EDUFLEX AN AI-POWERED TOOL FOR CREATING PERSONALIZED LEARNING MATERIALS

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Abstract

EduFlex is an AI-powered platform designed to revolutionize personalized learning by converting conventional lecture notes and academic materials into dynamic, adaptive study tools using Large Language Models (LLMs) and Retrieval-Augmented Generation (RAG). The system generates tailored flashcards, quizzes, and concise notes that align with individual learners' knowledge levels and progress, dynamically adjusting materials in real-time to ensure relevance and engagement unlike traditional e-learning platforms with static content. Developed using the Waterfall methodology, the project followed structured phases planning, analysis, design, implementation, testing, and documentation to ensure robustness, incorporating key features like an interactive AI chatbot for instant clarification, dynamic content generation, and real-time feedback within an intuitive interface. Usability testing with university students showed 100% functionality, with high satisfaction in ease of use, utility, and engagement. EduFlex addresses gaps in current e-learning systems by offering AI-driven personalization, mobile-friendly access, and multilingual support, demonstrating significant potential to enhance learning outcomes through adaptive study aids. Future improvements may include gamification, enhanced UI/UX, and broader language support to boost accessibility and retention. By merging advanced AI with practical educational tools, EduFlex sets a new standard for personalized, scalable learning solutions, benefiting students, educators, and lifelong learners.

Keywords*: Artificial Intelligence, Personalized Learning Material, Web Application, Usability Testing, Adaptive Learning* .

1. Introduction

EduFlex represents an innovative AI-powered learning platform that transforms traditional educational materials into personalized study tools using advanced Large Language Models (LLMs) and Retrieval-Augmented Generation (RAG) technology (Yang & Wen, 2023). Addressing the critical limitations of current e-learning systems that offer static, one-size-fits-all content (Khan & Ghasempour, 2024), EduFlex dynamically adapts learning materials like flashcards, quizzes, and notes to match each student's individual pace and comprehension level (Katiyar et al., 2024). By leveraging RAG-enhanced LLMs (Zhao et al., 2024), the system ensures content remains contextually relevant while providing educators with valuable performance insights (Katiyar et al., 2021). This research project aims to develop and evaluate this web-based tool, which promises to enhance engagement and knowledge retention (Ayeni et al., 2024) across both academic and professional training environments through its adaptive, AI-driven approach to personalized learning.

2. Methodology

This EduFlex was developed using the structured Waterfall mODEL methodology, proceeding sequentially through requirements analysis, system design, implementation, testing, and documentation. Requirements were derived from comprehensive literature reviews on AI in education and analysis of current e-learning systems. The system architecture was designed with data flow diagrams and ER models, utilizing Figma for user interface prototypes. Implementation employed a React frontend and Django backend, integrating LangChain and Google’s Gemini API for AI content generation, with SQLite managing data storage. Rigorous evaluation included functionality testing (100% success rate) and usability tests with 30 participants, resulting in an average SYSUSE rating of

1.63/7. These results demonstrated strong user acceptance of personalized learning features and reliable system performance, validating the technical approach and the methodology's effectiveness in meeting educational objectives.

3. Results / Findings

The evaluation of EduFlex focused on three dimensions: System Usefulness (SYSUSE), Information Quality (INFOQUAL), and Interface Quality (INTERQUAL). Participants reported high SYSUSE satisfaction, with 73.3% agreeing the platform improved learning efficiency and 83% confirming enhanced study productivity. INFOQUAL results were excellent, showing 92% accuracy in AI-generated content and 78% reduction in factual errors via the RAG system. For INTERQUAL, 80% found the dashboard intuitive. Functionality testing confirmed 100% operational reliability. These findings validate EduFlex's effectiveness in delivering personalized learning, with 87% of participants preferring it over traditional platforms, while identifying areas for interface optimization.

4. Novelty of Research

EduFlex is an innovative, AI-powered platform that uses Large Language Models (LLMs) and Retrieval-Augmented Generation (RAG) to transform academic materials into personalized learning experiences. Unlike static e-learning tools, EduFlex dynamically generates customized flashcards, quizzes, and concise notes in real-time, adapting to individual student needs and pace. It leverages the Gemini API and LangChain for accuracy, offering features like an interactive Q&A chatbot and multilingual support. With a user-friendly interface and proven 100% functionality, EduFlex bridges the gap between conventional and adaptive education, offering a scalable solution for personalized learning.

5. Conclusion or Future Work

EduFlex successfully demonstrates the potential of AI to revolutionize personalized learning. Future enhancements could include gamification elements, expanded multilingual support, and improved mobile optimization to further boost engagement. Additionally, integrating advanced analytics for real-time progress tracking and adaptive feedback will refine its effectiveness, ensuring broader applicability across diverse educational and professional contexts.

REFERENCE LIST

Khan, R., & Ghasempour, E. (2024). A Review of AI-Enhanced Personalized Learning Systems: Implications for the Learning Sciences. University of Toronto.

Katiyar, Prof. Dr. N., Awasthi, Mr. V. K., Pratap, Dr. R., Mishra, Mr. K., Shukla, Mr. N., singh, Mr. R., & Tiwari, Dr. M. (2024). Ai-Driven Personalized Learning Systems: Enhancing Educational Effectiveness. Educational Administration Theory and Practices. https://doi.org/10.53555/kuey.v30i5.4961

Wen, Q., Liang, J., Sierra, C., Luckin, R., Tong, R., Liu, Z., Cui, P., & Tang, J. (2024). AI for Education (AI4EDU): Advancing Personalized Education with LLM and Adaptive Learning. Proceedings of the ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, 6743–6744. https://doi.org/10.1145/3637528.3671498

Zhao, P., Zhang, H., Yu, Q., Wang, Z., Geng, Y., Fu, F., Yang, L., Zhang, W., & Cui, B. (2024). Retrieval-Augmented Generation for AI-Generated Content: A Survey. ArXiv, abs/2402.19473. https://doi.org/10.48550/arXiv.2402.19473