

KG Tutor: An Instructor-curated LLM Tutor

TEAM

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Motivation & Solution

Existing AI tools are not domain-grounded, causing **inaccurate** or **inconsistent answers**. **Insufficient AI-integrated guidance** to help students navigate complex problems, such as CTF challenges.

Develop an AI tutoring system that combines **Knowledge Graphs** and **Retrieval-Augmented Generation (RAG)** to deliver accurate, and consistent responses for learners.

- Instructors curate knowledge graph
- Students interact with chatbot that uses curated knowledge base
- Responses are based on instructor-defined materials to ensure accuracy and consistency

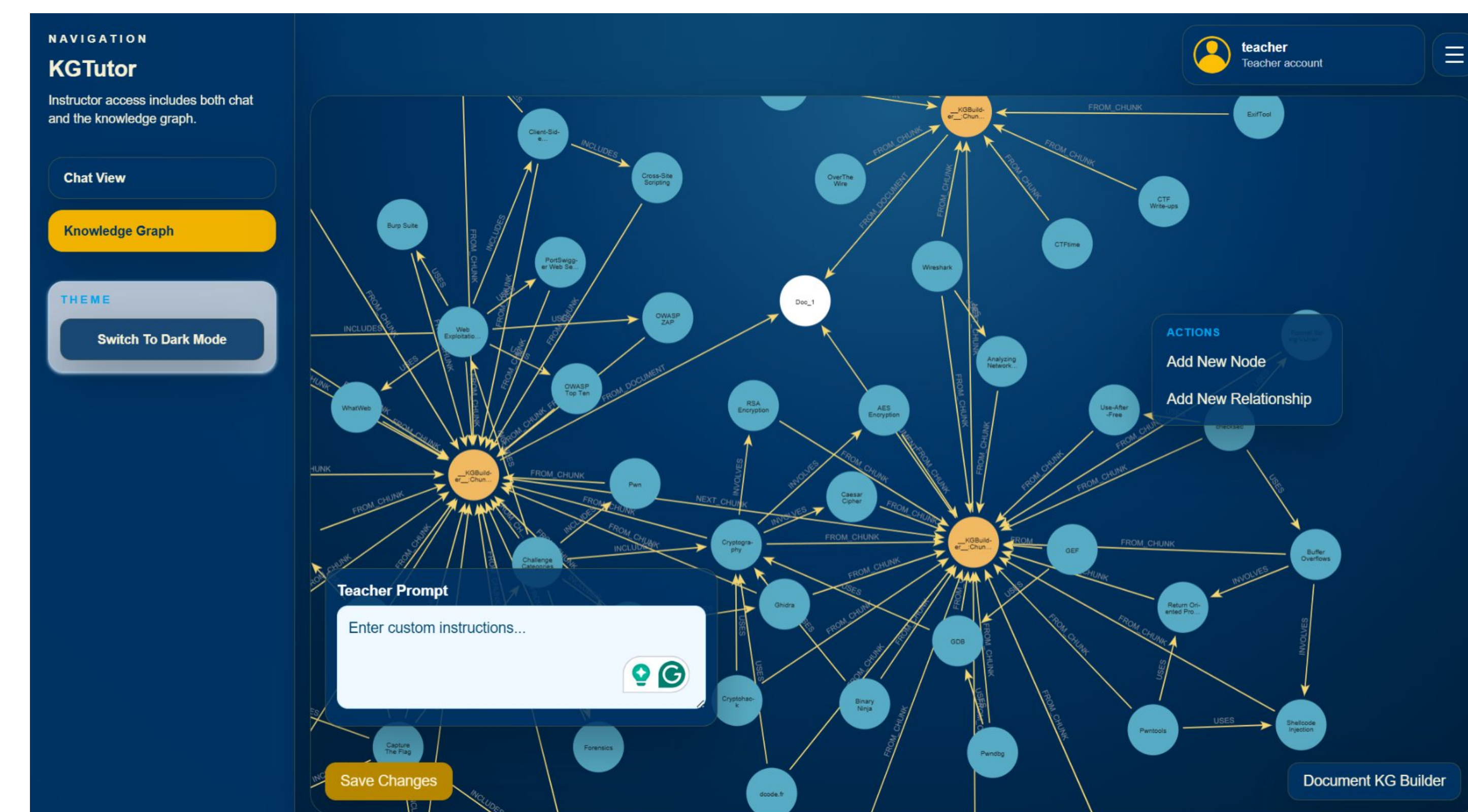
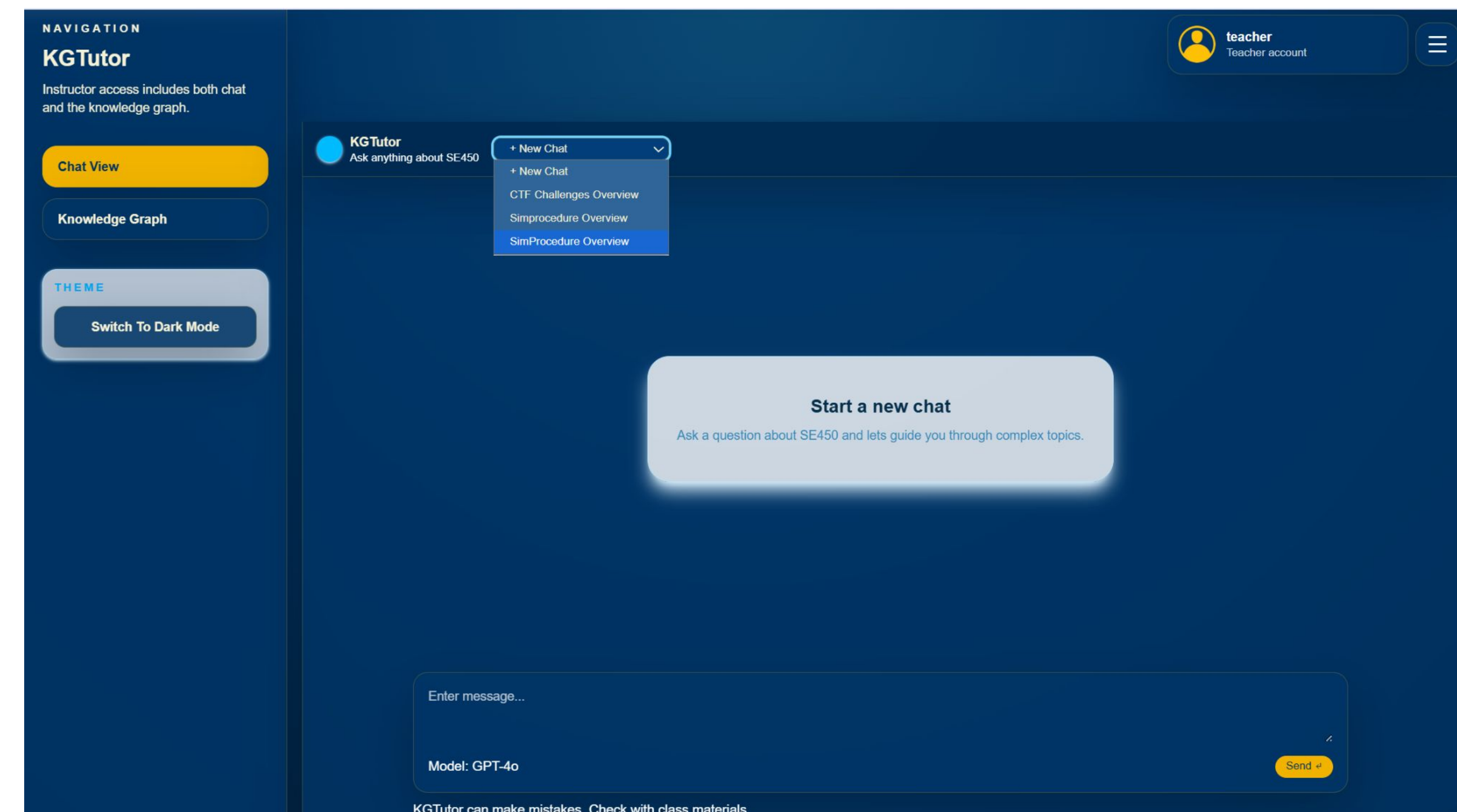
Technologies



Key Features

- **Chatbot Tutoring Agent:** Interactive AI tutor that generates course-aligned explanations
- **Domain-Specific Knowledge Graph:** Visual map that enables node editing and document import features for teacher curation.
- **Retrieval-Augmented Generation:** AI responses are based on class materials.
- **User Management System:** Database management and secure account creation for student and teachers.

Product Snapshot



Challenges

- **Security:** Prompt injection risks through input and validation layers
- **LLM Accuracy:** Hallucination free responses require RAG and prompt engineering
- **Scalability:** LLM and database hosting scale linearly with users
- **Neo4j:** Compatibility risks with database

Testing

- **Unit Testing:**
 - Backend validation using Pytest
 - Modules tested such as RAG pipeline, and knowledge graph retrieval
- **Integration:**
 - Ensure that main system features are tested
 - Test communication between frontend, backend, knowledge graph and database components
- **Usability:**
 - Students use chatbot for CTF challenges, and instructors validate knowledge graph
 - **Metrics:** task completion, errors, and effectiveness of responses
- **LLM:**
 - Responses manually scored based on accuracy, clarity, and helpfulness
 - Hallucination tracked and documented per response

Outcomes & Future Work

- Question templates and guided prompts to help students ask clarifying questions
- A feedback loop where students can rate explanations, helping to improve responses over time
- Concept tagging to help students locate related problems

