Effectiveness of the conducted piloting (WP5)

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

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Abstract	This report evaluates the effectiveness of the conducted piloting across ISILA partner institutions. The piloting confirms the value of integrating SRL and learning analytics into a structured intervention model with multiple breakpoints and provides suggestions for strengthening the ISILA guidelines developed in WP3.
Keywords	Learning Analytics, Interventions, Student Learning, Teacher Support, Dashboards

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1. Introduction

This report presents a synthesis and evaluation of the effectiveness of the interventions based on learning analytics piloted across the ISILA project partner institutions. The pilots were conducted across a variety of courses, learning modalities, student populations, and national contexts. Institutions tested the ISILA intervention framework, which integrates behavioral learning analytics, self-regulated learning (SRL) insights, teacher dashboards, and tiered intervention strategies. The goal of the pilots was to determine ISILA’s framework's ability to improve student engagement, learning processes, and learning outcomes.

Across institutions, all participating teams applied the intervention guidelines defined in WP3 to real course settings and collected evidence on its impact. The results provide an understanding of how students respond to data-informed pedagogical support, how teachers use analytics to guide decision-making, and how contextual factors shape the effectiveness of interventions. This report synthesizes these insights to determine the overall success of the piloting and to identify implications for refining the ISILA intervention guidelines.

2. Overview of the Piloting Approach

Each institution collected data from their respective learning management systems. Data sources include:

- Behavioral learning logs from LMSs (Canvas, LAMS, Moodle),
- Weekly SRL surveys capturing motivation, anxiety, time management, effort, help-seeking,
- Assignment submissions, quiz attempts, attendance records,
- Optional student feedback.

These data were processed through xAPI-compatible converters (csv2xapi) and stored in local learning record stores, enabling the construction of dashboards. The dashboards visualized temporal engagement patterns, activity levels, performance indicators, access to learning resources, and distributions of SRL answers. During the semester, teachers used these dashboards to identify emerging issues, detect at-risk students, and choose appropriate interventions. These dashboards served as the basis for identifying patterns, detecting at-risk students, and tailoring interventions.

The interventions included both general and individualized actions. General interventions involved:

- Extra teaching sessions
- Group consultations
- Deadline reminders
- Release of additional learning materials
- Practice tools (e.g., coding platforms, anxiety-reduction games)

Individual interventions consisted of highly personalized messages or meetings tailored to specific student profiles, including students showing no activity, late starters, students with high anxiety, low-performing but highly motivated students, or students with good performance but poor emotional well-being. These interventions were delivered multiple times during the semester, typically during early weeks, mid-term, and especially during the final weeks.

3. Findings on the Effectiveness of the Piloted Interventions

Across institutions, distinct patterns of responsiveness emerged:

- Students who were somewhat active but falling behind
- High-anxiety students who needed reassurance
- Late starters with good SRL but limited early engagement
- Students with no activity for extended periods
- Students who ignored or never read emails
- Students with poor SRL and low perceived self-efficacy

Despite multiple personalized interventions, a subset of students remained disengaged, indicating that analytics alone cannot reach every learner; some require institutional-level support or policy changes.

3.1 Impact on Student Engagement

Across almost all courses, interventions produced measurable increases in student activity, especially following personalized emails combined with additional teaching sessions. Observations:

- Activity peaks occurred immediately after mid-semester and interventions during the final weeks.
- Students who were partially active but lagging often re-engaged quickly after targeted support.
- In some courses, submission numbers increased after interventions during the final weeks (e.g., Web Development course: increase from 904 to 1,200 statements processed; rise in average grade from 2.3 to 3).
- Courses with repeated interventions saw fewer inactive students by the end of the semester compared to earlier weeks.

While general interventions generated noticeable bursts of activity, the evidence indicates that personalized messages were the most powerful mechanism for re-engagement. Students responded to the sense of personal attention and often appreciated the teacher’s awareness of their individual challenges, which encouraged them to resume their learning

3.2 Impact on Student Performance

The piloting showed that interventions contributed to improvements in summative and formative performance, particularly for students with:

1. Poor early performance but strong SRL skills
2. High anxiety but good working habits
3. Late engagement
4. External constraints limiting attendance

Performance improvements included higher assignment completion rates, increased quiz attempts, and overall grade increments. In several courses, students who had not engaged in early quizzes or preparatory activities began completing them after personalized support. Teachers observed that analytics-based communication is an opportunity for improvement and is better than surveillance when it comes to motivating students. Moreover, interventions during the final weeks engaged students to complete assignments they had previously ignored, improving both their continuous assessment scores and their final outcomes.

3.3 Effects on Self-Regulated Learning and Emotional Support

A key insight from the piloting is that SRL data proved useful in understanding students’ emotional and motivational states. Behavioral data alone could not explain why certain students were inactive or inconsistent. SRL indicators revealed patterns that strongly shaped the effectiveness of interventions. Students who reported high anxiety consistently responded better to supportive, empathetic communication than to standard reminders. Even students with strong overall performance sometimes needed reassurance and emotional validation to sustain their engagement.

An important finding was that students rarely disclosed emotional difficulties unprompted. However, their SRL profiles, especially combinations such as high anxiety with high effort, or low motivation with poor time management, enabled teachers to tailor interventions with far greater precision. Students with low motivation or weak help-seeking behaviors required multiple follow-ups and benefited from repeated scaffolding. SRL insights also helped differentiate between

students affected by external circumstances and those struggling primarily due to internal academic or emotional issues.

3.4 Other findings

Apart from impacts on student engagement, performance, and effects on SRL and emotional support, the pilots highlighted that contextual factors can shape engagement and responsiveness. The Serbian case, in particular, demonstrated how external disruptions can significantly affect learning behavior. Student protests, unreliable public transportation, and institutional policies that did not penalize non-attendance or late submissions contributed to very low engagement during the early and mid-semester weeks. Many students began active study only at the end of the semester, which meant that interventions delivered earlier had a limited effect. However, the interventions in the final weeks of the semester were markedly more effective. When students finally had the opportunity and motivation to re-engage, personalized support combined with flexible teaching arrangements produced rapid increases in activity and coursework completion. This scenario highlighted that learning analytics must be interpreted within the broader socio-institutional environment and that intervention strategies must be adapted to contextual realities.

4. Recommendations for Future Iterations

Based on the lessons learned from the piloting, several key recommendations emerge for future development and refinement of the intervention methodology:

1. Integrate SRL data as a standard component of interventions.
2. Adopt a tiered, intervention structure with multiple breakpoints during the semester.
3. Design dashboards with minimal, actionable indicators.
4. Develop stronger strategies for non-responsive students, potentially involving advisors or program-level policies.

First, SRL data should become a standard component of all LA-based interventions. The pilots showed that behavioral data alone cannot explain why students disengage or underperform; emotional, motivational, and self-management indicators are essential for tailoring support. Integrating SRL surveys systematically into the course structure and providing clear benefits to students can enhance the quality of interventions and improve student participation.

Second, intervention planning should adopt a tiered structure with multiple breakpoints during the semester. Interventions work best when they are not

occasional or reactive but instead structured as follows: early reminders and guidance, mid-semester check-ins combined with additional learning opportunities, and re-engagement activities that help students complete outstanding work in the final weeks of the semester.

Third, dashboards should be redesigned to emphasize a small set of actionable indicators. Teachers consistently found that simpler dashboards improved their ability to interpret data and take timely action. Clear visualisations of activity, deadlines, key performance markers, and selected SRL dimensions are more valuable than an abundance of metrics that require extensive interpretation. Streamlined dashboards also could reduce the cognitive load on teachers, making it easier to integrate analytics into everyday teaching practice.

Fourth, stronger strategies are needed for students who repeatedly do not respond to outreach. Since a subset of students remained disengaged despite multiple targeted attempts, future guidelines should involve broader institutional mechanisms such as advisor involvement, automated early-warning systems or policy-based interventions. Course-level analytics can identify these students early, but sustained support requires collaboration beyond individual instructors.

To adjust the phases in the teacher inquiry process:

1. In **Phase 1 (Why) -** include “contextual constraints” as part of purpose formulation

   Encourage teachers to explicitly note external factors (political unrest, transportation, overlapping exam periods, institutional policies) that may affect engagement and should shape intervention goals.

2. In **Phase 2 (What)** - make SRL data an explicit part of the “what”

   Recommend to include a guided checkpoint that helps teachers assess whether the data they want is actually attainable. The pilots highlighted that data availability is not simply a technical issue but also depends on student consent, institutional policy, and tool capability.

3. In **Phase 3 (So What)** - integrate “student profiles”

   Based on pilots, propose a simple, reusable profiling schema:

   - P1: No activity / dropout risk
   - P2: Average activity, no SRL data
   - P3: Late starter and high anxiety
   - P4: Below-average performance and high SRL
   - P5: High performance and high anxiety

- P6: Fully active, high performance, high SRL (no intervention needed)

If possible, map collected data into these profiles as a practical step before choosing intervention types.

4. In **Phase4 (Now What)** -embed the tiered and iterative intervention logic

   The piloting demonstrated that single, isolated interventions are insufficient. The “Now What” phase should be redefined to emphasise tiered, intervention planning in multiple breakpoints as the default approach. Teachers should plan interventions early, mid-semester, and late in the term, each breakpoint informed by updated analytics and student profiles.

5. Conclusion

The piloting across ISILA institutions provides compelling evidence that learning analytics with SRL can significantly enhance teaching and learning in higher education. The effectiveness of the piloting lies not only in the improvements in engagement and performance but also in the practical understanding gained about student behavior, teacher decision-making, and contextual factors.

These findings offer suggestions to refine and strengthen the WP3 ISILA Guidelines, moving them from a conceptual model toward a proven, operational, and adaptable framework for data-informed teaching practice.