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Integrating Dialogic Agents in Student Self-Regulation Dashboards

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Abstract: The integration of artificial intelligence (AI) and Learning Dashboards has opened new possibilities for supporting personalised and self-regulated learning (SRL). Zimmerman's (2008) model of SRL, which outlines the phases of forethought, performance, and self-reflection, provides a useful framework for guiding the design of student-facing dashboards. Key features such as goal-setting, progress monitoring, and reflective evaluation can be effectively supported through learning analytics dashboards. However, the effectiveness of these tools relies on thoughtful design that aligns with SRL processes rather than simply presenting data. This paper proposes a hybrid dashboard model that integrates learning analytics visualizations with dialogic agents to scaffold metacognitive processes following an SRL model. Alongside this framework, we identify three core design principles for metacognitive awareness, transparent and dialogic engagement with learning data, and for reflective feedback across time. Dialogic agents play a crucial role in interpreting learning traces, initiating reflective conversations, and fostering goal-setting, monitoring, and evaluation. This conversational layer makes learning behaviors visible and meaningful, enhancing both learner trust and engagement. We also highlight how transparent visual feedback, when paired with personalized guidance, can empower students to make informed decisions about their learning. While this work is conceptual, it lays the groundwork for developing evidence-based, trustworthy analytics systems that actively promote student agency.

Keywords: Self-Regulated Learning, Learning Analytics Dashboards, Dialogic Agents, AI in Education, Personalised Learning

1. Introduction

Artificial intelligence and smart learning environments present opportunities for transforming education by enabling personalized and adaptive learning experiences. This shift challenges traditional instructional design, emphasizing data-driven approaches that incorporate real-time feedback and adaptive technologies. Learning analytics (LA) dashboards support this by offering students insights into their progress and strategies for improvement. However, their effectiveness depends on thoughtful design, usability, and alignment with self-regulation frameworks (Kia et al., 2020).

Integrating dialogic agents (DA) into student-facing dashboards can enhance their effectiveness by engaging learners in personalized dialogues that prompt reflection and support deeper understanding of their strengths, challenges, and strategies for improvement (Klímová & Seraj, 2023). The data from these conversations can inform instructional design. This combination of dashboards and dialogic agents can improve self-regulated learning. This paper proposes a framework for dashboards that use both visual analytics and dialogic agents to support self-regulated learning. It reviews dashboards and self-regulated learning, emphasizing their role in promoting student agency. The paper then introduces a hybrid framework grounded in the Zimmerman (2008) SRL model, followed by a set of design principles that promote metacognitive awareness, transparent and dialogic engagement with learning data and reflective feedback. The paper concludes with implications and future work. This paper lays a foundation for developing learning analytics systems that support student learning and agency.

2. Self-Regulation Learning Framework and Student Facing Dashboard Design

Zimmerman's (2008) cyclical self-regulation model offers an optimal balance of theoretical rigor and practical applicability, providing clear entry points for feedback and intervention within digital learning tools. Zimmerman's three-phase SRL model, planning, performance, and reflection can be effectively scaffolded by dashboards offering goal-setting, strategy selection, monitoring, and evaluation tools. Open Learner Models exemplify this scaffolding by providing real-time feedback to support strategy adaptation, however Vreugd (2024) discussed such feedback only leads to meaningful behavioural change when students actively engage with it. While leaderboards may enhance engagement, their effect on intrinsic self-regulation remains ambiguous whereas embedding dialogic agents offer pedagogically grounded scaffolds that improve data interpretation, goal setting, strategy deployment, and reflection (Jin et al., 2025).

3. A Proposed Framework for Hybrid Dashboards with Dialogic Agents to Support SRL

This section outlines a framework for designing student-facing dashboard that seamlessly integrates learning analytics with dialogic agents to scaffold self-regulated learning. Through combined visual analytics and personalized conversational support, students can monitor their progress, reflect on challenges, and engage the agent in targeted dialogue to diagnose difficulties and receive tailored improvement strategies.

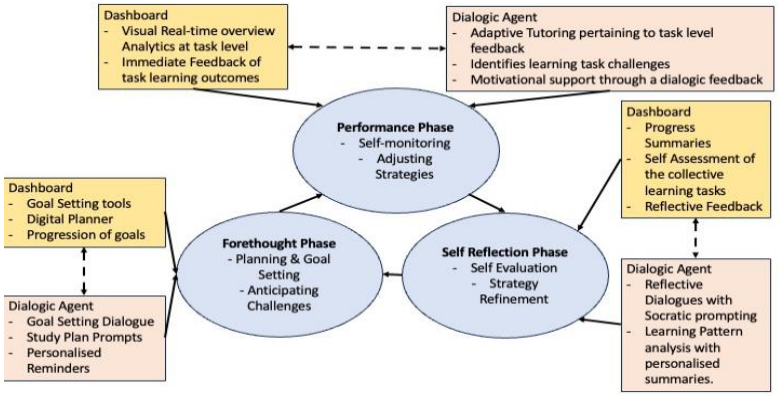

Fig. 1. Framework of a student facing dashboard with integration of LA and DA [Enlarge Fig.1]

The hybrid design supports more informed instructional decisions by offering teachers valuable insights into students' learning behaviours and preferences. To be effective, dialogic agent feedback must be closely aligned with students' goals and the underlying processes of self-regulation. The incorporation of dialogic agents to support the 'learning-by-teaching' where the agent receives instructions from students could enhance student's learning.

4. Design Principles for Hybrid Self-Regulation Student Facing Dashboards

To translate the proposed framework into practical application, it is essential to establish design principles that guide the development of hybrid dashboards aligned with self-regulated learning processes.

4.1 Design for Metacognitive Awareness

To support student self-regulated learning effectively, dashboards must be made to support thinking about their own learning in three steps. First, students set goals using tools and planners. Agents help by reminding them to plan. Second, students get feedback as they work, helping them watch their progress and change how they learn. Agents guide them to find and fix problems. Third, students look back at their work using summaries and questions from

agents. This helps them see what worked and use those ideas in the future, making learning a habit.

4.2 Design for Transparent and Dialogic Engagement with Learning Data

Transparent dashboards that elucidate data provenance and interpretation cultivate students' metacognitive awareness, fostering trust and deeper self-evaluation of their learning processes. When data is presented in interpretable friendly format such as progress summaries, students are better able to connect their actions with learning goals. Making learning traces like skipped learning activities visible helps students reflect on their habits across self-regulated learning phases. Trust, fostered by transparent data collection, interpretation processes and allowing students control over display parameters, is fundamental to meaningful dashboard use, as it enhances ownership, engagement, and self-regulatory capacity.

4.3 Design for Reflective Feedback Across Time

Effective self-regulated learning depends on timely feedback and longitudinal student's learning insight, so dashboards should integrate reflective feedback with temporal visualisations that reveal students' growth trajectories, struggle patterns, and behavior shifts, thereby fostering trust and understanding of their learning behaviours. Embedding dialogic agents enhances this design by prompting personalized reflection, translating behavioral cues into adaptive scaffolds, and guiding ongoing strategy refinement.

5. Conclusions, Limitations and Future Work

This paper proposes a design-principled framework for hybrid student-facing dashboards that integrate learning analytics with dialogic agents to support self-regulated learning. Grounded in Zimmerman's (2008) cyclical SRL model, the framework demonstrates how transparent data visualizations and reflective feedback can scaffold planning, monitoring, and reflection over time. Although this hybrid approach offers a promising pathway to adaptive, trustworthy, and student-centered learning analytics, it remains unvalidated in practice and faces challenges in agent personalization, natural language understanding, and trust building. Future work will involve participatory design sessions with students and teachers, iterative testing to evaluate effects on engagement and self-regulatory behaviors, and interdisciplinary collaboration to ensure ethical, inclusive, and scientifically grounded development.

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