A TWO-TIER ADAPTIVE QUESTION-GENERATION FRAMEWORK FOR LONGITUDINAL SELF-DIRECTED LEARNING

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Abstract. The efficacy of self-directed learning (SDL) is limited by a lack of continuous feedback, as most automated question-generation tools are single-session and fail to adapt to a learner’s evolving knowledge. We introduce a two-tier adaptive question-generation framework that extends our previously published hierarchical context retrieval model [1] into a continuous, multi-session learning cycle.

Intra-session adaptation adjusts question difficulty based on real-time performance, while our core innovation, inter-session adaptation, builds a diagnostic proficiency map after each session. This map, which updates topic weights based on item-level outcomes, is used to select instructional content and question contexts for future sessions: remediating weak areas and reinforcing mastered concepts for retention.

A small formative pilot (N≈5) is underway to evaluate feasibility, instrumentation reliability, and error patterns across several adaptive cycles. Results are preliminary but suggest the system’s capacity to track learner mastery and inform future sessions.

This work contributes a formal longitudinal question-generation framework integrating hierarchical retrieval with dynamic diagnostic feedback.

It explicitly aligns with Zimmerman's self-regulation cycle – supporting forethought through diagnostic goal-setting, performance via real-time self-monitoring, and self-reflection with end-of-session proficiency maps [2] – to better support multi-session SDL.

Key Words: *self-directed learning, self-regulated learning, adaptive assessment, diagnostic feedback, longitudinal learning support*

Acknowledgments

This study is supported by the project SP25-FMI-008 "Research and implementation of modern language models and artificial neural networks for automated processing, forecasting, and structuring of data and texts in specific application domains" at the Plovdiv University "Paisii Hilendarski".

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