Arts Instructional Support & Information Technology (Arts ISIT)

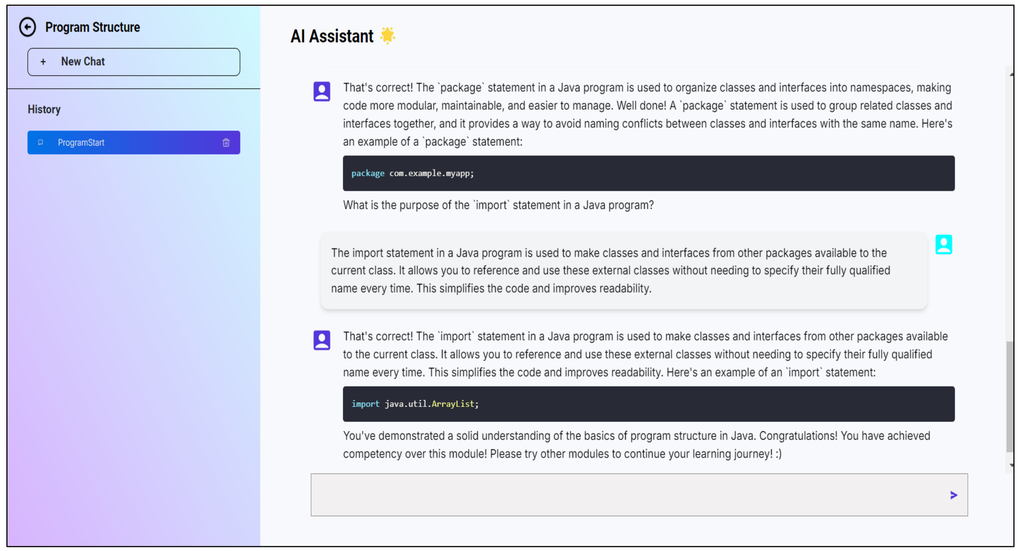
Cloud Innovation Center’s (CIC) AI Learning Assistant

Background and Introduction

The UBC Cloud Innovation Centre (CIC), in collaboration with the Centre for Teaching, Learning, and Technology (CTLT), has developed an **AI Learning Assistant** to support inclusive, personalized education through the power of large language models.

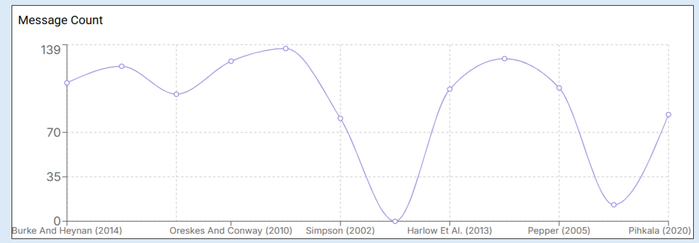
This AI-powered tool leverages a large language model (LLM) to provide continuous, tailored guidance for students beyond traditional classroom settings. Its conversational interface:

- Encourages active student engagement.
- Identifies knowledge gaps through interactive dialogue.
- Adapts responses to individual student needs.
- Enhances comprehension and critical thinking skills.



Pilot Study: Geography 423

The AI Learning Assistant was piloted (n=20) in **GEOG 423: Development of Environmental Thought**, a 4th-year seminar course in the UBC Department of Geography. Students engaged with the AI Learning Assistant for approximately 15-20 minutes every week.



Student Engagement with AI Learning Assistant

Key Features and Capabilities

The CIC AI Learning Assistant enhances student learning by combining personalized support with scalable, cloud-based technology. Specifically:

1. **Interactive Dialogue:** Engages students through conversational, question-and-answer interactions personalized to course content.
2. **Adaptive Knowledge Assessment:** Evaluates student responses to identify areas needing further reinforcement.
3. **RAG-Powered Responses:** Uses Retrieval-Augmented Generation to ground AI responses in curated course content for improved accuracy and relevance.
4. **Real-time Feedback and Progress Indicators:** Provides instant feedback with red/yellow/green indicators to show learning progress.
5. **Instructor Analytics Dashboard:** Allows instructors to manage prompts, track engagement, and review student performance trends.
6. **24/7 Web Accessibility:** Enables flexible, self-paced learning through a browser-based interface.
7. **Scalable Cloud Infrastructure:** Runs on a robust AWS serverless architecture (Amplify, Lambda, Amazon Bedrock with Llama 3) for high performance and reliability.
8. **Context-Aware Conversations:** The assistant retains previous interactions using conversation memory, allowing it to reference earlier responses and provide more coherent, personalized, and pedagogically relevant dialogue over time.

Technical Overview

The system is built on Amazon Web Services (AWS), providing the infrastructure for secure content delivery, user authentication, API management, data storage, and integration with generative AI tools. These components work together to support a responsive and scalable AI assistant for teaching and learning.

Security Layer
AWS WAF, CloudFront, and Shield provide protection, ensuring content delivery is secure and reliable.

Frontend Interface
The tool is accessed through an AWS Amplify-hosted web application, with user authentication managed via AWS Cognito.

API & Backend Logic
RESTful requests are routed through API Gateway to various Lambda functions, which manage tasks such as CRUD operations, conversation memory, and LLM responses.

Data Ingestion & Storage
Uploaded course materials are stored in Amazon S3, processed by Lambda functions, and stored in Amazon RDS.

Retrieval-Augmented Generation (RAG)
Before generating a response, the system performs a vector similarity search on the database to retrieve relevant content, grounding outputs in course-specific material.

Generative AI
Amazon Bedrock (hosting Meta’s Llama 3) processes queries and retrieved context, delivering tailored and coherent responses.

LLM Memory
Amazon DynamoDB tracks conversation history, enabling continuity in student interactions and context-aware responses.

Benefits and Challenges

Benefits:

- **Quick Setup for Instructors**: Initial setup was straightforward and took approximately 20 minutes, requiring little technical expertise.
- **Customizable Prompts**: Instructors could easily modify prompts to suit specific learning goals.
- **User-Friendly Interface**: Both instructors and students found the system intuitive and easy to navigate.
- **Enhanced Student Engagement**: Students showed increased engagement with course readings and classroom discussions.

Challenges:

- **Occasional Hallucinations**: Some students noted that the chatbot sometimes referenced content outside the relevant module.
- **Limited Critical Pushback**: Students wished the assistant would challenge their thinking more directly rather than affirming their responses.
- **Broader Ethical Concerns**: Students raised questions around AI ethics, including environmental impact and algorithmic bias. Importantly, provided an opportunity to discuss these issues as a class.

*We acknowledge that the land on which we gather, teach and learn is the traditional, ancestral, and unceded territory of the **xwməθkwəy̓əm** (Musqueam) People.*