

CogniX: Constructive learning with an AI-based web App for open-ended question support

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CogniX is an artificial intelligence-powered web application designed to enhance university students' ability to answer open-ended questions effectively. Open-ended questions are crucial for developing critical thinking and analytical skills; however, many students struggle to provide responses that meet examiner expectations, particularly under exam stress and time constraints. This challenge significantly impacts academic performance and the development of essential skills including analysis, communication, and thought organization. This research addresses these challenges through a comprehensive AI-powered web application that provides real time, personalized feedback to improve students' open-ended question responses. The primary objective is to develop a system that enhances response quality by fostering critical thinking, aligning answers with exam standards, and promoting self-directed learning to ultimately improve academic performance. Unlike conventional AI chatbots that rely on single language models, CogniX uses a multi-agent AI system combining Chain of Thought, RAG, and self-reflection for smarter, context-aware reasoning. These agents collaboratively extract relevant data from uploaded notes, store information in a Chroma DB vector database, process questions and answers from PDF documents, generate contextually appropriate responses using provided materials, evaluate student answers, and deliver constructive feedback based on individual responses. CogniX's feedback closely aligns with that of human educators and also can see an improvement in student answer quality after using the system. Based on the feedback survey conducted using 30 university students and model comparisons, 93% of respondents agreed that CogniX accurately identified their weak points and provided clear, constructive suggestions. Additionally, CogniX demonstrated significantly higher performance when compared to single-model systems. CogniX not only addresses the gap in automated answer evaluation but also opens new opportunities for intelligent tutoring applications in educational environments, especially where human resources are limited. Future developments will incorporate more sophisticated AI agents, integrate Sinhala language support, and extend functionality to O/L and A/L ICT students.

Keywords: *Agentic flow, Vector database, LLM, Personalized feedback, RAG*