

	- Develop the ability to create multimedia projects that integrate text, images, video, audio, and animation. - Produce content for various platforms, such as websites, social media, apps, and interactive presentations. - Explore branding and advertising strategies in digital media. 5. Apply Creativity and Concept Development - Learn to brainstorm and conceptualize innovative ideas for digital projects. - Translate creative concepts into visually compelling designs and media. - Develop critical thinking skills to solve design challenges effectively. 6. Understand Digital Storytelling and Branding - Explore storytelling techniques for creating narratives through multimedia. - Learn to design digital content aligned with brand identity and target audience. - Understand marketing strategies for promoting multimedia projects. 7. Learn Project Management and Collaboration - Develop skills in planning, organizing, and executing multimedia projects. - Collaborate with others in team-based projects, simulating real-world work environments. - Manage deadlines and deliverables in a structured workflow. 8. Explore Emerging Trends and Technologies - Understand the impact of emerging trends, such as AR/VR, AI, and 3D modeling, on digital design. - Explore innovations in interactive multimedia and experiential design. - Analyze ethical issues, such as copyright and fair use, in the digital design industry. 9. Build a Professional Portfolio - Develop a comprehensive portfolio showcasing a range of digital design and multimedia projects.
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	- Present work effectively to clients, employers, or collaborators. - Learn the basics of freelancing, client management, or working in creative agencies.
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2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	Getting insights into students' engagement with online learning resources. Improving student engagement with learning activities How engaged are students with online activities? How engaged are students in their assignment work? How engaged are students in their group collaboration? How are students progressing on course activities? How much do students engage in class preparation activities?

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	Which activities do students find engaging? Is regular engagement associated with better learning results? How much do students engage in class preparation activities?
Data sources	Engagement logs, quiz attempts, assignment submissions

4 Data collection strategy (How)

Data sources		Learning management system (LMS) Moodle, quizzes.	
Data aggregation		Data will be collected in xAPI format and integrated into Learning Locker either directly from the LMS plugin or through the csv2xAPI tool developed within the ISILA project	
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Introduction to digital media	- Course structure slides - Introductory videos	- Interaction with slides and videos, logged in the course LMS.
2	Possibilities and effects of audiovisual messages. Copyright basics.	- Slides on the topic - Videos on the topic - Class activity 1: Assignment “Rule of thirds” - Class activity 2: “Golden ratio” - Class activity 3: Assignment “Golden spiral”	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.
3	Photography. Introduction. History of Photography	- Slides on the topic - Videos on the topic - Class activity: Assignment “Photographic genres”	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.
4	Basics of digital photography, Part I. Working with a camera. Main parts, functionality, shooting techniques.	- Slides on the topic - Videos on the topic - Class activity: Assignment “Portrait photos”	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.

5	Basics of Digital Photography, Part II. Lenses. Light and Lighting	- Slides on the topic - Videos on the topic - Class activity: Assignment "Working with light" - Homework assignment 1: Photo story	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.
6	Audio Recording and Postproduction. Types of Microphones and Equipment. Sound Picture and Sound Design	- Slides on the topic - Videos on the topic - Class activity: Assignment "Soundscape description"	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.
7	Sound mixing, sound processing software, applying filters and effects. Basic approaches to working with sound for video production needs	- Slides on the topic - Videos on the topic - Class activity: Assignment "Sound recording and processing" - Homework assignment 2: Creating a soundscape	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.
8	Basic elements in video production. Script, director's book and shooting plan	- Slides on the topic - Videos on the topic - Class activity: Assignment "Storyboard (director's book)"	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.
9	Basics of cinematography. The great cinematographers	- Slides on the topic - Videos on the topic - Class activity: Assignment "Director's book on a literary basis" - Homework assignment 3: Short film	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.
10	Basic aspects of directing. Working with actors	- Slides on the topic - Videos on the topic - Class activity: Assignment "Documentary film, part 1"	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.

11	Video post-production. Basics of digital video editing. Working with effects	- Slides on the topic - Videos on the topic - Class activity: Assignment "Documentary film, part 2"	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.
12	History of movies	- Slides on the topic - Videos on the topic - Class activity: Assignment "Video editing"	- Interaction with slides and videos, logged in the course LMS. - Assignment grades and submission logs from LMS.
13	Movie Genres	- Slides on the topic - Videos on the topic	- Interaction with slides and videos, logged in the course LMS.
14	Author movies	- Slides on the topic - Videos on the topic	- Interaction with slides and videos, logged in the course LMS.
15	Production presentation	- Each student present project by uploading a presentation to the course forum.	- Forum posts and submission logs from LMS.

5 Data analysis and interpretation (So What)

Sense making and interpretation context	Use dashboards to visualize engagement levels. Analyze correlations between activities and outcomes. Compare results with course goals and prior expectations.
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6 Interventions plan (Now What)

Potential interventions	E-mail reminders & recommendations; Face-to-face interventions (devote more time to the assignment) Discuss assignments in one-to-one sessions.
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Pilot Course Curriculum and Intervention Plan for Human-computer Interaction (SU)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Table of Content

1	General course information>	4
2	Motivation and purpose (Why)	4
3	Defining more precisely what to explore (What)	5
4	Data collection strategy (How)	6
5	Data analysis and interpretation (So What)	7
6	Interventions plan (Now What)	7

1 General course information

Course name	Human-computer interaction (HCI)
Institution	Sofia University
Course level	Undergraduate
Teaching model	In-person
Course learning objectives	Human-Computer Interaction (HCI) course focuses on understanding, designing, and improving the interaction between humans and computer systems. Learning objectives: 1. Understand the Fundamentals of HCI - Grasp the principles of user-centered design (UCD). - Understand human cognitive and physical capabilities and limitations in interacting with technology. - Explore the evolution and scope of HCI as a discipline. 2. Design and Prototype Interactive Systems - Learn the methods for creating user-friendly and aesthetically pleasing interfaces. - Use prototyping tools and techniques to create mockups of digital interfaces. - Understand design principles like consistency, feedback, and affordances. 3. Conduct User Research and Analysis - Perform user research to identify user needs, behaviours, and preferences. - Develop personas, scenarios, and storyboards based on research findings. - Apply ethnographic and contextual inquiry techniques. 4. Evaluate Usability and User Experience (UX) - Understand usability principles and heuristics (e.g., Nielsen's heuristics). - Learn to design and conduct usability testing with real users. - Analyse and interpret test results to improve system design. 5. Apply Interaction Design Processes

	- Understand the stages of interaction design: discovery, ideation, prototyping, and evaluation. - Use iterative design and development methodologies. - Explore task analysis and workflow modelling. 6. Familiarize with Tools and Technologies - Gain hands-on experience with software and tools for prototyping, wireframing, and usability testing (e.g., Figma, Axure, Proto.io). - Overview of programming basics for creating interactive systems. 7. Explore Emerging Trends and Technologies - Discuss and analyse new HCI challenges related to emerging technologies like augmented reality (AR), virtual reality (VR), AI, and IoT. - Understand accessibility standards and inclusive design practices. - Examine ethical considerations in designing technology (e.g., privacy and data security). 8. Collaborate in Interdisciplinary Teams - Work in teams to tackle design problems and develop solutions collaboratively. - Communicate design decisions effectively through presentations and documentation. 9. Develop Critical Thinking and Problem-Solving Skills - Critically analyse existing systems for usability and user experience. - Solve real-world interaction challenges by applying design and evaluation principles.
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2 Motivation and purpose (Why)

Goal of the inquiry

What do you want to learn about the teaching and learning process?	Getting insights into students’ engagement with online learning resources. Improving student engagement with learning activities How engaged are students with online activities? How engaged are students in their assignment work? How engaged are students in their group collaboration? How are students progressing on course activities? How much do students engage in class preparation activities?
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3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	Which activities do students find engaging? Is regular engagement associated with better learning results? How much do students engage in class preparation activities?
Data sources	Engagement logs, quiz attempts, assignment submissions

4 Data collection strategy (How)

Data sources		Learning management system (LMS) Moodle, quizzes.	
Data aggregation		Data will be collected in xAPI format and integrated into Learning Locker either directly from the LMS plugin or through the csv2xAPI tool developed within the ISILA project	
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Course outline and structure. Understanding the process of project-based learning (PBL).	- Course structure slides	- Interaction with slides, logged in to the course LMS.
2	Models and theories of the psychological basis of human perception	- Slides on the topic - Discussions and feedback in the course forum	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS.
3	Methods and stages in the interface design process, the “Persona” technique & use cases	- Slides on the topic Each team submits a work file in the course forum with a "Persona" profile and user case ideas related to the development of their project. - Homework assignment 1: Project description	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS. - Assignment grades and submission logs from LMS.
4	Visual interface design	- Visual interface design slides - Each team submits in the course forum progress report.	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS.
5	Concept of Golden rules of design	- Golden rules of design slides	- Interaction with slides, logged in the course LMS,

		- Each member of the team submits individual sample designs - Homework assignment 2: First visual prototype	- Forum posts and submission logs from LMS. - Assignment grades and submission logs from LMS.
6	Requirements analysis – user and environment analysis	- Requirements analysis slides - Each member of the team submits in course forum individual report focusing on personal contribution to the project and possible obstacles at this stage	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS.
7	Basic methods for evaluating interfaces	- Evaluating interfaces slides - Each team is randomly assigned another team's project to evaluate and works on testing report. - Homework assignment 3: Results of testing the first prototype	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS, - Assignment grades and submission logs from LMS.
8	Basics of graphic design	- Graphic design slides - Each team review and discuss the reports of the first prototypes in course forum.	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS.
9	Designing interactive interfaces	- Designing interactive interfaces slides - Each team submits progress report in course forum.	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS.
10	Concepts of human-machine interface systems	- Human-machine interface systems slides - Each member of the team submits individual report focusing on personal contribution to the project and possible obstacles at this stage. - Homework assignment 4: Needs analysis	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS, - Assignment grades and submission logs from LMS.

11	Interactive models	- Interactive models slides - "Applying Interactive models" lecture video.	- Interaction with slides and videos, logged in the course LMS.
12	Rules and standards for availability of information	- Slides on the topic - Each team submits progress report in course forum.	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS.
13	Virtual and augmented reality	- Virtual and augmented reality slides - Example videos of Virtual and augmented reality.	- Interaction with slides and videos, logged in the course LMS.
14	Concepts of project presenting	- Project presenting slides - Each team presents their project by uploading a presentation to the course forum.	- Interaction with slides, logged in the course LMS, - Forum posts and submission logs from LMS.
15	Final test and evaluation	- Each student takes a test for a certain amount of time in LMS.	- Test grades and submission logs from LMS.

5 Data analysis and interpretation (So What)

Sense-making and interpretation context	Use dashboards to visualize engagement levels. Analyse correlations between activities and outcomes. Compare results with course goals and prior expectations.
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6 Intervention plan (Now What)

Potential interventions	E-mail reminders & recommendations; Face-to-face interventions (devote more time to the assignment).
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Pilot Course Curriculum and Intervention Plan for Data Management Systems (UEF)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Revised by:	Miroslava Raspopović Milić

Table of Content

1	General course information>	4
2	Motivation and purpose (Why)	4
3	Defining more precisely what to explore (What)	5
4	Data collection strategy (How)	6
5	Data analysis and interpretation (So What)	7
6	Interventions plan (Now What)	7

1 General course information

Course name	Data Management Systems
Institution	University of Eastern Finland
Course level	UEF
Teaching model	Hybrid (one group face-to-face, one group in the other classroom with classroom camera, one group on Zoom)
Course learning objectives	• Understand the fundamental concepts of databases and their role in data management • Grasp the principles of relational design and its importance in data organization • Gain proficiency in basic SQL (Structured Query Language) operations for data manipulation and retrieval • Operate databases using general-purpose programming languages through ORMs

2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	How engaged are students in the weekly exercises? What is the evolution of students' self-regulation throughout the course?

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	• Are students making use of all the learning resources provided to them? • Is students' perception of effort accurate when compared to their online activity? • Are their differences in engagement between students attending the course in different modalities? • In which ways do students use AI throughout the course?
Data sources	• Engagement with the lectures • Exercise/assignment submission and grades • SRL weekly survey • ChatGPT conversation data

4 Data collection strategy (How)

Data sources	• LMS logs and grades • Discord • Survey data		
Data aggregation	Data will be collected in xAPI format and integrated into Learning Locker directly from the LMS plugin (for logs) and through the csv2xAPI tool (the rest of the data) developed within the ISILA project		
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Intro to the course Key concepts of data management	1 intro lecture (no content, just logistics) 1 lecture (slides)	- Interaction with slides, logged in the course LMS, - Filling out SRL survey
2	From requirements to conceptual model	2 lectures (slides) 1 exercise session	- Interaction with slides and exercises, logged in the course LMS

	Logical model: Entity-Relationship diagram		- Exercise grades and submission logs from LMS - Filling out SRL survey
3	Enhanced ER diagram The relational model	2 lectures (slides) 1 exercise session	- Interaction with slides and exercises, logged in the course LMS - Exercise grades and submission logs from LMS - Filling out SRL survey
4	Normalization Design antipatterns	2 lectures (slides) 1 exercise session using ChatGPT 1 assignment (homework)	- Interaction with slides and exercises, logged in the course LMS - Exercise grades and submission logs from LMS - Assignment grades and submission logs from LMS - ChatGPT conversation public URLs - Filling out SRL survey
5	SQL introduction & MySQL SQL basics	2 lectures (slides) 1 exercise session	- Interaction with slides and exercises, logged in the course LMS - Exercise grades and submission logs from LMS - Filling out SRL survey
6	SQL group by SQL Joins	2 lectures (slides) 1 exercise session using ChatGPT 1 assignment (homework)	- Interaction with slides and exercises, logged in the course LMS - Exercise grades and submission logs from LMS - Assignment grades and submission logs from LMS - ChatGPT conversation public URLs - Filling out SRL survey

7	ORMs	2 lectures (slides) 1 exercise session	- Interaction with slides and exercises, logged in the course LMS - Exercise grades and submission logs from LMS - Filling out SRL survey
8	Data security	1 lecture 1 gamified assignment (meme competition: homework)	- Interaction with slides and exercises, logged in the course LMS - Exercise grades and submission logs from LMS - Assignment grades and submission logs from LMS - ChatGPT conversation public URLs - Filling out SRL survey

5 Data analysis and interpretation (So What)

Sense making and interpretation context	Use dashboards to visualize engagement levels. Analyze correlations between activities and outcomes. Identify students that are in the bottom quartile of activity and self-regulation Compare results with course goals and prior expectations.
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6 Interventions plan (Now What)

Potential interventions	Group-level interventions: • Add more gamification or motivating activities if attendance drops, or provide more rewards • Extend deadline of assignment if students are struggling • Add extra resources for difficult concepts Personalized interventions (for students at risk) • Personalized email offering 1-to-1 tutorial or additional support, trying to understand students' personal situation that might cause low engagement and try to help if possible
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Pilot Course Curriculum and Intervention Plan for Social Network Analysis (UEF)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Table of Content

1	General course information>	4
2	Motivation and purpose (Why)	4
3	Defining more precisely what to explore (What)	5
4	Data collection strategy (How)	6
5	Data analysis and interpretation (So What)	8
6	Interventions plan (Now What)	8

1 General course information

Course name	Social Network Analysis _ Advanced (SNA)
Institution	University of Eastern Finland
Course level	[Graduate]
Teaching model	[Hybrid]
Course learning objectives	1. Describe the types of networks, concepts, network representations and analysis methods. 2. Collect network data, create networks in appropriate format from different sources . 3. Analyse networks using visual methods with different layouts, tuning techniques and software. 4. Analyse networks using statistical methods on both the individual and network level. 5. Identify significant communities, nodes and structures and create meaningful reports using real life data. 6. Describe the dynamics of the networks, how networks form and evolve.

2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	Getting insights into students' engagement with online learning resources. 1. Improving Student Engagement with Learning Activities: Monitor student interaction with course materials on the LMS to identify patterns and areas for improvement. 2. Engagement in Assignment Work: Measure the level of student participation and completion rates and analyze the quality of submissions 3. Group Collaboration: Monitor the contribution of individual students within their groups to identify any issues with group dynamics.

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	1. How students making use of all the learning resources provided to them? And what are most and least utilized by students? 2. How do students' self-reported effort levels compare with their actual engagement data (e.g., time spent on LMS, participation in Discord discussions)? 3. Are there differences in engagement between students attending the course in different modalities? 4. How do students incorporate AI-generated data into their assignments and final projects?
Data sources	1. Lecture Engagement: Learning management systems LMS logs and Zoom attendance records 2. Assignment Submission and Grades 3. Responses from weekly SRL surveys. 4. AI Conversation Data 5. Discord Group Interactions: Activity logs from Discord.

4 Data collection strategy (How)

Data sources	• LMS logs and grades • Discord • Survey data		
Data aggregation	Data will be collected in xAPI format and integrated into Learning Locker either directly from the LMS plugin or through the csv2xAPI tool developed within the ISILA project		
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Introduction to SNA	• Lectures (slides) • slides • Scientific articles	- Interaction with course materials, logged in the course LMS - Assignment grades and submission logs from LMS - Filling out SRL survey
2	Working with Gephi	• Lectures (slides) • Scientific articles • Assignment 1 (constructing first SNA), • Group formation	- Interaction with course materials, logged in the course LMS - Assignment grades and submission logs from LMS - Filling out SRL survey
3	Centrality Measures	• Lectures (slides) • Scientific articles • Lectures, slides, videos Assignment 2 (calculate centrality from published and AI-generated data)	- Interaction with course materials, logged in the course LMS - Assignment grades and submission logs from LMS - Filling out SRL survey

4	Communities in Networks	• Lectures, slides, videos, Assignment 3 (plot network and identify clusters)	- Interaction with course materials, logged in the course LMS - AI conversation - Assignment grades and submission logs from LMS - Filling out SRL survey
5	Literature Review on SNA	• Scientific articles • Lectures, slides, videos Assignment 4 (review of literature for given 5 SNA articles)	- Interaction with course materials, logged in the course LMS - Assignment grades and submission logs from LMS - AI conversation - Filling out SRL survey
6	Group Work Presentations	• Instructions (slides) • Group Presentation	- Assignment grades and submission logs from LMS - Discord logs - Filling out SRL survey
7	Final Project Submission	• Final project (using group project data and AI-generated data)	- Assignment grades and submission logs from LMS - AI conversation - Filling out SRL survey

5 Data analysis and interpretation (So What)

Sense making and interpretation context	1. Use dashboards to visualize engagement levels. 2. Analyze correlations between activities and outcomes. 3. Identify students that are in the bottom quartile of activity and self-regulation 4. Compare results with course goals and prior expectations. 5. Analyze feedback from students on their learning experience and Use this feedback to make continuous improvements to the course. 6. understand how actively students are interacting and collaborating on Discord.
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6 Interventions plan (Now What)

Potential interventions	Individual Level: 1. Personalized Support: Schedule one-on-one meetings to discuss challenges and provide tailored guidance. 2. Additional Resources: Offer extra study materials and resources. 3. rying to understand students' personal situation that might cause low engagement and try to help if possible 4. Regular Check-ins: Monitor their progress and provide continuous encouragement and feedback. Group Level: 1. Facilitate Group Discussions: Encourage open communication within groups to address any collaboration issues. 2. Add more gamification or motivating activities if attendance drops, or provide more rewards 3. Balanced Participation: Ensure all group members are contributing equally and provide support to less active members. 4. Conflict Resolution: Address any conflicts to maintain a positive group dynamic. 5. Add extra resources for difficult concepts
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Pilot Course Curriculum and Intervention Plan for Basic course in statistics (UiB)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Author(s)	Hans Julius Skaug, Jelena Jovanovic
With contributions by:	Jessica Renz
Revised by:	Sonsoles López-Pernas, UEF

Table of Content

1 General course information	3
2 Motivation and purpose (Why)	3
3 Defining more precisely what to explore (What)	4
4 Data collection strategy (How)	5
5 Data analysis and interpretation (So What)	7
6 Interventions plan (Now What)	7

1 General course information

Course name	STAT110: Basic course in statistics
Institution	University of Bergen
Course level	Undergraduate
Teaching model	Blended
Course learning objectives	To give an introduction to probability theory and statistical methods, with emphasis on the former.

2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	The overall objective is to obtain insights into students' engagement with online learning resources and activities, and how this engagement associates with students' learning outcomes. In particular, the aim is to answer questions such as: - How engaged are the students with online course materials (slides, videos, formative quizzes)? - How regular and how successful are the students in completing the course quizzes and assignments? - What course materials are most visited / used by the students? And what course materials receive less students' attention? - Is there an association between the use of distinct online course materials and the students' course performance? - How successful are the students in regulating (planning, monitoring, adjusting) their learning in this course? - How motivated and interested are the students for the course topics? - How well do students regulate their effort and time devoted to this course? - If / How do students seek help and provide help to their peers?

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	How many students access online course materials (slides, videos) for the given week before the week's lecture? How do students interact with online course materials: do they use both videos and slides or tend to focus on one of these? How much time do they spend on videos? Do / How do they engage with formative quizzes? ... If / How do the students' interaction with online course materials change over time? What course materials receive more / less students' attention? Do students engage with optional readings? Which course materials may require revisions / improvements to be more comprehensible / useful to the students? Is regular engagement with online course materials associated with better course performance (quiz and assignment scores)? If / How the students' motivation change throughout the course? How successful the students are in regulating their learning time and effort throughout the course? How often do students provide help (feedback) to their peers? What is the quality of the feedback they provide to their peers?
Data sources	Data logged by Canvas LMS, including logs of students' engagement with online course materials (videos, slides), quiz and assignment submissions and scores, and the like. Survey data about different aspects of students' self-regulated learning (time management, effort regulation, motivation, etc.)

4 Data collection strategy (How)

Data sources		Canvas, the LMS used in the course as the main learning platform Concise SRL survey, weekly survey administered through Canvas Students will be asked to give their informed consent for the use of the collected data, using Informed consent form prepared for the ISILA project. If a student does not consent to the data use, the data of that student will not be used for any data analyses.	
Data aggregation		Data will be collected in xAPI format and integrated into Learning Locker using custom xAPI mappings developed within the ISILA project	
Detailed methods for data collection			
Course week	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Descriptive statistics	Video 1 Chapter 1 slides Quiz 1 (formative assessment) Optional python code examples and tasks (1)	Engagement data logged by Canvas SRL survey
2	Probability	Video 2 Chapter 2 slides Quiz 2 (formative assessment) Optional python code examples and tasks (2)	Engagement data logged by Canvas SRL survey
3-4	Discrete probability distributions	Video 3 Chapter 3 slides Quiz 3 (formative assessment) Optional python code examples and tasks (3)	Engagement data logged by Canvas SRL survey
5	Continuous probability distribution	Video 4 Chapter 4 slides	Engagement data logged by Canvas SRL survey

		Quiz 4 (formative assessment) Optional python code examples and tasks (4)	
6	Simultaneous distributions	Video 5 Chapter 5 slides Quiz 5 (formative assessment) Optional python code examples and tasks (5)	Engagement data logged by Canvas SRL survey
7-8	Distributions of sums of random values	Video 6 Chapter 6 slides Quiz 6 (formative assessment) Optional python code examples and tasks (6)	Engagement data logged by Canvas SRL survey
9-10	Parameter estimation	Video 7 Chapter 7 slides Quiz 7 (formative assessment) Optional python code examples and tasks (7)	Engagement data logged by Canvas SRL survey
11	Confidence intervals	Video 8 Chapter 8 slides Quiz 8 (formative assessment) Optional python code examples and tasks (8)	Engagement data logged by Canvas SRL survey
12-13	Hypotheses testing	Video 9 Chapter 9 slides Quiz 9 (formative assessment) Optional python code examples and tasks (9)	Engagement data logged by Canvas SRL survey

5 Data analysis and interpretation (So What)

Sense making and interpretation context	The data collected and stored in the UiB’s Learning Locker instance, will be visually explored in order to identify patterns in the data, which may be indicative of a need for intervention. In particular, dashboards will be used to visually explore and analyze: - The level and dynamics of students’ engagement with distinct course materials, including videos, slides, and formative quizzes, as well as extra-curricular content (code examples and tasks) - How easy / difficult distinct formative quizzes are for students (based on the number of attempts and incorrect responses) - The patterns in accessing videos, slides, and formative quizzes, as these may indicate learning strategies adopted by students - Correlations between the level of engagement with distinct online course materials and course performance (assignment scores) - The level of engagement in peer feedback and its association with the students’ course performance - The dynamics of the students’ motivation, effort, time management, help seeking and other aspects of self-regulation of learning throughout the course
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6 Interventions plan (Now What)

Potential interventions	Intervention strategies that will be considered include: - Face-to-face interventions in the form of consultations with either individual students or groups of students whose patterns of interaction with learning materials suggest significantly lower engagement compared to the overall cohort or form of engagement not aligned with the course design and/or objectives. Such interventions (consultations) may include talking to students to understand any issues they may be facing with the course; suggesting / arranging additional / different learning activities; offering direct help (e.g., explanations) regarding particular course topics, etc. - Internet-based interventions oriented to many / all students in the cohort, in case low engagement with certain course materials or misunderstanding of certain course topics are detected. These interventions may take the form of email reminders, or recommendations of additional learning resources or explanations of misconceptions (course or subject matter related), communicated via course forum. - Revision of learning materials that received low engagement. This may include, for example, adding more / different additional reading materials, offering the same topic in different modalities (e.g., video tutorials), etc. - Rethinking of the course design and considering potential changes for the following course edition
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Pilot Course Curriculum and Intervention Plan for Fantastic Data (UiB)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Author(s)	Fredrik Sundt Breien, Sofie Steinsund, Jelena Jovanovic
With contributions by:	Barbara Wasson
Revised by:	Sonsoles López-Pernas, UEF

Table of Content

1 General course information	3
2 Motivation and purpose (Why)	3
3 Defining more precisely what to explore (What)	4
4 Data collection strategy (How)	5
5 Data analysis and interpretation (So What)	7
6 Interventions plan (Now What)	7

1 General course information

Course name	DIGI110: Fantastic data
Institution	University of Bergen (UiB)
Course level	Undergraduate
Teaching model	Online
Course learning objectives	The goal of the course is to give participants basic knowledge of what data and digitalization do to us and the society we are a part of, what kind of technology is behind it, and what one can do to get a hand on the wheel. Participants will also acquire the necessary basic skills to perform critical thinking about the roles of data in society.

2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	The overall objective is to obtain insights into students' engagement with online learning materials, and how this engagement associates with students' learning outcomes. In particular, the aim is to answer questions such as: - How engaged are the students with course readings (Datareisen and extra material)? - How regular and how successful are the students in completing the course assessments (quizzes and assignments)? - What course materials are most visited / used by the students? And what course materials receive less students' attention? - Is there an association between the use of distinct online course materials and the students' course performance? - How successful are the students in regulating their learning in this course? - How motivated and interested are the students for the course topics? - How well do students regulate their effort and time devoted to this course?

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	How frequently do they access course materials? How regular are they in completing the (obligatory and optional) readings and (formative and summative) tasks and quizzes? If / How do the students' interaction with online course materials change over time? What course materials receive more / less students' attention? Do students engage with optional readings? Which course materials may require revisions / improvements to be more comprehensible / useful to the students? Is regular engagement with distinct online course materials associated with better course performance (quiz scores and passed assignments)? If / How the students' motivation change throughout the course? How successful the students are in regulating their learning time and effort throughout the course? How successful the students are in self-regulating (planning, monitoring, adjusting) learning throughout the course?
Data sources	Data logged by Canvas LMS, including logs of students engagement with course activities, assignment submissions, and the like. Engagement data logged by the Datareisen, the tool used in the course as the main source of the course materials. This includes data about students' access to reading materials and completion of formative and summative quizzes. Survey data about different aspects of students' self-regulated learning (time management, effort regulation, motivation, etc.)

4 Data collection strategy (How)

Data sources	Canvas, the LMS used in the course as the main learning platform Datareisen, an online learning tool offering access to course materials (readings and quizzes) Concise SRL survey, weekly survey administered through Canvas Students will be asked to give their informed consent for the use of the collected data, using Informed consent form prepared for the ISILA project. If a student does not consent to the data use, the data of that student will not be used for any data analyses.		
Data aggregation	Data will be collected in xAPI format and integrated into Learning Locker using custom xAPI mappings developed within the ISILA project		
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	What is Data?	Datareisen, Chapter 1, Part 1: “Why Should I Care About Data?” Additional readings Assignment 1 “We are data” Quiz 1 “What is data”	Engagement data logged by Datareisen Engagement data logged by Canvas SRL survey
2	What kinds of data do I create?	Datareisen, Chapter 1, Part 2: “What Kind of Data Am I Creating—And What Happens to It?” Additional readings Assignment 2 “Data iceberg” Quiz 2 “What kinds of data do I create?”	Engagement data logged by Datareisen Engagement data logged by Canvas SRL survey
3	By whom and how is data used?	Datareisen, Chapter 1, Part 3: “What Challenges and	Engagement data logged by Datareisen

		Opportunities Does Data Provide?" Additional readings Assignment 3 "Data use" Quiz 3 "Use of data!"	Engagement data logged by Canvas SRL survey
4	Data processing and communication	Datareisen, Chapter 2, Part 1: "How Does Data, Computers and Programming Work?" Datareisen, Chapter 2, Part 2: "What Technologies is Data Dependent On?" Additional readings Assignment 4 "Data representation (ASCII)" Quiz 4 "Data management and data communication"	Engagement data logged by Datareisen Engagement data logged by Canvas SRL survey
5	Technologies that use data and data security	Datareisen, Chapter 2, Part 3: "... And Which Technologies Depend on Data?" Datareisen, Chapter 2, Part 4: "How Do We Secure Our Data and Computer Systems?" Additional readings Assignment 5 "Technologies that use data" Quiz 5 "Technologies that use data and data related security"	Engagement data logged by Datareisen Engagement data logged by Canvas SRL survey
6	Data categorisation, data collection and privacy regulations	Datareisen, Chapter 3: "How We Get a Hold of Data?" Additional readings Quiz 6 "Data categorization, data collection, and privacy regulations"	Engagement data logged by Datareisen Engagement data logged by Canvas SRL survey
7	Course summary and evaluation		Engagement data logged by Canvas

5 Data analysis and interpretation (So What)

Sense making and interpretation context	The data collected and stored in the UiB's Learning Locker instance, will be visually explored in order to identify patterns in the data, which may be indicative of a need for intervention. In particular, dashboards will be used to visually explore and analyze: - The level and dynamics of students' engagement with distinct course materials, both obligatory ones (content in Datareisen) and optional ones (additional readings) - How easy / difficult distinct assessments are for students (based on the number of attempts and incorrect responses) - The patterns in accessing readings and formative tasks and quizzes, as these may indicate learning strategies adopted by students - Correlations between the level of engagement with distinct course materials and learning outcomes (assessment scores) - The dynamics of the students' motivation, effort, time management, and other aspects of self-regulation of learning throughout the course
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6 Interventions plan (Now What)

Potential interventions	Intervention strategies that will be considered include: - Face-to-face interventions in the form of online consultations with either individual students or groups of students whose patterns of interaction with learning materials suggest significantly lower engagement compared to the overall cohort or form of engagement not aligned with the course design and/or objectives. Such interventions (consultations) may include talking to students to understand any issues they may be facing with the course; suggesting / arranging additional / different learning activities; offering direct help (e.g., explanations) regarding particular course topics, etc. - Internet-based interventions oriented to many / all students in the cohort, in case low engagement with certain course materials or misunderstanding of certain course topics are detected. These interventions may take the form of email reminders, motivational messages, and/or recommendations of additional / alternative learning resources. - Revision of learning materials that received low engagement. This may include, for example, adding more /
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	different additional reading materials, offering the same topic in different modalities (e.g., video tutorials or podcasts), etc. - Rethinking of the course design and considering potential changes for the following course edition
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Pilot Course Curriculum and Intervention Plan for Computer Animation (ULE)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Author(s)	Francisco Rodríguez Sedano
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Revised by:	Ramy Elmoazen, UEF

Table of Content

1	General course information>	4
2	Motivation and purpose (Why)	4
3	Defining more precisely what to explore (What)	5
4	Data collection strategy (How)	6
5	Data analysis and interpretation (So What)	7
6	Interventions plan (Now What)	7

1 General course information

Course name	Computer Animation
Institution	University of León
Course level	Undergraduate
Teaching model	In-person
Course learning objectives	▪ Understand and apply 3D design, modeling and animation techniques. ▪ Know how to approach all stages of an audiovisual production project in real contexts. ▪ Develop problem-solving skills with initiative, decision-making and creativity in animation projects. ▪ Encourage teamwork skills by collaborating effectively on group projects.

2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	Assess students' level of engagement in theoretical and practical activities. Analyze the impact of group work on learning and collaboration. Identify how early intervention methods based on learning analytics can improve academic performance. How do students interact with learning materials and activities when using 3D editing software? Is regular engagement correlated with better results in group projects? Which learning resources are most effective for students?

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	1. How engaged are students in practical and design activities? 2. How does group work affect the development of individual competencies? 3. What impact does personalized feedback based on learning analytics have?
Data sources	Activity logs from the learning management system (Moodle). Submissions of group projects. Weekly self-regulation (SRL) surveys. Student feedback and peer assessment of results.

4 Data collection strategy (How)

Data sources		▪ Learning management tools (LMS). ▪ Blender: tracking interactions and progress in 3D design. ▪ Weekly SRL surveys. ▪ Telegram (or Discord).	
Data aggregation		Data will be collected in xAPI format and integrated into Learning Locker either directly from the LMS plugin or through the csv2xAPI tool developed within the ISILA project	
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Introduction to Animation	Lecture and initial exercise in Blender	Attendance and participation logs
2	Modeling Basics	Introduction to polygonal modeling; creating basic shapes	Logs of interactions in Blender and LMS
3	Advanced Modeling	Creating detailed objects with extrusion and subdivision techniques	Logs of interactions in Blender and LMS
4	Group Modeling Project	Collaborative modeling of an environment or complex object	Group progress reports and LMS activity
5	Materials and Textures Basics	Applying basic materials and using procedural textures	Assignment submissions and SRL surveys
6	Advanced Texturing	Creating custom UV maps and hand-painted textures	Assignment submissions and SRL surveys
7	Lighting Fundamentals	Introduction to light types; setting up basic lighting in a scene	Analysis of results and class participation
8	Cameras and Rendering Basics	Configuring cameras; rendering test scenes	Analysis of results and class participation

9	Animation Basics	Animating objects and learning keyframing techniques	Evaluation of group progress and Telegram interactions
10	Character Rigging	Rigging a basic character and creating simple animations	Evaluation of group progress and Telegram interactions
11	Advanced Animation	Adding secondary motion and refining animations	Evaluation of group progress and Telegram interactions
12	Animation Presentation	Preparing animations for presentation; receiving feedback	Evaluation of group progress and Telegram interactions
13	Final Project Work	Group work on final animation project	Group and individual feedback
14	Final Project Refinement	Refining animations and finalizing project deliverables	Group and individual feedback
15	Final Presentation	Project showcase and peer review	Group and individual feedback

5 Data analysis and interpretation (So What)

Sense making and interpretation context	Use dashboards to visualize engagement levels. Analyze correlations between activities and learning outcomes. Identify students with low participation levels for personalized interventions.
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6 Interventions plan (Now What)

Potential interventions	▪ Group-level: Add more gamified activities to increase engagement. Extend deadlines in case of general difficulties. ▪ Individual-level: Offer personalized tutoring and additional support for at-risk students. ▪ Design Improvements: Simplify less effective learning resources and add interactive examples.
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Pilot Course Curriculum and Intervention Plan for Computer Architecture (ULE)

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

Project No. 2023-1-FI01-KA220-HED-000159757



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Table of Content

1	General course information>	4
2	Motivation and purpose (Why)	4
3	Defining more precisely what to explore (What)	5
4	Data collection strategy (How)	6
5	Data analysis and interpretation (So What)	7
6	Interventions plan (Now What)	7

1 General course information

Course name	Computer Architecture
Institution	University of Leon
Course level	Undergraduate
Teaching model	In-person
Course learning objectives	• Knows and understands the fundamentals of computer architecture, as well as the basic components that comprise them. • Knows and applies methodologies and tools for estimating and comparing computer performance. • Know the fundamentals of Big Data and cloud computing: architectures, services and applications. • Know the fundamentals of developing data capture, storage, intelligent analysis and visualization applications using Big Data tools. • Know how to detect possible applications of cloud computing in the context of Industry 4.0.

2 Motivation and purpose (Why)

Goal of the inquiry	
What do you want to learn about the teaching and learning process?	Assess students' level of engagement in theoretical and practical activities. Identify how early intervention methods based on learning analytics can improve academic performance. How do students interact with learning materials and proposed activities? Is regular engagement correlated with better results? Which learning resources are most effective for students?

3 Defining more precisely what to explore (What)

Specific questions of interest	
Key inquiry questions	1. How engaged are students in practical and design activities? 2. How much do students engage in class preparation activities? 3. What impact does personalized feedback based on learning analytics have?
Data sources	Activity logs from the learning management system (Moodle). Submissions of the projects. Weekly self-regulation (SRL) surveys. Student feedback and peer assessment of results. Evaluation of fundamentals of the activities

4 Data collection strategy (How)

Data sources		• Learning Management Tools (LMT) • Github classroom • Weekly SRL surveys	
Data aggregation		Data will be collected in xAPI format and integrated into Learning Locker either directly from the LMS plugin or through the csv2xAPI tool developed within the ISILA project	
Detailed methods for data collection			
Week#	Topic	Learning activities and materials	Data source(s) and collection method(s)
1	Introduction to CUDA	Introduction to the system and first examples with CUDA	Interaction with slides and videos, logged in the course LMS Attendance and participation logs
2	CUDA memory	Differences between shared and global memory in GPU. Explain the first deliverable (CUDA exercise in Github)	Attendance and participation logs
3	CUDA individual work	Elaborate first deliverable and upload to github	Assignment submissions and SRL surveys
4	RISC V Review	Review of the instructions of RISC V	Attendance and participation logs
5	Pipelined RISC V	Explain Pipelined RISC V with the web tool	Attendance and participation logs
6	Benchmarking	Explain how get metrics from tool Explain the second deliverable (RISC V codes with metrics in Github)	Assignment submissions and SRL surveys

7	Review of C++ examples	Introduction to algorithms in C++	Attendance and participation logs Evaluation of concepts of first and second deliverables
8	Introduction to OpenMP	Introduction to the OpenMP	Attendance and participation logs
9	BSC Tools	Installation of Barcelona Supercomputing Center Tools (BSC)	Attendance and participation logs
10	OpenMP Loop	Lecture of different methods to distributed workload with OpenMP	Attendance and participation logs
11	OpenMP Sections	Lecture of different methods to distributed workload with OpenMP	Analysis of results and class participation
12	Optimize algorithms	Work on the different optimizations over the proposed algorithms	Attendance and participation logs
13	Measure optimizations	Use of BSC Tools for analyse optimizations	Attendance and participation logs
14	Final delivery	Elaborate third deliverable and upload to github	Assignment submissions and SRL surveys
15	Final evaluation		Evaluation of concepts of third deliverable

5 Data analysis and interpretation (So What)

Sense making and interpretation context	Use dashboards to visualize engagement levels. Analyze correlations between activities and learning outcomes. Identify students with low participation levels for personalized interventions.
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6 Interventions plan (Now What)

Potential interventions	Individual-level: face-to-face interventions during the laboratory sessions and Offer personalized tutoring and additional support for at-risk students. Design Improvements: Simplify less effective learning resources and add interactive examples.
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