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Beyond the LMS: Algorithmic Personalization Engine Performance-Driven Learner Profiling and Dynamic Pathway Regeneration

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Abstract

Introduces a performance-driven personalization engine that operates independently of any specific Learning Management System. Its innovation lies in decoupling the algorithmic decision layer from the platform that delivers content, activities, assessments, and communication. At the start of a course, the engine combines a multidimensional learner profile with the approved curriculum, learning objectives, assessment requirements, pedagogical principles, and available learning resources to construct an initial individual pathway. The pathway is not treated as a fixed recommendation. During learning, each interaction feeds an iterative decision cycle, ensuring continuous adaptation. The engine analyzes achievement, pace, engagement, knowledge gaps, task completion, demonstrated competencies, learning barriers, collaboration patterns, preferred resource formats, and responses to previous interventions. These signals are used to iteratively update the learner profile and recalibrate pathway components, including sequence, difficulty, pacing, practice, resources, collaboration, and support. The resulting profile is designed to evolve longitudinally across subjects, courses, and learning settings, creating a persistent diagnostic basis for future personalization. This architecture enables organizations to retain their existing LMS while adding an independent adaptive intelligence mechanism that can scale across educational and professional contexts. Rather than replacing the teacher, lecturer, or trainer, it shifts routine adaptation to the system while preserving human judgment, mentoring, and pedagogical oversight.

Keywords: Personalized Learning; Adaptive Sequencing; Learner Analytics; Longitudinal Diagnostics; System Interoperability