Enhancing Aviation Training Through Micro Learning and Large Language Models: A Bayesian Network Approach

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Abstract:

The rapid evolution of distance learning is transforming aviation training, driven by technological advancements and shifting learner needs. This paper examines the integration of micro learning with large language models (LLMs) and Bayesian Networks to enhance the personalization and effectiveness of distance learning for aviation training. Micro learning, characterized by short, focused learning modules, is gaining traction for its efficiency and ability to boost learner retention.

This study investigates the application of LLMs and Bayesian Networks in optimizing micro learning for Private Pilot License (PPL(A)) training, which includes extensive theoretical and practical components. Flight instructors often lack detailed insights into each student's progress, leading to inefficiencies. We propose that personalized micro lessons, powered by LLMs and informed by Bayesian Networks, can significantly improve training outcomes by ensuring thorough preparation for both students and instructors, thus reducing redundant or canceled flight lessons.

Bayesian Networks will be used to model and predict relationships between learning segments, student performance, and instructional strategies. This approach provides a probabilistic framework that dynamically tailors the learning experience based on real-time data. LLMs enhance distance learning in pilot training by facilitating seamless communication between students and instructors, scheduling lessons, delivering personalized content, and assessing knowledge levels. This digital support is crucial in aviation, where every grounded flight lesson incurs financial losses for Approved Training Organizations (ATOs). Additionally, students often require refresher content during practical training phases.

We review current literature on distance learning, micro learning, Bayesian Networks, and LLMs in education, presenting a framework for integrating these technologies into aviation training. Through case studies, we demonstrate the practical implementation of LLM-driven micro learning and Bayesian Network analysis in PPL(A) training, comparing its effectiveness with traditional methods.

Our results indicate that combining Bayesian Networks with LLM-enhanced micro learning significantly improves learner engagement, knowledge retention, and training efficiency. We discuss the benefits, challenges, and potential of this approach, providing valuable insights for flight instructors, students, and ATOs. Key findings suggest that well-prepared students and instructors can minimize unnecessary or repeated lessons, thereby enhancing the quality of each flight lesson.

Keywords:

Micro learning, Large Language Models (LLMs), Bayesian Networks, Aviation training, Distance learning.