

Structural- knowledge Q&A

Users can ask structural questions to Ivy which relates to foundational theories, procedural steps to skill-learning.

Response Pathway^{4,5}

Step 1: Load relevant TMK files that encapsulate the queried problem or skill.

Step 2: Classify user's question into Task/Method/Knowledge/Multi-model/Can't Answer categories.

Step 3: Retrieve the highest matching Task, Method and Knowledge modules from the TMK model based on user's query.

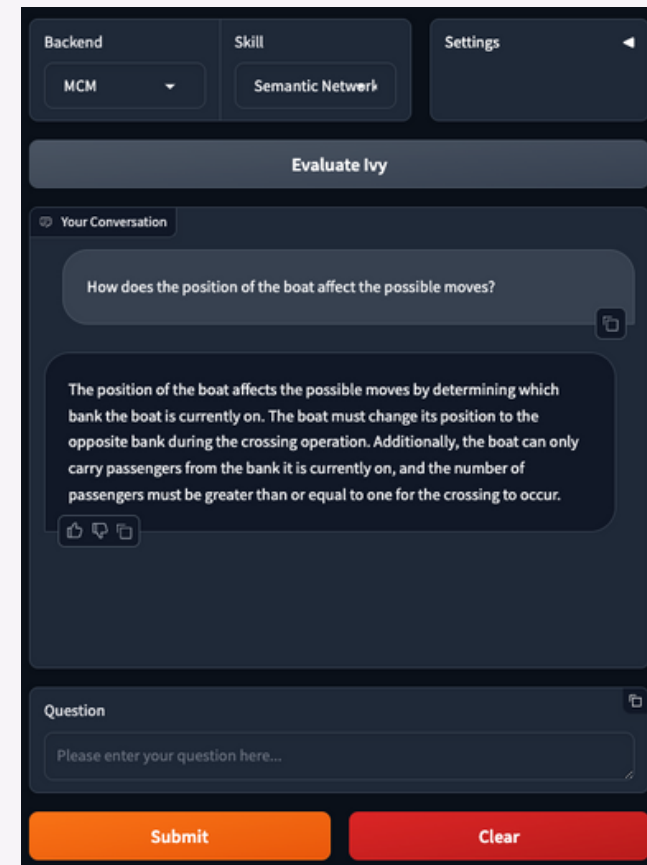
Step 4: Generate a response by processing through a series of GenAI steps, including LangChain, Chain-of-Thought, and prompt engineering.

Acknowledgements



References

1. Madhusudana R. et al. (2024) Integrating Cognitive AI with Generative Models for Enhanced Question Answering in Skill-based Learning. ArXiv.
2. Chi M. et al. (2018) Translating the ICAP theory of cognitive engagement into practice. Cognitive science 42.6
3. Murdock J and Goel A (2008) Meta-case-based reasoning: self-improvement through self-understanding
4. LangChain (2022) Available at: <https://www.langchain.com/>
5. Wei J. et al. (2022) Chain-of-thought prompting elicits reasoning in large language models. NeurIPS.



What is Ivy?

Interactive Videos (Ivy) is an **intelligent coaching** system that can be embedded in online education for **skill learning**.¹

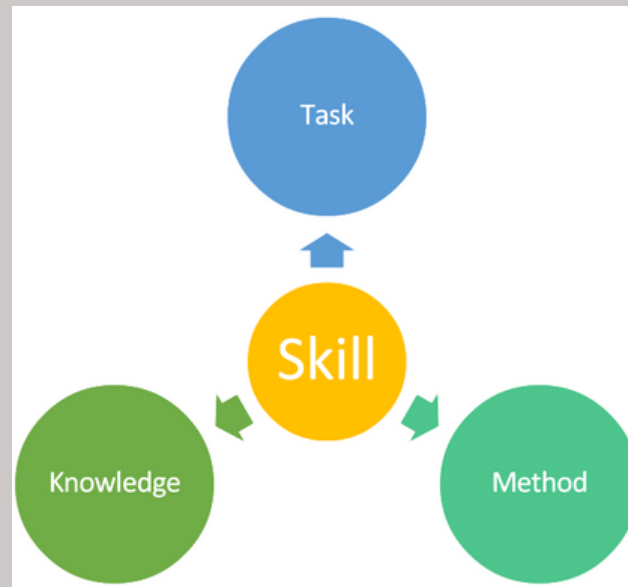
ICAP Theory²

Four modes of cognitive engagement



TMK Framework³

Model skills using a structured knowledge representation called Task-Method-Knowledge model.



Pilot study

Using an online graduate CS course taught at Georgia Tech, here is an example of Ivy answering a user question.

Example Question

Steps to solve the concept hierarchies problem

- The task is broken down into subtasks and transitions...
 - We **successfully set up** the concept hierarchies problem. This data condition transitions us from the **'set up the problem'** subtask to the **'generate the next percept'** subtask.
 - ...

"Classification" TMK

