



Piloting Interventions (WP4)

“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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1 Introduction

The ISILA project aims to transform higher education teaching by leveraging data-driven methodologies to identify and support at-risk students. Through the development and deployment of learning analytics dashboards, SRL (Self-Regulated Learning) surveys, and targeted pedagogical interventions, ISILA seeks to provide instructors with actionable insights while enhancing students’ engagement, motivation, and overall academic performance.

This Global Piloting Report presents a comprehensive overview of the piloting activities carried out across partner institutions, encompassing a diverse range of courses, from Object-Oriented Programming and Distributed Systems to Social Network Analysis and Digital Design. The pilots involved systematic collection of learning data, the design and execution of both general and personalized interventions, and the evaluation of their effects through continuous feedback loops.

Across the various institutions, instructors employed learning analytics dashboards to monitor student behavior, identify early signs of disengagement or emotional distress, and implement timely interventions. These interventions were categorized into general (affecting the whole class) and individual (tailored by student profile), and were further adapted based on changes observed in the students’ activity patterns between checkpoints. The pilot also revealed several external and contextual factors, such as sociopolitical unrest and institutional policy changes, that influenced engagement levels, underlining the necessity of a flexible and student-centered support framework.

The report not only outlines the execution and outcomes of each piloting effort but also serves as a critical reflection on the benefits, challenges, and scalability of learning analytics interventions in real-world educational settings.

1.1. Description of interventions

In table 1 it is possible to see the summary of the main interventions with engaged participants, number interventions, type of interventions and responses from the participants.

Table 1.- Summary of main interventions

		Participants	Interventions	Int Types	Responses Interventions
BMU Object-Oriented Programming	Int 1	90	74	5	15
	Int 2	90	54	5	6
BMU Fundamentals of Web Development	Int 1	61	31	1	8
	Int 2		31	1	5
	Int 3	26	26	2	6
BMU Distributed Systems	Int 1	53	47	7	13
	Int 2	53	42	7	21
UEF Data Management Systems Course	Int 1	42	11	3	6
	Int 2	42	11	3	3
UEF – Social Network Analysis	Int 1	72	16	2	11
	Int 2	72	16	2	5
UiB - DIGI110: Fantastic Data Course	No personal int	88	-	-	-
UiB - STAT110: Basic Course in Statistics	No personal int	14	-	-	-
SU – Human Computer Interaction	Int 1,2 and 3	113	32	2	-
SU – Digital Design and Multimedia	Int 1,2,3	91	24	3	2
ULE – Computers Architecture	Int 1	78	56	5	7
	Int 2	78	47	1	10
ULE – Computer Animation	Int 1	25	8	5	5
	Int 2	26	18	1	-

1.2. Conclusions about interventions

Learning Analytics and Dashboards Proved Effective Tools. Across all partner institutions, learning analytics dashboards enabled instructors to:

- Monitor student engagement and performance in real time.
- Detect early signs of risk, such as inactivity, missing assignments, and self-reported anxiety.
- Personalize interventions based on a combination of behavioral and self-regulation data.

The dashboards were successfully implemented across various platforms (Canvas, LAMS, iMet, etc.), offering both course-wide and individual visualizations.

Personalized Interventions Yielded Positive Results. The project implemented a tiered intervention model, combining:

- General interventions (e.g., group consultations, additional practice resources).

- Individualized interventions (tailored emails based on student profiles).
- Team based interventions.

Key outcomes:

- Students with high anxiety but good performance benefited from emotional support emails.
- Dropout-risk students often re-engaged after personal outreach.
- Tailored communication based on SRL profiles (self-regulated learning) helped align support with individual student needs.

However, non-responsiveness remained a challenge among a segment of students, even after multiple outreach attempts.

External Factors Affected Student Engagement. Several pilots—particularly in Serbia—were disrupted by student protests, transportation issues, and institutional flexibility regarding attendance and deadlines. These conditions:

- Reduced regular participation.
- Increased reliance on asynchronous learning formats.
- Led to delayed engagement, making end-of-semester interventions more critical.

This highlights the importance of contextual adaptation when designing interventions.

SRL Data Added Diagnostic Value. The weekly SRL surveys offered valuable insights into:

- Emotional states (stress, anxiety).
- Motivation, time management, and help-seeking behaviors.
- Discrepancies between perceived effort and actual performance.

These insights allowed for more nuanced student categorization, improving the targeting of support efforts.

Response Rates and Data Consent Were Challenges. In some courses:

- Consent for data usage was limited, especially when anonymity was not initially guaranteed.
- Low survey completion rates limited the scope of SRL-based interventions.
- Students were more open to sharing data when they perceived a clear benefit (e.g., personalized feedback or visualizations of their learning paths).

This suggests that student-facing dashboards and better communication about the value of analytics could improve participation and impact.

Timing and Frequency of Interventions Matter. The most successful pilots conducted multiple interventions at different stages (e.g., Weeks 6, 9, 13, and 15), showing that:

- Early interventions help prevent disengagement.
- Mid- and late-semester interventions are essential for reactivation, especially for students with delayed starts.
- Repetition increases effectiveness, particularly when interventions evolve based on updated dashboard data.

Institutional Reflections and Future Plans. Partners reported that:

- The integration of analytics tools (like xAPI, csv2xapi, LRS, etc.) was technically feasible.
- Teachers found dashboards useful for identifying patterns, but overload of reports could reduce usability.
- Future plans include:
 - Improving the alignment of course design with analytics insights.
 - Automating alerts and feedback (e.g., using tools like OnTask).
 - Making student-facing analytics available to promote self-awareness and autonomy.

The ISILA pilots confirmed that learning analytics-based interventions can significantly enhance student success, provided they are:

- Timely, personalized, and context-aware.
- Based on transparent and ethical data practices.
- Combined with a flexible course design that allows for re-engagement opportunities.

At the same time, the pilots revealed the need for continued refinement, especially in engaging hard-to-reach students and building analytics literacy among both students and staff.

2 BMU Pilots

2.1. Object-Oriented Programming Course

This course offers a hands-on introduction to Java programming with a strong emphasis on object-oriented principles. Students begin with the foundations of procedural programming and gradually progress toward mastering concepts such as classes, objects, inheritance, and polymorphism. Through weekly coding exercises, case studies, and practical projects, learners develop the ability to design and implement modular Java applications. The course also includes file handling, arrays, exception management, and testing with JUnit, giving students a comprehensive toolkit for real-world programming tasks.

2.1.1 Data Collection

At BMU, the learning analytics data was collected from multiple institutional sources and stored in the BMU LRS. Student and course-related data were extracted from iMet, the university’s information system that manages academic records and administrative data. Additional activity data was gathered from the LAMS learning platform and Discord, which was used to support student interaction and course communication.

The SRL survey was also administered during the course. Survey responses and log data were converted into xAPI statements using the csv2xapi tool developed in ISILA and uploaded to the BMU LRS for centralized storage and analysis.

2.1.2 Dashboard Overview

An overall dashboard was created to get the general picture of the course, including the time spent, the exercise submission and the SRL survey results (Fig.1-5).



Fig 1. - Dashboard overview of the course in Week 6

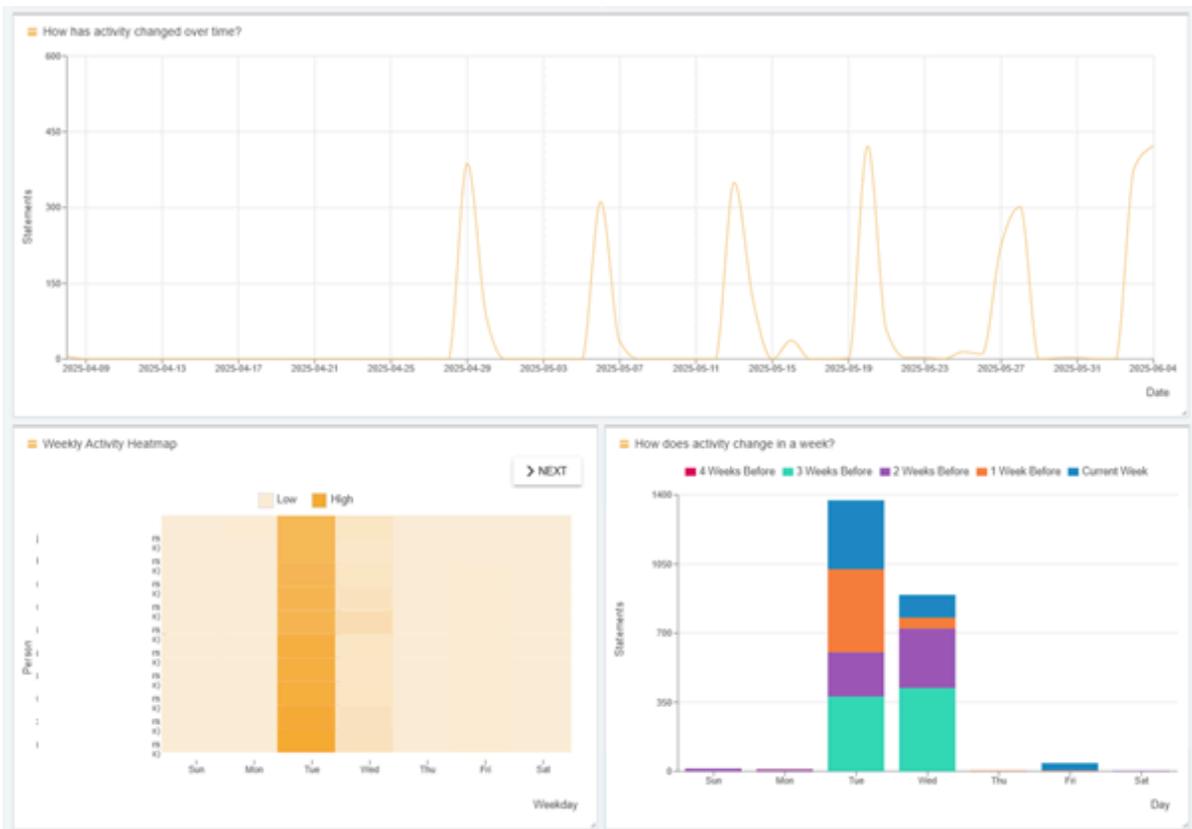


Fig 2. - Dashboard overview 2 of the course in Week 6



Fig 3. - Dashboard overview 3 of the course in Week 6



Fig 4. - Dashboard overview 4 of the course in Week 6



Fig 5. - Dashboard overview 5 of the course in Week 6

2.1.3. Individual insights

We filtered the dashboard data to examine each individual student who provided consent to participate in the ISILA project interventions, using the filtering functionality developed within the ISILA system. The visualizations reviewed were the same as those presented in Figures 1 to 5, but displayed on a per-student basis.

2.1.4 Intervention 1

Interventions were conducted in Weeks 6 and 13 to address issues such as low engagement, missing assignments, or high anxiety. Actions were tailored based on student profiles, with both general and individualized strategies.

2.1.4.1 Intervention 1 : Week 6

Based on the data from the iMet and LAMS platforms, students were categorized according to their level of engagement, performance, and Self-Regulated Learning (SRL) survey responses. The goal of the first intervention was to provide timely support for students who showed signs of disengagement, academic difficulties, or high levels of anxiety.

- Students with no learning activity detected (dropout risk): These students were personally contacted to explore reasons for inactivity and to offer support for re-engagement.

- Students with average activity but no SRL data: These students were contacted individually to encourage survey participation and to provide guidance on improving engagement and learning strategies.
- Students who started activity only in Week 6 with high anxiety: These students were personally contacted to address their concerns, provide emotional support, and help them organize their study approach.
- Students with below-average performance but high SRL: These students were contacted to discuss strategies for leveraging their self-regulation skills to improve performance.
- Students who completed all exercises and achieved high grades (with or without SRL data): No direct intervention was required for these students.
- Students with high performance but high anxiety: These students were personally contacted to address emotional well-being and provide strategies for managing stress while maintaining performance.

This categorization ensured that each student received an appropriate response, from personalized outreach to continued monitoring for those who were progressing well and is summarized in the table 2.

Table 2. - Intervention 1 summary, the type of intervention is colored and mentioned below

Student	Intervention 1 : Week 6	Intervention 1 : Week 6 - actions
S1	Average SRL. Submitted all exercises and high grades.	NONE
S2	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S3	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S4	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S5	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S6	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S7	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S8	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S9	Submitted all exercises, high grades and no SRL.	NONE
S10	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S11	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S12	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S13	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S14	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S15	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S16	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S17	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S18	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S19	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S20	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S21	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S22	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S23	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S24	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S25	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S26	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S27	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S28	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S29	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S30	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S31	Submitted all exercises, high grades and no SRL.	NONE
S32	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S33	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S34	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S35	Submitted all exercises, high grades and no SRL.	NONE
S36	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S37	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S38	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S39	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S40	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S41	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S42	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S43	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S44	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S45	First activity recorded only in Week 6, high level of anxiety.	CONTACT PERSONALLY

Student	Intervention 1 : Week 6	Intervention 1 : Week 6 - actions
S46	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S47	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S48	Submitted all exercises, high grades and high SRL.	NONE
S49	Submitted all exercises, high grades and high SRL.	NONE
S50	Average SRL. Submitted all exercises and high grades.	NONE
S51	Submitted all exercises, high grades and high SRL.	NONE
S52	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S53	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S54	Below-average performance, but high SRL.	CONTACT PERSONALLY
S55	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S56	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S57	First activity recorded only in Week 6, high level of anxiety.	CONTACT PERSONALLY
S58	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S59	Submitted all exercises, high grades and high SRL.	NONE
S60	Submitted all exercises, high grades and high SRL.	NONE
S61	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S62	Submitted all exercises, high grades and high SRL.	NONE
S63	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S64	Submitted all exercises, high grades and high SRL.	NONE
S65	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S66	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S67	Submitted all exercises, high grades and high SRL.	NONE
S68	Submitted all exercises, high grades and high SRL.	NONE
S69	Below-average performance, but high SRL.	CONTACT PERSONALLY
S70	Submitted all exercises, high grades and high SRL.	NONE
S71	Below-average performance, but high SRL.	CONTACT PERSONALLY
S72	Submitted all exercises, high grades and high SRL.	NONE
S73	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S74	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S75	First activity recorded only in Week 6, high level of anxiety.	CONTACT PERSONALLY
S76	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S77	Below-average performance, but high SRL.	CONTACT PERSONALLY
S78	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S79	Submitted all exercises, high grades and high SRL.	NONE
S80	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S81	Submitted all exercises, high grades and high SRL.	NONE
S82	Submitted all exercises, high grades and high SRL.	NONE
S83	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S84	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S85	Submitted all exercises, high grades and high SRL.	NONE
S86	Below-average performance, but high SRL.	CONTACT PERSONALLY
S87	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S88	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S89	Submitted all exercises, high grades and high SRL.	NONE
S90	Submitted all exercises, high grades and high SRL.	NONE

2.1.4.2. General interventions

In Week 5, all students were provided with access to the CodingBat platform as a tool for practicing Java programming tasks. The aim was to encourage regular practice, strengthen programming skills, and provide immediate feedback through an interactive environment. This

general intervention was intended for all students, regardless of their engagement level or performance, to support continuous learning and skill development throughout the course.

2.1.4.3. Individual interventions

Five distinct student profiles were detected based on engagement, performance, and SRL survey responses. Accordingly, five tailored email models were developed and sent, ensuring that each student received communication suited to their specific needs.

Students that showed dropout signs - No learning activity detected on the system - dropout. (S3, S4, S5, S7, S8, S10, S11, S13, S14, S16, S19, S20, S22, S23, S26, S28, S30, S32, S33, S36, S38, S40, S42, S44, S46, S47, S53, S55, S56, S58, S63, S66, S74, S78, S84, S87)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the *Object-oriented programming 1* course. Based on your activity in iMet and LAMS and the survey responses, we have noticed a significant decrease in your engagement since the beginning of the course.

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

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

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who demonstrated average level of activity. No SRL data available. - Average level of activity. No SRL data available. (S2, S6, S12, S15, S17, S18, S21, S24, S25, S27, S29, S34, S37, S39, S41, S43, S52, S73, S83)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Object-Oriented Programming 1 course. Based on your activity on the iMet and LAMS platforms, we've noticed that your engagement in the course has been at an average level so far. However, we don't yet have your responses to the Self-Regulated Learning (SRL) survey, which means we're missing an important part of understanding how you approach studying and whether you might need additional support.

You still have the opportunity to complete the weekly SRL surveys, which will help our research and also give you a chance to share your perspective on the course activities. The surveys are important because they help us better understand how you study, how you plan your work, and what challenges you face, so we can provide timely and appropriate support if needed.

You can access the surveys here: [SURVEY LINKS].

If you have any questions or need help, whether with the course material, organizing your study, or even with the survey itself, just reply to this message or contact your teacher directly. We’re here to support you and help you stay on track.

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who started learning in Week 6 and demonstrated a high level of anxiety - First activity recorded only in Week 6, high level of anxiety. (S45, S57, S75)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Object-Oriented Programming 1 course. Based on your activity on the iMet and LAMS platforms, we’ve noticed that your first activity in the course was recorded in Week 6, and in the Self-Regulated Learning (SRL) survey you reported experiencing a higher level of anxiety.

We completely understand that personal, emotional, or organizational challenges can affect when and how you engage with the course. Please know that you are not alone, and support is available. If you feel overwhelmed or unsure about how to proceed, we encourage you to reply to this email or contact your teacher directly so that we can work together on finding the best way forward.

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who demonstrated below-average performance but reported a high level of self-regulation - Below-average course performance combined with high SRL survey results. (S61, S65, S76, S80, S88)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Object-Oriented Programming 1 course. Based on your activity on the iMet and LAMS platforms, we’ve noticed that your performance in the course so far has been

below average. However, in the Self-Regulated Learning (SRL) survey, you reported a high level of self-regulation, which is an excellent foundation for further progress.

We believe that with additional support and focus, you can significantly improve your performance. We would be glad to discuss possible learning strategies, clarify course content, or provide resources that can help you achieve better results. If you would like to talk or have any questions, please reply to this email or contact your teacher directly.

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who submitted all exercises and achieved high grades but reported a high level of anxiety - Submitted all exercises, high grades. High level of anxiety. (S61, S65, S76, S80, S88)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Object-Oriented Programming 1 course. We’ve noticed that you have successfully completed and submitted all tests and assignments, achieving high grades, which clearly shows your dedication and serious approach to learning. However, in the Self-Regulated Learning (SRL) survey, you reported experiencing a higher level of anxiety.

We understand that even when you are performing well academically, studying can sometimes feel overwhelming. Please know that you are not alone, and support is available. If you feel anxious or need advice on managing your study load more effectively, we encourage you to reply to this email or contact your professor directly so we can work together on strategies to support you.

Looking forward to hearing from you.

Best regards,
The ISILA team

2.1.4.4. Responses obtained

Only a small number of students responded to the personalized emails, as shown in the table 3.

Table 3. – Intervention 1 responses

Student	Intervention 1 : Week 6 - responses
S4	The student reported being unable to participate in learning activities due to family problems.
S10	The student reported not using LAMS, as they are currently learning Java through Udemy. They stated that they will complete all activities afterwards.
S11	The student reported starting to learn from 30.06.2025
S14	The student reported not receiving the survey. It has been resent.
S22	The student reported working part-time and therefore being unable to follow the course regularly.
S25	The student reported that they will start studying in the following period.
S36	The student reported starting to learn from 01.07.2025.
S39	The student reported transferring to another study program.

S41	The student reported being occupied with work and other activities.
S42	The student stated that they will start learning after receiving the email.
S43	The student reported transferring exams, with points still valid.
S55	The student reported transferring exams, with points still valid.
S58	The student reported being delayed with coursework due to personal problems and stated they will try to catch up.
S74	The student reported being delayed with coursework due to personal problems and stated they will try to catch up.
S77	They reported having many pending exams but expressed determination to catch up. The student stated that obligations are causing anxiety, and an in-person meeting was held.

2.1.5. Intervention 2: Week 13

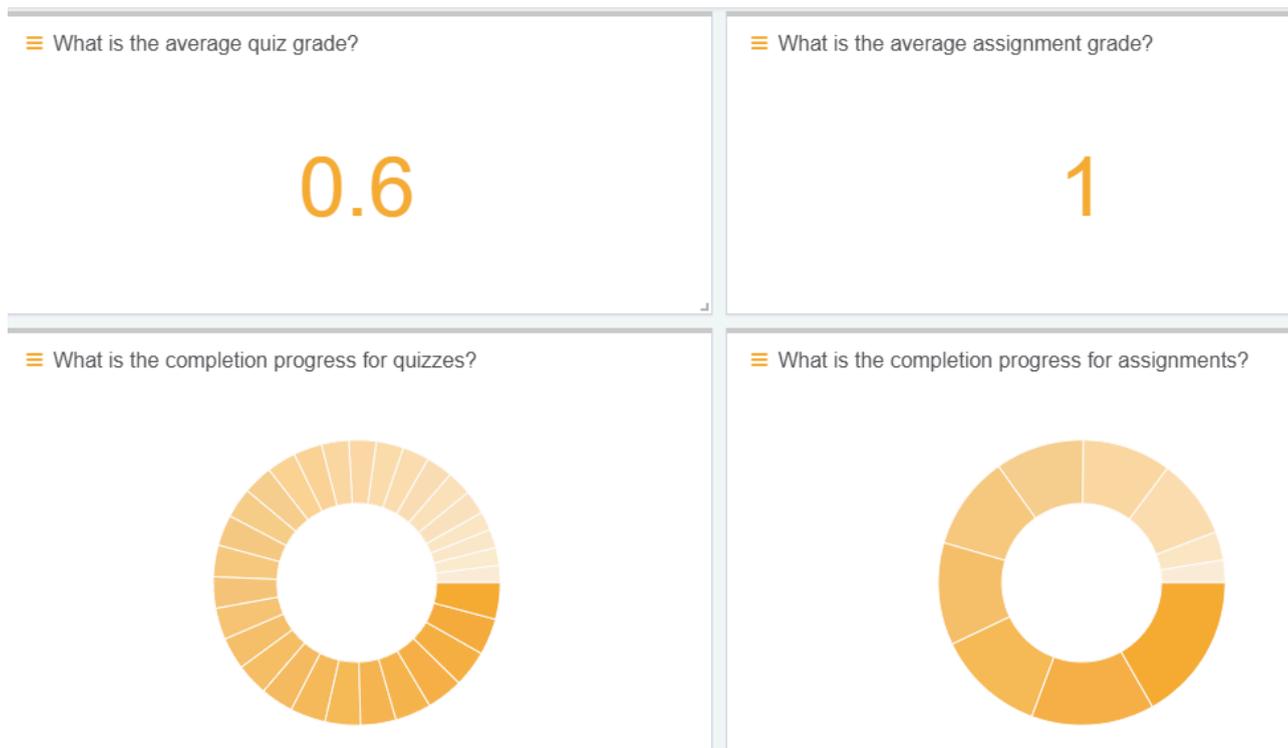


Fig 6. - Dashboard overview 1 of the course in Week 13

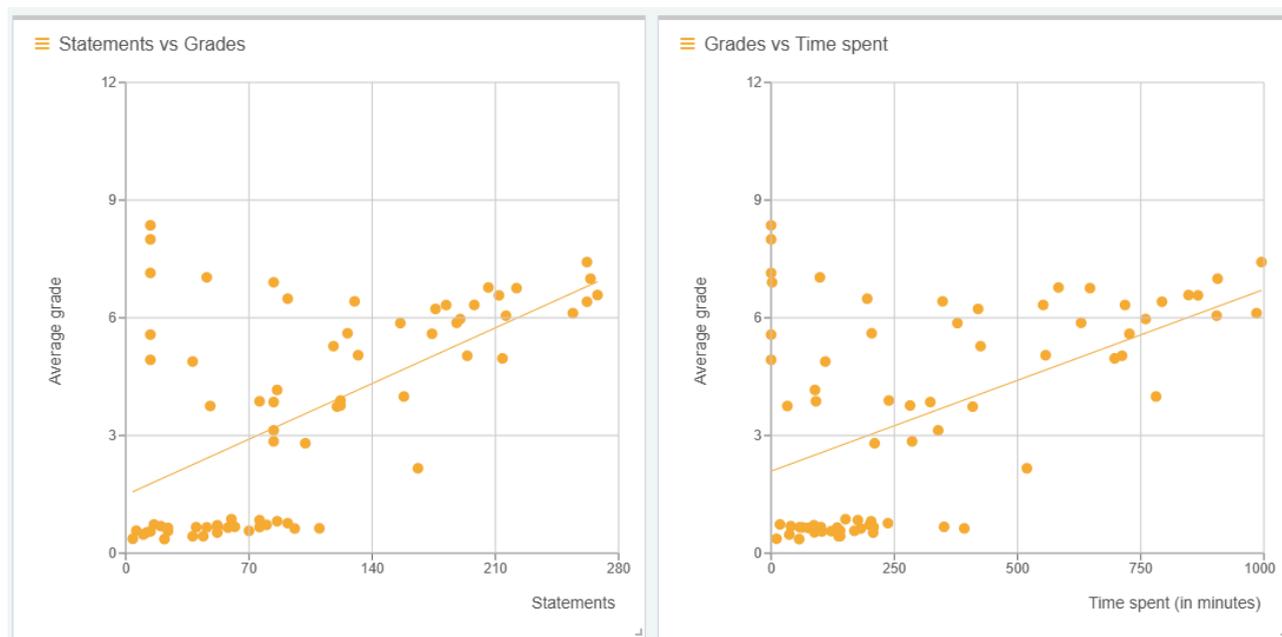


Fig 7. - Dashboard overview 2 of the course in Week 13

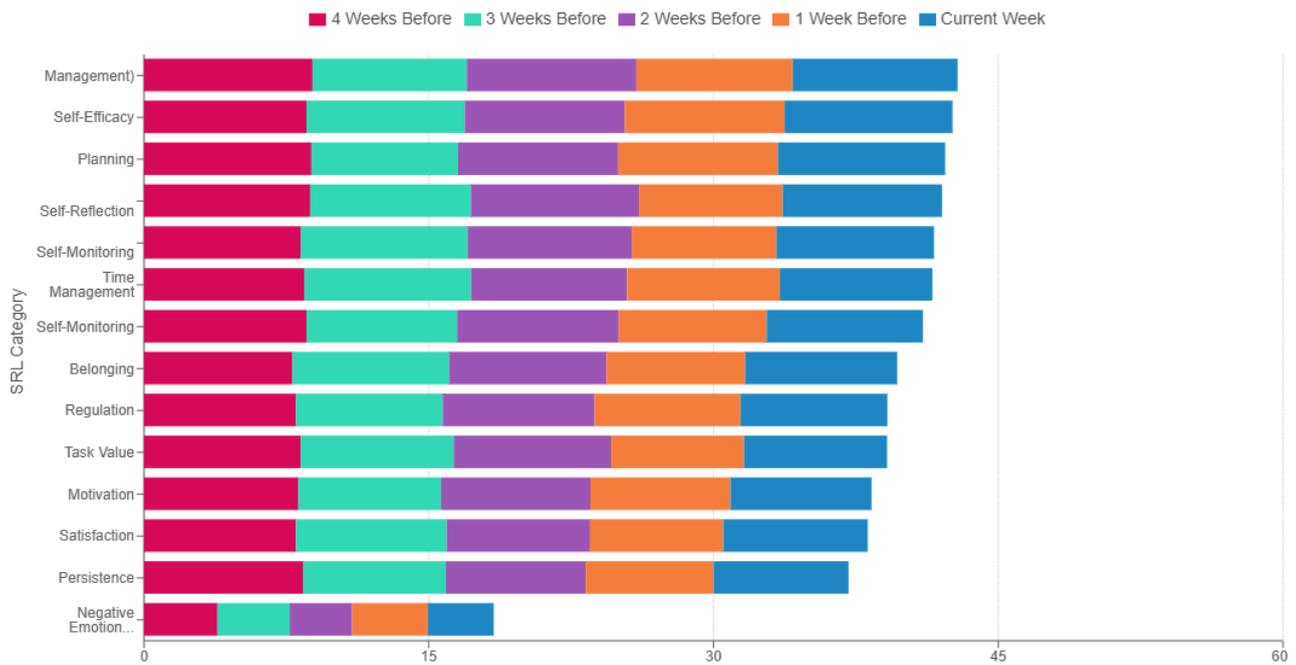


Fig 8. - Dashboard overview 3 of the course in Week 13

Table 4. - Summary of actions for intervention 2 with colors differentiating the type of action

Student	Intervention 2 : Week 13	Intervention 2 : Week 13 - actions
S1	Submitted all exercises, high grades and high SRL.	NONE
S2	Submitted all exercises, average grades and no SRL.	NONE
S3	Below-average performance and no SRL.	CONTACT PERSONALLY
S4	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S5	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S6	Below-average performance and no SRL.	CONTACT PERSONALLY
S7	Below-average performance and no SRL.	CONTACT PERSONALLY
S8	Below-average performance and no SRL.	CONTACT PERSONALLY
S9	Submitted all exercises, high grades and no SRL.	NONE
S10	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S11	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S12	Submitted all exercises, average grades and no SRL.	NONE
S13	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S14	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S15	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S16	Submitted all exercises, high grades and high SRL.	NONE
S17	Submitted all exercises, high grades and high SRL.	NONE
S18	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S19	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S20	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S21	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S22	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S23	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S24	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S25	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S26	Below-average performance and no SRL.	CONTACT PERSONALLY
S27	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S28	No learning activity detected on the system - dropout.	/
S29	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S30	Submitted all exercises, high grades and high SRL.	NONE

S31	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S32	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S33	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S34	Submitted all exercises, high grades and high SRL.	NONE
S35	Submitted all exercises, high grades and no SRL.	NONE
S36	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S37	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S38	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S39	No learning activity detected on the system - dropout.	/
S40	Submitted all exercises, high grades and high SRL.	NONE
S41	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S42	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S43	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S44	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S45	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S46	Submitted all exercises, high grades and high SRL.	NONE
S47	Submitted all exercises, high grades and high SRL.	NONE
S48	Submitted all exercises, high grades and high SRL.	NONE
S49	Submitted all exercises, high grades and high SRL.	NONE
S50	Submitted all exercises, high grades and high SRL.	NONE
S51	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S52	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S53	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S54	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S55	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S56	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S57	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S58	Submitted all exercises, high grades and high SRL.	NONE
S59	Submitted all exercises, high grades and high SRL.	NONE
S60	Submitted all exercises, high grades and high SRL.	NONE
S61	Submitted all exercises, high grades and high SRL.	NONE
S62	Submitted all exercises, high grades and high SRL.	NONE
S63	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S64	Submitted all exercises, high grades and high SRL.	NONE
S65	Submitted all exercises, high grades and high SRL.	NONE
S66	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S67	Submitted all exercises, high grades and high SRL.	NONE
S68	Submitted all exercises, high grades and high SRL.	NONE
S69	Submitted all exercises, high grades and high SRL.	NONE
S70	Below-average performance, but high SRL.	CONTACT PERSONALLY
S71	Submitted all exercises, high grades and high SRL.	NONE
S72	Below-average performance, but high SRL.	CONTACT PERSONALLY
S73	Submitted all exercises, high grades and high SRL.	NONE
S74	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S75	Submitted all exercises and high SRL	NONE
S76	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S77	Submitted all exercises and high SRL	NONE
S78	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S79	Submitted all exercises, high grades and high SRL.	NONE
S80	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S81	Submitted all exercises, high grades and high SRL.	NONE
S82	Submitted all exercises, high grades and high SRL.	NONE
S83	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S84	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S85	Submitted all exercises, high grades and high SRL.	NONE

S86	Below-average performance, but high SRL.	CONTACT PERSONALLY
S87	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S88	Submitted all exercises, high grades and high SRL.	NONE
S89	Submitted all exercises, high grades and high SRL.	NONE
S90	Submitted all exercises, high grades and high SRL.	NONE

Students who showed dropout signs in Week 6 (S3, S4, S5, S7, S8, S10, S11, S13, S14, S16, S19, S20, S22, S23, S26, S28, S30, S32, S33, S36, S38, S40, S42, S44, S46, S47, S53, S55, S56, S58, S63, S66, S74, S78, S84, S87) had mixed outcomes by Week 13:

- Re-engaged and improved: S16, S30, S40, S46, S47, S56, S58 – moved from no activity to completing all exercises with high grades.
- Partially reactivated: S5, S14, S20, S23, S33, S38, S74 – increased their activity to an average level (still without SRL data).
- Moved from dropout to low performance: S3, S7, S8, S26 – began engaging but are still below average.
- Confirmed dropout reasons: S39 (transfer to another study program).
- No change (remained disengaged): The majority (S4, S10, S11, S13, S19, S22, S28, S32, S36, S42, S44, S53, S55, S63, S66, S78, S84, S87).

Students with high anxiety in Week 6 (S45, S57, S61, S65, S75, S76, S80, S88) showed varying progress:

- Improved outcomes: S61, S65, S75, S88 – completed all exercises with good results.
- Still struggling: S76, S80 – maintained good academic results but continued reporting high anxiety.
- Decreased engagement: S45, S57 – regressed to no activity.

New high-anxiety cases emerged (S8, S27, S56, S83).

Students with below-average performance but high self-regulation (S54, S69, S70, S71, S77, S86) showed mixed progress between Week 6 and Week 13. Some students (S69, S71, S77) demonstrated clear improvement, moving from below-average to completing all exercises and achieving high performance, indicating that their strong self-regulation helped them catch up when engaged. S86 maintained low performance, but S54 dropping out entirely despite sustained self-regulation.

High-performing students with strong self-regulation (e.g., S1, S48, S49, S50, S59, S60, S62, S64, S67, S68, S79, S81, S82, S85, S89, S90) maintained good progress and required no additional intervention.

2.1.5.1. General interventions

In Week 13, general interventions were implemented to provide support for all students and prepare them for the end of the semester:

- Group consultations were scheduled both online and in the classroom, giving students an opportunity to discuss academic challenges (e.g., backlog exams, project preparation, time management) and personal concerns. Group consultations were scheduled on 18.07.2025. A visible peak in student activity was recorded on 20.07.2025, as shown in Figure 9, indicating that the consultations had a direct impact on re-engagement.
- Additional study materials were distributed, including sample projects and past exam examples, aimed at helping students better prepare for upcoming assessments.
- Reminders about the importance of regular platform activity and using available resources were sent to encourage consistent engagement.

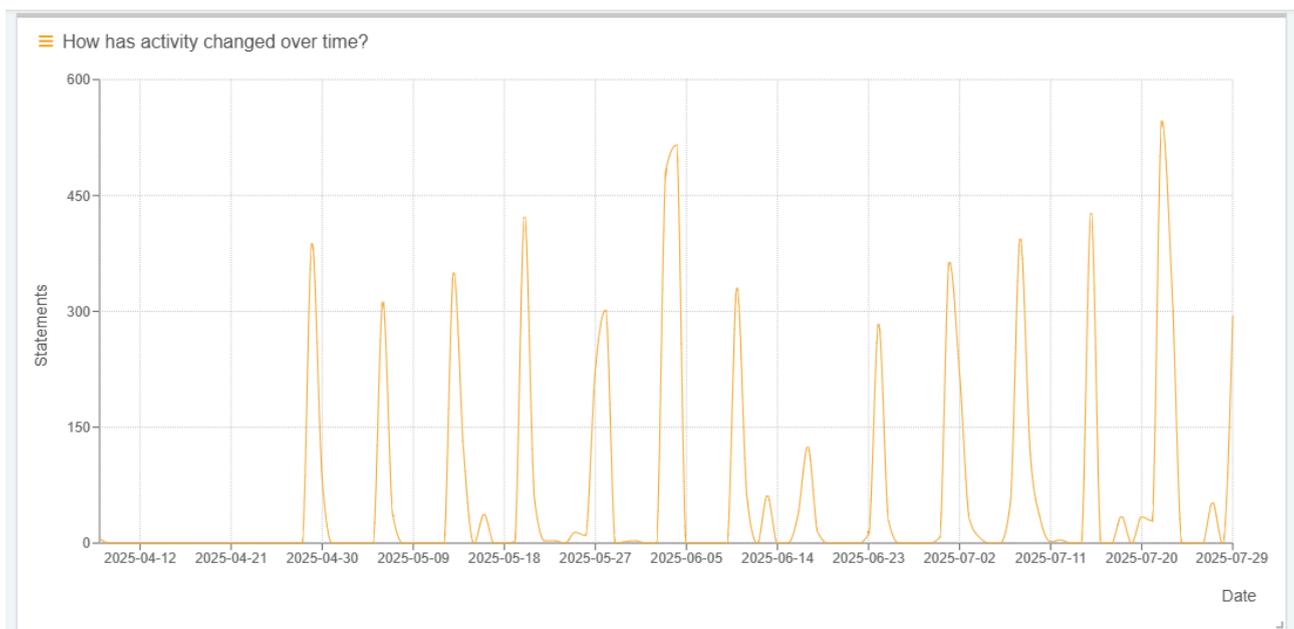


Fig 9. - Dashboard overview 4 of the course in Week 15

2.1.5.2. Individual interventions

Personalized follow-up emails were sent to students, with content tailored based on the analysis of their activity changes between interventions and their current academic status. These emails had a similar structure and tone, but were adjusted to address specific issues such as lack of engagement, below-average performance, or high levels of anxiety.

A particular emphasis was placed on the approaching end of the semester, encouraging students to take immediate action to complete pending tasks, use available consultations, and prepare for

final assessments. The goal of these communications was to motivate students to re-engage with the course, reduce stress related to backlog work, and ensure they had clear guidance on how to successfully finalize their obligations.

2.1.5.3. Responses obtained

Table 5. – Responses to intervention 2.

Student	Intervention 2 : Week 13 - responses
S8	I'm trying to improve my performance. Any advice on preparing for the final project would help.
S27	Due to personal commitments and ongoing protests, I am unable to work on the course at the moment.
S56	I've been struggling with time management. Can you recommend how to prioritize tasks?
S57	I still have some backlog exams from previous semesters, so this course is not my main priority right now.
S63	Due to personal commitments and ongoing protests, I am unable to work on the course at the moment.
S83	I've been struggling with time management. Can you recommend how to prioritize tasks?

2.1.6. Conclusion

During the semester, students engaged with the course from the beginning, but the level of participation and assignment completion varied significantly. While some students were active and consistent, a considerable number showed irregular engagement or delayed starting their work, which created a gap in overall progress.

This semester was also marked by student protests across Serbia, which disrupted regular study routines. Many students reported that protests, travel difficulties, and changes in their schedules affected their ability to follow the course continuously or meet deadlines. To address these challenges, we conducted two targeted interventions: in Week 6 and Week 13. In Week 6, personalized emails were sent to students with low or no activity, those with missing SRL survey data, students reporting high anxiety, and those with below-average performance. The goal was to understand the reasons for their difficulties and offer direct support.

By Week 13, we organized follow-up interventions: additional personalized emails, as well as group consultations both online and in the classroom. We also provided sample projects and past exam tasks to help students prepare for final assessments. This intervention had a visible impact, student activity increased, more assignments were submitted, and average grades improved. Still, a portion of students remained inactive despite repeated outreach, often due to personal challenges, focus on other academic obligations, or confirmed reasons like transferring to other programs.

Overall, the interventions helped many students improve their progress, showing that targeted, well-timed support is effective. However, the experience also highlighted that some students need

additional, alternative forms of support to ensure consistent engagement throughout the semester, particularly in semesters affected by external disruptions such as protests.

2.2. Fundamentals of Web Development Course

The aim of the course is to familiarize students with the fundamentals of various web technologies and the core principles of websites and web applications. Through an overview of topics and concepts, students will acquire the basic knowledge and skills needed for client-side (front-end) programming and will be able to create simple web applications. Topics include markup and styling languages such as HTML (HyperText Markup Language) and CSS (Cascading Style Sheets); the basics of scripting with JavaScript and its interaction with the DOM (Document Object Model); the use of jQuery, Bootstrap and Semantic UI; fundamental front-end programming techniques and principles of good design; event-driven programming and responsive design; network protocols (HTTP) and web server–browser communication; the basics of AJAX (Asynchronous JavaScript and XML); and an introduction to search-engine optimization (SEO).

2.2.1. Data Collection

At BMU, the learning analytics data was collected from multiple institutional sources and stored in the BMU LRS. Student and course-related data were extracted from iMet, the university’s information system that manages academic records and administrative data. Additional activity data was gathered from the LAMS learning platform, which was used to support student interaction and course communication.

2.2.2. Interventions

Interventions were conducted in Week 9, Week 14 and Week 15 to address issues such as low engagement, missing assignments and lack of motivation. Actions were tailored based on student profiles, with general and individualized strategies.

2.2.2.1. Intervention 1 : Week 9

Due to the unique circumstances during this semester, caused by the political situation in Serbia and ongoing student protests, students were not required to attend classes and faced no penalties for late submission of homework or tests. As a result, both class attendance and assignment completion rates were noticeably low. We waited until the middle of the semester to see whether students would begin attending classes more regularly and completing their assignments. However, by Week 8, this had not occurred, so the first intervention was implemented in Week 9.

2.2.2.1.1. Individual interventions

Since all students (1–61) showed very low activity levels until Week 9, we decided to give them a questionnaire to understand why they were not attending classes regularly and completing their tasks on time, and to explore ways we could support them in increasing their engagement. Below is the introductory text of the survey:

Dear CS105 students,

We have noticed very low attendance and activity related to pre-exam obligations in the CS105 course. This survey is intended to help us understand the reasons behind this and how we can support you in earning pre-exam points and completing the required coursework by the end of the semester.

Please complete the survey by Monday, July 7, 2025, so that we can assess whether there is sufficient interest in organizing additional class sessions and opportunities to complete pre-exam requirements, as well as consider potential changes in the way classes are conducted.

The following questions were included in the survey. Each question had multiple answer options, and students were allowed to select more than one.

1. What are the reasons for not attending lectures?
2. What are the reasons for not attending practical classes (exercises)?
3. I would attend practical classes if:
4. I would attend lectures if:
5. What are the reasons for not completing pre-exam obligations?
6. My performance and participation in pre-exam activities would improve if:

All students received the questionnaire and responded individually, so we consider these as individual interventions.

2.2.2.1.2. Responses obtained

Eight students responded on the survey, and here are responses summarised in the following table:

Table 6. – Responses to the intervention

	Student	Responses on survey
1	23	Participation in ongoing protests, difficulties with physically accessing the university due to road blockades, and personal issues outside of academic life were cited as reasons for low attendance and activity. Additional challenges include preparing for exams from the previous semester and not residing in Belgrade. Unreliable public transportation, particularly frequent cancellations by the <i>Lasta</i> bus service from Smederevo, has made travel unpredictable very often, it’s unclear whether transportation is available until reaching the local station. Attendance occurs whenever possible, and there is hope that the situation will normalize after the protests. It was suggested that organizing more in-person or online sessions for completing or improving pre-exam tasks would be beneficial.

	Student	Responses on survey
2	35	Participation in ongoing protests and difficulties accessing the university, particularly due to poor public transportation during the summer were listed as key reasons for low engagement. Being located outside of Belgrade has further limited the ability to attend classes. It was noted that attending lectures would be more feasible if they were held online. Additionally, improved participation and performance in pre-exam activities were linked to the availability of more online sessions for completing or retaking pre-exam tasks.
3	60	Limited physical access to the university, particularly due to unreliable public transportation during the summer, was mentioned as a challenge. The lack of mandatory attendance was also noted as a factor influencing class participation. It was suggested that online lectures would encourage more consistent attendance. Despite these challenges, regular attendance at practical sessions is maintained, and all pre-exam obligations are being completed on time. No additional sessions are considered necessary.
4	41	Ongoing participation in protests and preparation for exams from the previous semester that have not yet been passed were identified as reasons for reduced lecture attendance and engagement. It was noted that attending lectures would be more likely if they were held online. Improved performance and participation in pre-exam activities were linked to the availability of additional sessions for completing or retaking pre-exam tasks, both in the classroom and online.
5	38	Barriers to attending the university in person, including road blockades and unreliable public transportation, were cited as significant challenges. Personal issues unrelated to the university and preparation for exams from the previous semester also contributed to reduced class attendance. It was noted that attending lectures would be more feasible if a reliable means of transportation to the faculty were available. Improved success and participation in pre-exam activities were associated with the possibility of organizing additional sessions for completing or retaking pre-exam tasks, both in person and online.
6	57	Participation in protests, road blockades, and personal issues outside of the university were identified as major barriers to attending classes. The student indicated they would be more likely to attend lectures if they were held online. Challenges in completing pre-exam obligations were also linked to difficulties in reaching the university, specifically due to blockades and poor public transportation during the summer, especially in high temperatures. Improved performance and participation in pre-exam activities were associated with the organization of additional sessions for completing or retaking these tasks, both in the classroom and online.
7	37	A lack of time due to other academic obligations, road blockades preventing physical access to the university, and preparation for exams from the previous semester were cited as primary reasons for low attendance and incomplete pre-exam tasks. The non-mandatory nature of attendance was also noted as a contributing factor. Attending lectures would be more feasible if they were held online and if more time were available. The student also mentioned not studying as one of the reasons for not completing pre-exam obligations. Improved participation and success were linked to the availability of additional online sessions for completing or retaking pre-exam assignments.
8	39	Physical access to the university was limited due to road blockades, and preparation for exams from the previous semester was a major focus. The student expressed a lack of interest in attending practical sessions and indicated they would be more likely to participate if those sessions were held online. Incomplete pre-exam obligations were attributed to both ongoing exam preparation and a lack of studying. Improved performance and participation were associated with the availability of additional opportunities to complete or retake pre-exam tasks, both in-person and online.

Analysis of student responses revealed several recurring challenges that contributed to low attendance and engagement. Many students cited participation in ongoing protests and physical barriers to reaching the university, such as road blockades and unreliable public transportation, particularly during the summer months. A significant number were also focused on preparing for exams from previous semesters, while others faced personal difficulties or lacked sufficient time due to other academic responsibilities. Several students expressed a preference for online delivery of lectures and practical sessions, suggesting that this format would make participation more feasible. Additionally, many noted that their performance and completion of pre-exam obligations would improve if more opportunities both in-person and online were provided for completing or retaking assignments. These insights highlight the need for increased flexibility and targeted support in order to enhance student engagement.

2.2.2.2. Intervention 2: Week 14

After analysis of the survey answers after individual interventions it was obvious that students need more additional opportunities to complete or retake pre-exam tasks. So, the next intervention was conducted in Week 14.

2.2.2.2.1. General intervention

In Week 14, a general intervention was carried out by offering an additional session for completing pre-exam activities. All students were invited to attend this session in order to complete their assignments and improve their level of engagement.

2.2.2.2.2. Dashboard Overview

An overall dashboard was created to get the general picture of the course, including the time spent on the course, the exercise submission etc. which is shown on Fig1-Fig8.

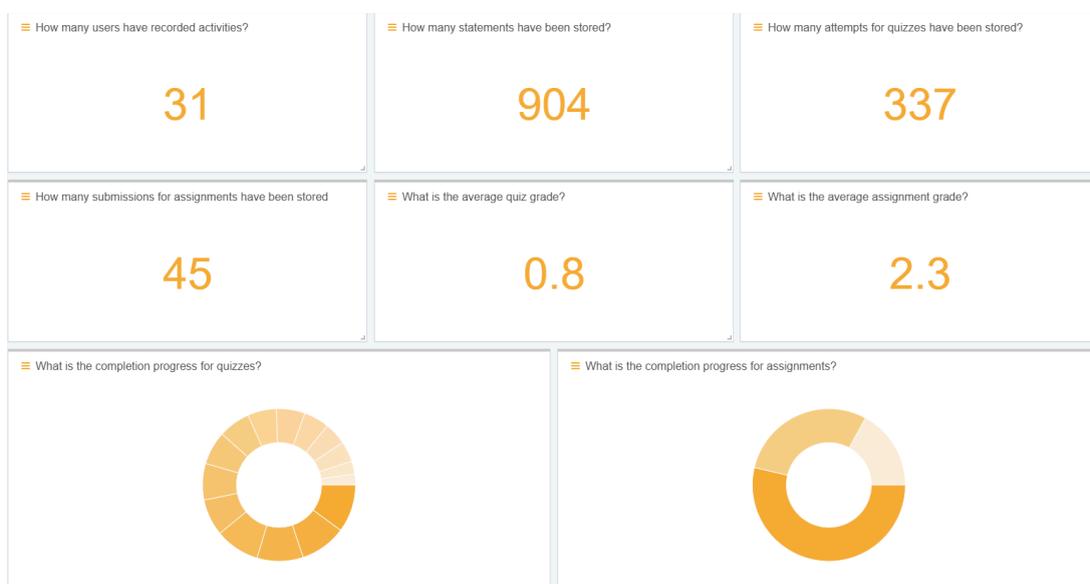


Fig 10. – Dashboard overview 1 of the course in Week 14

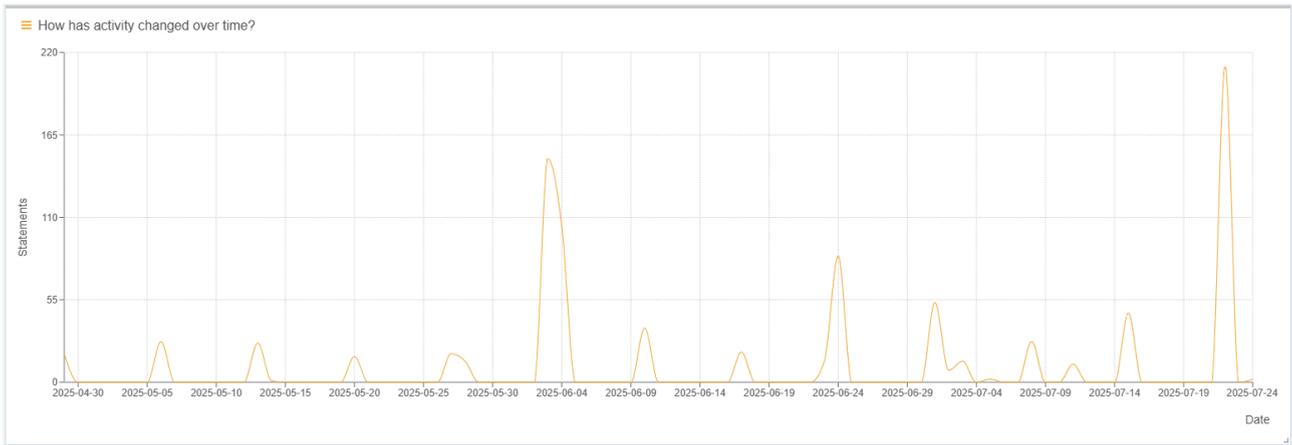


Fig 11. - Dashboard overview 2 of the course in Week 14

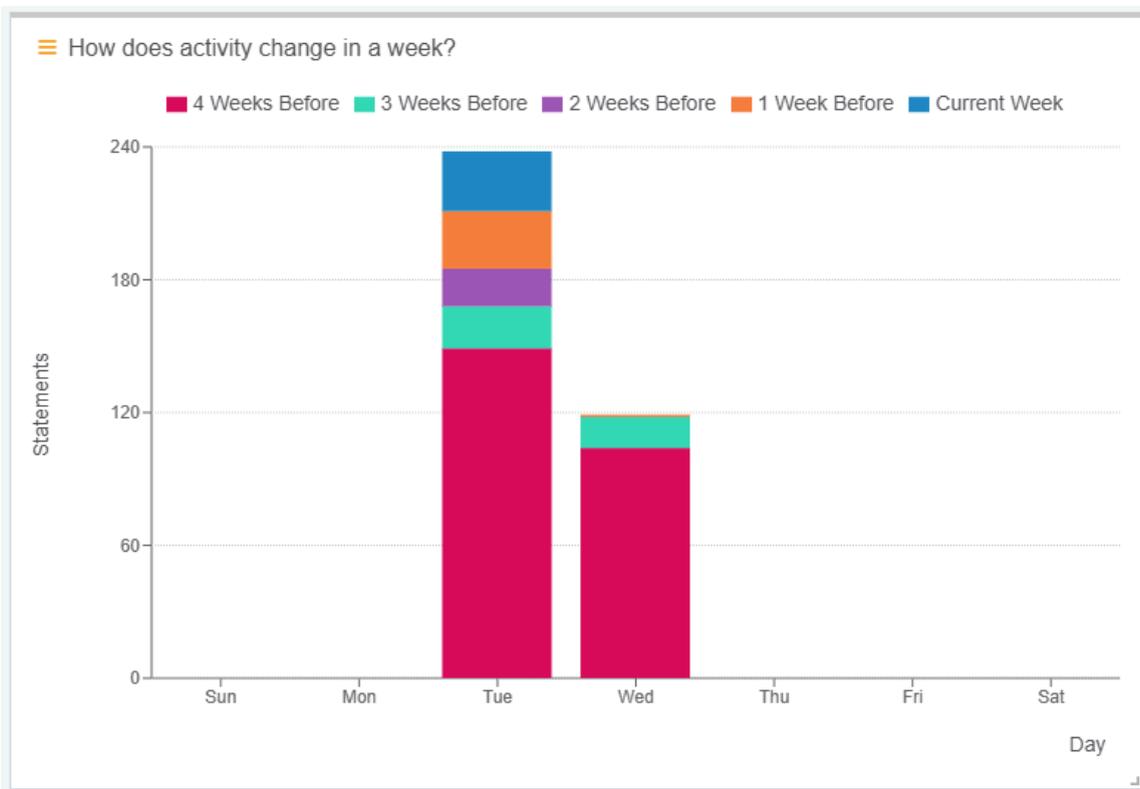


Fig 12. - Dashboard overview 3 of the course in Week 14

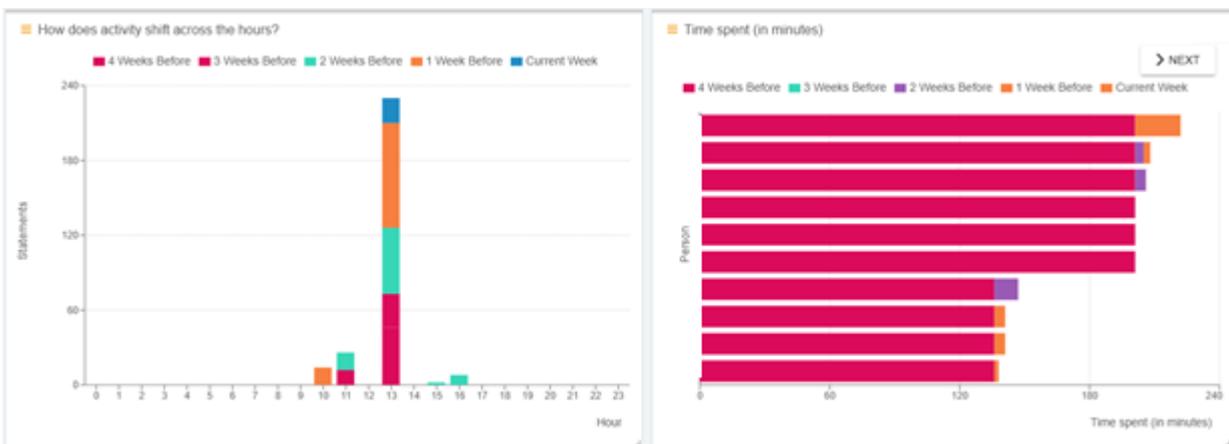


Fig 13. - Dashboard overview 4 of the course in Week 14

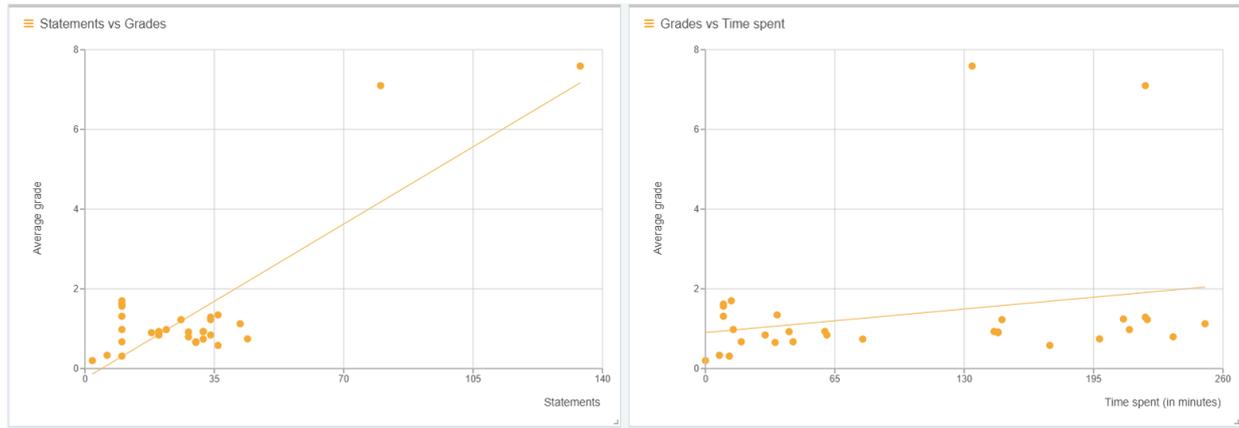


Fig 14. - Dashboard overview 5 of the course in Week 14

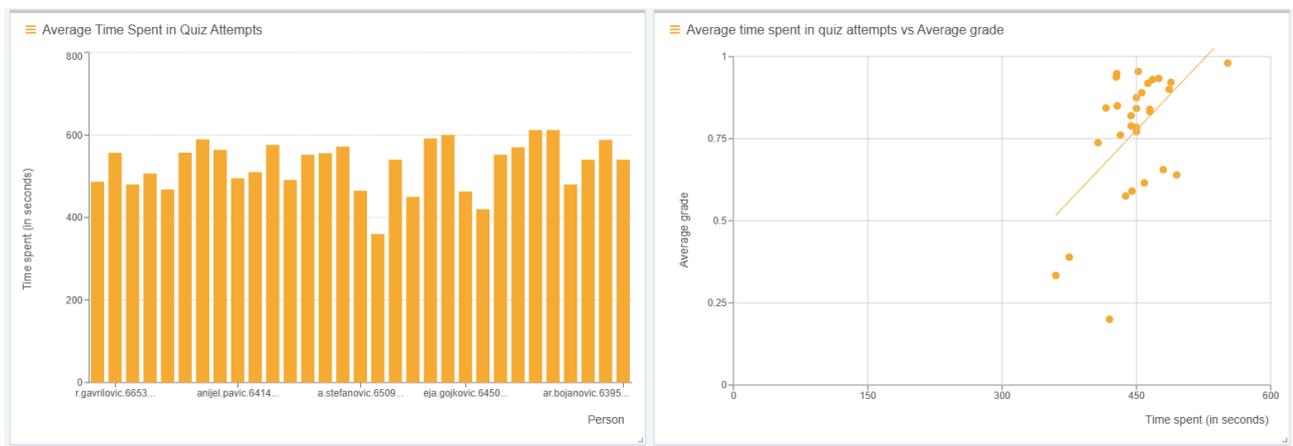


Fig 15. - Dashboard overview 6 of the course in Week 14



Fig 16. - Dashboard overview 7 of the course in Week 14

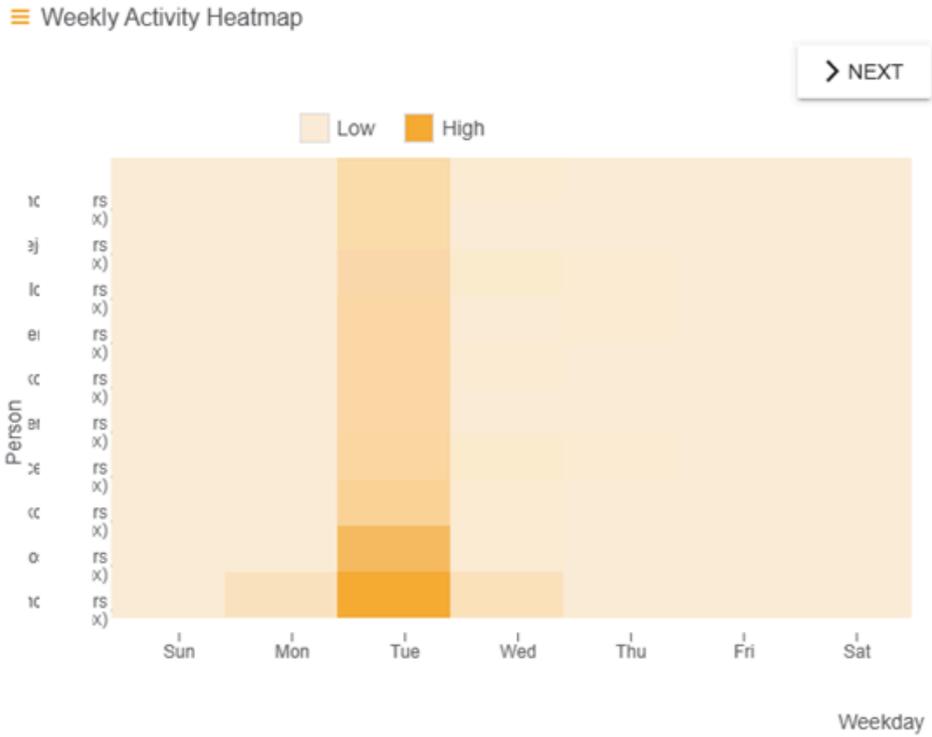


Fig 17. - Dashboard overview 8 of the course in Week 14

Number of Quiz Attempts – Basic Level (Level 1)

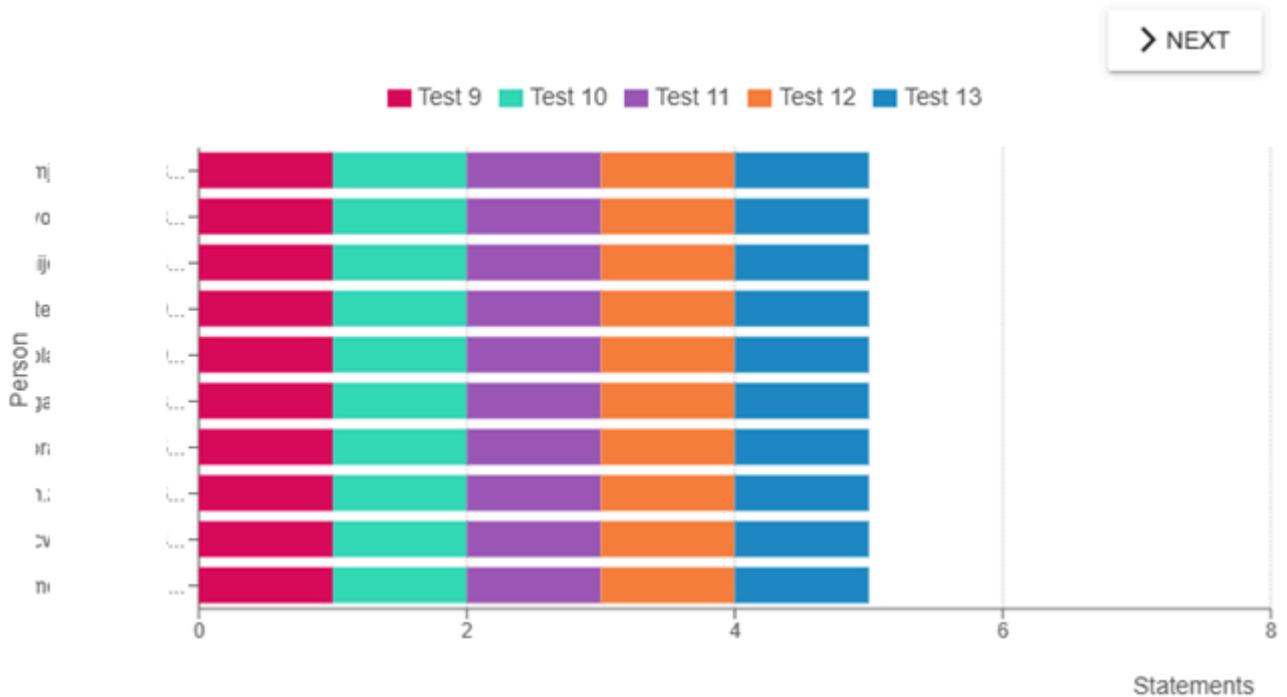


Fig 18. - Dashboard overview 9 of the course in Week 14

2.2.2.2.3. Individual insights from dashboard

We also filtered the dashboard data to examine each individual student who provided consent to participate in the ISILA project interventions, using the filtering functionality developed within the ISILA system. The visualizations reviewed were the same as those presented in Figures 1 to 8, but displayed on a per-student basis.

2.2.2.2.4. Responses obtained

We can see from the dashboard that there was a noticeable peak in activity in Week 14, when five students took advantage of the new opportunity to retake their assignments. However, up to that point, only 31 students had recorded activities, which is not sufficient considering that the CS105 course has 61 enrolled students and Week 14 marks the near end of the semester.

2.2.2.3. Intervention 3: Week 14

After the general intervention in Week 14 and a review of the dashboard results, we observed that some students remained highly inactive. As a result, we compiled a list of these students and contacted them via email. In the table below, students marked in red were completely inactive, while those marked in yellow had fewer than 5 points across all pre-exam activities.

Table 7. – Interventions week 14 by student

Student	Action
28	CONTACT PERSONALLY
30	CONTACT PERSONALLY
31	CONTACT PERSONALLY
34	CONTACT PERSONALLY
36	CONTACT PERSONALLY
37	CONTACT PERSONALLY
38	CONTACT PERSONALLY
39	CONTACT PERSONALLY
40	CONTACT PERSONALLY
41	CONTACT PERSONALLY
43	CONTACT PERSONALLY
45	CONTACT PERSONALLY
46	CONTACT PERSONALLY
47	CONTACT PERSONALLY
50	CONTACT PERSONALLY
51	CONTACT PERSONALLY
54	CONTACT PERSONALLY
55	CONTACT PERSONALLY
56	CONTACT PERSONALLY
57	CONTACT PERSONALLY
58	CONTACT PERSONALLY
59	CONTACT PERSONALLY
61	CONTACT PERSONALLY

2.2.2.3.1 Individual interventions

We sent two different emails: one to students who had been completely inactive since the beginning of the semester, and another to those with very low levels of activity. Text of the mails for individual interventions is following:

Dear [Student Name],

I've noticed that you have not yet completed any of the pre-exam assignments for CS105. To give you an opportunity to catch up and sit for the exam, we have scheduled an extra session on Tuesday, July 29, 2025, during our regular lecture and lab hours.

Please consider attending this session and take advantage of the chance to finish your pre-exam obligations. If you have any questions, concerns, or need additional support, feel free to contact me by email.

Best regards,

[Name]

[Title / Department]

Dear [Student name],

I have noticed that you are significantly behind on your pre-exam assignments for CS105. To give you the opportunity to catch up and sit the exam, we have scheduled an additional session on Tuesday, 29 July 2025, during the regular lecture and lab time.

Please consider this date and make use of the chance to complete your pre-exam requirements. If you have any questions, uncertainties, or need further assistance, feel free to email me.

Best regards,

[Name]

[Title / Department]

2.2.2.3.2 Responses obtained

Table 8. – Responses from students on the intervention

	Student	Responses on survey
1	31	Student 31 indicated having health issues that prevented participation in the pre-exam tests.
2	38	Student 38 thanked for the new sessions and asked whether more will be organized in the near future.
3	39	Student 39 confirmed attendance at the next session and asked a technical question regarding how points will be calculated, noting that CS105 has only one level of tests, unlike some other courses that have three.
4	47	Student 47 responded that attendance at this session is not possible and requested to be informed if another session is scheduled.
5	56	Student 57 inquired about which pre-exam obligations could be completed during the additional session and whether it is possible to redo previously completed tasks.
6	61	Student 61 asked if the assignments could be completed from home.

From 23 students that received mail, only 6 responded. Also, we noticed that only two students who were totally inactive responded to the mail, while others didn't. The survey responses clearly indicate that students welcomed the opportunity for additional sessions and expressed a strong need for flexibility in completing their pre-exam activities. Several students faced personal or health-related challenges that prevented them from participating earlier, while others were eager to understand how the evaluation would be handled in comparison to other courses. The interest in attending future sessions, completing assignments remotely, or retaking already attempted

activities suggests that the organization of an additional term was both necessary and well-received. It was evident from the feedback that students needed another opportunity to fulfill their pre-exam obligations.

2.2.2.4 Intervention 4: Week 15

After analysis of the dashboard in Week 14 and responses obtained after individual interventions it was obvious that students need one more additional opportunity to complete or retake pre-exam tasks. So, the next intervention was conducted in Week 15.

2.2.2.4.1 General intervention

In Week 15, a general intervention was carried out by offering an additional session for completing pre-exam activities. All students were invited to attend this session in order to complete their assignments and improve their level of engagement.

2.2.4.2 Dashboard Overview

An overall dashboard was created to get the general picture of the course, including the time spent on the course, the exercise submission etc. which is shown on Fig1-Fig7.

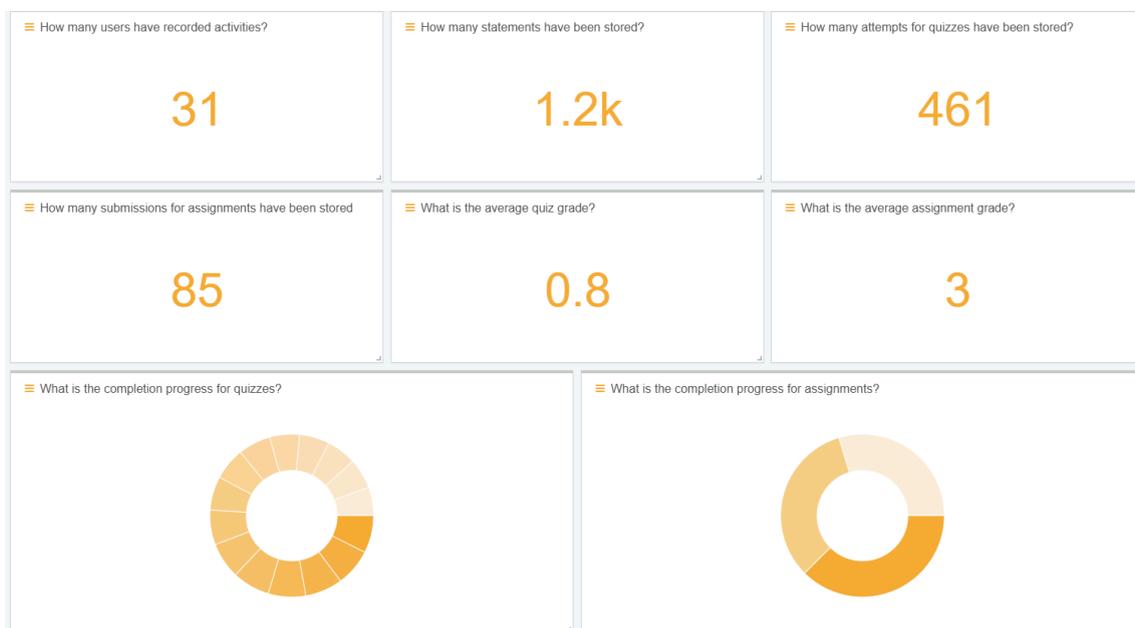


Fig 19. - Dashboard 1 overview of the course in Week 15

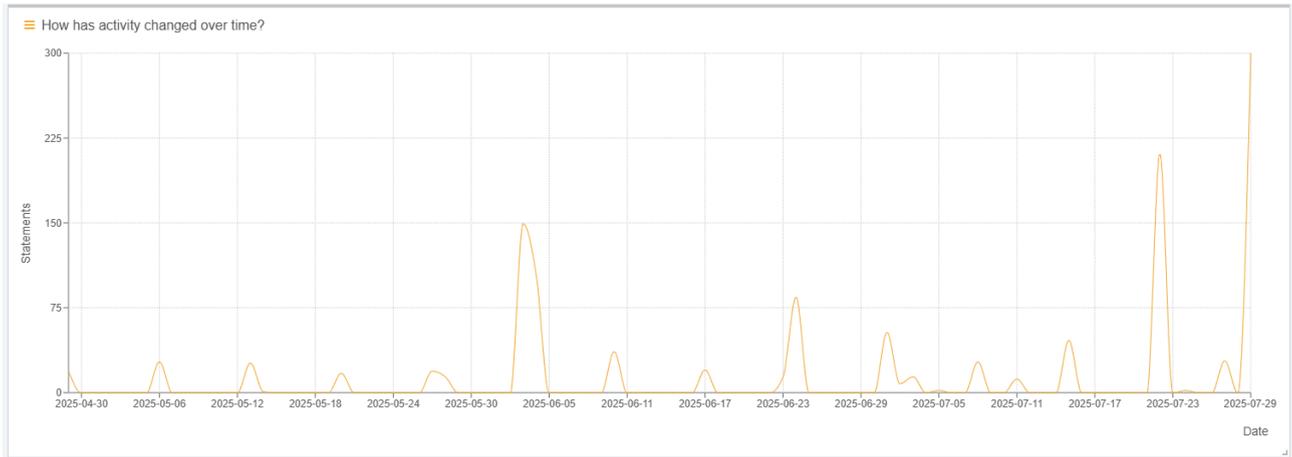


Fig 20. - Dashboard 2 overview of the course in Week 15

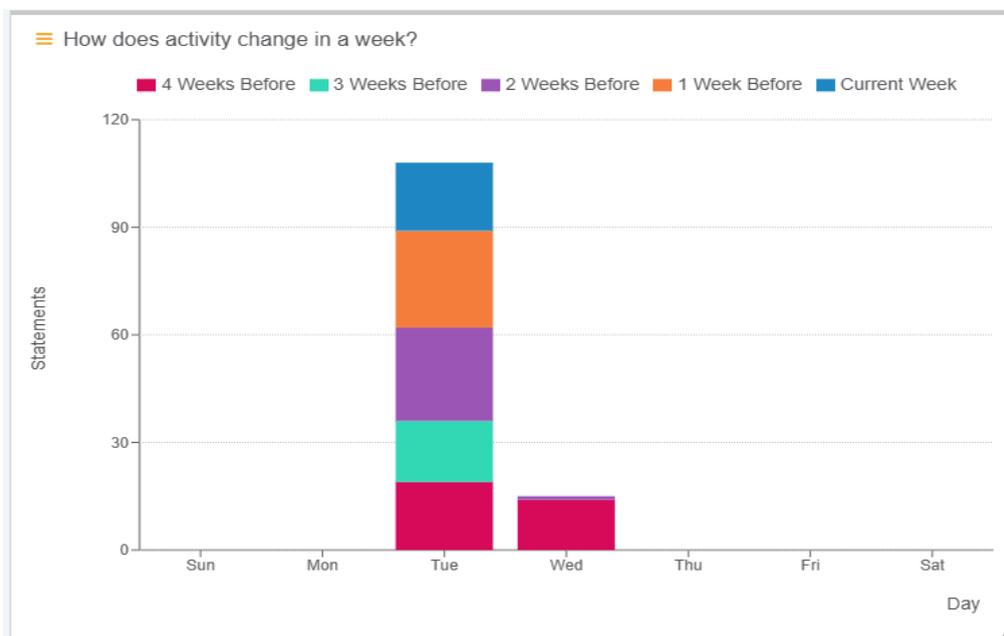


Fig 21. - Dashboard overview 3 of the course in Week 15

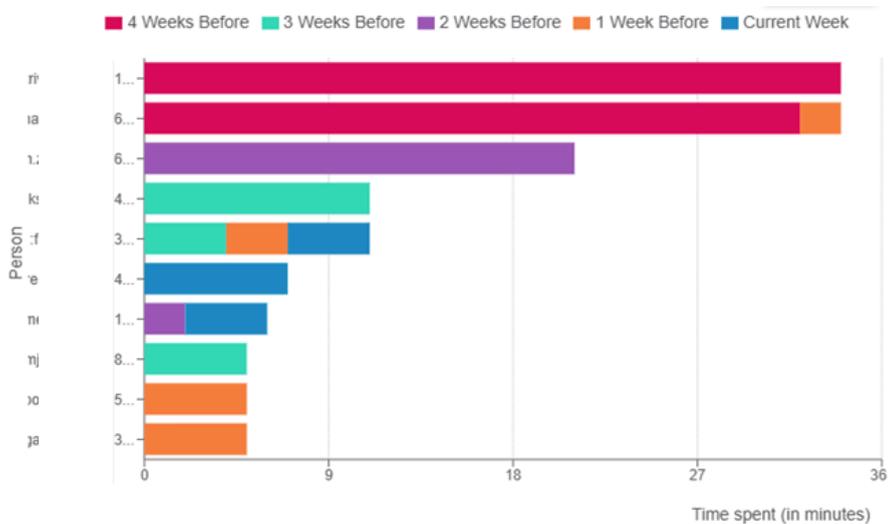


Fig 22. - Dashboard overview 4 of the course in Week 15

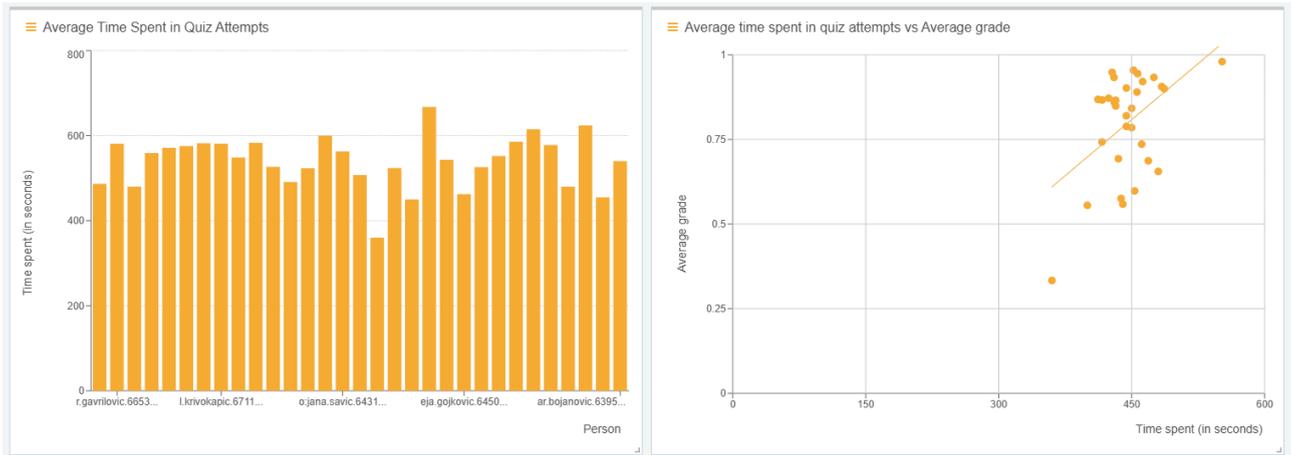


Fig 23. - Dashboard overview 5 of the course in Week 15

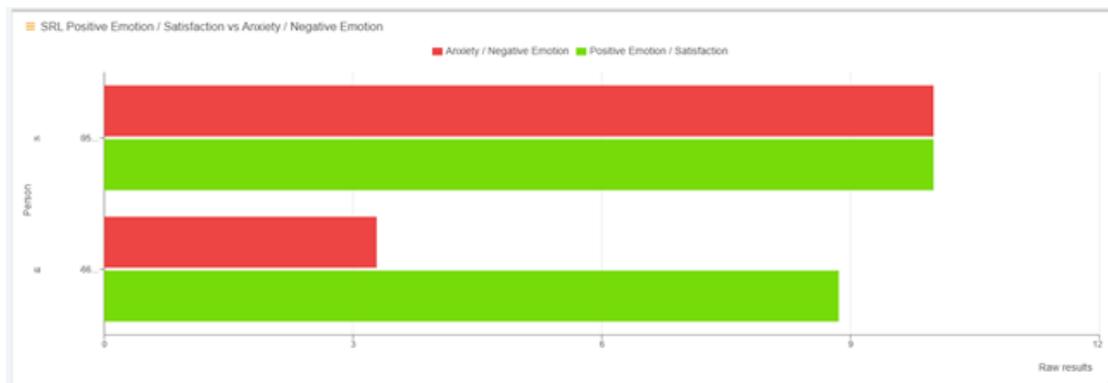


Fig 24. - Dashboard overview 6 of the course in Week 15

Number of Quiz Attempts – Basic Level (Level 1)

> NEXT



Fig 25. - Dashboard overview 7 of the course in Week 15

2.2.2.4.3. Individual insights from dashboard

We also filtered the dashboard data to examine each individual student who provided consent to participate in the ISILA project interventions, using the filtering functionality developed within the ISILA system. The visualizations reviewed were the same as those presented in Figures 1 to 7, but displayed on a per-student basis.

2.2.2.4.4. Responses obtained

The dashboard shows a clear peak in activity during Week 15, which was significantly higher than the peak observed in Week 14. Interestingly, the number of students who completed pre-exam activities by Week 14 remained the same in Week 15, indicating that the same group of students took advantage of the additional opportunity to complete their tasks. The average assignment grade increased from 2.3 to 3. Additionally, the number of submitted statements rose significantly from 904 to 1,200. These results suggest that the intervention at the end of the semester was highly effective. However, a group of critical students did not respond to any of the interventions and remained inactive.

2.2.2.4.5. Conclusion

During the semester, we organized several interventions to help students who were not participating, missing assignments, or struggling with motivation. These actions were based on student activity data and direct feedback and were adjusted to meet individual student needs. The semester was unusual due to the political situation in Serbia and student protests, which meant students were not required to attend classes or submit assignments on time. Because of this, class attendance and assignment completion were very low.

We waited until mid-semester to see if students would become more active, but by Week 8, this had not happened. So, the first intervention was done in Week 9, focusing on understanding the reasons for low engagement. Students shared several challenges, such as problems with transport due to protests, focus on older exams, personal issues, and lack of time. Many also said they preferred online classes and needed more chances to complete or redo their tasks.

In Week 14, we held an extra session to help students complete pre-exam activities. While this led to a small increase in activity, only 31 out of 61 students were active by then. In Week 14 we also emailed students who were inactive, but only a few responded, especially those who had never participated. Still, survey answers showed that students appreciated the extra opportunities and wanted more chances to work online or in person.

Based on this, we organized another intervention in Week 15. This had a bigger impact, student activity increased, average grades went up, and the number of completed assignments grew. This showed that offering support near the end of the semester was helpful. However, some students still stayed inactive, even after all the efforts.

In general, the actions we took during the semester helped many students and improved their progress in the course. The experience showed that students benefit from flexible support, especially during difficult times. All interventions were helpful and made a positive impact, but some critical students did not respond to any of them. Because of this, we need to consider different approaches and additional activities to better support these students in the future.

2.3. Distributed Systems

The CS230 Distributed Systems course covers fundamental concepts and modern technologies that enable multiple computers to function as a single, coordinated system. Students explore system architectures, processes and threads, communication models (such as RPC and sockets), as well as synchronization and coordination without a central clock. The course delves into naming systems, data replication, fault detection and tolerance, and security mechanisms including authentication, encryption, and access control. Special emphasis is placed on blockchain technology as an advanced distributed model. Practical exercises using Python Client/Server programming, as well as JSP and JSF frameworks reinforce theoretical knowledge. By the end of the course, students gain the skills and understanding necessary to design scalable, reliable, and secure distributed systems.

2.3.1. Data Collection

At BMU, the learning analytics data was collected from multiple institutional sources and stored in the BMU LRS. Student and course-related data were extracted from iMet, the university’s information system that manages academic records and administrative data. Additional activity data was gathered from the LAMS learning platform and Discord, which was used to support student interaction and course communication.

The SRL survey was also administered during the course. Survey responses and log data were converted into xAPI statements using the csv2xapi tool developed in ISILA and uploaded to the BMU LRS for centralized storage and analysis.

2.3.2. Dashboard Overview

An overall dashboard was created to get the general picture of the course, including the time spent, the exercise submission and the SRL survey results (Fig.26, Fig 27).



Fig 26. - Dashboard overview 1 of the course in Week 6



Fig 27. - Dashboard overview 2 of the course in Week 6



Fig 28. - Dashboard overview 3 of the course in Week 6



Fig 29. - Dashboard overview 4 of the course in Week 6

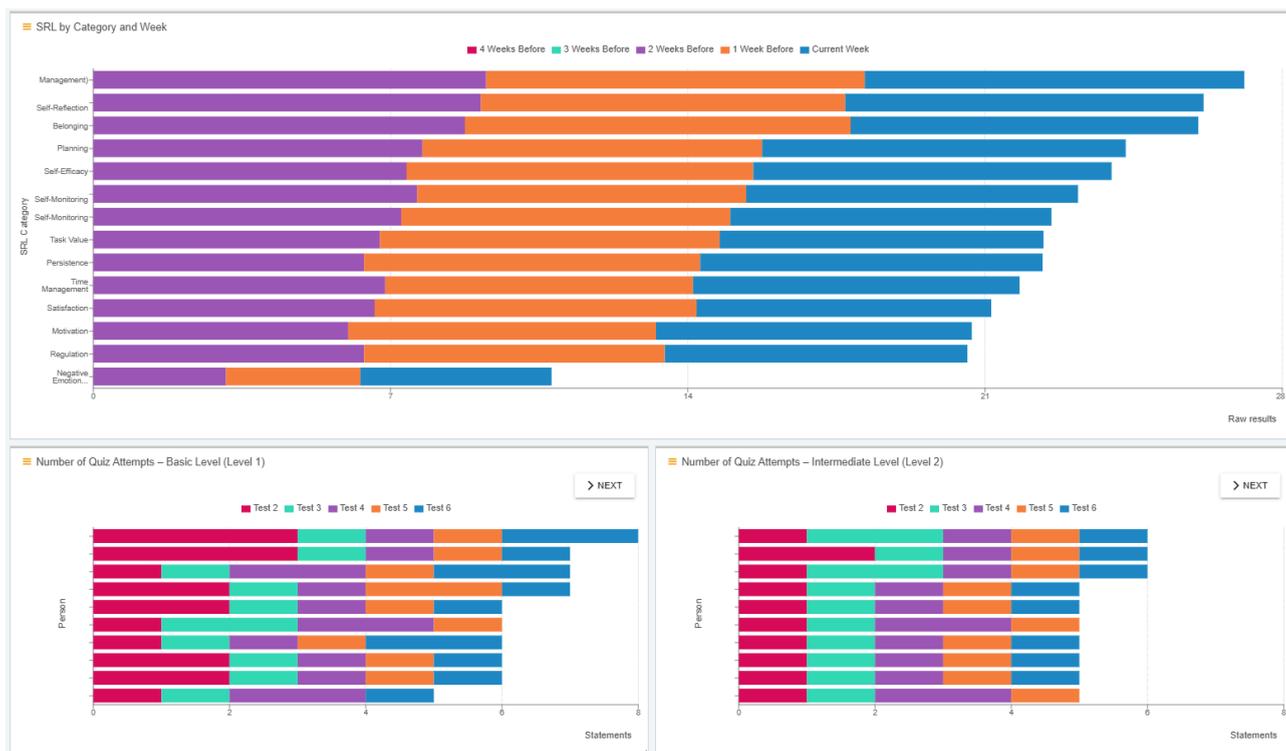


Fig 30. - Dashboard overview 5 of the course in Week 6

2.3.3. Individual insights

We filtered the dashboard data to examine each individual student who provided consent to participate in the ISILA project interventions, using the filtering functionality developed within the ISILA system. The visualizations reviewed were the same as those presented in Figures 26 to 30, but displayed on a per-student basis.

2.3.4. Interventions

Interventions were conducted in Weeks 6 and 13 to address issues such as low engagement, missing assignments, or high anxiety. Actions were tailored based on student profiles, with general and individualized strategies.

2.3.4.1. Intervention 1: Week 6

The following table summarizes student evaluation for students need - Week 6 interventions:

Tabla 1. – Interventions for week 6 by student and type of intervention specified by the color and described below

Student	Intervention 1: Week 6	Intervention 1: Week 6 - actions
S1	Below-average performance, but high SRL	CONTACT PERSONALLY
S2	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S3	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S4	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S5	Below-average performance, but high SRL.	CONTACT PERSONALLY
S6	Average level of activity. No SRL data available.	CONTACT PERSONALLY

Student	Intervention 1: Week 6	Intervention 1: Week 6 - actions
S7	Below-average performance. High level of anxiety.	CONTACT PERSONALLY
S8	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S9	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S10	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S11	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S12	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S13	Average level of activity. Average level of SRL	CONTACT PERSONALLY
S14	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S15	Submitted all exercises and high SRL	NONE
S16	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S17	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S18	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S19	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S20	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S21	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S22	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S23	Average level of activity. High level of anxiety.	CONTACT PERSONALLY
S24	Average SRL. Submitted all exercises	NONE
S25	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S26	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S27	Submitted all exercises and high SRL	NONE
S28	Submitted all exercises and high SRL	NONE
S29	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S30	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S31	Average level of activity. High level of anxiety.	CONTACT PERSONALLY
S32	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S33	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S34	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S35	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S36	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S37	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S38	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S39	Average level of activity. Average level of SRL	CONTACT PERSONALLY
S40	Average level of activity. Average level of SRL	CONTACT PERSONALLY
S41	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S42	No learning activity detected on the system - dropout.	CONTACT PERSONALLY

Student	Intervention 1: Week 6	Intervention 1: Week 6 - actions
S43	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S44	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S45	Submitted all exercises and high SRL	NONE
S46	Submitted all exercises and high SRL	NONE
S47	Average level of activity. High level of anxiety.	CONTACT PERSONALLY
S48	Average level of activity. Average level of SRL	CONTACT PERSONALLY
S49	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S50	Submitted all exercises and high SRL	NONE
S51	Submitted all exercises and high SRL	NONE
S52	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S53	No learning activity detected on the system - dropout.	CONTACT PERSONALLY

2.3.4.1.1. General interventions

Several students showed lower metacognition so additional activities in the form of games were uploaded to the LMS to increase chances of students to test their knowledge without increasing anxiety.

Several students had anxiety despite completing all course tasks in time. Thus, we extended assignment 1 deadline to reduce anxiety

2.3.4.1.2. Individual interventions

Three profiles were detected and three email models were sent depending on the type of problem detected. The emails were sent by someone other than the teacher to avoid them feeling shy or vulnerable.

Students that showed dropout signs - **No learning activity detected on the system - dropout.**

Dear [NAME],

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

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

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

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who demonstrated adequate self-regulation but reported high levels of anxiety and average level of activity. No SRL data available. - Average level of activity. No SRL data available.

Dear [NAME],

Based on your activity on the iMet and LAMS platforms, we notice that you have achieved an average level of engagement in the Distributed Systems subject so far. However, your data from the Self-Regulated Learning (SRL) survey is not available, which means we are unable to fully understand your learning style and potential challenges.

You still have the opportunity to give your consent to participate in the ISILA project and, by completing the SRL survey, contribute to the research and at the same time express your opinion regarding the activities on the subject. The survey is important so that we can offer adequate and timely support to students who need it.

If you have any questions, concerns about the material or the organization of the study, feel free to reply to this message or contact us directly. We will be happy to help you move forward successfully.

Sincerely,

[NAME OF TEACHER]

Below average Activities with anxiety – Below Average Performance and High Anxiety Reported
First activity recorded only in Week 6, high level of anxiety.

Dear [NAME],

Based on the records from the iMet and LAMS platforms, we see that your activity in the Distributed Systems course is below average, and that you reported an elevated level of anxiety in the self-regulated learning survey.

We understand that circumstances may arise during studies that make it difficult to follow classes - be it personal, emotional or organizational challenges. We want you to know that you are not alone and that support is available.

You still have time to get involved and successfully complete the course. If you feel overwhelmed or have difficulties in your work, we will be happy to talk and find ways to help you together - through learning strategies, clarification of material or organization of time.

If you want to talk, feel free to reply to this message or contact us directly.

Sincerely,

[NAME OF TEACHER]

Below-Average Performance – High Self-Regulation Reported – Below-average performance, but high SRL.

Dear [NAME],

Based on the available data from the iMet and LAMS platforms, it has been observed that your results so far in the subject Distributed Systems are below average. However, in the survey on self-regulated learning, you showed a high level of independence and organization in your approach to learning, which is an important basis for further progress.

We believe that with additional support and focus, you can significantly improve your performance. We would be happy to talk with you about possible learning strategies, clarifications of teaching content or resources that can help you achieve better results.

If you want to talk or have any questions, feel free to reply to this message or contact us directly. You still have plenty of time to improve your course performance.

Sincerely,

[NAME OF TEACHER]

Average Performance with Anxiety - Average performance, but high Anxiety levels

Dear [NAME],

Based on the available data from the iMet and LAMS platforms, it was noted that your results so far in the course Distributed Systems are in the average course. However, in the survey on self-regulated learning, they reported an elevated level of anxiety.

We believe that with additional support and focus, you can significantly improve your performance. We would be happy to talk with you about possible learning strategies, clarifications of teaching content or resources that can help you achieve better results.

If you want to talk or have any questions, feel free to reply to this message or contact us directly. You still have plenty of time to improve your course performance.

Sincerely,

[NAME OF TEACHER]

Average Performance with average SRL - Average performance, but average SRL levels.

Dear [NAME],

Based on the available data from the iMet and LAMS platforms, it was noted that your results so far in the course Distributed Systems are in the average course. However, in the self-regulated learning survey you indicated that you have both positive and negative feelings.

We believe that with additional support and focus, you can significantly improve your performance. We would be happy to talk with you about possible learning strategies, clarifications of teaching content or resources that can help you achieve better results.

If you want to talk or have any questions, feel free to reply to this message or contact us directly. You still have plenty of time to improve your course performance.

Sincerely,

[NAME OF TEACHER]

Excellent Performance – High Anxiety Reported – Submitted all exercises, high grades. High level of anxiety.

Dear [NAME],

We would like to praise your work so far on the subject Distributed systems. You successfully completed and submitted all tests and assignments, and achieved high grades, which speaks of your dedication and serious approach to learning.

However, according to your responses to the self-regulated learning (SRL) survey, you reported an elevated level of anxiety. We are aware that despite successful work, stress and the feeling of pressure can negatively affect your overall experience during your studies.

If you need to discuss ways to get better organized, reduce stress, or get additional support, feel free to get in touch - we'll be happy to help. You can reply to this message or contact the teacher directly.

Sincerely,
 [NAME OF TEACHER]

2.3.4.1.3. Responses obtained

Student	Intervention 1 : Week 6	Intervention 1: Week 6 - responses
S1	Below-average performance, but high SRL	Didn't respond.
S2	No learning activity detected on the system - dropout.	Didn't respond.
S3	No learning activity detected on the system - dropout.	Student will start doing his activities.
S4	Submitted all exercises, high grades. High level of anxiety.	Didn't respond.
S5	Below-average performance, but high SRL.	Student will start doing her activities.
S6	Average level of activity. No SRL data available.	Student will start doing his activities.
S7	Below-average performance. High level of anxiety.	Student will start his activities later.
S8	Average level of activity. No SRL data available.	Didn't respond.
S9	No learning activity detected on the system - dropout.	Didn't respond.
S10	No learning activity detected on the system - dropout.	Didn't respond.
S11	No learning activity detected on the system - dropout.	Didn't respond.
S12	No learning activity detected on the system - dropout.	Student will start doing his activities.
S13	Average level of activity. Average level of SRL	Student will start his activities later.
S14	No learning activity detected on the system - dropout.	Didn't respond.
S16	No learning activity detected on the system - dropout.	Didn't respond.
S17	Submitted all exercises, high grades. High level of anxiety.	Student will start his activities after another course.
S18	Average level of activity. No SRL data available.	Didn't respond.
S19	No learning activity detected on the system - dropout.	Didn't respond.
S20	Average level of activity. No SRL data available.	Didn't respond.
S21	No learning activity detected on the system - dropout.	Didn't respond.
S22	Average level of activity. No SRL data available.	Didn't respond.
S23	Average level of activity. High level of anxiety.	Didn't respond.
S25	Average level of activity. No SRL data available.	Didn't respond.
S26	Average level of activity. No SRL data available.	Didn't respond.
S29	No learning activity detected on the system - dropout.	Didn't respond.
S30	No learning activity detected on the system - dropout.	Didn't respond.

Student	Intervention 1 : Week 6	Intervention 1: Week 6 - responses
S31	Average level of activity. High level of anxiety.	Didn't respond.
S32	No learning activity detected on the system - dropout.	Personal problems
S33	Submitted all exercises, high grades. High level of anxiety.	Didn't respond.
S34	No learning activity detected on the system - dropout.	Didn't respond.
S35	Average level of activity. No SRL data available.	Didn't respond.
S36	No learning activity detected on the system - dropout.	Student will start doing his activities.
S37	No learning activity detected on the system - dropout.	Didn't respond.
S38	No learning activity detected on the system - dropout.	Didn't respond.
S39	Average level of activity. Average level of SRL	Asked for consultations.
S40	Average level of activity. Average level of SRL	Asked for consultations.
S41	Average level of activity. No SRL data available.	Didn't respond.
S42	No learning activity detected on the system - dropout.	Personal problems
S43	No learning activity detected on the system - dropout.	Didn't respond.
S44	No learning activity detected on the system - dropout.	Didn't respond.
S47	Average level of activity. High level of anxiety.	Didn't respond.
S48	Average level of activity. Average level of SRL	Student will start doing her activities.
S49	No learning activity detected on the system - dropout.	Didn't respond.
S52	No learning activity detected on the system - dropout.	Didn't respond.
S53	No learning activity detected on the system - dropout.	Didn't respond.

2.3.4.2. Intervention 2: Week 13

2.3.4.2.1. Dashboard overview

An overall dashboard was created to get the general picture of the course, including the time spent, the exercise submission and the SRL survey results (Fig.31-35).

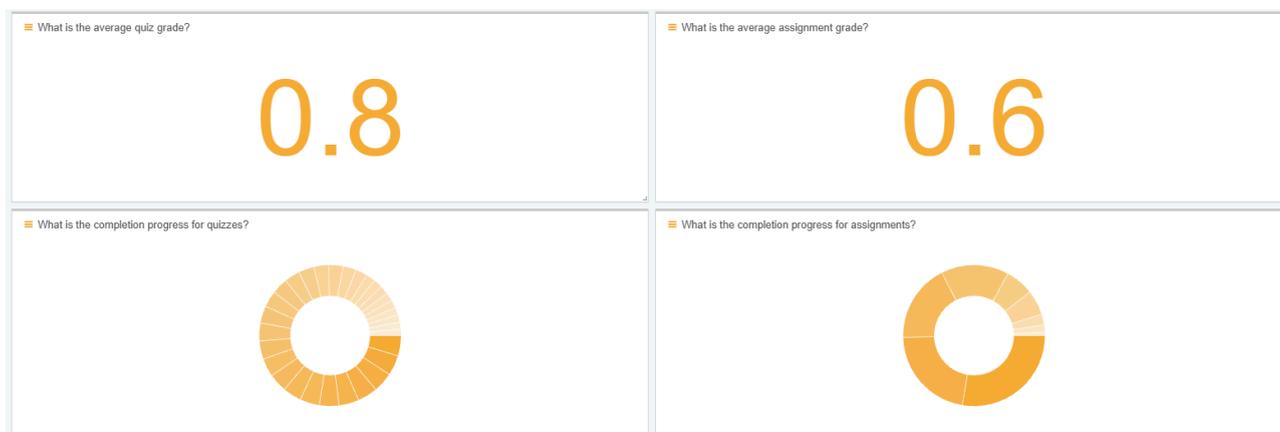


Fig 31. – Dashboard overview 1 after week 13



Fig 32. - Dashboard overview 2 after week 13



Fig 33. - Dashboard overview 3 after week 13

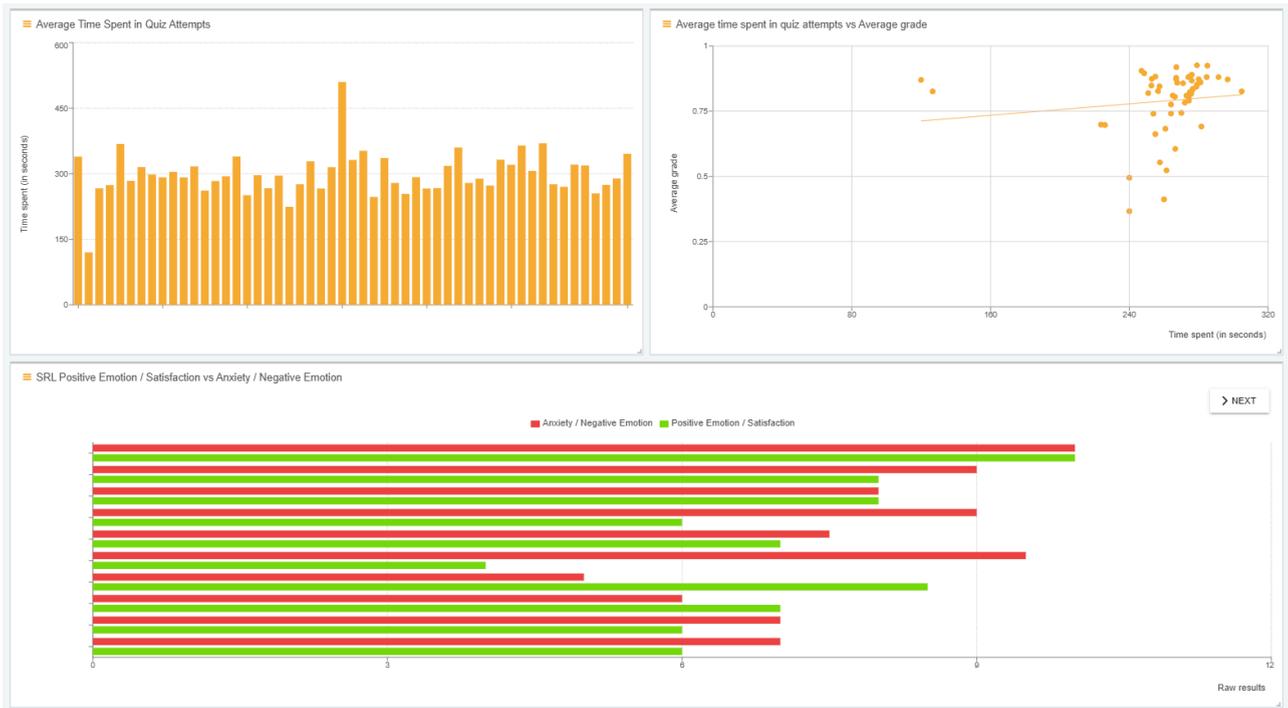


Fig 34. - Dashboard overview 4 after week 13



Fig 35. - Dashboard overview 5 after week 13

2.3.4.2.2. Interventions by student

The following table summarizes student evaluation for students need during Week 13 interventions:

Table 9. – Interventions by student and type specified by the color and described below

Student	Intervention 2: Week 13	Intervention 2: Week 13 - actions
S1	Below-average performance, but high SRL	CONTACT PERSONALLY
S2	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S3	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S4	Average level of activity. High level of anxiety.	CONTACT PERSONALLY
S5	Average level of activity. Average level of SRL	CONTACT PERSONALLY
S6	Submitted all exercises and high SRL	NONE
S7	Below-average performance. High level of anxiety.	CONTACT PERSONALLY
S8	Average level of activity. Average level of SRL	CONTACT PERSONALLY
S9	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S10	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S11	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S12	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S13	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S14	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S15	Submitted all exercises and high SRL	NONE
S16	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S17	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S18	Submitted all exercises and high SRL	NONE
S19	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S20	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S21	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S22	Average level of activity. Average level of SRL	CONTACT PERSONALLY
S23	Average level of activity. High level of anxiety.	CONTACT PERSONALLY
S24	Submitted all exercises and high SRL	NONE
S25	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S26	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S27	Submitted all exercises and high SRL	NONE
S28	Average level of activity. High level of anxiety.	CONTACT PERSONALLY
S29	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S30	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S31	Average level of activity. High level of anxiety.	CONTACT PERSONALLY
S32	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S33	Submitted all exercises, high grades. High level of anxiety.	CONTACT PERSONALLY
S34	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S35	Submitted all exercises and high SRL	NONE
S36	No learning activity detected on the system - dropout.	CONTACT PERSONALLY

Student	Intervention 2: Week 13	Intervention 2: Week 13 - actions
S37	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S38	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S39	Average level of activity. Average level of SRL	CONTACT PERSONALLY
S40	Average level of activity. Average level of SRL	CONTACT PERSONALLY
S41	Submitted all exercises and high SRL	NONE
S42	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S43	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S44	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S45	Submitted all exercises and high SRL	NONE
S46	Submitted all exercises and high SRL	NONE
S47	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S48	Below-average performance, but high SRL	CONTACT PERSONALLY
S49	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S50	Submitted all exercises and high SRL	NONE
S51	Submitted all exercises and high SRL	NONE
S52	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S53	No learning activity detected on the system - dropout.	CONTACT PERSONALLY

2.3.4.2.3. Responses obtained

Student	Intervention 1 : Week 6	Intervention 2: Week 13 - responses
S1	Below-average performance, but high SRL	Student started doing his activities.
S2	No learning activity detected on the system - dropout.	Didn't respond.
S3	No learning activity detected on the system - dropout.	Didn't respond.
S4	Average level of activity. High level of anxiety.	Student will start doing his activities.
S5	Average level of activity. Average level of SRL	Student started doing her activities.
S7	Below-average performance. High level of anxiety.	Student started doing his activities.
S8	Average level of activity. Average level of SRL	Student started doing his activities.
S9	No learning activity detected on the system - dropout.	Didn't respond.
S10	No learning activity detected on the system - dropout.	Didn't respond.
S11	No learning activity detected on the system - dropout.	Didn't respond.
S12	No learning activity detected on the system - dropout.	Didn't respond.
S13	Average level of activity. No SRL data available.	Student started doing his activities.
S14	No learning activity detected on the system - dropout.	Didn't respond.
S16	No learning activity detected on the system - dropout.	Didn't respond.

Student	Intervention 1 : Week 6	Intervention 2: Week 13 - responses
S17	Submitted all exercises, high grades. High level of anxiety.	Student started doing his activities.
S19	No learning activity detected on the system - dropout.	Didn't respond.
S20	Average level of activity. No SRL data available.	Student started doing his activities.
S21	No learning activity detected on the system - dropout.	Didn't respond.
S22	Average level of activity. Average level of SRL	Student started doing his activities.
S23	Average level of activity. High level of anxiety.	Student started doing his activities.
S25	Average level of activity. No SRL data available.	Student started doing his activities.
S26	Average level of activity. No SRL data available.	Student started doing his activities.
S28	Average level of activity. High level of anxiety.	Student started doing his activities.
S29	No learning activity detected on the system - dropout.	Didn't respond.
S30	No learning activity detected on the system - dropout.	Didn't respond.
S31	Average level of activity. High level of anxiety.	Student started doing his activities.
S32	No learning activity detected on the system - dropout.	Personal problems
S33	Submitted all exercises, high grades. High level of anxiety.	Student started doing his activities.
S34	No learning activity detected on the system - dropout.	Didn't respond.
S36	No learning activity detected on the system - dropout.	Student will start doing his activities.
S37	No learning activity detected on the system - dropout.	Didn't respond.
S38	No learning activity detected on the system - dropout.	Didn't respond.
S39	Average level of activity. Average level of SRL	Student started doing her activities.
S40	Average level of activity. Average level of SRL	Student started doing his activities.
S42	No learning activity detected on the system - dropout.	Didn't respond.
S43	No learning activity detected on the system - dropout.	Didn't respond.
S44	No learning activity detected on the system - dropout.	Didn't respond.
S47	Average level of activity. No SRL data available.	Student started doing his activities.
S48	Below-average performance, but high SRL	Student started doing his activities.
S49	No learning activity detected on the system - dropout.	Didn't respond.
S52	No learning activity detected on the system - dropout.	Didn't respond.
S53	No learning activity detected on the system - dropout.	Didn't respond.

2.3.4.3. Conclusion

Despite initial low engagement levels during the first six weeks, likely influenced by external sociopolitical factors such as student protests and academic disruptions, the two intervention rounds initiated in Weeks 6 and 13 demonstrated the value of targeted, personalized support.

The first intervention revealed a substantial segment of students (nearly half) with no detectable activity in the system, signifying either disengagement or dropout risks. The individualized approach, offering structured encouragement, emotional reassurance, and guidance based on SRL profiles caused a mixed response. Some students began working on their assignments following the intervention, while others remained unresponsive, underscoring the limitations of non-intrusive, email-based outreach alone.

By the second intervention, a slight improvement in engagement was observed among several students who had previously shown low or no activity. Notably, students who responded to the first outreach were more likely to respond again and maintain or increase their engagement. However, a consistent portion of the cohort remained unreachable, suggesting either systemic disengagement, personal difficulties, or a need for more proactive and multimodal support strategies.

3 UEF Pilots

3.1 Data Management Systems Course

This course provides a comprehensive introduction to databases, covering fundamental concepts of data management, relational database design, and their role in efficient data organization. Students will gain hands-on proficiency in SQL for data manipulation and retrieval, and learn to operate databases using general-purpose programming languages through Object-Relational Mappings (ORMs).

3.1.1. Data Collection

The LMS data was obtained from the UEF IT services in the form of a course backup including the logs. It was uploaded to a dedicated Moodle instance and sent to the UEF LRS through the xAPI plugin. The survey data was downloaded and sent to the UEF LRS using the csv2xapi app developed in ISILA.

3.1.2. Dashboard Overview

An overall dashboard was created to get the general picture of the course, including the time spent, the exercise submission and the SRL survey results (Fig.36).

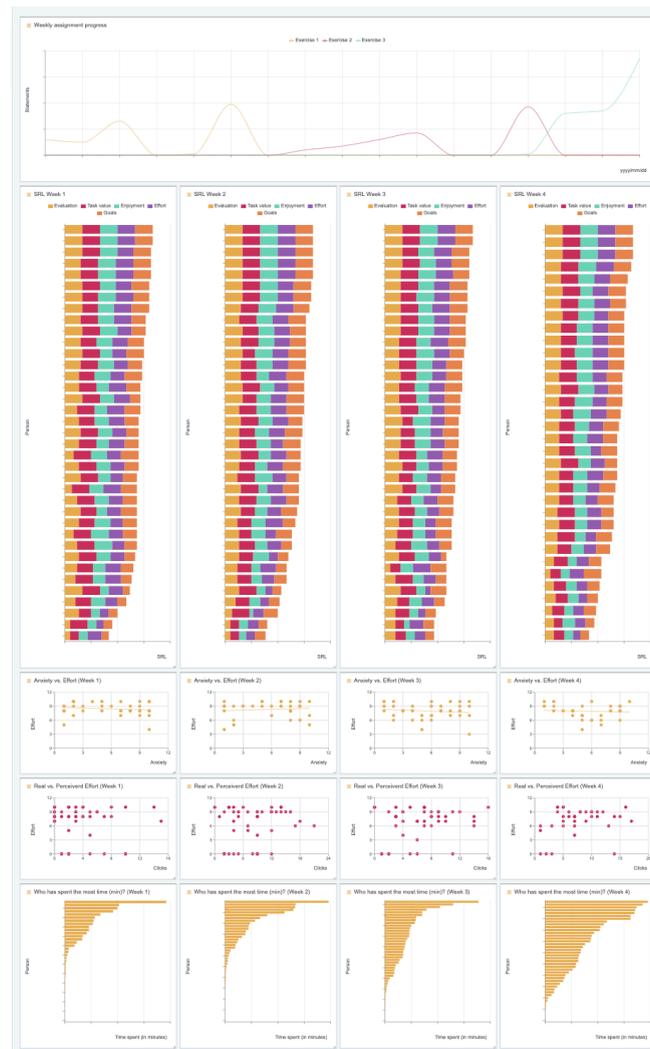


Fig 36. - Dashboard overview of the course in Week 2

3.1.3. Individual insights

We filtered the dashboard data to inspect each individual student who gave consent to participate in the ISILA project interventions, using the filter feature developed in ISILA. The visualizations examined were

- Evolution of SRL survey.
- Anxiety levels
- Submitted exercises
- Material usage at the scheduled time



Fig 37. - Example of an individual student’s dashboard

3.1.4. Interventions

Interventions were conducted in Weeks 4 and 8 to address issues such as low engagement, missing assignments, or high anxiety. Actions were tailored based on student profiles, with general and individualized strategies.

3.1.4.1. Intervention 1 : Week 2

The table 10 summarizes student evaluation for students need - Week 2 interventions.

Table 10. – Evaluation of students’ needs and actions specified by colours described below.

Student	Observation	Action
1	Arrived one week late. Submitted all exercises and high SRL	NONE
2	Submitted all exercises and high SRL mostly. Initially not good at goals, corrected throughout the weeks	NONE
3	Low reported effort while clicks suggest otherwise, low goals and high anxiety	CONTACT PERSONALLY
4	Low SRL. But submitted everything in time.	CONTACT PERSONALLY
5	Decent levels of SRL and all exercises have been completed	NONE
6	Submitted all exercises and high SRL	NONE
7	Had early activity. Didn't turn in exercises. Possible dropout	CONTACT PERSONALLY
8	Submitted all exercises and high SRL	NONE
9	Submitted all exercises and high SRL. High anxiety	CONTACT PERSONALLY
10	Submitted all exercises and high SRL. High anxiety	CONTACT PERSONALLY
11	Submitted all exercises and high SRL	NONE
12	Submitted all exercises and high SRL	NONE
13	Submitted all exercises and high SRL	NONE
14	Average SRL. Submitted all exercises	NONE
15	Average SRL. Submitted all exercises	NONE
16	Re-take from last year. Just wants access to materials but is not following.	NONE

Student	Observation	Action
17	Decent levels of SRL and all exercises have been completed but one	NONE
18	Submitted all exercises and high SRL	NONE
19	Two weeks only. Dropout?	CONTACT PERSONALLY
20	Two weeks only. Dropout?	CONTACT PERSONALLY
21	Submitted all exercises and high SRL	NONE
22	Submitted all exercises and high SRL	NONE
23	Submitted all exercises and high SRL	NONE
24	Decent levels of SRL and all exercises have been completed but one	NONE
25	Submitted all exercises and high SRL	NONE
26	Arrived one week late. Submitted all exercises and high SRL	NONE
27	Arrived 2 weeks late. Submitted all exercises and decent SRL	NONE
28	No more data after week 2. Dropout?	CONTACT PERSONALLY
29	Arrived one week late. Submitted all exercises and high SRL	NONE
30	High SRL. Only one exercise. Dropout?	CONTACT PERSONALLY
31	Completed all exercises. Little data of SRL but seems okay	NONE
32	Submitted all exercises and high SRL	NONE
33	Submitted all exercises and high SRL	NONE
34	Decent levels of SRL and all exercises have been completed	NONE
35	Submitted all exercises and high SRL	NONE
36	Submitted all exercises and high SRL	NONE
37	Missing week 3 but recovered	NONE
38	Submitted all exercises and high SRL	NONE
39	Two weeks only. Dropout?	CONTACT PERSONALLY
40	Submitted all exercises and high SRL	NONE
41	Submitted all exercises and high SRL	NONE
42	Submitted all exercises and high SRL. High anxiety	CONTACT PERSONALLY

3.1.4.1.1 General interventions

Several students showed lower metacognition so additional activities in the form of games were uploaded to the LMS to increase chances of students to test their knowledge without increasing anxiety.

Several students had anxiety despite completing all course tasks in time. Thus, we extended assignment 1 deadline to reduce anxiety

3.1.4.1.2 Individual interventions

Three profiles were detected and three email models were sent depending on the type of problem detected. The emails were sent by someone other than the teacher to avoid them feeling shy or vulnerable.

- Students that showed dropout signs (7, 19, 20, 28, 30, 39)

Dear [NAME],

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

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

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

Looking forward to hearing from you.

Best regards,
The ISILA team

- Students that had okay self-regulation but high anxiety (3,9,10,42)

Dear [NAME],

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

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

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

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

Best regards,

The ISILA team

- Students that had low self-regulation (4)

Dear [NAME],

You are receiving this email as part of the ISILA project research study in the *Data Management Systems* course. Based on your responses, we noticed that goal setting and study strategies might be areas where additional support could be helpful.

Developing effective learning habits can make coursework feel more manageable and improve overall success. If you'd like, we can discuss strategies for setting clear goals, planning your study sessions, and tracking your progress in a way that works for you. We can also share tools and techniques that might help you stay organized and focused throughout the course.

We’d love to support you in finding an approach that works best for you. Feel free to reply to this email or contact your teacher directly. Looking forward to hearing from you!

Best regards,

The ISILA team

3.1.4.1.3 Responses obtained

Table 11. Responses obtained from intervention

Student	Problem	Response
S3	High anxiety	No reply
S4	Low SRL	No reply
S7	Dropout signs	After discussing with the teacher, they are now confident about completing the course.
S9	High anxiety	Answered by mistake, they are enjoying the course
S10	High anxiety	High stress due to overlapping academic workloads from two universities but is striving to manage her responsibilities

Student	Problem	Response
S19	Dropout signs	No reply
S20	Dropout signs	No reply
S28	Dropout signs	Dropped out because the course is not counting towards his master credits
S30	Dropout signs	Was sick and is now catching up
S39	Dropout signs	No reply
S42	High anxiety	Facing academic challenges and personal circumstances and planning to seek additional support (1-on-1) closer to the exam

3.1.4.2. Intervention 2 (Week 8)

Table 12. – Observations of the students and interventions classified by colours and described below

Student	Observations	Intervention
1	Submitted all exercises and high SRL	NONE
2	Submitted all exercises and high SRL	NONE
3	Avg SRL. Submitted all exercises	NONE
4	Withdrawn last week?	CONTACT PERSONALLY
5	Submitted all exercises and high SRL	NONE
6	Submitted all exercises and high SRL	NONE
7	Submitted all exercises and high SRL	NONE
8	Submitted all exercises and high SRL	NONE
9	Submitted all exercises and high SRL	NONE
10	Submitted all exercises and high SRL	NONE
11	Submitted all exercises and high SRL	NONE
12	Submitted all exercises and high SRL. Not a lot of time spent though	NONE
13	Submitted all exercises and high SRL	NONE
14	Submitted all exercises and high SRL	NONE
15	Submitted all exercises and high SRL. Moderate anxiety for some time but went down	NONE
16	Confirmed Dropout	NONE
17	Missing last exercise? High SRL	NONE
18	Submitted all exercises and high SRL	NONE
19	No data after week 5. DROPOUT	CONTACT PERSONALLY
20	No data after week 6. DROPOUT	CONTACT PERSONALLY
21	Okay SRL, moderate anxiety. Submitted all exercises	CONTACT PERSONALLY

Student	Observations	Intervention
22	Submitted all exercises and high SRL	NONE
23	Submitted all exercises and high SRL	NONE
24	Submitted all exercises and high SRL	NONE
25	Submitted all exercises and high SRL	NONE
26	Submitted all exercises and high SRL	NONE
27	Submitted all exercises and high SRL	NONE
28	Confirmed dropout	NONE
29	Submitted all exercises and high SRL	NONE
30	No data	CONTACT PERSONALLY
31	No data	CONTACT PERSONALLY
32	Missing some exercises. High anxiety	CONTACT PERSONALLY
33	Submitted all exercises and high SRL	NONE
34	Submitted all exercises and high SRL	NONE
35	Submitted all exercises and high SRL	NONE
36	Submitted all exercises and high SRL (although missing some submissions). Little time spent	NONE
37	Submitted all exercises but on and high SRL	NONE
38	Submitted all exercises and high SRL. High anxiety	CONTACT PERSONALLY
39	No data after week 5. DROPOUT	CONTACT PERSONALLY
40	Submitted all exercises. but last. High SRL. Slightly high anxiety	NONE
41	Submitted all exercises and high SRL	NONE
42	Submitted all exercises. but last. High SRL. Somewhat high anxiety	CONTACT PERSONALLY

Students that showed dropout signs (S7, S19, S20, S28, S30, S39) in the previous intervention remained showing no engagement except for S7, who has back on track. S28 confirmed that they were dropping out because of curriculum incompatibility so no further action was taken. The rest of the students showed the same signs again (S19, S20, S30, S39). In addition, S4 and S31 were newly identified as potential dropouts.

Students that had acceptable self-regulation and engagement but high anxiety (3,9,10,42) showed signs of improvement, although one still had somewhat high anxiety (S42). In addition (S21, S32, S38) showed high anxiety for the first time.

3.1.4.2.1. General interventions

In general there was somewhat low attendance and a few potential dropouts. To enable the possibility to succeed in the final exam (2 weeks from the moment of intervention), all lecture

recordings were made available (they were not before to promote attendance). An email was sent to the whole class to clarify the exam structure and to give them some study tips.

3.1.4.2.2. Individual interventions

Two profiles were detected and three email models were sent depending on the type of problem detected. The emails were sent by someone other than the teacher to avoid them feeling shy or vulnerable.

- Students that showed dropout signs
 - For the first time (S4, S31)

Dear [NAME],

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

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

If you'd like to talk, please reply to this email or contact your teacher directly. Your success in the course is important to us, and we are happy to assist in any way we can. You are definitely still in time to pass and succeed in your studies. The course lecture recordings have been made available and you can request a deadline extension for the assignments if you need it.

Looking forward to hearing from you.

Best regards,

The ISILA team

- Again and didn't reply (S19,S20,S30)

Subject: Follow-Up: Support for Your Progress

Dear [Student's Name],

I wanted to follow up on our previous email regarding your participation in the ISILA project and your progress in the *Data Management Systems* course. We understand that things can get busy, and sometimes it's difficult to reach out, but we want to remind you that we are here to support you.

We’re still available to discuss any challenges you may be facing—whether academic, personal, or technical—and to help you find ways to get back on track. If you’d like to chat, please feel free to reply to this email or reach out to your teacher directly.

You are still in time to pass the course, and we’d love to help you succeed. The course lecture recordings have been made available and you can request a deadline extension for the assignments if you need it. Let us know how we can assist you.

Looking forward to hearing from you.

Best regards,
The ISILA Team

- Again and was sick (S39)

Subject: Follow-Up: Support for Your Progress

Dear [Name],

I hope you’re feeling better. I wanted to check in since you mentioned you’d be catching up, but I noticed on eLearn that you haven’t had the chance to engage with the materials yet. If there’s anything I can do to support you or if you’re facing any challenges, please don’t hesitate to reach out.

Let me know how you’re doing when you get a chance. I’m happy to discuss any concerns or help you find a way to get back on track. The course lecture recordings have been made available and you can request a deadline extension for the assignments if you need it.

Take care,
The ISILA team

- Students that had okay self-regulation but high anxiety
 - For the first time (S21, S32, S38)

Dear [NAME],

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

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

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

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

Best regards,
The ISILA team

- Again (S42)

Subject: Checking In – Support Available

Dear [Student’s Name],

I just wanted to check in and remind you that if you’d like to explore additional support, we are still here for you. We understand that anxiety can be difficult to manage, and we want to ensure you have the resources and space you need.

If you feel that talking through any concerns—whether about the course or anything else—would be helpful, please don’t hesitate to reach out. We can discuss strategies, workload management, or simply provide a space to talk.

Let us know how you’re doing whenever you feel ready. Your well-being is important, and we’re here to support you.

Take care,
The ISILA Team

3.1.4.2.3. Responses obtained

Table 13. – Responses of the students to the interventions

Student	Problem	Response
S4	Significant decrease in course engagement since the midpoint.	Null
S31	Significant decrease in course engagement since the midpoint.	The student has other course commitments, plans to catch up using lecture recordings, and requests a deadline extension
S19	Lack of progress in the course and has not responded to previous outreach attempts	The student has some personal circumstances requiring travel, has not completed the exercises, and seeks options like a re-exam to finish the course.
S20	Lack of progress in the course and has not responded to previous outreach attempts	Null
S30	Lack of progress in the course and has not responded to previous outreach attempts	The student is unsure which course is being referenced

S39	Experienced health issues and planned to catch up, but has still not engaged with the course materials.	Null
S21	Showing adequate self-regulation but is experiencing high levels of anxiety	Null
S32	Showing adequate self-regulation but is experiencing high levels of anxiety	Null
S38	Showing adequate self-regulation but is experiencing high levels of anxiety	Null
S42	Facing difficulties managing anxiety, which may be impacting their well-being and engagement	Null

3.1.4.3. Conclusion

The Data management course pilot showed the effectiveness of learning analytics in identifying at-risk students and implementing targeted interventions. While some students responded positively, others faced ongoing challenges, indicating the need for sustained support. Future iterations will refine intervention strategies to enhance engagement and course completion rates.

3.2 Social Network Analysis Course

This course is an introduction for social network analysis and networks in general. Students are expected to familiarize themselves with the concepts of networks and network analysis as well as practice the analysis of different types of networks and report results.

3.2.1 Data Collection

The LMS data was obtained from the UEF IT services in the form of a course backup including the logs. Students’ data anonymized and uploaded to a dedicated Moodle instance and sent to the UEF LRS through the xAPI plugin. The survey data was downloaded and sent to the UEF LRS using the csv2xapi app developed in ISILA.

3.2.2. Dashboard Overview

An overall dashboard was created to get the general picture of the course, including the time spent, the exercise submission and the SRL survey results (Fig. 38).



Fig 38. - Dashboard overview of the course in Week 2

3.2.3. Individual insights

Using a custom filter feature, dashboards were generated for students consent to ISILA interventions. Key metrics analyzed included: Evolution of SRL survey , Anxiety levels, Submitted exercises, Material usage at the scheduled time, and Discord interactions.

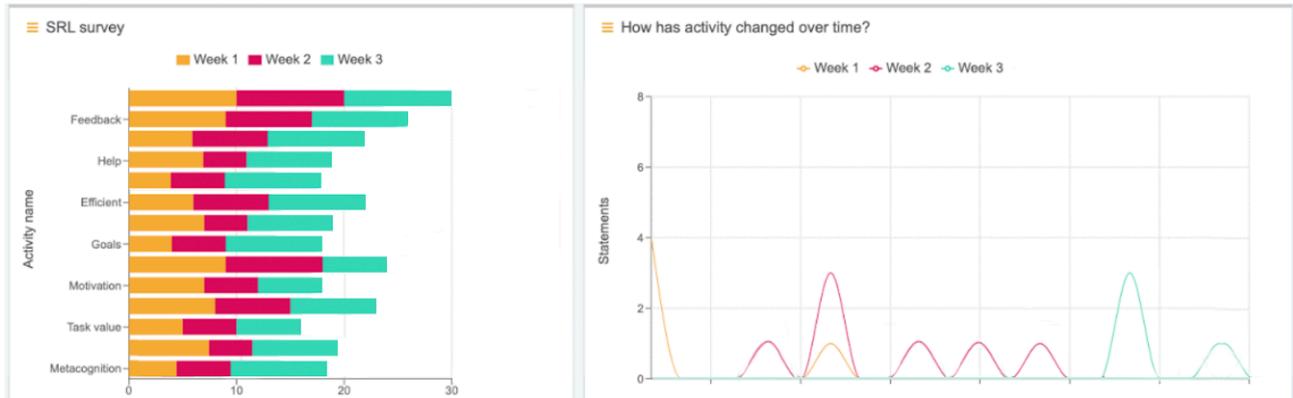


Fig 39. - Example of an individual student's dashboard

3.2.4. Interventions

Interventions were conducted in Weeks 2 and 4 to address issues such as low engagement, missing assignments, or high anxiety. Actions were tailored based on student profiles, with general and individualized strategies.

3.2.4.1. Intervention 1 : Week 2

The table 14 summarizes student evaluation for students need - Week 2 interventions

Table 14. – Observations by students and interventions classified by colour

No.	Observation	Intervention
2	No group activity+Assignment	CONTACT PERSONALLY
3	No activity at ALL	CONTACT PERSONALLY
5	Low activity + Assignment	CONTACT PERSONALLY
6	group+Assignment	CONTACT PERSONALLY
15	Assignment + high SRL	CONTACT PERSONALLY
16	group+Assignment	CONTACT PERSONALLY
22	No activity at ALL	CONTACT PERSONALLY
25	Low activity + high SRL	CONTACT PERSONALLY
27	Assignment + high SRL	CONTACT PERSONALLY
33	group+Assignment low grade	CONTACT PERSONALLY
49	Assignment + high SRL	CONTACT PERSONALLY
57	Assignment + high SRL	CONTACT PERSONALLY
64	group+ high SRL	CONTACT PERSONALLY
65	Assignment + high SRL	CONTACT PERSONALLY
66	Low activity+ high SRL	CONTACT PERSONALLY
67	Low activity + Assignment	CONTACT PERSONALLY

3.2.4.1.1 General interventions

- Some students showed lower metacognition, so additional practical sessions were arranged to increase practice with the SNA software.
- Some students had anxiety. Thus, we give students the chance to have a second attempt at the assignment based on the feedback provided by the instructor

3.2.4.1.2 Individual interventions

Personalized interventions were designed based on observed patterns, such as non-submission of assignments, lack of group participation, or low activity. These were delivered via emails from a non-instructor contact to maintain a supportive tone.

No activity at ALL Students show dropout signs No. 22, 03

Dear [NAME],

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

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

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

Looking forward to hearing from you.

Best regards,

No group form nor assignment submission (No 16, 6, 2)

Dear [NAME],

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

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

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

Looking forward to hearing from you.

Best regards,

Low Activity (few days) and didn’t submit Assignment 1 (67, 05)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the **Social Network Analysis Course** . Based on your activity in eLearn and the survey responses in the first two weeks of the course, we have noticed a significant decrease in your engagement since the beginning of the course. Additionally, you have not submitted your first assignment.

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

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

Looking forward to hearing from you.

Best regards,

No group form and low grade assignment 1 (No 33)

Dear [NAME],

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

We understand that challenges can arise during the semester, and we want to ensure that you have the support you need to succeed. If there are any difficulties—academic, personal, or technical—that may be affecting your progress, please know that we are here to help. We

would love to discuss how we can support you, whether through study strategies, available resources, or guidance on course content.

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

Looking forward to hearing from you.

Best regards,

Low Activity (few days) (No. 66, 25)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the **Social Network Analysis Course**. Based on your activity in eLearn and the survey responses of the first two weeks of the course, we have noticed a significant decrease in your engagement since the beginning of the course.

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

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

Looking forward to hearing from you.

Best regards,

No group Involvement (No. 64)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the **Social Network Analysis Course**. Based on your activity, we have noticed that you have not completed the group project enrollment form [Here](#).

We understand that challenges can arise during the semester, and we want to ensure that you have the support you need to succeed.

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

Looking forward to hearing from you.

Best regards,

Did Not submit assignment 1 (No. 49, 27, 15, 65, 57)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the *Social Network Analysis Course* . Based on your activity in eLearn in the first two weeks of the course, we have noticed you have not submitted your first assignment.

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

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

Looking forward to hearing from you.

Best regards,

3.2.4.1.3. Responses obtained

Table 15.- Students responses to the intervention

No .	WEEK 2	Response _ Week2
2	group+Assignment	had a busy start to the semester and couldn't finish Assignment 1 on time but is working to complete the course.
3	No activity at ALL	struggling to keep up with the course due to busy work schedule and is requesting an extension to submit assignments
5	Low activity + Assignment	The student fell behind on coursework due to health issues but is now feeling better and seeking guidance on how to catch up.
6	group+Assignment	Did't reply but filled the form and joined the group
15	Assignment	No Response
16	group+Assignment	No Response

22	No activity at ALL	unable to complete the course due to time constraints from working full-time and managing multiple courses, leading them to request unenrollment.
25	Low activity	A bit busy the last two weeks and intends to be more active moving forward.
27	Assignment	finds the course valuable but is struggling to keep up with assignments due to her focus on dissertation but planning to complete the course
33	group+Assignment low grade	Apologized for not going to the discord group and planning to start working with peers
49	Assignment	has health issues but intends to continue the course and submit the next assignment on time.
57	Assignment	struggling to balance part-time work and other courses. Requesting extra time for assignments.
64	group	Didn't know about the group work. But she is keen to continue working with peers
65	Assignment	No Response
66	Low activity	No Response
67	Low activity + Assignment	No Response

3.2.4.2. Intervention 2 (Week 4)

The exact process was conducted after Week 4 of the course. The Table 17 observations were made.

Table 16. – Observations and actions about students in intervention 2

	WEEK 4	Intervention
2	Assignment 2 +No SRL	Contact Personally
3	Assignment 2 + NO SRL	Contact Personally
5	Assignment 2 + low SRL	Contact Personally
6	Contact Low grade assignment 2	Contact Personally
1 5	Assignment 2+ High SRL	Contact Personally
1 6	Assignment 2 + High SRL	Contact Personally
2 4	Contact Low grade assignment 2	Contact Personally
3 2	Assignment 2+No group+ enroll+ unenroll	Contact Personally
3 3	Contact Low grade assignment 2	Contact Personally

40	Contact Low grade assignment 2	Contact Personally
49	Assignment 2 + High SRL	Contact Personally
55	Assignment 2+ High SRL	Contact Personally
57	Assignment 2+ High SRL	Contact Personally
65	Assignment 2+ High SRL	Contact Personally
67	Assignment 2+ High SRL	Contact Personally
72	Contact Low grade assignment 2	Contact Personally

- Four students (S25, S27, S64, S66) showed improvement post-Week 2 interventions.
- Student 22 unenrolled due to time constraints.
- 16 students need intervention again :
 - o 11 students remain to show low activity (S2, S3, S5, S6, S15, S16, S33, S49, S57, S65, S67)
 - o Five New students need intervention (S 24, S32, S40, S55, S 72)

No Activity S32

Dear [NAME],

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

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

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

Looking forward to hearing from you.

Best regards,

No assignment 2 (S2, S 3,S5, S15, S16, S32, S49, S55, S57, S65, S67

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the *Social Network Analysis Course* . Based on your activity in eLearn in the first four weeks of the course, we have noticed a significant decrease in your engagement of the course. Additionally, you have not submitted your second assignment

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

Your success in the course is important to us, and we are happy to assist in any way we can. You are definitely still in time to pass and succeed in your studies.

Looking forward to hearing from you.

Best regards,

Low Grade Assignemt 2 (S6, S24, S33, S40, S72)

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Social Network Analysis Course , based on your activity in eLearn in the first four weeks of the Social Network Analysis Course, we have noticed a significant decrease in your engagement with the course. Additionally, you got a low grade in your second assignment.

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

We care about your success in the course and are happy to assist you in any way we can. You are definitely still in time to pass and succeed in your studies.

Looking forward to hearing from you.

Best Regards

3.2.4.2.1. Responses obtained

Table 17. – Students responses to intervention 2.

	Week 4 Contact	response week 4
2	Assignment 2 +No SRL	No Response
3	Assignment 2 + NO SRL	No Response
5	Assignment 2 + low SRL	will continue and catch up assignment
6	Contact Low grade assignment 2	No Response
1 5	Assignment 2+ High SRL	problem with laptop and need repair. Ask for extension
1 6	Assignment 2 + High SRL	No Response
2 4	Contact Low grade assignment 2	No Response
3 2	Assignment 2+No group+ enroll+ uneroll	thought it should unenroll form the beginning .
3 3	Low grade assignment 2	did other assignment better and palnning to perform better
4 0	Low grade assignment 2	No Response
4 9	Assignment 2 + High SRL	No Response
5 5	Assignment 2+ High SRL	No Response
5 7	Assignment 2+ High SRL	No Response
6 5	Assignment 2+ High SRL	No Response
6 7	Assignment 2+ High SRL	No Response
7 2	Low grade assignment 2	Is wondering if he failed or if he can resubmit

3.2.4.3. Conclusion

The SNA course pilot showed the effectiveness of learning analytics in identifying at-risk students and implementing targeted interventions. While some students responded positively, others faced ongoing challenges, indicating the need for sustained support. Future iterations will refine intervention strategies to enhance engagement and course completion rates.

4. UiB Pilots

4.1. DIGI110: Fantastic Data Course

The objective of this undergraduate fully-online course is to provide students with 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. Students develop the skills required for critical thinking about the roles of data in society.

The course lasts seven weeks and is delivered fully online via the UiB’s instance of the Canvas Learning Management Systems (LMS).

4.1.1 Data Collection

The collected data include:

- Data about students’ interactions with the course materials available in Canvas, as the main learning platform.
- Data about students’ interactions with reading materials and quizzes in Datareisen, an online learning tool offering access to additional course materials.
- Data collected through a concise self-regulated learning (SRL) survey, a weekly survey administered through Canvas to collect data about different aspects of students’ regulation of learning (e.g., goal setting, effort regulation, and motivation)

All the collected data were mapped, via custom mappings (developed within the project), from Canvas and Datareisen specific formats to the common xAPI format and stored as xAPI statements in the UiB’s instance of Learning Locker¹, an open-source learning record store.

The data was collected for 88 students (out of over 200 enrolled in the course) who gave informed consent for the collection and analysis of their learning related data for research purposes. It should be noted that this number of consents was achieved only after the data was fully anonymised, so that student identities were hidden even from the course teachers.

The original intention was to have student identities known to the course teachers so that the teachers could provide students with individualised feedback. However, as only about two dozen students gave consent for such a level of visibility, we decided to fully anonymise the data in order to increase the chances of getting students’ approval for the use of their learning related data for learning analytics and pedagogical interventions. Even with this full anonymisation, only 54% of the students who filled out the survey with the consent form (N=163) gave their consent for the data use. This points to an important challenge related to the deployment of learning analytics based

¹ <https://github.com/learninglocker>

solutions in practice, since without access to the students’ learning related data, the advantages of learning analytics cannot be leveraged for advancing learning through feedback provision or other forms of pedagogical interventions.

4.1.2 Dashboard Overview

Several dashboards have been created to facilitate monitoring of student course activities throughout the course. Specifically, a module-specific dashboard was created for each course module (six in total), visually communicating information about students’ engagement with readings, quizzes, and assignments related to each course module. Fig. 1 and Fig. 2 present the upper and bottom part, respectively, of such a dashboard for the first course module.

The upper part of the dashboard (Fig. 40) presents the number of students who completed the module’s quiz, assignment, and readings, then the timeline of all module-related activities, and finally the distribution of quiz scores.

The bottom part of the dashboard (Fig. 41) presents data about the readings and quizzes completed in the Datareisen tool, as well as data about student responses to the concise SRL survey administered during the first course module.

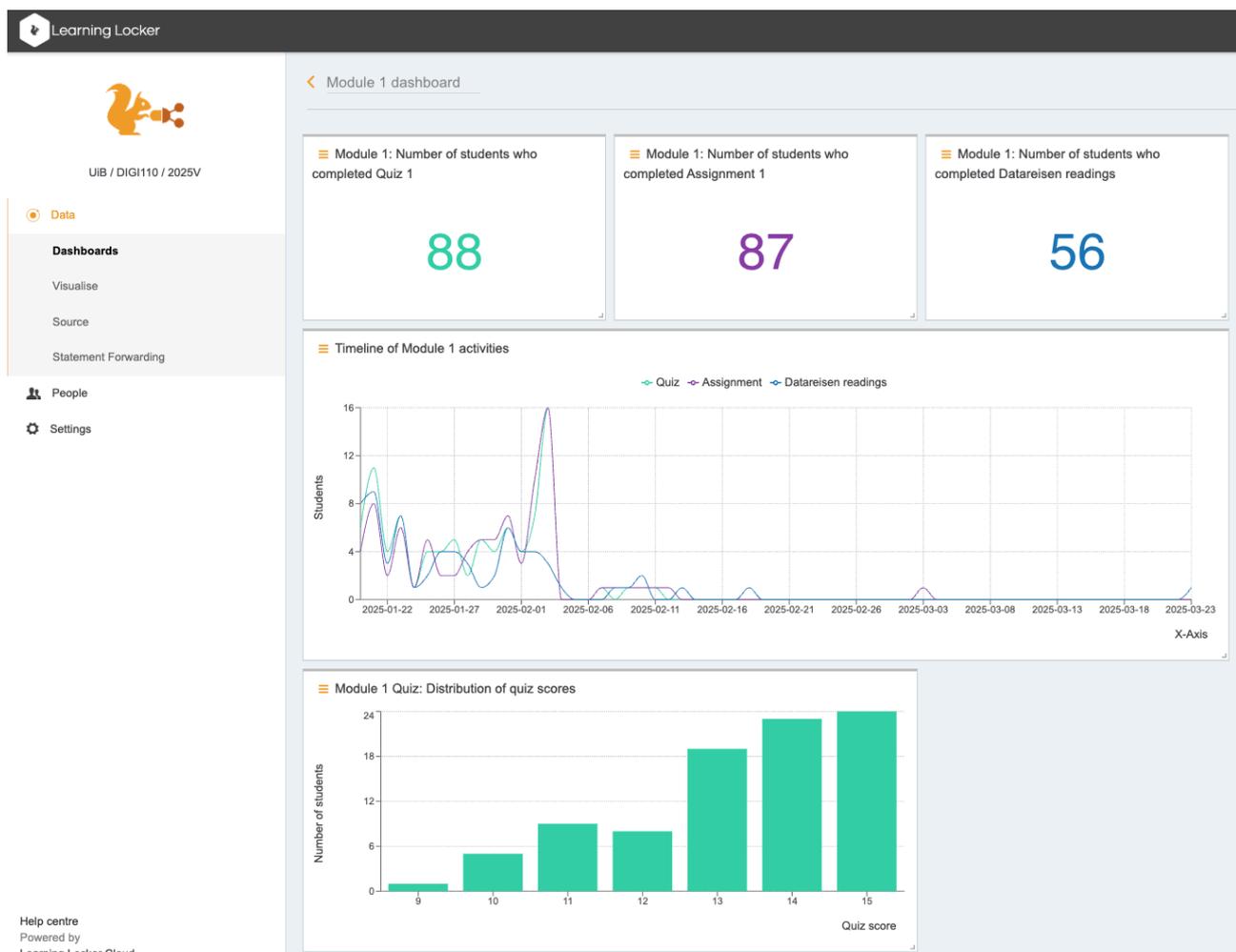


Fig 40. - Dashboard for Module 1 of the DIGI110 course: the upper part

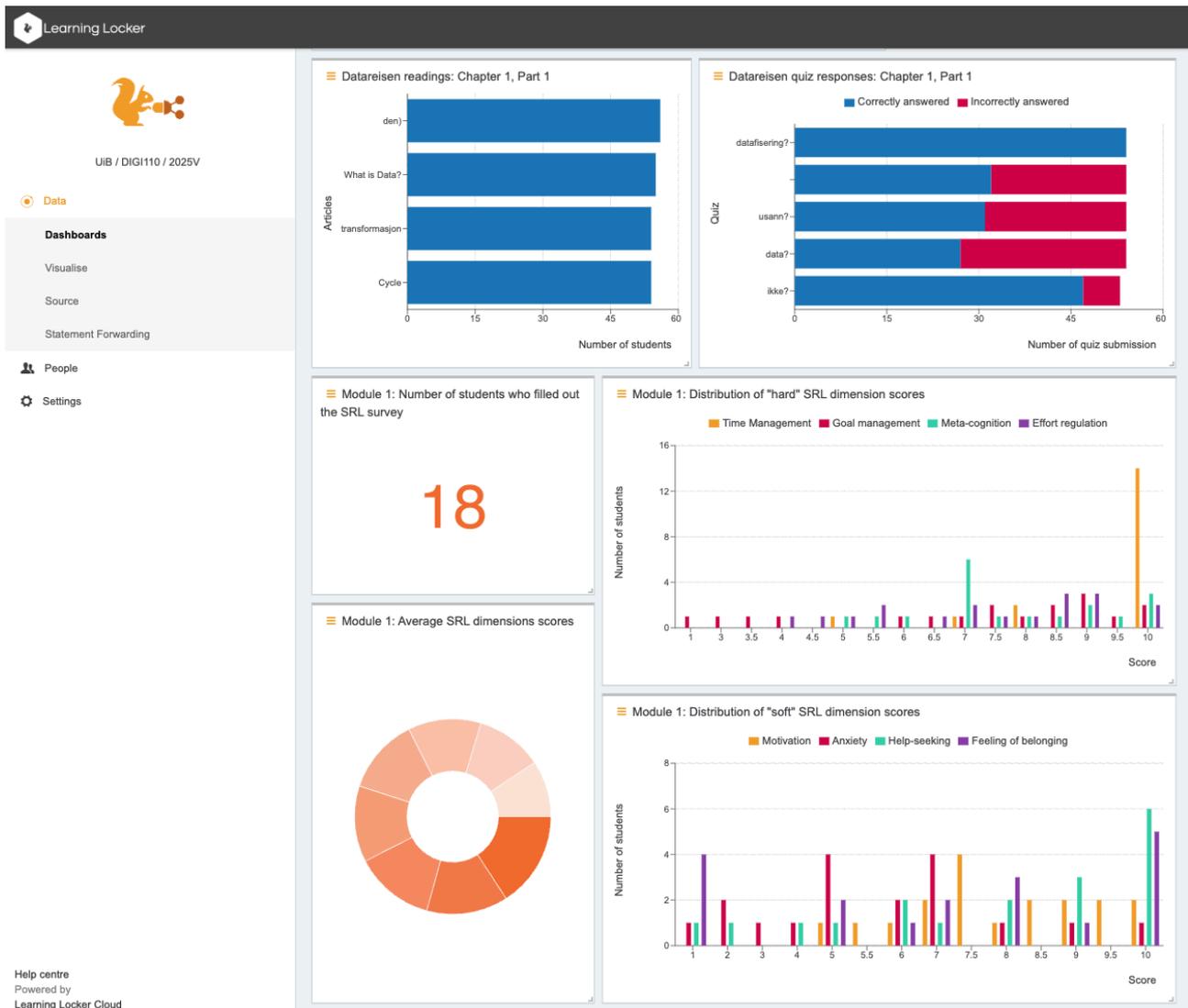


Fig 41. - Dashboard for Module 1 of the DIGI110 course: the bottom part

In addition to the module-specific dashboards, a cross-module dashboard (Fig. 42) has also been available to the teachers. It provides teachers with aggregated information about student activities across all the course modules. In particular, this includes visual depictions of a timelines of course activities (quiz completions, assignment submissions, and readings), counts of students who completed each of the course quizzes, counts of those who submitted each of the course assignments, average scores on the course quizzes, as well as correlations between the counts of quiz and assignment submissions.

Finally, an SRL-focused cross-module dashboard (Fig. 43) has also been created, with the objective of presenting aggregated information about students' responses to the weekly SRL surveys and thus offering an overall view of how distinct SRL aspects (e.g., motivation, time management, help

seeking) changed across course modules. As such, it complements the SRL-related visual reports at the module level (Fig. 41).

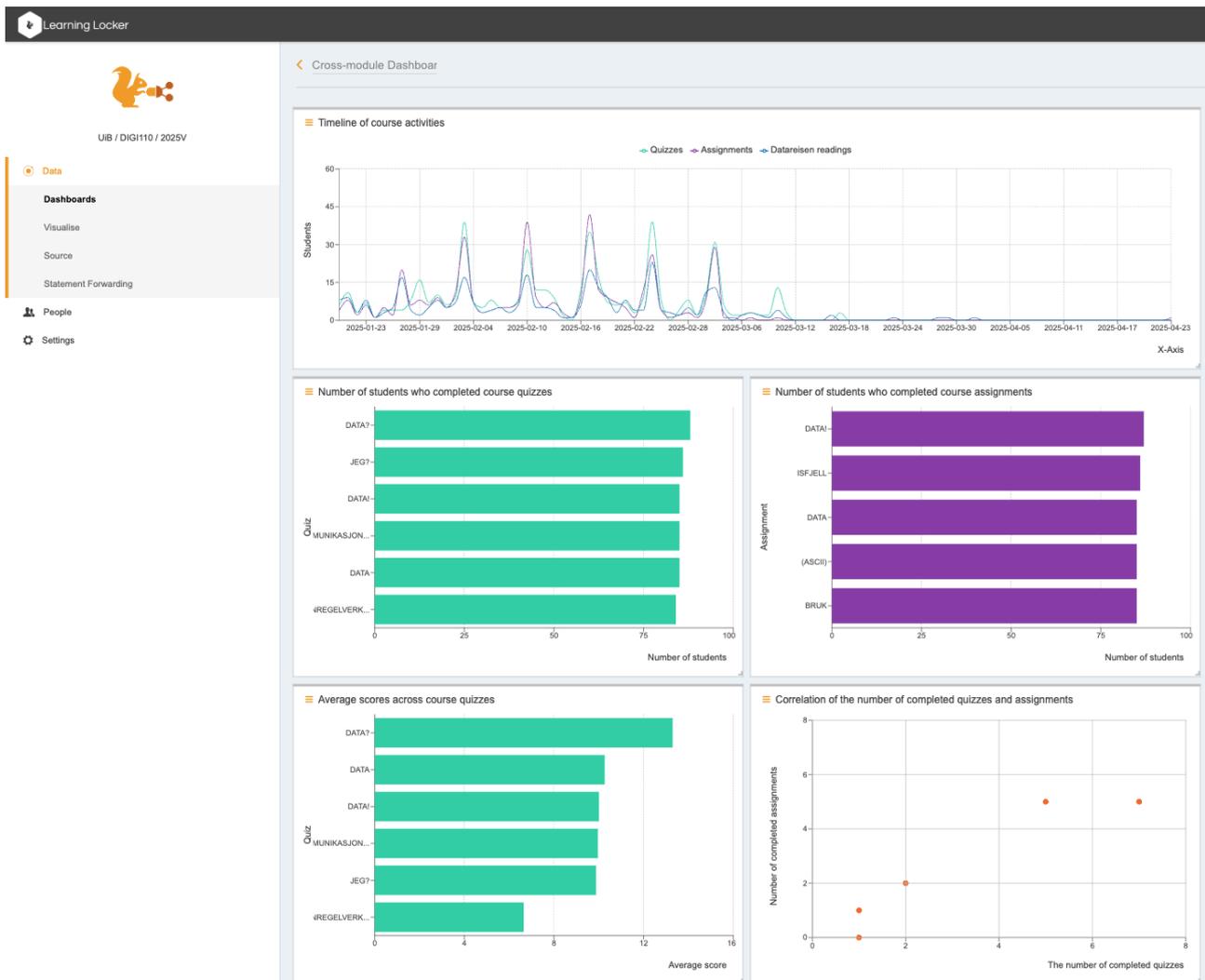


Fig 42. - The cross-module dashboard

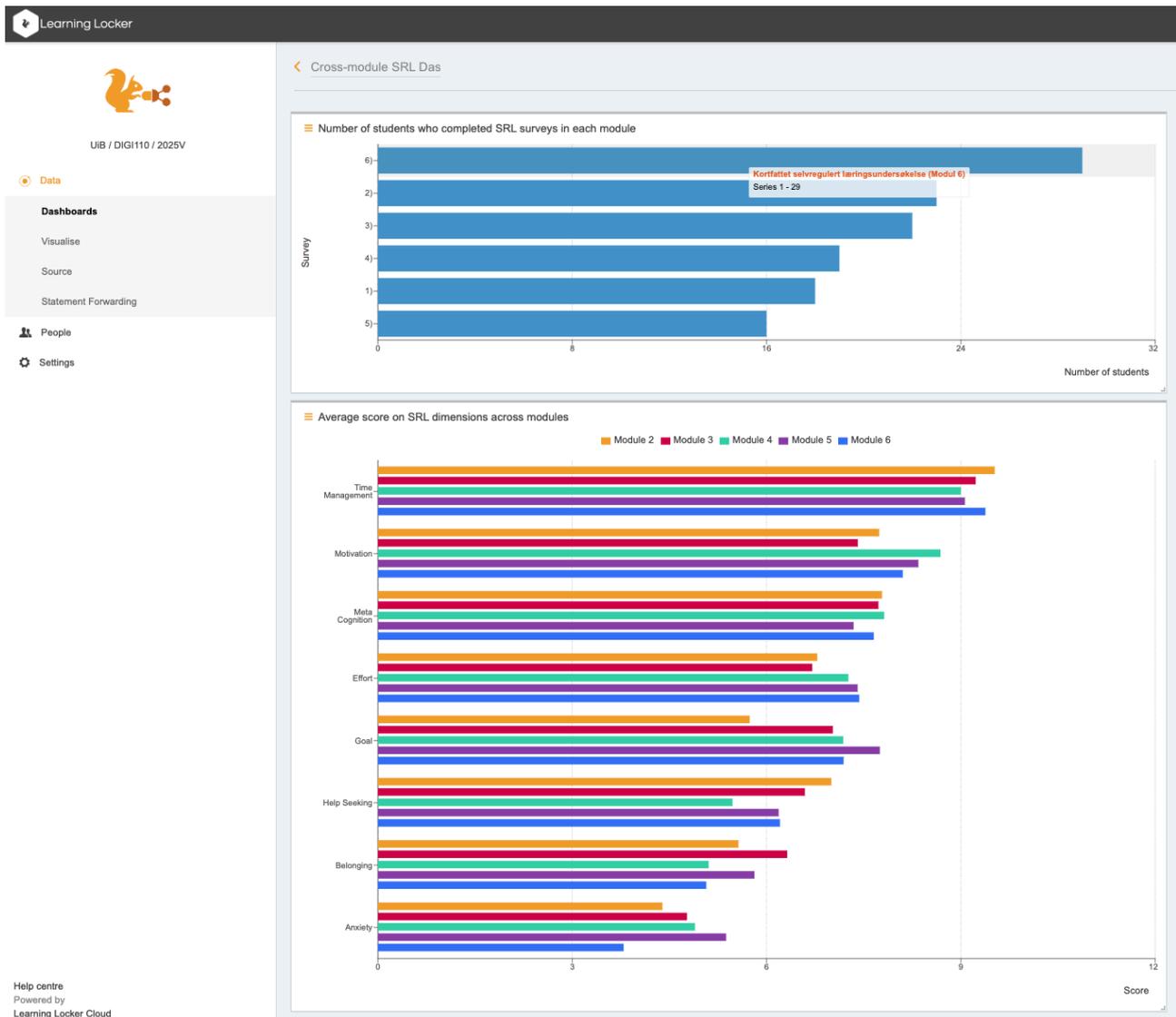


Fig 43. - SRL-focused cross-module dashboard

Fig. 4 SRL-focused cross-module dashboard

4.1.3 Intervention

As noted in Section 3.3.1, to obtain student consent for data use, we needed to anonymise the students’ learning-related data and thus were not able to apply interventions targeted at individual students. Therefore, we have made use of the insights obtained through the dashboards to reconsider the course design and materials, and introduce some changes for the next course edition.

In the following subsections, we present how we reflect on prospective course design revisions through post course analysis of student behaviour. Note in particular that we are building out course structures that can be reused with some tweaking for specific iterations (“Baseemne” = Base Courses). We are also contemplating ways in which the elements of the course design can be modified to utilise learning analytics natively.

4.1.4. Things we find interesting in the LL reports

The report on correct answering of quizzes (Fig. 40) is useful as it shows us which quizzes students are struggling with. It would be helpful to be able to drill into the quizzes and see specific questions.

The SRL survey has given us some interesting insights about our cohort and how they are responding to the course. In particular,

The time management dimension is consistently high across all modules, which is something we were hoping to see. The DIGI courses are designed for asynchronous learning where student participation is essential, and we think this is reflected in the consistently high responses.

The feeling of belonging is much lower than we would like. We think this is due to the fully online nature of the course and its lack of opportunities for students to communicate and collaborate. Students are essentially learning by themselves in the current design, which could perhaps be changed. We think there is an opportunity to encourage students to reflect on what they are learning and discuss this among themselves, perhaps in some well designed discussion fora. Thus, this insight was useful and has provided us with a new idea about how the course might be improved. Note that this course has been designed for scalability, and so monitoring student behaviour in such fora might prove problematic. So we are currently reflecting on whether this is a factor we can improve or if it will cause problems for the scalability of the course.

However, response rates are very low, and the survey is not well integrated with the course learning objectives. As such we consider this a bit of a distraction from the main activities.

4.1.5. Issues and concerns about the data and implementation

Firstly, the reports in LL only became available during the course. This meant that the teaching team were already busy and did not use them during the running of the course, beyond a cursory examination of what was available. No interventions were planned with the data during the course.

Students had to agree to participate in the data collection. Response rates were reasonably low (88 out of the 237 who signed up for the course consented to data collection - 178 passed the course), which means some of the statistics generated are not necessarily representative of the cohort. This factor was then accentuated by the fact that not many students tended to complete the SRL surveys so the data obtained by them is difficult to evaluate.

Something like 50% of students are not clicking Datareisen buttons presented at the bottom of each page (Fig. 44), which serves as a means of denoting that the content of the given page (with

reading materials) is completed. This does not mean that they are not reading the page, just that they have not clicked that button.

The ‘Completed’ button is a bit of a work around to establish student completion, but this project pilot has shown us that it is not very effective as many students are not using it. We are contemplating a new activity around the “blob” (which grows when students mark pages as read) as a result (Fig. 45).

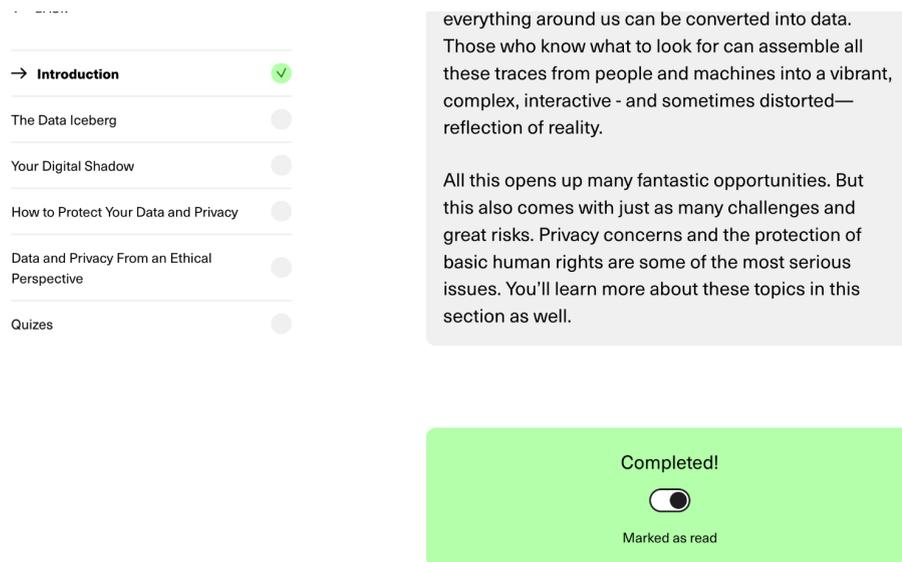


Fig 44. - An example of the Completed button in Datareisen, which students used as reading materials. The students could use this button to denote that they completed the readings on the current page.

Data and Privacy From an Ethical Perspective

Quizzes

As long as you live normally and participate in society, you will leave a digital shadow. We'll look further into this in the next topic.

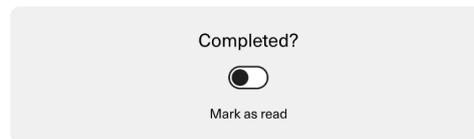


Fig 45. - An example of the Completed button in Datareisen, which students used as reading materials. The students could use this button to denote that they completed the readings on the current page.

Some of the reports in Learning Locker are not very useful when considered in the context of the learning design of the course. For example, both the quizzes and the assignments are mandatory for completion of the course and so show up in the course grade book. So the reports about completion are expected and provide no new insights. On the other hand, the timeline of course activities allow for observing the dynamics of assignment submissions; though, as expected, the assignment submissions reflect the weekly due dates of the course. To make them more informative, it would be nice to link some of these reports to the learning design of the course a bit more closely in future.

We will further think which of these visualizations are really allowing instructors to extract relevant insights and turn the others off for the next iteration of the DIGI course, to avoid overwhelming instructors with reports of limited informative value.

4.1.6. Pain points in the course

We are often chasing students who have not completed the mandatory assessments and quizzes, sending them personal messages in Canvas (the UiB's main learning platform) and asking them to submit. Now that we have a data infrastructure, there is a possibility for automating this process via tools like OnTask (Pardo et al., 2018) or other personalised LA messaging tools. This is also expected to help improve the students' sense of belonging as they would be having more "contact" with the teaching team and more frequent feedback. It would also help to enhance equity as currently not all students receive these kinds of interventions due resourcing constraints.

Since this course is free, many students sign up but then do nothing. We do not contact them, due to resource constraints, but could potentially start doing so, if this type of service is implemented and the students give their consent for data collection and use for learning support provision.

4.1.7 Future possibilities and plans now that we have this infrastructure

Having looked through the reports, these are the immediate actions we are considering taking as we design out new iterations of DIGI110:

1. Creating an activity that encourages students to reflect upon their digital blob early in the course; the intention is to create a broader understanding among the cohort of how marking learning activities as completed (e.g., marking a page as being read, see Fig. 6) results in a larger blob.
2. Using the above activity in some sort of a discussion forum to encourage students to communicate with one another and compare their different digital footprints in the course.
3. Turning the survey-based SRL data collection off, and using a well designed assessment task instead, to encourage deeper student engagement and reflection about their learning processes (possibly related to the aforementioned digital blob).
4. Redesigning the course evaluation form to better reflect lessons learned by looking at actual student behaviour patterns. We may attempt to link student feedback about the course with student activity in the course.

Longer term, we are considering the following actions to build upon the ISILA data architecture:

1. Extracting the data from the Learning Locker and using it in a student facing report that is made available in Canvas via an LTI plugin and can be used in assessment items. This will encourage deeper student engagement with their personal data as well as provide them with a benefit from agreeing to data collection (see, for example, (Kitto et al., 2017)). Right now the students are not motivated to sign up for data collection as they (rightly) perceive it to be of no real benefit to themselves.
2. Adding further data collection points in both Canvas and the Datareisen pages to generate richer data traces.
3. Aligning the learning design in the course with expected learning analytics reports and interventions (e.g., as was done at the Open University (Rienties & Toetenel, 2016)).

4.1.8. Conclusion

This pilot study proved very effective in helping us identify the benefits but also the weaknesses of both the course learning design and the adopted data collection approach. The course instructors identified in learning analytics, available via teacher-facing dashboards, some useful points to

inform the course (re-)design. They have also identified several ways for advancing the data collection and use, through elements of the learning design that promise to motivate students not only to engage more with the course activities, but also to be more positive towards data collection. This is important to ensure that course design and other kinds of pedagogical interventions are informed by analytics based on data from a larger and more representative student cohort.

4.1.9. References

Kitto, K., Lupton, M., Davis, K., & Waters, Z. (2017). Designing for student-facing learning analytics. *Australasian Journal of Educational Technology*, 33(5), Article 5.

<https://doi.org/10.14742/ajet.3607>

Pardo, A., Bartimote, K., Shum, S. B., Dawson, S., Gao, J., Gašević, D., Leichtweis, S., Liu, D., Martínez-Maldonado, R., Mirriahi, N., Moskal, A. C. M., Schulte, J., Siemens, G., & Vigentini, L. (2018). OnTask: Delivering Data-Informed, Personalized Learning Support Actions. *Journal of Learning Analytics*, 5(3), Article 3. <https://doi.org/10.18608/jla.2018.53.15>

Rienties, B., & Toetenel, L. (2016). The impact of learning design on student behaviour, satisfaction and performance: A cross-institutional comparison across 151 modules. *Computers in Human Behavior*, 60, 333–341. <https://doi.org/10.1016/j.chb.2016.02.074>

4.2. STAT110: Basic Course in Statistics

The objective of this first-year undergraduate course is to provide students with an introduction to probability theory and statistical methods, with emphasis on the former. Students develop a practical understanding of the concept of probability, as well as competences required for performing and interpreting statistical analyses.

The course consists of nine modules (corresponding to the textbook chapters) and is delivered in a blended mode, with the online component of the course enabled by the UiB’s instance of the Canvas Learning Management Systems (LMS).

4.2.1. Data Collection

The collected data include:

- Data about students’ interactions with the course materials available in Canvas, as the main learning platform.
- Data collected through a concise self-regulated learning (SRL) survey, administered via Canvas within each course module, to collect data about different aspects of students’ regulation of learning (e.g., goal setting, effort regulation, and motivation)

All the collected data were mapped, via custom mappings (developed within the project), from Canvas specific formats to the common xAPI format and stored as xAPI statements in the UiB’s instance of Learning Locker², an open-source learning record store.

The data was collected for only 14 students (out of 115 students active in the course), who gave informed consent for the collection and analysis of their learning related data for research purposes. It should be noted that even after fully anonymising data, so that student identities were hidden even from the course teachers, the students were reluctant to approve the use of their learning-related data for course analysis and pedagogical interventions.

The original intention was to have student identities known to the course teachers so that the teachers could provide students with individualised feedback. However, as only a few students gave consent for such a level of visibility, we decided to fully anonymise the data in order to increase the chances of getting students’ approval for the use of their learning related data for learning analytics and pedagogical interventions. Even with this full anonymisation, only about 10% of the active students gave their consent for the data use. This points to an important challenge related to the deployment of learning analytics based solutions in practice, since without access to the students’ learning related data, the advantages of learning analytics cannot be leveraged for advancing learning through feedback provision or other forms of pedagogical interventions.

² <https://github.com/learninglocker>

4.2.2. Dashboard Overview

Teacher dashboards have been created to facilitate monitoring of student course activities throughout the course.

Specifically, a dashboard aggregating information across the nine course modules was created, visually communicating information about students’ engagement with all the course quizzes and assignments. Figures 1-3 present sections of such a dashboard.

The upper part of the dashboard (Fig. 46) refers to the students’ overall interactions with non-mandatory quizzes and presents the number of students who completed such quizzes as well as average score on each quiz; these are followed by timelines of quiz completions.

The middle part of the dashboard (Fig. 47) presents the engagement of individual students with non-mandatory quizzes; to protect student privacy, anonymous identifiers are used instead of student names.

The bottom part of the dashboard (Fig. 48) presents data about mandatory assignments, in particular, the number of students who completed each of the assignments, average scores on the auto-graded assignments, as well as a timeline of assignments submissions.



Fig 46. - The main teacher dashboard in the STAT110 course: non-mandatory quizzes, part 1



Fig 47. - The main teacher dashboard in the STAT110 course: non-mandatory quizzes, part 2

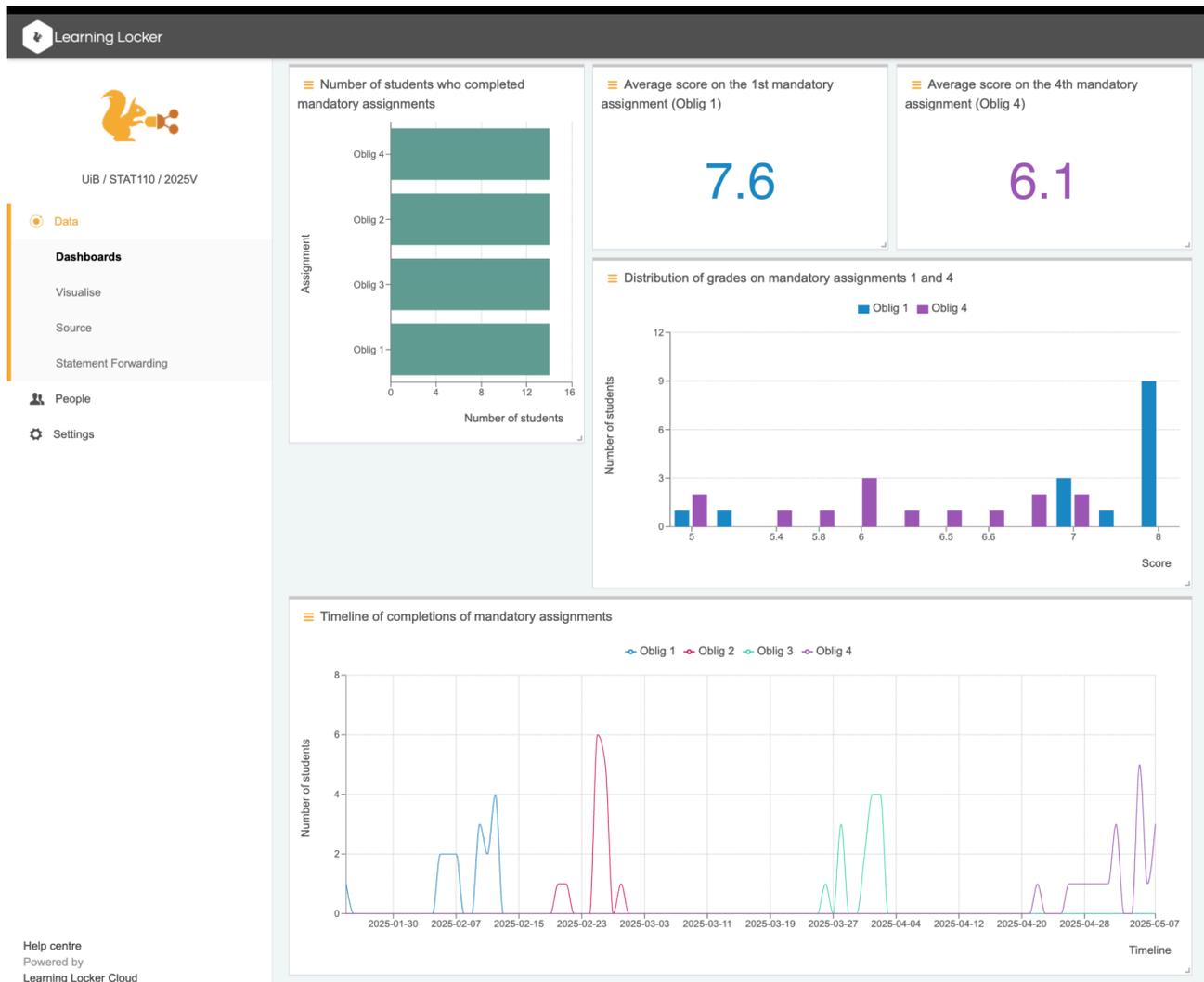


Fig 48. - The main teacher dashboard in the STAT110 course: mandatory assignments

Finally, an SRL-focused cross-module dashboard (Fig. 49) has also been created, with the objective of presenting aggregated information about students’ responses to the weekly SRL surveys and thus offering an overall view of how distinct SRL aspects (e.g., motivation, time management, help seeking) changed across course modules.

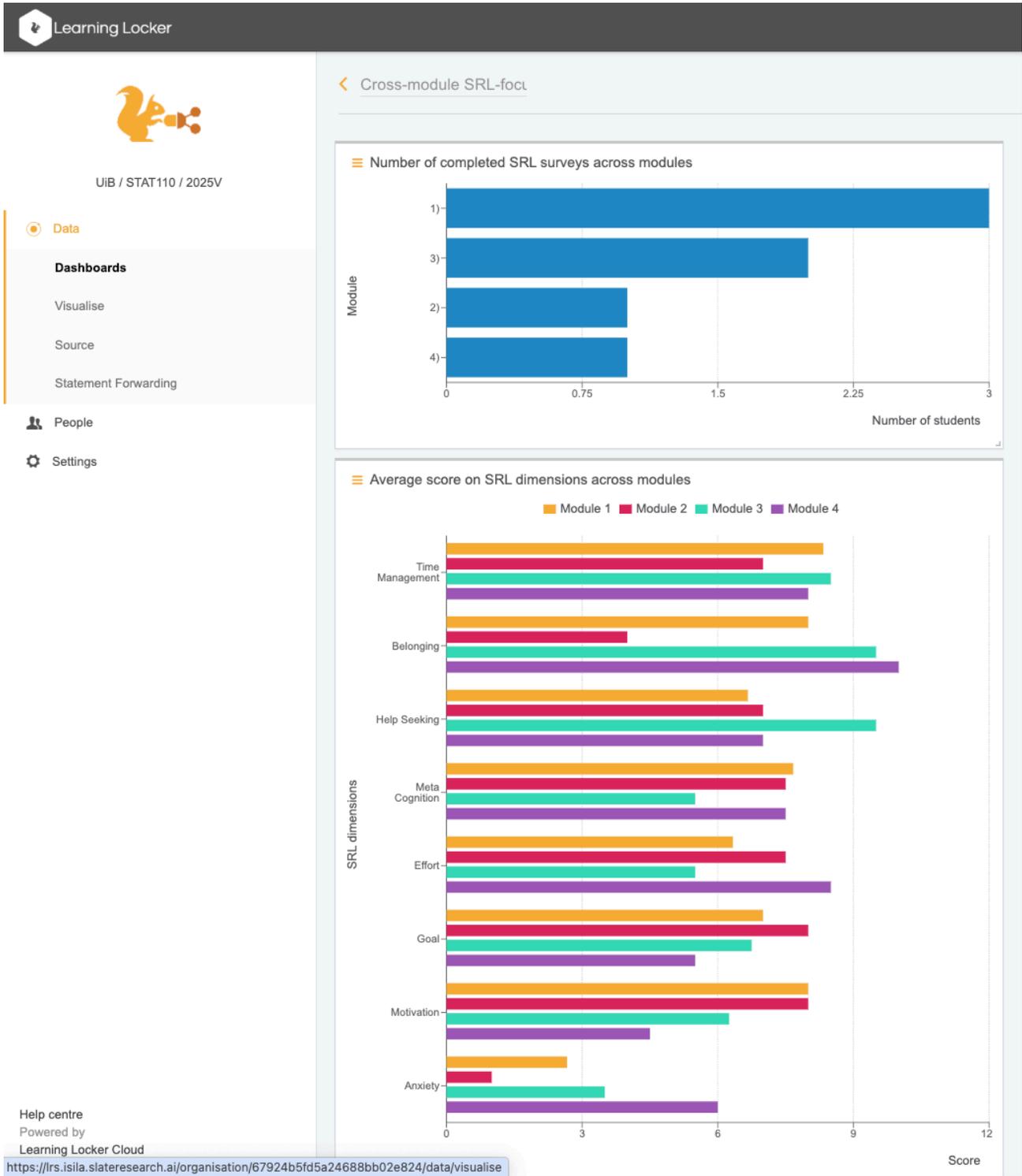


Fig 49. - SRL-focused cross-module dashboard

4.2.3. Intervention

As noted in Section 1.1, to obtain student consent for data use, we needed to anonymise the students’ learning-related data and thus were not able to apply interventions targeted at individual students. Therefore, we have made use of the insights obtained through the dashboards to reconsider the course design and materials, as well as the data collection approach adopted in this

pilot, and plan some changes for the next course edition. The planned changes are summarized below.

A main challenge is to increase student participation, that is, the number of students willing to give their consent to data collection and use in learning analytics. Reflecting on the experiences from this pilot, we have identified distinct approaches that may, collectively, contribute to higher student participation in the next course iterations:

- Making clear the benefits of learning data collection to the students. One strategy is to state clearly that the collected data will inform the improvement of the course and thus benefit students who enroll in the future editions of this course. Another, complementary strategy is to introduce a student-facing dashboard (e.g., via an ³ connection) that students may use to monitor and reflect on their course progress and their self-regulation of learning. Based on anecdotal evidence, for students, this is even a preferred option over enabling the teacher to monitor the progress of each individual student. By being able to clearly recognize the benefits of sharing their learning data, the students are expected to be more willing to approve data sharing.
- Simplification of the informed consent form. The length and formal language of the informed consent form the students were asked to sign might have deterred some students from engaging with it and giving their consent to data use. Thus, we intend to make the form shorter and to simplify the language, to make it easier to understand.
- Making it clear from the very start that the data will be fully anonymised. In this pilot that was not the case as the original intention was to enable teachers to provide students with personalised interventions during the course (which required student identities to be known to the teacher). However, through this pilot, we have learned that anonymous data collection is the preferred option for students.

Regarding the dashboards and the information, they communicate, we find this information to be much more detailed and useful to the teacher than the information available in the UiB’s setup of Canvas. In particular, the most useful information provided is correlations between different formative quizzes, along two axes: number of attempts and score, as it offers an insight into how students use formative assessment for learning.

Of special importance are the compulsory quizzes. There are four such quizzes in the course (Oblig 1-4). The first and the last one are multiple choice quizzes with numerical scores that are automatically recorded in Canvas. The other two quizzes are peer reviewed and are registered in Canvas just as submitted, without an associated score. Having recognised the usefulness of

³ <https://www.ledtech.org/standards/lti>

monitoring the students’ progress on obligatory assessments via the dashboards such as the ones used in this pilot, we are planning to make the scores of the second and the third mandatory quizzes (Oblig 2 and 3) available in Canvas, so that these can be included in the dashboards. Correlation plots between these two types of quizzes (i.e., multiple-choice and peer reviewed ones) will be useful for the teacher.

Furthermore, diagnostics for individual questions within mandatory quizzes based on multiple choice questions (Oblig 1 and 4) would be useful. However, this should be done with caution as it may create too many plots in Learning Locker, and thus may introduce more noise than signal. If such plots prove too noisy, plots with aggregate measure (similar to the ones currently available) will serve, as well.

The following is a prioritized list of dashboard elements (plots) that, based on the experience from this course edition, could offer useful insights for monitoring students progress and better understanding the role and usefulness of distinct assessments in the course:

1. Correlation between the students’ score on the first mandatory quiz (Oblig 1) and their average score and number of attempts on the formative variant of this quiz (Oblig 1 øve).
2. Pairwise correlations between the four mandatory quizzes (Oblig 1-4), either as plots, or as a table. This will be enabled by the abovementioned change in how scores for the second and the third quizzes are recorded in Canvas.
3. Correlation between each SRL dimension and the average score on obligatory quizzes (Oblig 1-4). This will help us better understand the relationship between different aspects of students’ regulation of learning (e.g., planning, help seeking, feeling of belonging, etc.) and their course achievements.
4. For formative quizzes (Quiz 1-9), it would be useful to see, for individual students, the difference between the first and the second trial, as a solution is given after the completion of the first trial.

4.2.4. Conclusion

Even though this pilot study had low student participation, it proved effective in helping us identify both the benefits and the weaknesses of the adopted data collection and visualisation approaches. Furthermore, the course instructor identified in learning analytics, available via teacher-facing dashboards, some useful points to inform elements of the course (re-)design. They have also identified several strategies for advancing the data collection and use, and are eager to apply them in the upcoming course edition and explore the additional insights those changes are expected to bring about. By ensuring a larger and more representative student cohort, broadening the available data points, and further improving the data use, we expect to establish a much stronger foundation

for rethinking the course design and other kinds of pedagogical interventions informed by learning analytics.

5. SU Pilots

5.1. Human Computer Interaction

The Human-Computer Interaction (HCI) course explores how people interact with digital systems, focusing on user-centered design, prototyping, usability testing, and emerging technologies. Students gain practical skills in designing intuitive interfaces, conducting user research, and applying interaction design principles to create accessible and effective digital experiences.

A total of 122 students enrolled in the course, which applied teaching materials developed within WP3 and utilized a Learning Record Store (LRS) to monitor student engagement and learning progress via multimodal dashboards. Based on these insights, teachers implemented targeted interventions aimed at enhancing learning outcomes. This report outlines the types of interventions applied and reflects on their integration into the learning process.

The survey data was downloaded and sent to the UEF LRS using the csv2xapi app.

5.1.1. Dashboard overview

The dashboard served as a visual monitoring tool, enabling the quick identification of student behaviour patterns, assessment of engagement levels, and timely intervention based on observed trends (Fig 50). It featured line graphs to illustrate progress over time, bar charts to compare performance across students, heatmaps to highlight areas of low engagement and scatter plots that represent a student’s data based on two selected metrics – such as time spent on learning activities versus assignment scores. Progress was tracked on a weekly basis to monitor progress closely.

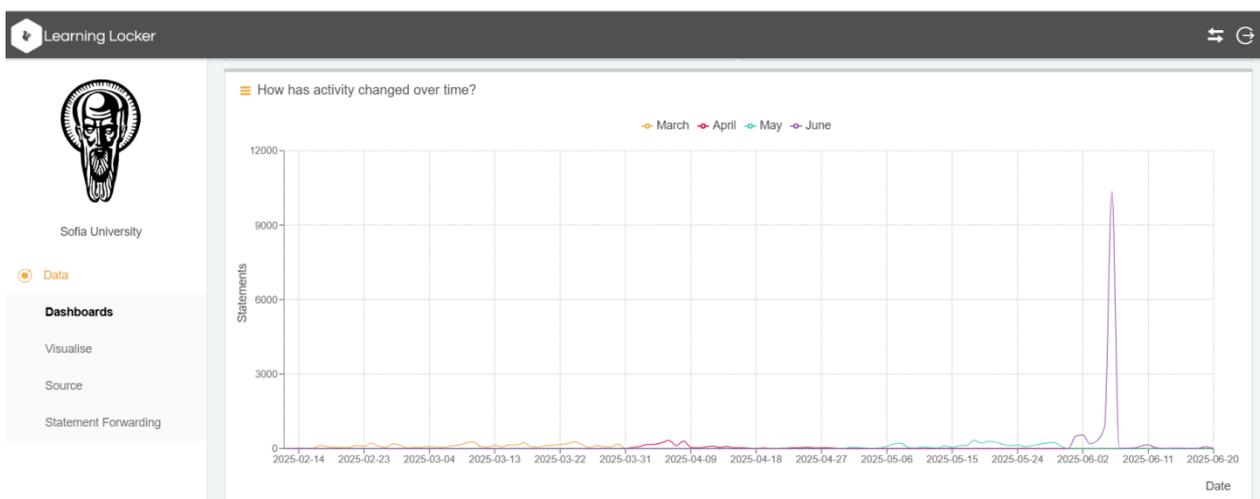


Fig 50. - How has activity changed over time

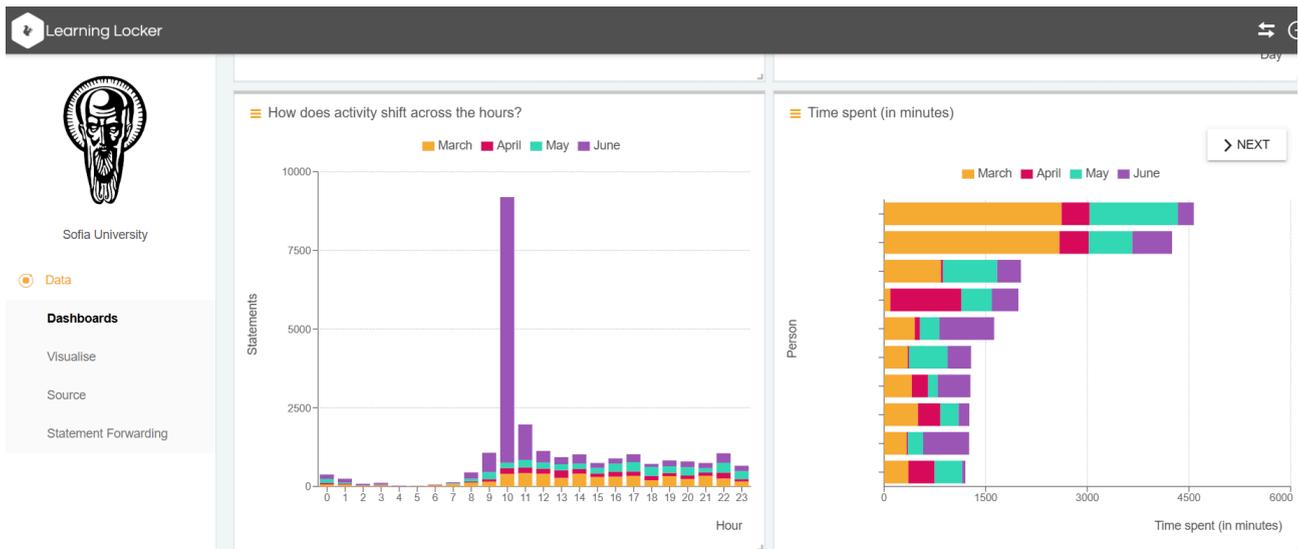


Fig 51. - Time Spent and Activity Peaks in Student Learning

5.1.2. General Overview

To provide an overview of the course—including time spent (Fig. 51), exercise submissions (Fig. 52), and SRL survey results (Fig. 54)—a dashboard was created, covering the period from the first week of March through the end of the month.

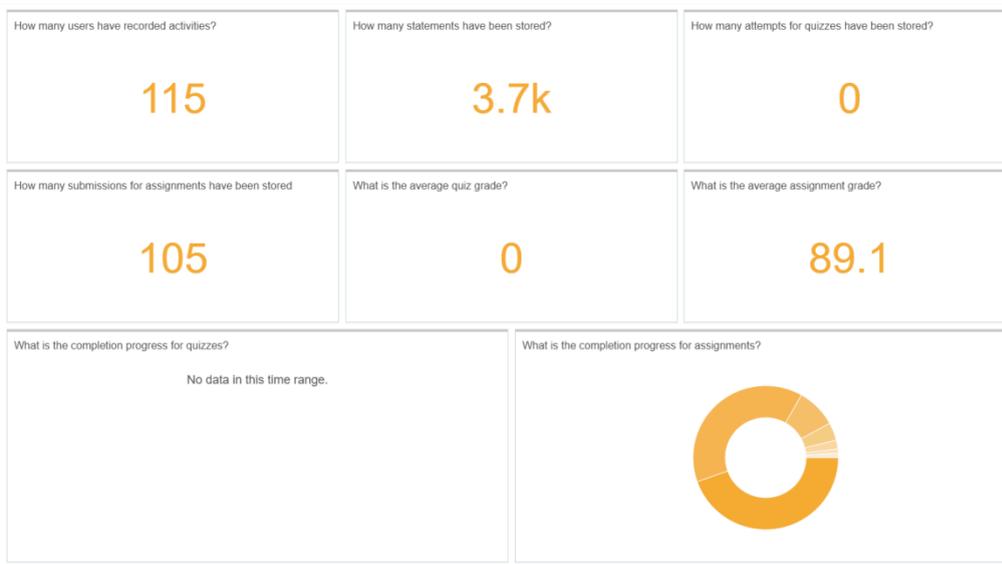


Fig 52. - Dashboard overview of the course for March

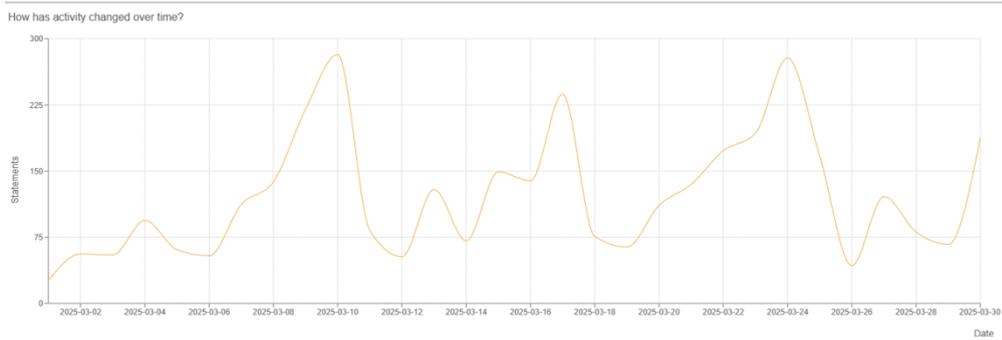


Fig 53. - How has activity changed over time (week 1-4)

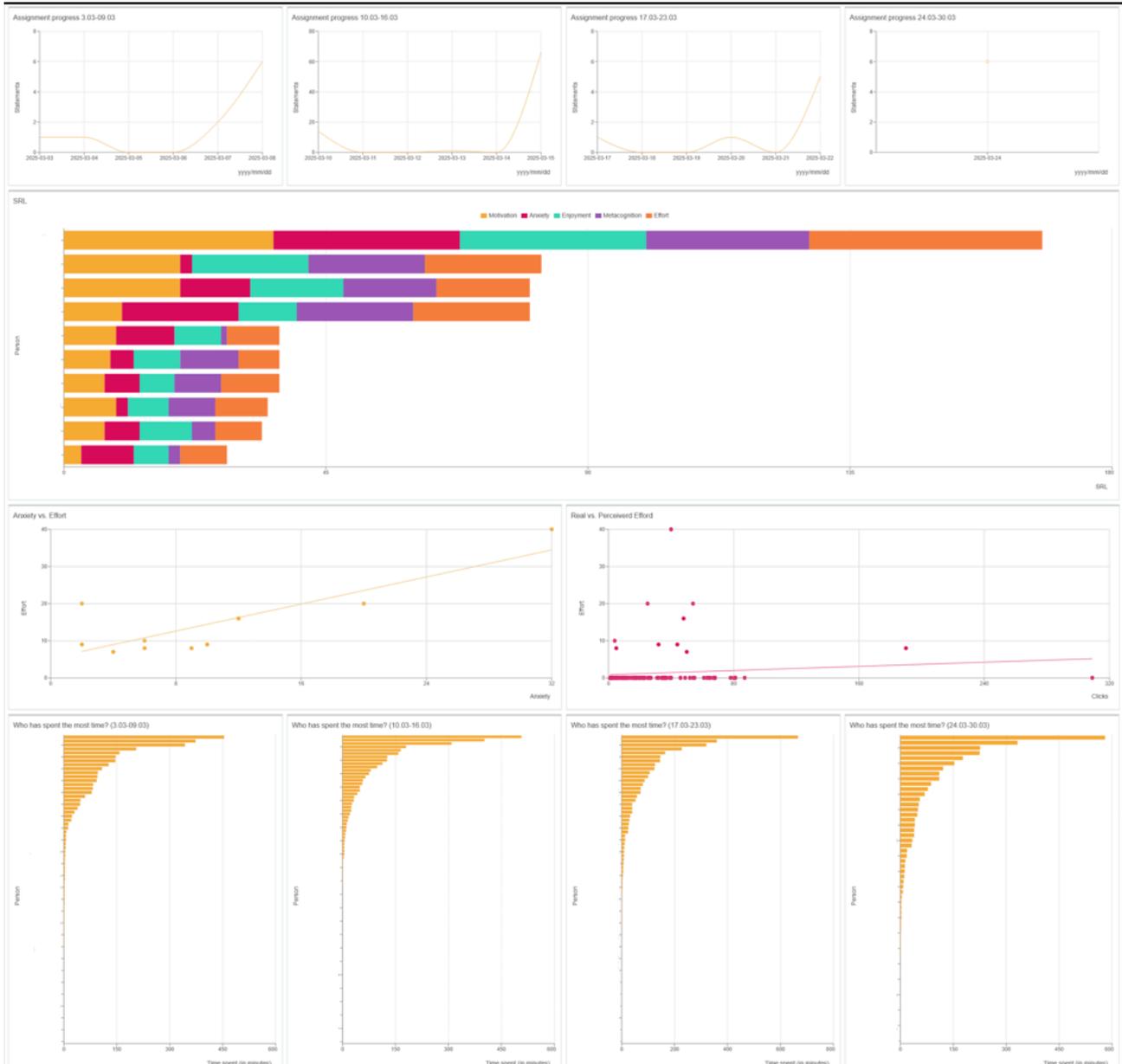


Fig 54. – SRL Overview

5.1.3. SRL analysis

The survey responses from students who enrolled in the summer semester of the "Human-Computer Interaction" course offer a multifaceted view into their academic behaviors,

emotional experiences, and attitudes toward their learning environment. The responses reveal notable diversity in student engagement, motivation, and emotional well-being.

Overall, most students indicate that they put a considerable amount of effort into their academic tasks. Several respondents rated their effort levels highly, suggesting that many students are committed to doing well in their coursework. However, this is not uniformly reflected in their ability to stay focused and avoid distractions. Responses to the question regarding sustained attention during daily learning activities vary widely. While a few students reported a strong ability to focus, others indicated significant difficulty maintaining concentration, hinting at possible challenges with time management or environmental distractions.

When seeking help for difficult tasks, students showed polarized behavior. While some actively seek support from instructors, peers, or online resources, others rarely do so. This contrast may reflect differences in self-efficacy, trust in the learning community, or awareness of available support mechanisms. Relatedly, perceptions of community belonging and interpersonal relationships within the university also differed among students. Some expressed strong connections and a sense of comfort in the academic environment, while others appeared more neutral or disconnected.

Time management and adherence to deadlines generally received favorable ratings, with most students indicating that they manage to complete tasks in a timely manner. This discipline correlates with their reported levels of academic motivation. Enthusiasm for learning and improving grades was consistently moderate to high, which is encouraging, although a few respondents expressed more neutral or even indifferent attitudes.

One of the more concerning insights emerged from responses related to academic stress and anxiety. A significant number of students reported high stress levels when working on assignments or participating in class. This stress may stem from workload, performance pressure, or gaps in understanding, and it underlines the importance of providing emotional support alongside academic guidance.

Despite these stressors, some students still indicated that they enjoy their coursework and feel satisfaction from their achievements, although this sentiment was not universal. Emotional satisfaction with academic activities appears to be heavily influenced by personal confidence and perceived success.

The survey also explored metacognitive strategies such as learning from feedback and self-assessment. A fair proportion of students recognized the value of learning from mistakes and

using feedback constructively. However, fewer students reported regular self-evaluation of their work, suggesting that while the concept of reflective learning is appreciated, its consistent application might require reinforcement within the course structure.

In conclusion, the survey paints a complex picture of the student experience in the HCI summer course. While many students are motivated, disciplined, and connected to their academic environment, a substantial proportion also face difficulties with focus, stress, and self-assessment. These findings suggest opportunities for further support in mental well-being, development of metacognitive skills, and fostering a stronger sense of community and collaboration among students.

5.1.4. Individual insights

Based on the developed ISILA dashboard filter we created visualizations to analyze individuals who demonstrated lower levels of engagement in the learning process.

The visualizations analyzed included:

- Evolution of the SRL survey responses, if completed by the student
- Change in activity over time
- Submitted exercises

5.1.5. Interventions

Interventions were conducted in Weeks 4, 8 and 12 and adapted to the specific needs of HCI students in the context of the teaching. The weekly dashboard analysis approach ensures that the interventions are evidence-based, allowing for refinement throughout the pilot phase. The described methodology for the first intervention was implemented at week 8 and 12.

5.1.5.1. Intervention 1: Week 4

There are 2 assignments in the course, whose deadline has passed:

- Assignment 1- Project Description
- Assignment 2 – First Prototype – Team Presentation

The Table 18 presents a detailed analysis of the students' activity and actions.

Table 18. – Analysis of studnets activities and interventions classified by colours

Student	Activity	Suggestions
1	Last activity 22.03	No action
2	Regular	No action
3	Regular	No action
4	Weak	For observation

Student	Activity	Suggestions
5	Weak has not entered the last week	No action
6	Average activity	No action
7	Weak - in March has entered only 3 times	For observation
8	Never entered	Danger of dropping out – Contact personally
9	Regular	No action
10	Regular	No action
11	Regular	No action
12	Never entered	Danger of dropping out – Contact personally
13	Regular	No action
14	Regular	No action
15	Regular	No action
16	Entered the week 1 time, High anxiety in SRL	No action
17	Regular, SRL- High motivation, no anxiety	No action
18	Hasn't logged in for a month	For observation
19	Never entered	Danger of dropping out- Contact personally by mail
20	Regular, SRL- High motivation and engagement	No action
21	Once a week	No action
22	Regular	No action
23	Irregular- Super high perception of effort in SRL, low anxiety	For observation
24	Irregular last on 16.03 has entered	For observation
25.	Regular	No action
26	Enter 1 time per month	For observation
27	Enter 1 time per week	No action
28	Regular	No action
29	Not logged in from 16.03	No action
30	Never entered	Danger of dropping out- Contact personally by mail
31	Regular	No action
32	Regular, SRL- perception of not enough engagement, low motivation, high anxiety	No action
33	Active	No action
34	Weak activity, SRL- shows low engagement in university community	For observation
35.	Average activity	No action
36	Active	No action
37	Active	No action
38	Active	No action
39	Never entered	Danger of dropping out-Contact personally by mail
40	Regular	No action
41.	Regular	No action
42.	Irregular	For observation
43	Irregular, Shows high perception for engagement and no anxiety in SRL	For observation
44	Never entered	Danger of dropping out – Contact personally
45	Does not enter regularly	For observation
46	Not logged in from 16.03	No action
47	Regular	No action

Student	Activity	Suggestions
48	Regular	No action
49	Never entered	Danger of dropping out – Contact personally
50	Active	No action
51	Active- High motivation in SRL, same results in the different weeks	No action
52	Regular	No action
53	Regular	No action
54	Regular	No action
55	Regular	No action
56	Regular	No action
57	Regular	No action
58	Regular	No action
59	Regular	No action
60	Regular	No action
61	Regular	No action
62	Regular	No action
63	Never entered	Danger of dropping out – Contact personally
64	Very low activity	For observation
65	Low activity	No action
66	Never entered	Danger of dropping out - Contact personally
67	Regular, High anxiety in SRL during the first week, that decreased in second one, motivated	No action
68	Active	No action
69	Almost no entry - only three times	For observation
70	Active	No action
71	Very regular	No action
72	Very regular	No action
73	Regular	No action
74	Never entered	Danger of dropping out - Contact personally by mail
75	Active	No action
76	Medium regular	No action
77	Regular, Medium motivation, Very High anxiety in SRL	No action
78	Never entered	Danger of dropping out - Contact personally
79	Medium activity	No action
80	Regular	No action
81	Medium activity	No action
82	Medium activity	No action
83	Regular	No action
84	Regular	No action
85	Regular	No action
86	Regular	No action
87	Never entered	Danger of dropping out – Contact personally
88	Regular	No action
89	Regular	No action
90	Regular, very active in SRL, high motivation	No action
91	Medium activity	No action
92	Rarely enters	For observation

Student	Activity	Suggestions
93	Only entered twice	For observation
94	Regular	No action
95	Medium activity	No activity
96	Medium regular	No action
97	Regular	No action
98	Regular	No action
99	Regular	No action
100	Regular, SRL- no anxiety, shows perception for low engagement	No action
101	Regular	No action
102	Regular, SRL-High engagement, no anxiety	No action
103	Never entered	Danger of dropping out - Contact personally
104	Only twice entered	For observation
105	Not logged in from 01.03-20.03	For observation
106	He entered at the beginning and then from 07.03 he has not entered	Danger of dropping out - Contact personally
107	Regular	No action
108	Regular	No action
109	Not logged in from 09.03-31.03	Danger of dropping out - Contact personally
110	Never entered	Danger of dropping out - Contact personally
111	Never entered	Danger of dropping out - Contact personally
112	Regular	No action
113	Regular	No action

5.1.5.2. General interventions

The intervention strategy followed a data-driven approach, relying on weekly dashboard reviews and SRL feedback to identify at-risk students.

5.1.5.3. Individual interventions

Three primary groups were targeted: students with no activity at all, students with irregular engagement – with some of them showing emotional stress indicators in the SRL survey – and the actively engaged students. Personalized emails were the main method of outreach, offering encouragement, resources, and concrete suggestions for re-engagement. In several cases, students who had previously disengaged resumed participation after receiving support. However, a portion remained inactive despite repeated contact, highlighting the need for more diversified and multi-channel intervention methods in future iterations of the course. During the piloting, we focused particularly on students with no activity and those with irregular engagement. Their activity was monitored over the following weeks to evaluate the effects of the interventions and better understand their support needs.

Dear [NAME]

You are receiving this message as part of the ISILA project research study in the *Human Computer Interaction* course.

Based on your activity in eLearn and the survey responses, we have observed that you are currently not committed to the course.

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

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

Looking forward to hearing from you.

Best regards,
The ISILA team

Fig 55. – Mail template

5.1.6. Conclusion

The piloting of the Human-Computer Interaction course at Sofia University within the ISILA project demonstrated the effective integration of learning analytics tools to monitor student progress and support early interventions. The use of a multimodal dashboard allowed teachers to visualize patterns of engagement and performance across the semester, helping identify students at risk of disengagement or dropout.

Interventions were designed based on real-time data, enabling timely and personalized support for students. General trends revealed that many students submitted their assignments at the last minute, while a significant portion showed irregular or no activity, especially among those flagged as high-risk. 17 students were identified as completely inactive and were contacted individually as part of the project's early intervention approach. 13 of them did not enroll in the course at all. 77 out of 113 students successfully completed the course at the pre exam phase.

In general the implementation of these tools and methods has laid the groundwork for scalable, evidence-based improvements in teaching and learning, with a focus on personalized support and student well-being.

5.2. Digital Design and Multimedia

This report presents the results of piloting activities and interventions implemented during the Digital Design and Multimedia elective course at Sofia University as part of Work Package 4 (WP4) of the ISILA project.

The course is open to all students and introduces key concepts in digital creativity and content development. It combines various forms of media – visual, audio, interactive – into a coherent learning framework. Students develop creative, technical, and conceptual skills for designing engaging digital content and multimedia experiences, while also exploring tools and platforms used in the digital media industry.

A total of 91 students participated in the pilot. Learning analytics tools, including a Learning Record Store (LRS), were used to monitor student progress and engagement through dashboards. Based on the data, targeted interventions were introduced to support learners at risk of disengagement and to foster academic success.

5.2.1. General Overview

5.2.1.1. Dashboard visualizations

The dashboard provided weekly insights into students' learning behavior. It visualized patterns of participation, time spent on tasks, frequency of platform access, and performance indicators related to key assignments. The dashboard enabled the early detection of students with no activity or irregular engagement patterns.

The following visualizations were included (Fig 56):

- Time spent on the course platform
- Submission rates of assignments
- Activity variation by hour
- SRL survey results (if completed)

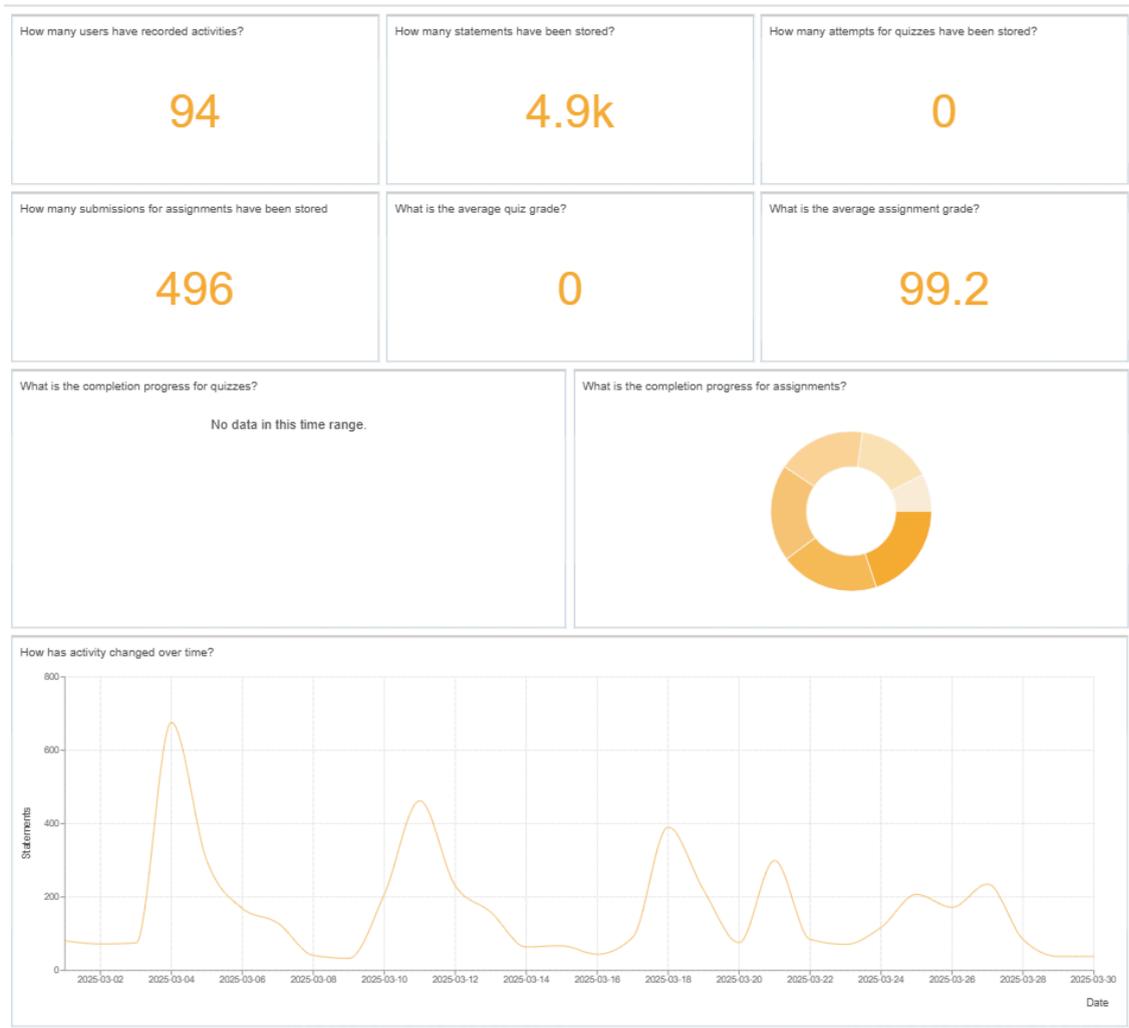


Fig 56. - Dashboard overview of the course in week 1,2,3,4

5.2.1.2. SRL analysis - week 1,2,3,4

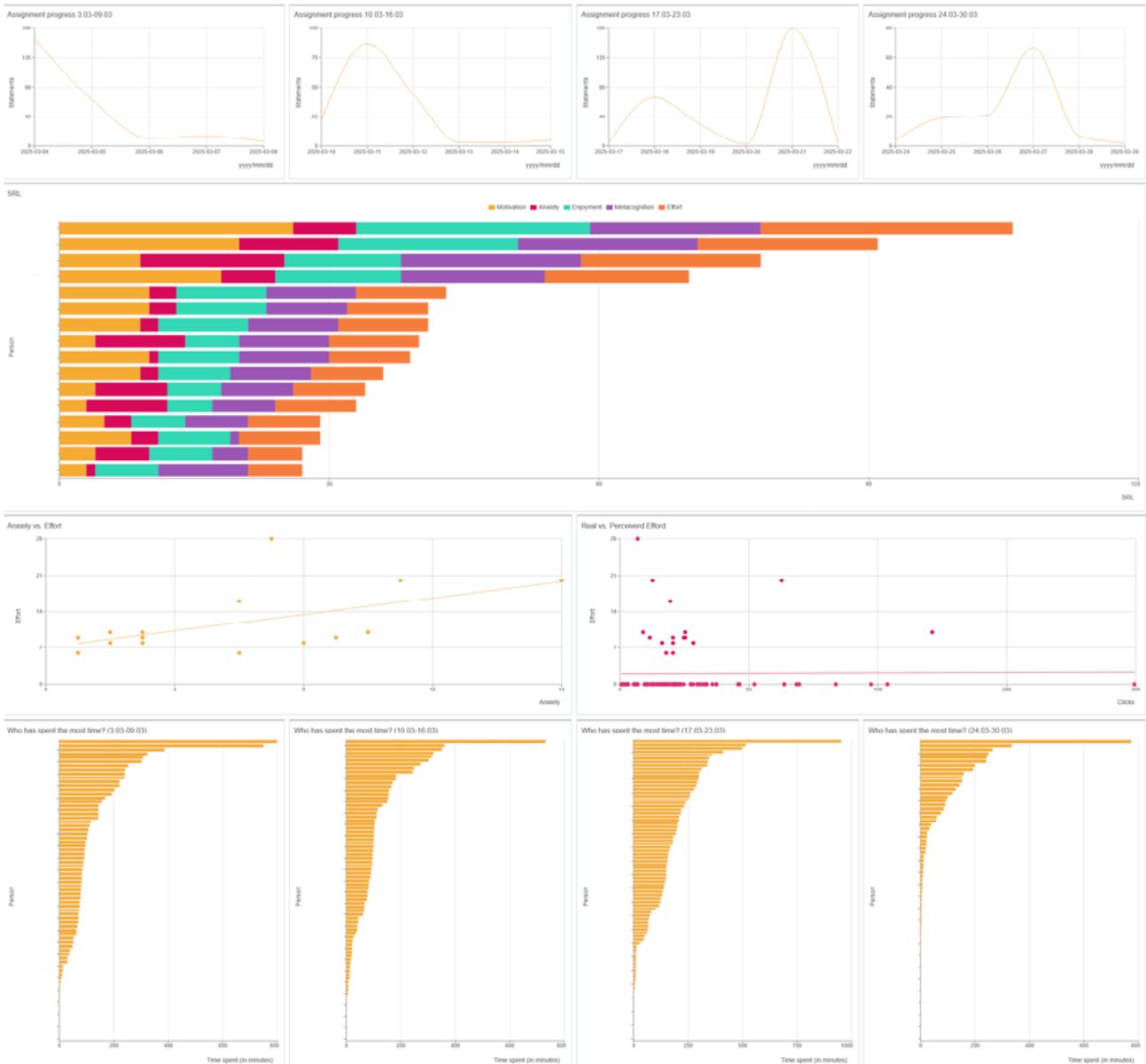


Fig 57. – SRL Analysis

During the summer semester of the *Digital Design and Multimedia* course, student responses to the self-regulated learning (SRL) survey reflected strong engagement and overall positive attitudes toward their academic efforts. On average, students reported putting considerable effort into their coursework and managing deadlines effectively, indicating good task management and responsibility. However, maintaining focus appeared to be more variable, with some students struggling to avoid distractions, suggesting that concentration could be improved for a portion of the class.

Students showed a very high tendency to seek help when needed, particularly from teachers or online resources. This willingness to engage with external support is a positive indicator of

self-awareness and active problem-solving. Their sense of belonging within the university community was moderate, pointing to a potential area for improvement in fostering stronger interpersonal and academic connections.

Motivation levels varied, with some students feeling enthusiastic about their studies, while others reported lower levels of drive. Stress and anxiety levels while working on assignments were a concern for several respondents, as these scores were the lowest and showed the widest range. This suggests that emotional support or stress-reduction strategies may be beneficial.

On a more positive note, most students reported enjoyment in their academic work and felt a sense of satisfaction with their achievements. They also showed a strong tendency to use feedback constructively and engage in self-evaluation, although the consistency in reflective practice varied among individuals.

5.2.1.3. Individual insights

Using ISILA's dashboard filters, instructors visualized and analyzed the behaviour of students who exhibited minimal or erratic participation. These visualizations included:

- SRL evolution (if available)
- Frequency of login and time spent
- Project progress and submission gaps

Students showing no activity and irregular engagement were flagged for follow-up. Their progress was tracked over time to assess responsiveness to interventions.

5.2.2. Interventions

Interventions were applied at Weeks 4, 8, and 12, reflecting key phases in the course: initial concept development, media production, and final project submission.

These actions were grounded in weekly dashboard reviews and SRL data (when available), allowing for real-time decisions on how best to support at-risk students.

Described methods of intervention in week 4 have been implemented at week 8 and 12.

5.2.2.1. Focus Areas for Intervention

Students were grouped into three categories:

- Inactive students – no recorded activity on the platform.
- Irregular participants – sporadic access and limited engagement with course tasks.
- Consistently active students – no intervention needed.

Intervention efforts focused primarily on the first two groups. By the end of the month students need to submit 6 assignments.

5.2.2.2. Methods

- Personalized outreach via email, using predefined templates tailored to each group.
- Offering additional learning resources, reminders for project deadlines, and study strategies
- Optional virtual consultations for students needing creative or technical support

Student	Observations	Actions taken
1	Completed 6 assignments, actively engaged	None
2	6 assignments, actively engaged	None
3	6 assignments, actively engaged	None
4	4 assignments - has not logged in for 2 weeks	Contact personally
5	0 assignments	Risk of dropping out
6	4 assignments, low anxiety in SRL	Contact personally
7	0 assignments- has not logged in for the last 3 weeks	Risk of dropping out
8	6 assignments, engaged, show high anxiety in SRL	None
9	2 assignments	Contact personally
10	3 assignments, motivated in SRL	Contact personally
11	4 assignments	Contact personally
12	0 assignments - has not logged in the last two weeks	Risk of dropping out
13	3 assignments - not logged in for 1 month	Contact personally
14.	0 assignments	Risk of dropping out
15.	4 assignments	Contact personally
16	5 assignments	None
17	3 assignments	Contact personally
18	6 assignments, actively engaged	None
19	6 assignments, actively engaged	None
20	4 assignments	Contact personally
21	0 assignments	Risk of dropout
22	6 assignments, engaged	None
23	6 assignments, engaged	None
24	4 assignments	Contact personally
25	6 assignments, decrease in motivation and engagement in SRL and increase in anxiety	None
26	4 assignments	Contact personally
27	6 assignments, active	None
28	6 assignments, active	None
29	6 assignments, active, high motivation, low anxiety in SRL	None
30	5 assignments	None

Student	Observations	Actions taken
31	0 assignments, active	Contact personally
32	4 assignments, active	Contact personally
33	6 assignments, active	None
34	6 assignments, active, motivation in SRL	None
35	2 assignments - irregular	Contact personally
36	6 assignments - regular	No action
37	6 assignments – regular, medium anxiety in SRL	No action
38	3 assignments- high anxiety, medium motivation in SRL	Contact personally
39	6 assignments - regular	None
40	6 assignments - regular	None
41	6 assignments - regular	None
42	4 assignments	Contact personally
43	4 assignments	Contact personally
44	6 assignments- engaged and motivated in SRL	None
45	5 assignments	None
46	4 assignments	Contact personally
47	0 assignments - not logged in for 2 weeks	Risk of dropping out
48	0 assignments - not entered for 9 days	Risk of dropping out
49	3 assignments - not logged in for 4 weeks	Contact personally
50	4 assignments	Contact personally
51	6 assignments	None
52	3 assignments	Contact personally
53	6 assignments – regular, low anxiety in SRL	None
54	6 assignments – regular, low metacognition in SRL	None
55	6 assignments - regular	None
56	6 assignments - regular	None
57	6 assignments - regular	None
58	3 assignments	Contact personally
59	5 assignments	None
60	3 tasks	Contact personally
61	6 assignments – regular, anxiety in SRL	None
62	6 assignments - regular	None
63	6 assignments - regular	None
64	6 assignments	None
65	4 assignments - not logged in for 11 days	Contact personally
66	6 assignments - regular	None
67	5 assignments	None
68	6 assignments – regular, low anxiety in SRL	None
69	0 assignments - not logged in for 4 weeks	Risk of dropping out
70	6 assignments - regular	None
71	6 assignments – regular, low motivation, high anxiety in SRL	None
72	6 assignments - regular	None
73	3 assignments, feels not focused on the learning in SRL	Contact personally
74	0 assignments	Risk of dropout
75	0 assignments	Risk of dropping out

Student	Observations	Actions taken
76	6 assignments	None
77	6 assignments- regular	None
78	6 assignments - regular	None
79	6 assignments – regular, reported medium motivation in SRL	None
80	6 assignments - regular	None
81	6 assignments regular	None
82	3 assignments, irregular	Contact personally
83	5 assignments, high motivation in SRL	None
84	3 assignments	Contact personally
85	1 assignment	Contact personally
86	6 assignments regular, very active in SRL, no anxiety	None
87	6 assignments - regular	None
88	6 assignments - regular	None
89	6 assignments - regular	None

10 students were identified with potential risk of dropping out, while 14 showed irregular activity and did not submit all the assignments on time.

All of them were contacted by email.

Student 47 responded that the reason for not being active for two weeks was travelling abroad, while Student 82 reported having technical problems with their computer.

5.2.3 Conclusion

The piloting of the Digital Design and Multimedia course within the ISILA project confirmed the value of integrating learning analytics to monitor student progress and tailor interventions.

The use of dashboards allowed instructors to detect early signs of disengagement and act accordingly. Most students benefitted from timely reminders and personalized guidance. A smaller group, identified as inactive or minimally involved, received targeted support, although some remained unresponsive.

The pilot highlighted that creative courses like Digital Design and Multimedia require not only tracking technical engagement but also fostering motivation, project pacing, and emotional readiness. Combining platform data with self-assessment inputs (e.g., SRL surveys) provided a more holistic understanding of the learner experience.

6. ULE Pilots

6.1. Computer Architecture Course

Computer Architecture is a second-year undergraduate course designed to provide students with a comprehensive understanding of the principles, design, and evaluation of modern computer systems. In the theoretical component, students learn fundamental techniques for analyzing and calculating the performance and cost of various architectures, including core concepts such as instruction-level parallelism, memory hierarchy, and processor organization. Practical sessions complement theoretical learning by engaging students in hands-on optimization tasks, employing multiple programming languages to implement and benchmark different architectures and configurations. This approach equips students with the analytical and technical skills required to assess, compare, and optimize computing systems in diverse real-world scenarios.

6.1.1 Data Collection

At Universidad de León (ULE), the learning analytics data was collected from multiple institutional sources and stored in the ULE Learning Record Store (LRS). Student and course-related data were extracted from the university's Learning Management System, which utilizes Moodle as the primary platform for student interaction with course materials. Additional activity data was gathered from students' interactions with learning resources and assignments through the LMS platform, capturing comprehensive engagement patterns throughout the Computer Architecture course.

The Self-Regulated Learning (SRL) survey was administered to students on a weekly basis during the course duration. Survey responses and learning activity log data were converted into xAPI statements using the csv2xapi tool developed specifically within the ISILA project framework. This tool enables the transformation of tabular data from various sources into standardized xAPI format, facilitating seamless integration with the Learning Record Store. All processed data, including both behavioral learning analytics and self-reported survey responses, were uploaded to the ULE LRS for centralized storage, analysis, and dashboard visualization.

6.1.2. Dashboard Overview

An overall dashboard was created to get the general picture of the course, including the time spent, the exercise submission and the SRL survey results (Fig.58-61).



Fig 58. - Dashboard overview 1 of the course in Week 7

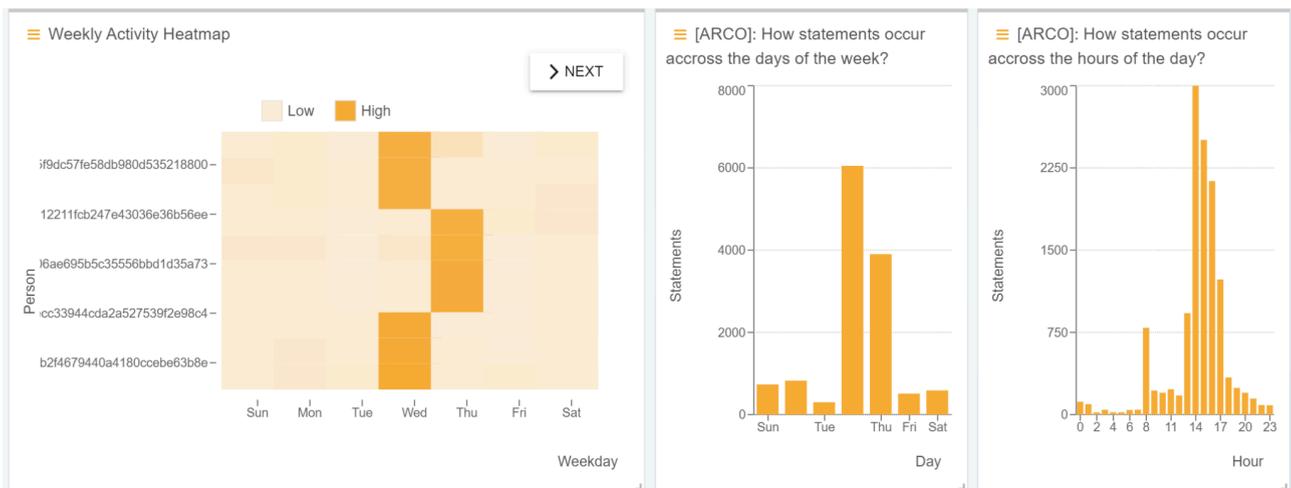


Fig 59. - Dashboard overview 2 of the course in Week 7



Fig 60. - Dashboard overview of the course in Week 7

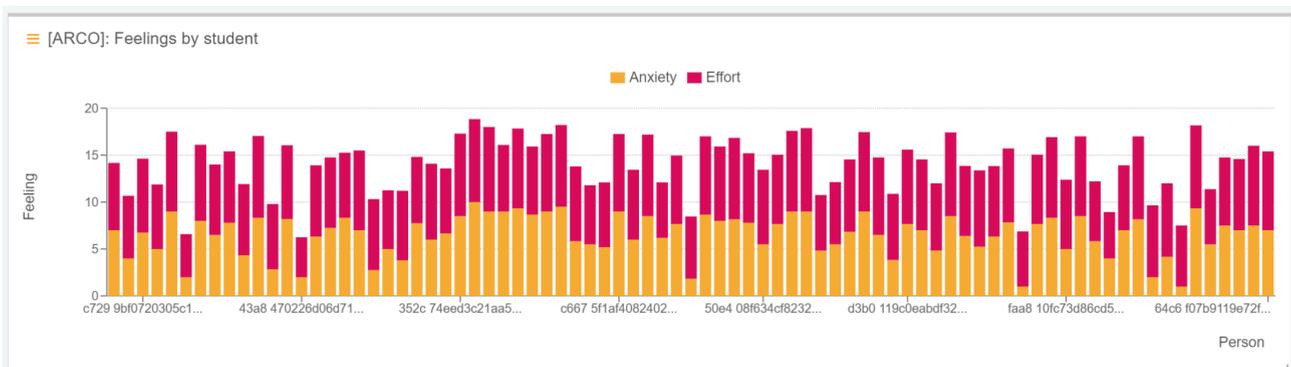


Fig 61. - Dashboard overview of the course in Week 7

6.1.3. Individual insights

We filtered the dashboard data to examine each individual student who provided consent to participate in the ISILA project interventions, using the filtering functionality developed within the ISILA system. The visualizations reviewed were the same as those presented in Figures 1 to 5, but displayed on a per-student basis.

6.1.4. Interventions

Interventions were conducted in Weeks 7 and 11 to address issues such as low engagement, missing assignments, or high anxiety. Actions were tailored based on student profiles, with both general and individualized strategies.

6.1.4.1. Intervention 1 : Week 7

Based on the data from the platforms, students were categorized according to their level of engagement, performance, and Self-Regulated Learning (SRL) survey responses. The goal of the first intervention was to provide timely support for students who showed signs of disengagement, academic difficulties, or high levels of anxiety. Also this week was the first attempt at lab tests.

- Students with no learning activity detected (dropout risk): These students were personally contacted to explore reasons for inactivity and to offer support for re-engagement.
- Students with average activity but no SRL data: These students were contacted individually to encourage survey participation and to provide guidance on improving engagement and learning strategies.
- Students who started activity only in Week 7 with high anxiety: These students were personally contacted to address their concerns, provide emotional support, and help them organize their study approach.
- Students with below-average performance but high SRL: These students were contacted to discuss strategies for leveraging their self-regulation skills to improve performance.
- Students who completed all exercises and achieved high grades (with or without SRL data): No direct intervention was required for these students.
- Students with high performance but high anxiety: These students were personally contacted to address emotional well-being and provide strategies for managing stress while maintaining performance.

This categorization ensured that each student received an appropriate response, from personalized outreach to continued monitoring for those who were progressing well and is summarized in the table 19.

Table 19. – Observations by student and intervention carried out.

Student	Intervention 1 : Week 7	Intervention 1 : Week 7 - actions
S1	Average SRL. Submitted all exercises and high grades.	NONE
S2	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S3	No learning activity detected on the system - dropout.	CONTACT PERSONALLY

Student	Intervention 1 : Week 7	Intervention 1 : Week 7 - actions
S4	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S5	Average SRL. Submitted all exercises and high grades.	NONE
S6	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S7	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S8	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S9	Average SRL. Submitted all exercises and high grades.	NONE
S10	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S11	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S12	Average SRL. Submitted all exercises and high grades.	NONE
S13	Average SRL. Submitted all exercises and high grades.	NONE
S14	Average SRL. Submitted all exercises and high grades.	NONE
S15	Average SRL. Submitted all exercises and high grades.	NONE
S16	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S17	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S18	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S19	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S20	Average SRL. Submitted all exercises and high grades.	NONE
S21	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S22	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S23	Average SRL. Submitted all exercises and high grades.	NONE
S24	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S25	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S26	Average SRL. Submitted all exercises and high grades.	NONE

Student	Intervention 1 : Week 7	Intervention 1 : Week 7 - actions
S27	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S28	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S29	Average SRL. Submitted all exercises and high grades.	NONE
S30	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S31	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S32	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S33	Average SRL. Submitted all exercises and high grades.	NONE
S34	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S35	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S36	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S37	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S38	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S39	Average SRL. Submitted all exercises and high grades.	NONE
S40	Average SRL. Submitted all exercises and high grades.	NONE
S41	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S42	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S43	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S44	Average SRL. Submitted all exercises and high grades.	NONE
S45	Average SRL. Submitted all exercises and high grades.	NONE
S46	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S47	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S48	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY

Student	Intervention 1 : Week 7	Intervention 1 : Week 7 - actions
S49	Average SRL. Submitted all exercises and high grades.	NONE
S50	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S51	Average SRL. Submitted all exercises and high grades.	NONE
S52	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S53	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S54	Average SRL. Submitted all exercises and high grades.	NONE
S55	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S56	Average SRL. Submitted all exercises and high grades.	NONE
S57	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S58	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S59	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S60	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S61	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S62	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S63	Average SRL. Submitted all exercises and high grades.	NONE
S64	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S65	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S66	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S67	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S68	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S69	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY

Student	Intervention 1 : Week 7	Intervention 1 : Week 7 - actions
S70	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S71	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S72	Average SRL. Submitted all exercises and high grades.	NONE
S73	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S74	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY
S75	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S76	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S77	Average level of activity. No SRL data available.	CONTACT PERSONALLY
S78	Average level of activity. No SRL data available & Low scores.	CONTACT PERSONALLY

6.1.4.1.1. General interventions

In week 6, students were required to submit the first two components of their coursework and present their defenses on paper, which served as an interim assessment point within the course. This approach made it possible to evaluate each student's current academic status and engagement, providing timely insights into their progress and helping to identify those who might benefit from additional support or targeted intervention at an early stage.

6.1.4.1.2. Individual interventions

Five distinct student profiles were detected based on engagement, performance, and SRL survey responses. Accordingly, five tailored email models were developed and sent, ensuring that each student received communication suited to their specific needs.

Students that showed dropout signs - No learning activity detected on the system - dropout.

Dear [NAME],

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

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

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

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who demonstrated average level of activity. No SRL data available. - Average level of activity. No SRL data available.

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Computer Architecture course. Based on your activity on platforms, we've noticed that your engagement in the course has been at an average level so far. However, we don't yet have your responses to the Self-Regulated Learning (SRL) survey, which means we're missing an important part of understanding how you approach studying and whether you might need additional support.

You still have the opportunity to complete the weekly SRL surveys, which will help our research and also give you a chance to share your perspective on the course activities. The surveys are important because they help us better understand how you study, how you plan your work, and what challenges you face, so we can provide timely and appropriate support if needed.

You can access the surveys here: [SURVEY LINKS].

If you have any questions or need help, whether with the course material, organizing your study, or even with the survey itself, just reply to this message or contact your teacher directly. We're here to support you and help you stay on track.

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who started learning in Week 6 and demonstrated a high level of anxiety - First activity recorded only in Week 7, high level of anxiety.

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Computer Architecture course. Based on your activity on the platforms, we've noticed that your first activity in the course was recorded in Week 7, and in the Self-Regulated Learning (SRL) survey you reported experiencing a higher level of anxiety.

We completely understand that personal, emotional, or organizational challenges can affect when and how you engage with the course. Please know that you are not alone, and support is available. If you feel overwhelmed or unsure about how to proceed, we encourage you to reply to this email or contact your teacher directly so that we can work together on finding the best way forward.

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who demonstrated below-average performance but reported a high level of self-regulation - Below-average course performance combined with high SRL survey results.

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Computer Architecture course. Based on your activity on the platforms, we’ve noticed that your performance in the course so far has been below average. However, in the Self-Regulated Learning (SRL) survey, you reported a high level of self-regulation, which is an excellent foundation for further progress.

We believe that with additional support and focus, you can significantly improve your performance. We would be glad to discuss possible learning strategies, clarify course content, or provide resources that can help you achieve better results. If you would like to talk or have any questions, please reply to this email or contact your teacher directly.

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who submitted all exercises and achieved high grades but reported a high level of anxiety - Submitted all exercises, high grades. High level of anxiety.

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Computer Architecture course. We’ve noticed that you have successfully completed and submitted all tests and assignments, achieving high grades, which clearly shows your dedication and serious approach to learning. However, in the Self-Regulated Learning (SRL) survey, you reported experiencing a higher level of anxiety.

We understand that even when you are performing well academically, studying can sometimes feel overwhelming. Please know that you are not alone, and support is available. If you feel anxious or need advice on managing your study load more effectively, we encourage you to reply to this email or contact your professor directly so we can work together on strategies to support you.

Looking forward to hearing from you.

Best regards,
The ISILA team

6.1.4.1.3. Responses obtained

Only a small number of students responded to the personalized emails. In the Table 20, there are a summary of the answers received to the first attempt to contact students.

Table 20. – Responses to the intervention

Student	Intervention 1 : Week 7 - responses
S10	The student explained that personal commitments have limited their time for study, but they intend to catch up with the activities in the following weeks.

S35	The student reported experiencing technical problems accessing the online platform and has requested additional support.
S50	The student indicated they have been focusing on other subjects but plan to dedicate more time to this course after midterms.
S59	The student acknowledged late submission due to illness and requested an extension for the remaining activities.
S67	The student mentioned a lack of clarity regarding the submission process and requested further instructions from the instructor.
S73	The student stated they are repeating the course and have already started working on the assignments.
S77	The student justified their low participation by citing increased work obligations and has requested to discuss an alternative assessment schedule.

6.1.4.2. Intervention 2: Week 11



Fig 62. - Dashboard overview of the course in Week 11

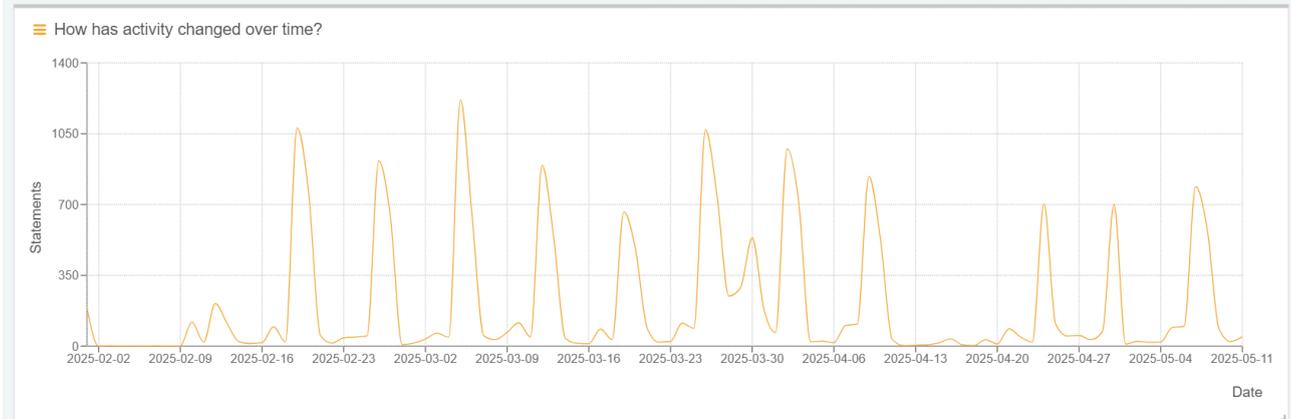
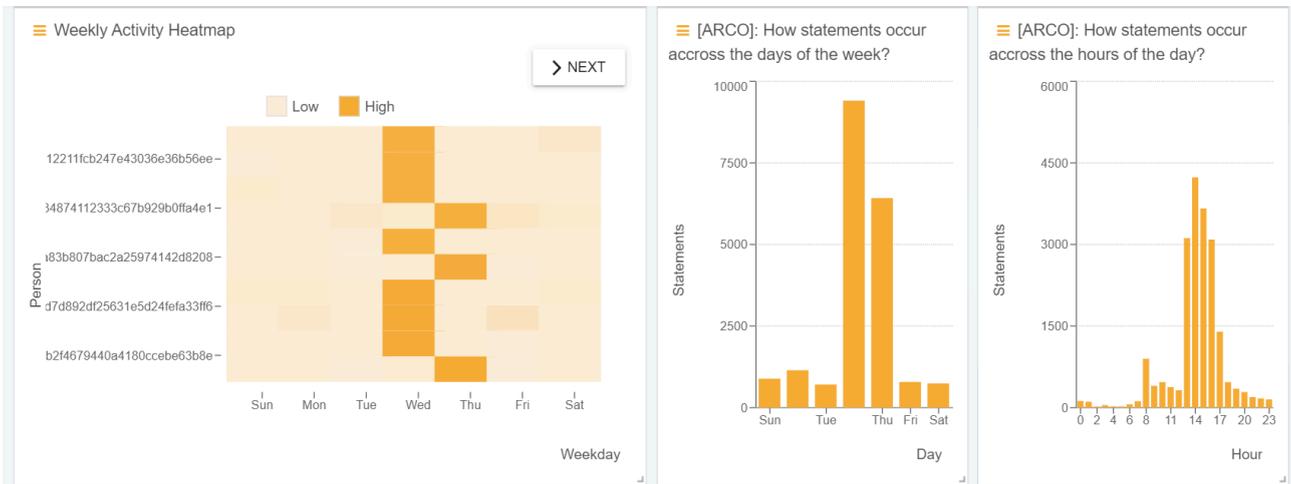


Fig 63. - Dashboard overview of the course in Week 11

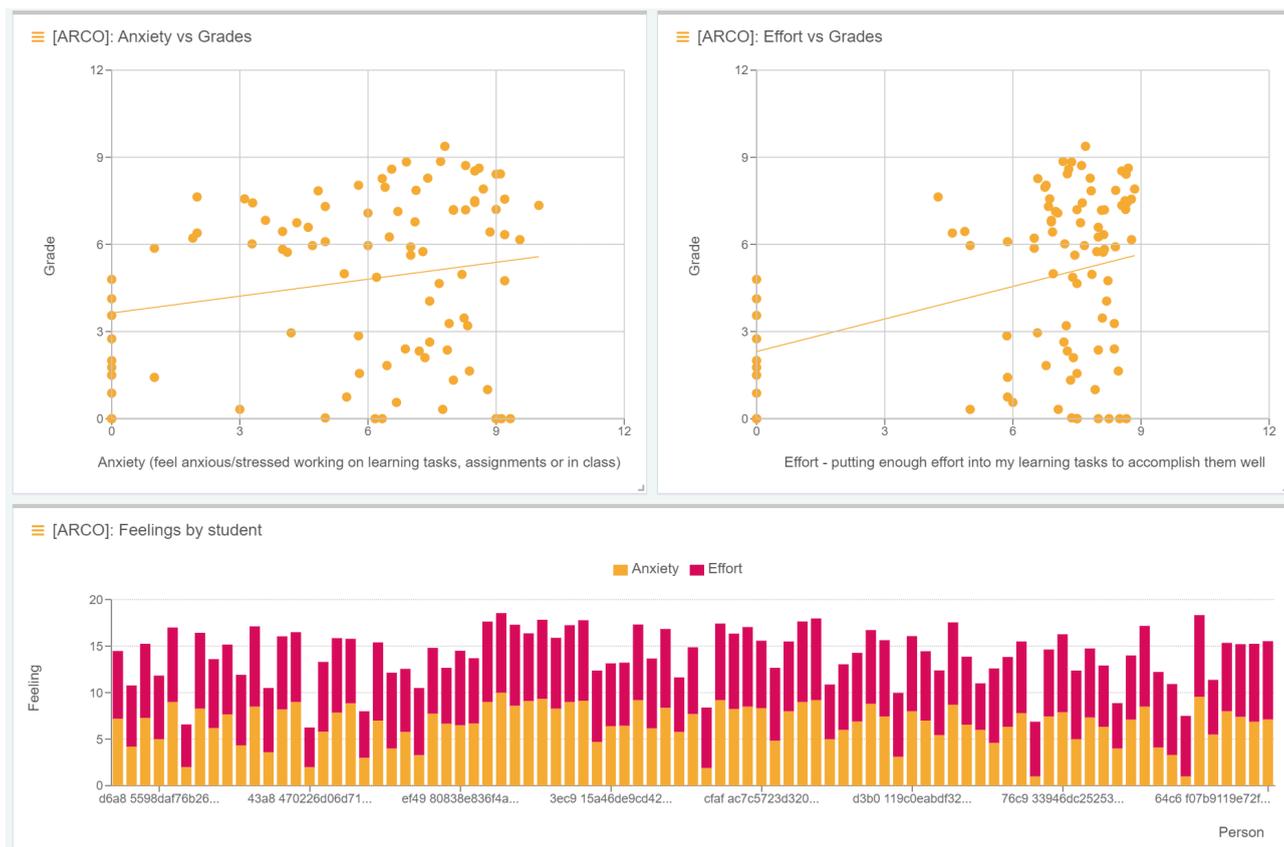


Fig 64. - Dashboard overview of the course in Week 11

Table 21. Interventions by student

Student	Intervention 2 : Week 13	Intervention 2 : Week 13 - actions
S1	Submitted all exercises, high grades and high SRL.	NONE
S2	Submitted all exercises, high grades and high SRL.	NONE
S3	Submitted all exercises, high grades and high SRL.	NONE
S4	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S5	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S6	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S7	Submitted all exercises, high grades and high SRL.	NONE
S8	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S9	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S10	Submitted all exercises, high grades and high SRL.	NONE
S11	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S12	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S13	Submitted all exercises, high grades and high SRL.	NONE

Student	Intervention 2 : Week 13	Intervention 2 : Week 13 - actions
S14	Submitted all exercises, high grades and high SRL.	NONE
S15	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S16	Submitted all exercises, high grades and high SRL.	NONE
S17	Below-average performance and no SRL.	CONTACT PERSONALLY
S18	Below-average performance and no SRL.	CONTACT PERSONALLY
S19	Submitted all exercises, high grades and high SRL.	NONE
S20	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S21	Submitted all exercises, high grades and high SRL.	NONE
S22	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S23	Submitted all exercises, high grades and high SRL.	NONE
S24	Submitted all exercises, high grades and high SRL.	NONE
S25	Submitted all exercises, high grades and high SRL.	NONE
S26	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S27	Below-average performance and no SRL.	CONTACT PERSONALLY
S28	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S29	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S30	Submitted all exercises, high grades and high SRL.	NONE
S31	Below-average performance and no SRL.	CONTACT PERSONALLY
S32	Submitted all exercises, high grades and high SRL.	NONE
S33	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S34	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S35	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S36	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S37	Below-average performance and no SRL.	CONTACT PERSONALLY
S38	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S39	Below-average performance and no SRL.	CONTACT PERSONALLY
S40	Submitted all exercises, high grades and high SRL.	NONE
S41	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S42	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY

Student	Intervention 2 : Week 13	Intervention 2 : Week 13 - actions
S43	Submitted all exercises, high grades and high SRL.	NONE
S44	Low grades, possible disengagement.	CONTACT PERSONALLY
S45	Submitted all exercises, high grades and high SRL.	NONE
S46	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S47	Submitted all exercises, high grades and high SRL.	NONE
S48	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S49	Submitted all exercises, high grades and high SRL.	NONE
S50	Submitted all exercises, high grades and high SRL.	NONE
S51	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S52	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S53	Submitted all exercises, high grades and high SRL.	NONE
S54	Submitted all exercises, high grades and high SRL.	NONE
S55	Below-average performance and no SRL.	CONTACT PERSONALLY
S56	Below-average performance and no SRL.	CONTACT PERSONALLY
S57	Submitted all exercises, high grades and high SRL.	NONE
S58	Submitted all exercises, high grades and high SRL.	NONE
S59	Submitted all exercises, high grades and high SRL.	NONE
S60	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S61	Submitted all exercises, high grades and high SRL.	NONE
S62	Below-average performance and no SRL.	CONTACT PERSONALLY
S63	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S64	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S65	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S66	Low grades, possible disengagement.	CONTACT PERSONALLY
S67	Below-average performance and no SRL.	CONTACT PERSONALLY
S68	Submitted all exercises, high grades and high SRL.	NONE
S69	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S70	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S71	Low grades, possible disengagement.	CONTACT PERSONALLY

Student	Intervention 2 : Week 13	Intervention 2 : Week 13 - actions
S72	No learning activity detected on the system - dropout.	CONTACT PERSONALLY
S73	Submitted all exercises, high grades and high SRL.	NONE
S74	Submitted all exercises, high grades and high SRL.	NONE
S75	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S76	Submitted all exercises, average grades and no SRL.	CONTACT PERSONALLY
S77	Submitted all exercises, high grades and high SRL.	NONE
S78	Below-average performance and no SRL.	CONTACT PERSONALLY

In the week 11 intervention, a generic reminder was sent to all students flagged for contact, emphasizing that the end of the course was approaching and encouraging them to attend lab sessions and tutorials to improve their academic performance. This action aimed to boost participation and ensure that students at risk of low engagement or dropout had clear guidance and opportunities to seek support during the critical final phase of the semester, as reflected in the intervention tracking tables.

6.1.4.2.1. General interventions

In Week 11, general interventions were implemented to provide support for all students and prepare them for the end of the semester:

- Group consultations were scheduled both online and in the classroom, giving students an opportunity to discuss academic challenges (e.g., backlog exams, project preparation, time management) and personal concerns.
- A visible peak in student activity was recorded between 06.05.2025 and 28.05.2025, as shown in Figure 65, indicating that the consultations had a direct impact on re-engagement.
- Reminders about the importance of regular platform activity and using available resources were sent to encourage consistent engagement.

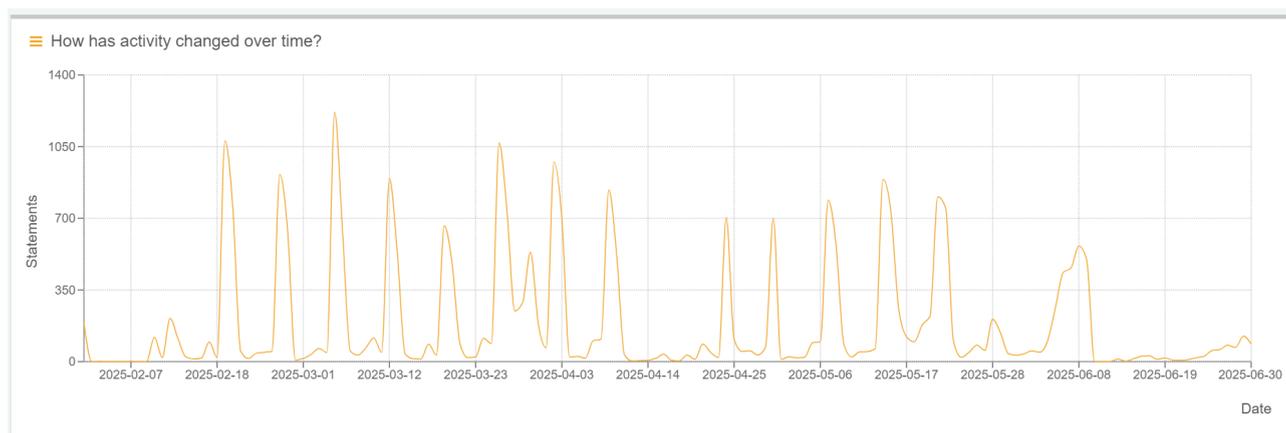


Fig 65. - Dashboard overview of the course in Week 15

6.1.4.2.2. Individual interventions

Personalized follow-up emails were sent to students, with content tailored based on the analysis of their activity changes between interventions and their current academic status. These emails had a similar structure and tone, but were adjusted to address specific issues such as lack of engagement, below-average performance, or high levels of anxiety.

A particular emphasis was placed on the approaching end of the semester, encouraging students to take immediate action to complete pending tasks, use available consultations, and prepare for final assessments. The goal of these communications was to motivate students to re-engage with the course, reduce stress related to backlog work, and ensure they had clear guidance on how to successfully finalize their obligations.

6.1.4.2.3. Responses obtained

Table 22. – Students responses to the interventions

Student	Intervention 2 : Week 13 - responses
S6	I have been unable to keep up due to overlapping work commitments, but I will try to submit the remaining assignments before the deadline.
S12	I had some health problems during the term, but I expect to complete all required activities this week.
S21	I am finding it difficult to stay motivated, but I hope attending the final tutorials will help. Can you recommend specific sessions to focus on?
S27	I have been absent due to family issues and protests. I would appreciate advice on how to catch up effectively.
S36	I am working in a different city and could not participate in person. Is there a way to submit the practicals online?
S44	I am struggling to prepare for the final exam. Any resources or suggestions?
S53	I started a new job recently, which affected my study time. I will try to finish all lab assignments on time.
S64	I've encountered technical issues with the platform. Can you help me access the practice sessions?
S70	My exam schedule has been very tight, but I am now focusing on this course and will try to pass the final evaluations.

S77	I am ready to complete all outstanding projects. Thank you for your help and encouragement throughout the course.
-----	---

Other students contact teachers directly during presential sessions, in which teachers focus more on emphasizing that work done during the semester has a lot of importance for their results. So they need to be quiet and feel sure of their work.

6.1.5. Conclusion

Throughout the semester, students began engaging with the course promptly, but the overall patterns of participation and assignment completion showed substantial variation. While some students maintained steady progress and consistently met academic deadlines, a significant portion displayed fluctuating engagement or delayed their involvement, resulting in an uneven distribution of learning progress across the group.

This semester was notably affected by the scheduling of the Easter break, which interrupted nearly three consecutive weeks of teaching activities mid-semester. This prolonged pause in academic routines impacted students’ ability to sustain momentum and contributed to irregular study patterns for some. As a result, several students found it challenging to maintain consistent preparation, and many postponed coursework until after the holiday period, which created bottlenecks in assignment submissions and progress tracking.

To address these challenges, two interventions were implemented. In week 7, personalized contact was initiated with students exhibiting low participation, missing key learning analytics data, or demonstrating signs of falling behind. The purpose was to identify underlying difficulties and encourage re-engagement. By week 11, a second wave of interventions included targeted reminders, invitations to lab sessions and tutorials, and the distribution of supplementary resources for final assessments. These actions led to visible improvements in student engagement, increased rates of assignment submission, and overall progress for many in the class.

Nevertheless, some students remained disengaged by the end of the term, often due to individual study habits or personal workload management challenges. Overall, the findings demonstrate that timely and differentiated interventions can foster academic recovery and improved outcomes, especially in semesters where the academic rhythm is disrupted by lengthy breaks or calendar irregularities.

6.2. Computer Animation

The "Computer Animation" course at the University of León is part of the Bachelor of Engineering in Computer Science and is offered by the School of Industrial, Informatics, and Aerospace Engineering. This subject provides students with essential knowledge of 3D design, modeling, and animation techniques, covering all stages of audiovisual production projects in real-world contexts. The course encourages teamwork and the development of creativity, problem-solving, and decision-making skills, focusing on both theoretical concepts and practical activities using professional 3D editing software. Students participate in collaborative group projects to develop animation works, refine their skills with character rigging and advanced motion, and prepare presentations that foster peer feedback and critical analysis. The course is designed to assess individual and group engagement through interactive assignments and interventions, preparing students for professional roles in animation and multimedia industries.

6.2.1. Data Collection

At ULe, the learning analytics data was collected from multiple institutional sources and stored in the ULe Learning Record Store (LRS). Student and course-related data were extracted from the university's Learning Management System, which utilizes Moodle as the primary platform for student interaction with course materials. Additional activity data was gathered from students' interactions with learning resources and assignments through the LMS platform, capturing comprehensive engagement patterns throughout the Computer Architecture course. Also Discord were used as a tool for students interaction.

The Self-Regulated Learning (SRL) survey was administered to students on a weekly basis during the course duration. Survey responses and learning activity log data were converted into xAPI statements using the csv2xapi tool developed specifically within the ISILA project framework. This tool enables the transformation of tabular data from various sources into standardized xAPI format, facilitating seamless integration with the Learning Record Store. All processed data, including both behavioral learning analytics and self-reported survey responses, were uploaded to the ULe LRS for centralized storage, analysis, and dashboard visualization.

6.2.2. Dashboard Overview

An overall dashboard was created to get the general picture of the course, including the time spent, the exercise submission and the SRL survey results (Fig.66-69).



Fig 66. - Dashboard overview 1 of the course in Week 7

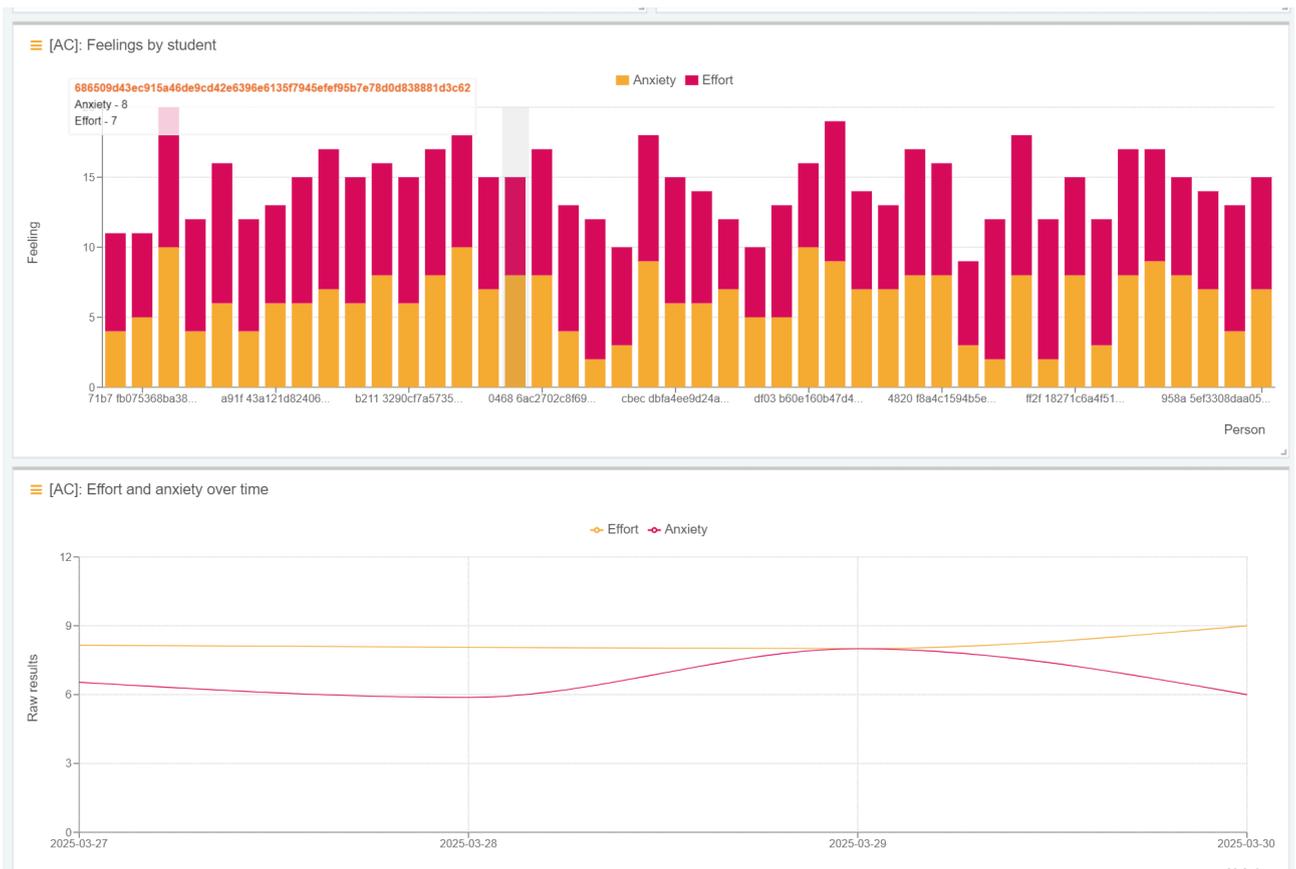


Fig 67. - Dashboard overview 2 of the course in Week 7

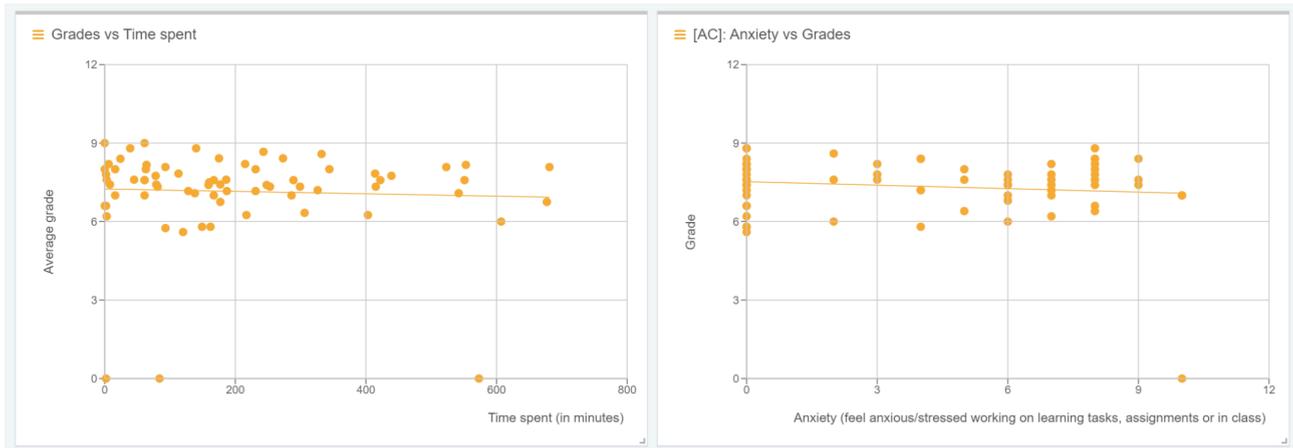


Fig 68. - Dashboard overview 3 of the course in Week 7

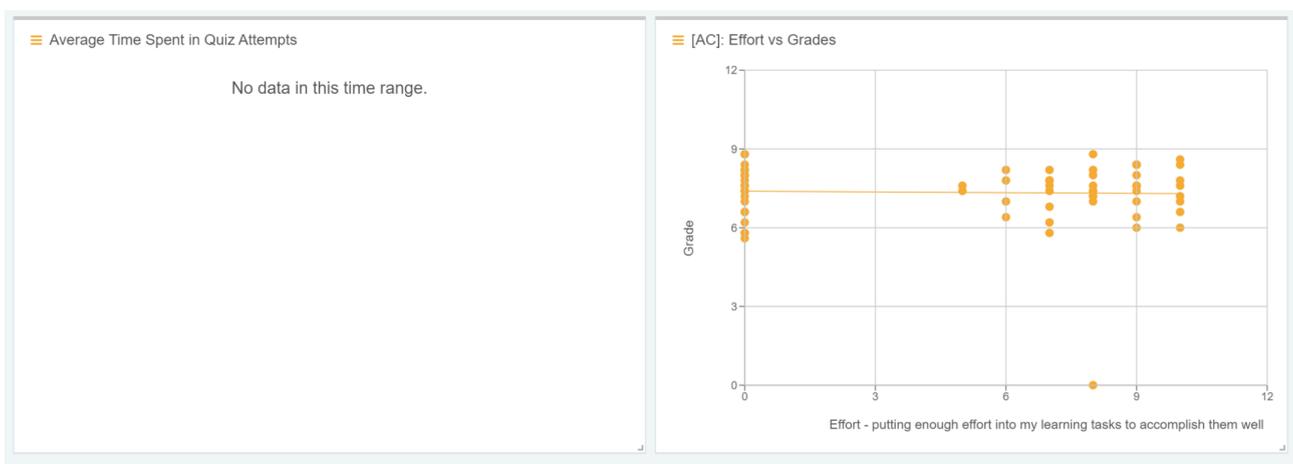


Fig 69. - Dashboard overview 4 of the course in Week 7

6.2.3. Individual insights

We filtered the dashboard data to examine each individual student who provided consent to participate in the ISILA project interventions, using the filtering functionality developed within the ISILA system. The visualizations reviewed were the same as those presented in Figures 1 to 5, but displayed on a per-student basis.

6.2.4. Interventions

Interventions were conducted in Weeks 7 and 12 to address issues such as low engagement, missing assignments, or high anxiety. Actions were tailored based on student profiles, with both general and individualized strategies. In addition, the course adopted a set of team-focused, learning-analytics–triggered interventions to better support collaborative work throughout the term. These interventions were activated during weeks 7 and 12 and remained available thereafter as light operating procedures for teams.

6.2.4.1. Intervention 1 : Week 7

Based on the data from the platforms, students were categorized according to their level of engagement, performance, and Self-Regulated Learning (SRL) survey responses. The goal of the

first intervention was to provide timely support for students who showed signs of disengagement, academic difficulties, or high levels of anxiety. Also this week was the first attempt at lab tests.

- Students with no learning activity detected (dropout risk): These students were personally contacted to explore reasons for inactivity and to offer support for re-engagement.
- Students with average activity but no SRL data: These students were contacted individually to encourage survey participation and to provide guidance on improving engagement and learning strategies.
- Students who started activity only in Week 6 with high anxiety: These students were personally contacted to address their concerns, provide emotional support, and help them organize their study approach.
- Students with below-average performance but high SRL: These students were contacted to discuss strategies for leveraging their self-regulation skills to improve performance.
- Students who completed all exercises and achieved high grades (with or without SRL data): No direct intervention was required for these students.
- Students with high performance but high anxiety: These students were personally contacted to address emotional well-being and provide strategies for managing stress while maintaining performance.

This categorization ensured that each student received an appropriate response, from personalized outreach to continued monitoring for those who were progressing well and is summarized in the table 23.

Table 23. – Interventions per student

Student	Intervention Description	Intervention Action
S1	Average SRL. Submitted all exercises and high grades.	NONE
S2	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S3	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S4	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S5	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT
S6	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE

Student	Intervention Description	Intervention Action
S7	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S8	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S9	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S10	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S11	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S12	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S13	Average SRL. Submitted all exercises and high grades.	NONE
S14	Average SRL. Submitted all exercises and high grades.	NONE
S15	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S16	Average SRL. Submitted all exercises and high grades.	NONE
S17	Average SRL. Submitted all exercises and high grades.	NONE
S18	Average SRL. Submitted all exercises and high grades.	NONE
S19	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S20	Average SRL. Submitted all exercises and high grades.	NONE
S21	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S22	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S23	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE
S24	Average SRL. Submitted all exercises and high grades.	NONE
S25	Average level of activity. High anxiety - High effort but some low result.	CONTACT PERSONALLY & OFFER STRESS SUPPORT

Student	Intervention Description	Intervention Action
S26	Average level of activity. High anxiety (good start, drop off)	CONTACT PERSONALLY & MOTIVATE

6.2.4.1.1. General interventions

During the first six weeks of the course, students were asked to upload five deliverables related to the lab part. Grades obtained in this part joined with surveys were used to do the first intervention.

6.2.4.1.2. Individual interventions

Five distinct student profiles were detected based on engagement, performance, and SRL survey responses. Accordingly, five tailored email models were developed and sent, ensuring that each student received communication suited to their specific needs.

Students that showed dropout signs - No learning activity detected on the system - dropout.

Dear [NAME],

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

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

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

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who demonstrated average level of activity. No SRL data available. - Average level of activity. No SRL data available.

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Computer *Animation* course. Based on your activity on platforms, we’ve noticed that your engagement in the course has been at an average level so far. However, we don’t yet have your responses to the Self-Regulated Learning (SRL) survey, which means we’re missing an important part of understanding how you approach studying and whether you might need additional support.

You still have the opportunity to complete the weekly SRL surveys, which will help our research and also give you a chance to share your perspective on the course activities. The surveys are important because they help us better understand how you study, how you plan your work, and what challenges you face, so we can provide timely and appropriate support if needed.

You can access the surveys here: [SURVEY LINKS].

If you have any questions or need help, whether with the course material, organizing your study, or even with the survey itself, just reply to this message or contact your teacher directly. We’re here to support you and help you stay on track.

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who started learning in Week 6 and demonstrated a high level of anxiety - First activity recorded only in Week 7, high level of anxiety.

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Computer *Animation* course. Based on your activity on the platforms, we’ve noticed that your first activity in the course was recorded in Week 7, and in the Self-Regulated Learning (SRL) survey you reported experiencing a higher level of anxiety.

We completely understand that personal, emotional, or organizational challenges can affect when and how you engage with the course. Please know that you are not alone, and support is available. If you feel overwhelmed or unsure about how to proceed, we encourage you to reply to this email or contact your teacher directly so that we can work together on finding the best way forward.

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who demonstrated below-average performance but reported a high level of self-regulation - Below-average course performance combined with high SRL survey results.

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Computer *Animation* course. Based on your activity on the platforms, we’ve noticed that your performance in the course so far has been below average. However, in the Self-Regulated Learning (SRL) survey, you reported a high level of self-regulation, which is an excellent foundation for further progress.

We believe that with additional support and focus, you can significantly improve your performance. We would be glad to discuss possible learning strategies, clarify course content, or provide resources that can help you achieve better results. If you would like to talk or have any questions, please reply to this email or contact your teacher directly.

Looking forward to hearing from you.

Best regards,
The ISILA team

Students who submitted all exercises and achieved high grades but reported a high level of anxiety - Submitted all exercises, high grades. High level of anxiety.

Dear [NAME],

You are receiving this email because you are participating in the ISILA project research study through your enrollment in the Computer *Animation* course. We’ve noticed that you have successfully completed and submitted all tests and assignments, achieving high grades, which clearly shows your dedication and serious approach to learning. However, in the Self-Regulated Learning (SRL) survey, you reported experiencing a higher level of anxiety.

We understand that even when you are performing well academically, studying can sometimes feel overwhelming. Please know that you are not alone, and support is available. If you feel anxious or need advice on managing your study load more effectively, we encourage you to reply to this email or contact your professor directly so we can work together on strategies to support you.

Looking forward to hearing from you.

Best regards,
The ISILA team

6.2.4.1.3. Responses obtained

Only a small number of students responded to the personalized emails. In the table 24, there are a summary of the answers received to the first attempt to contact students.

Table 24. – Intervention 1 responses.

Student	Intervention 1 : Week 6 - responses
S2	The student expressed difficulty managing anxiety related to assignment deadlines and requested advice on stress reduction techniques.
S3	The student reported confusion about certain technical concepts and asked for a tutorial session to reinforce their understanding.
S4	The student indicated challenges balancing coursework with extracurricular commitments and requested more flexible deadlines.
S6	The student stated that a recent illness affected their ability to complete tasks on time and asked about make-up opportunities.
S7	The student explained they felt demotivated after consecutive low grades but are willing to try suggested learning strategies to improve.
S10	The student mentioned technical problems submitting assignments and asked for additional explanations on how to use the platform correctly.

6.2.4.2. Intervention 2: Week 11

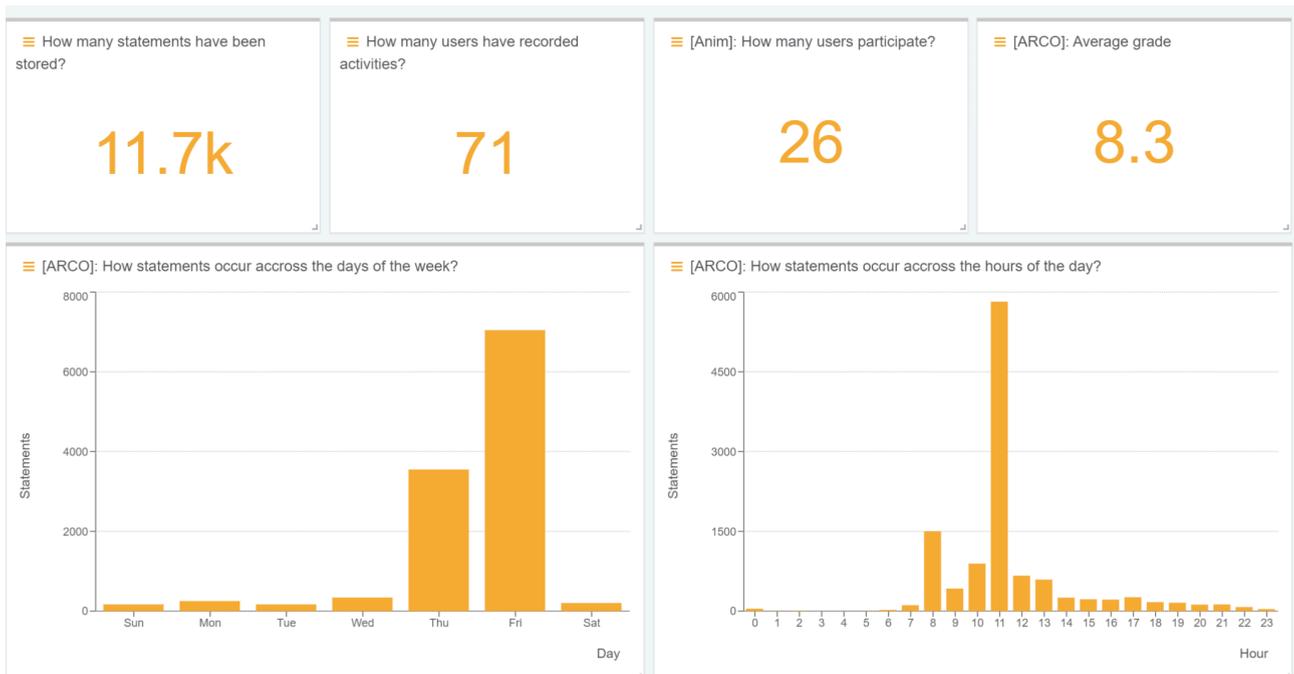


Fig 70. - Dashboard overview of the course in Week 11

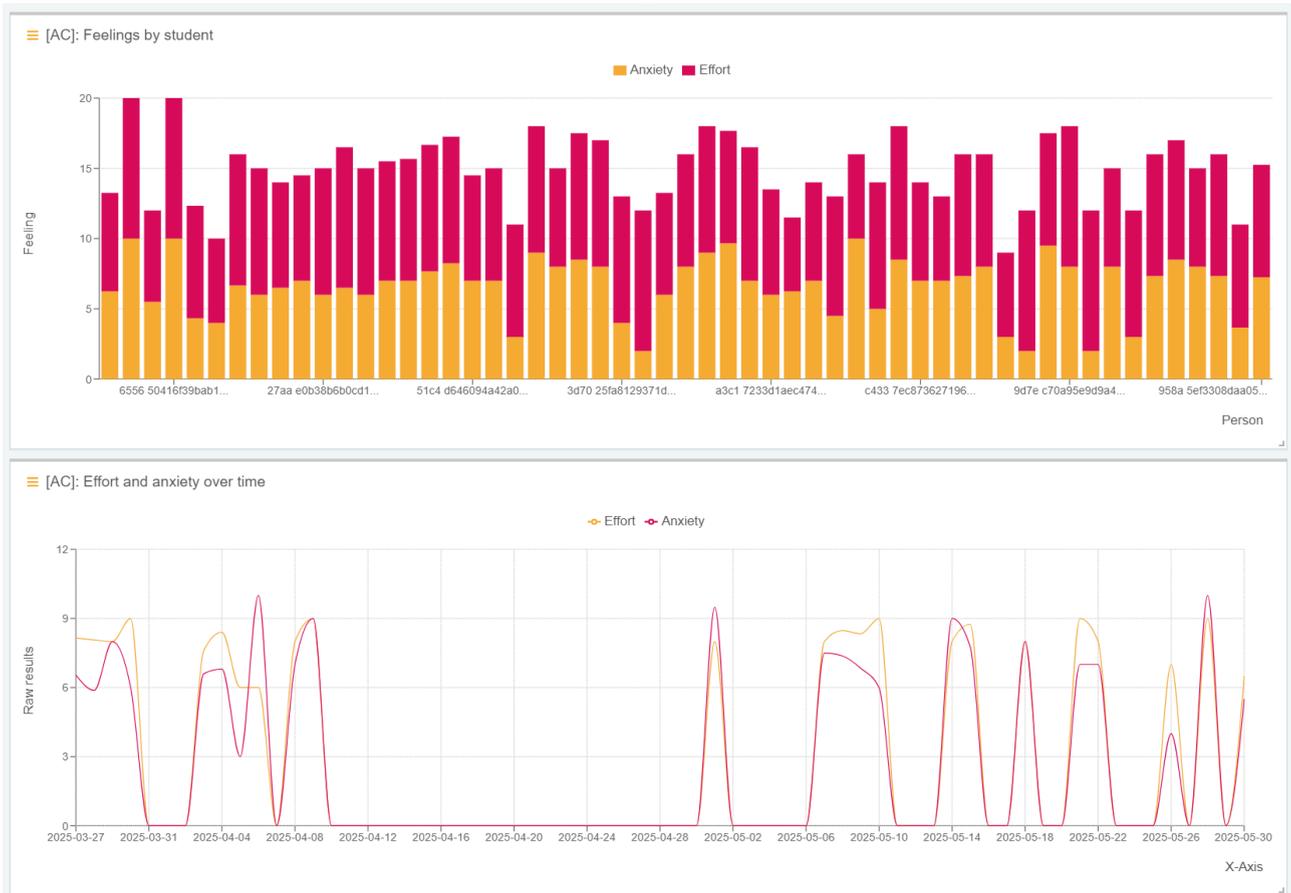


Fig 71. - Dashboard overview of the course in Week 11

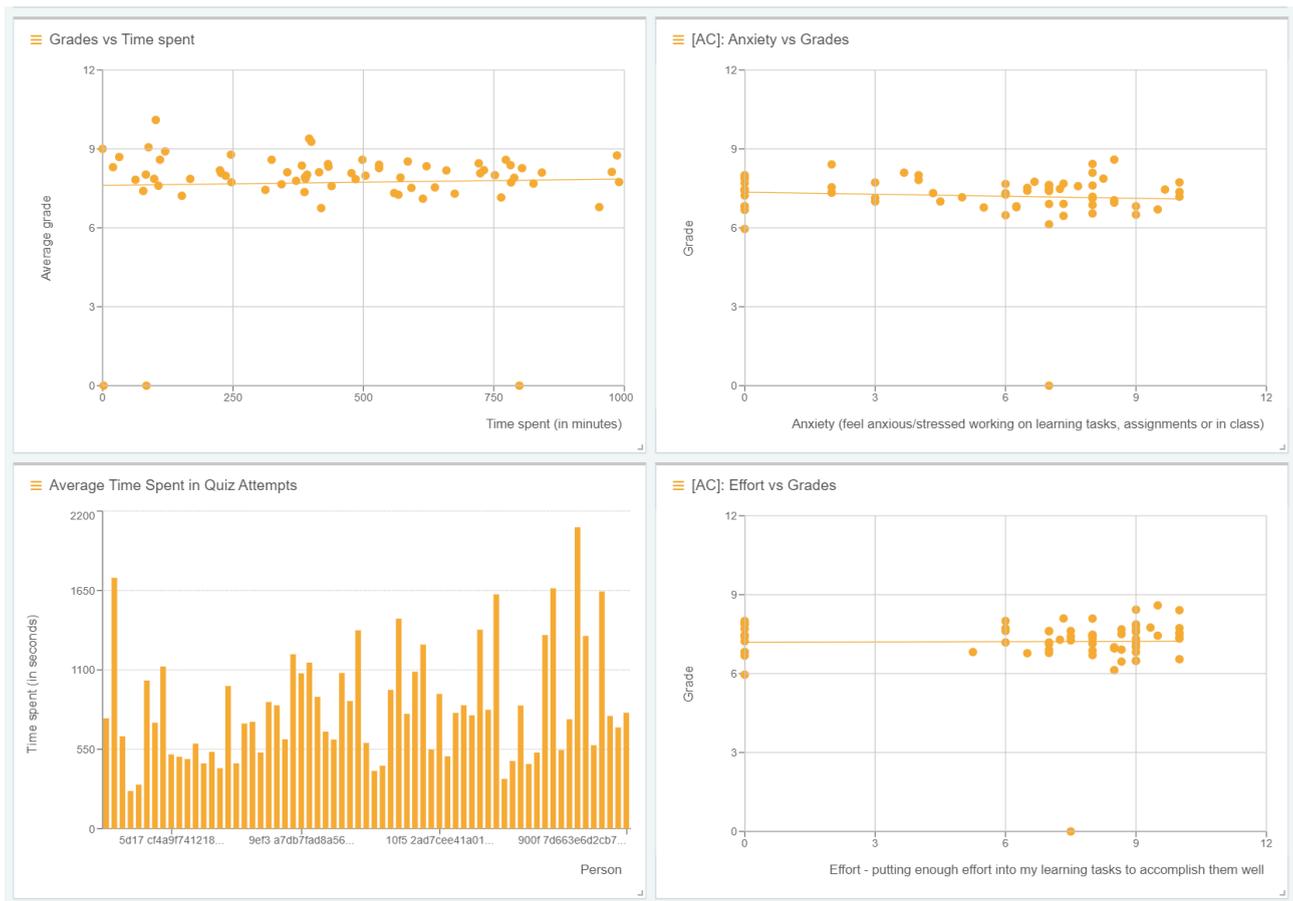


Fig 72. - Dashboard overview of the course in Week 11

Table 25. – Students intervention info

Student	Intervention Description	Intervention Needed
S1	Student consistently performs with high grades; no intervention required.	NO
S2	Student demonstrates moderate activity; academic support recommended.	YES
S3	Student shows good progress but would benefit from motivational coaching.	YES
S4	Student demonstrates moderate activity; academic support recommended.	YES
S5	Student demonstrates moderate activity; academic support recommended.	YES
S6	Student shows good progress but would benefit from motivational coaching.	YES
S7	Student shows good progress but would benefit from motivational coaching.	YES
S8	Student shows good progress but would benefit from motivational coaching.	YES

Student	Intervention Description	Intervention Needed
S9	Student shows good progress but would benefit from motivational coaching.	YES
S10	Student shows good progress but would benefit from motivational coaching.	YES
S11	Student shows good progress but would benefit from motivational coaching.	YES
S12	Student shows good progress but would benefit from motivational coaching.	YES
S13	Student consistently performs with high grades; no intervention required.	NO
S14	Student consistently performs with high grades; no intervention required.	NO
S15	Student shows good progress but would benefit from motivational coaching.	YES
S16	Student consistently performs with high grades; no intervention required.	NO
S17	Student consistently performs with high grades; no intervention required.	NO
S18	Student consistently performs with high grades; no intervention required.	NO
S19	Student shows good progress but would benefit from motivational coaching.	YES
S20	Student consistently performs with high grades; no intervention required.	NO
S21	Student shows good progress but would benefit from motivational coaching.	YES
S22	Student shows good progress but would benefit from motivational coaching.	YES
S23	Student shows good progress but would benefit from motivational coaching.	YES
S24	Student consistently performs with high grades; no intervention required.	NO
S25	Student demonstrates moderate activity; academic support recommended.	YES
S26	Student demonstrates moderate activity; academic support recommended.	YES

During week 12, student interventions were conducted in person by reviewing the practical components of their coursework. These face-to-face sessions enabled instructors to provide

individualized feedback and guidance, encouraging students to strengthen their weaker areas and make targeted improvements. The hands-on approach fostered a constructive and motivating environment, helping students focus on practical skills and clarify any doubts directly related to their performance.

6.2.4.3. Additional team-focused interventions

Each item specifies a data trigger, the action, supporting artefacts, and the owner responsible for follow-through. Triggers use SRL entries, LMS traces, forum activity, and rubric outcomes.

A. Deadline anxiety & uneven workload across teams

- **Trigger:** ≥ 2 SRL entries reporting “high anxiety” within two weeks and at least one late submission in the team.
- **Action:** Two-stage deadlines for each deliverable: (1) Team Soft Lock 48h before due date for internal review; (2) Final Submission. Provide two team grace tokens (48h each) for the term, spent at the team’s discretion.
- **Artefacts:** One-page Team Sprint Plan (tasks/owners/week), simple checklist burn-down.
- **Owner:** Team coordinator (rotating), overseen by instructor/TAs.

B. Conceptual confusion about technical content

- **Trigger:** Forum/Discord clusters on the same topic or quiz items with $< 50\%$ success.
- **Action:** 10-minute micro-tutorials at the start of lab (recorded) plus peer clinics with rotating pair-programming across teams to diffuse expertise.
- **Artefacts:** Short annotated examples (blend files/scripts) and a FAQ/Recipe Bank in the LMS linked from Discord.
- **Owner:** Instructor curates; each team appoints a Knowledge Curator to keep the FAQ fresh.

C. Schedule constraints, extracurricular load, or illness

- **Trigger:** Missed activity followed by SRL notes citing time constraints or health.
- **Action:** Compassionate Extension Protocol with Buddy Handover: re-assign tasks using a handover template (state, files, next steps). Allow asynchronous contribution windows (e.g., time-shifted critiques/voice notes).
- **Artefacts:** Handover template; partial-credit rubric for handed-over tasks.
- **Owner:** Team initiates; instructor validates token/extension use.

D. Demotivation after low grades

- **Trigger:** Grade below cohort median and SRL indicating low motivation.
- **Action:** Rapid feed-forward loop: short Reflection & Plan unlocks a targeted re-attempt on one rubric dimension (not full re-grade). Teams open the next stand-up with a 5-minute “Win Walk” (each member shares one micro-success).

- **Artefacts:** Reflection template; rubric-dimension checklists.
- **Owner:** Student initiates; TA signs off scope.

E. Platform/submission friction

- **Trigger:** LMS logs show failed uploads/resubmissions or student reports of technical issues.
- **Action:** Submission Sandbox (dummy assignment open all term) + Pre-flight Checklist (naming, formats, render settings). Offer twice-weekly 20-minute “tech office hours.”
- **Artefacts:** 2-minute screencast on export/upload; pinned checklist (LMS + Discord).
- **Owner:** TA team.

F. Team-process scaffolding across the course

- **Trigger:** Heterogeneous engagement within a team (e.g., one high performer + low-activity peers).
- **Action:** Lightweight Team Operating System: Weekly 10-minute stand-up (yesterday/today/blocked), Rotating roles (Coordinator, QA, Curator, Presenter), End-of-week Retro with “Start/Stop/Continue” + “One ask for help.”
- **Artefacts:** One-page Team Contract; Retro notes submitted to LMS (count as participation).
- **Owner:** Teams; instructor samples Retro notes to spot risk.

G. Analytics-driven nudges

- **Trigger:** Any of: no LMS activity for 5 days; missing SRL for 2 weeks; repeated late Soft Locks.
- **Action:** Automated just-in-time nudges to the student and the team coordinator, linking the relevant micro-tutorial or checklist.
- **Artefacts:** Nudge message bank (supportive tone); dashboard tiles per team showing “risk flags” and “next recommended action.”
- **Owner:** Instructor/LA dashboard.

6.2.5. Conclusion

The pilot implementation of the “Computer Animation” course at the University of León revealed substantial variation in student engagement and performance over the semester. While many students progressed steadily through regular participation, a sizable subset struggled with pacing and timely submissions, producing uneven learning outcomes across teams.

The course design leveraged early learning-analytics signals and self-regulated learning (SRL) data to differentiate support. Initial actions—ranging from group-wide guidance to personalized emails and, in Week 12, face-to-face practical reviews—proved valuable in clarifying expectations, addressing anxiety, and helping students target weak areas. Building on Week-6 responses and the

realities of team-based work, the intervention set was expanded to include team-process scaffolds (stand-ups, rotating roles, short retros), two-stage deadlines with limited grace tokens, micro-tutorials and peer clinics for difficult concepts, a Compassionate Extension Protocol with Buddy Handover, rapid feed-forward re-attempts on specific rubric dimensions after low grades, and a submission sandbox with a pre-flight checklist.

Together, these measures connect concrete analytics triggers (inactivity, repeated anxiety reports, rubric weaknesses, and upload failures) to transparent, lightweight responses at both individual and team levels. The observed effects were positive: platform activity rose, on-time submission rates improved, and most students showed noticeable gains in animation skills and collaborative practices.

Despite these gains, a minority of students continued to face organizational or motivational barriers. This underscores the importance of maintaining a flexible toolkit of interventions, ensuring equitable access to support, and continuing to normalize transparent team processes (e.g., short stand-ups and retros) that help distribute workload and surface blockers early.

Looking ahead, we recommend: (i) embedding simple, team-visible analytics tiles that signal risk and suggest next actions; (ii) retaining the two-stage deadline structure with limited tokens to reduce deadline-related anxiety; and (iii) monitoring the impact of each intervention on both individual proficiency and team artefact quality. Overall, systematic monitoring via learning analytics—combined with adaptive, team-aware interventions—appears to enhance engagement, equity within teams, and the quality of learning outcomes in a highly practical course such as computer animation.