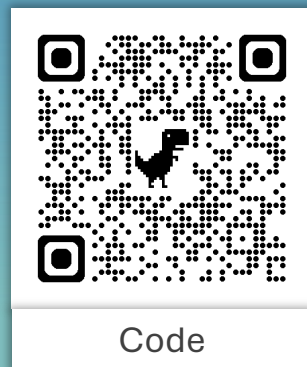
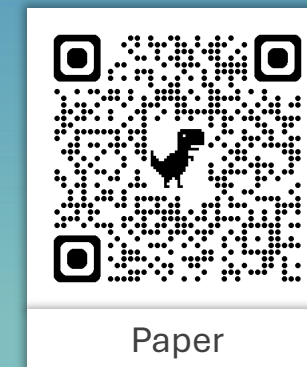




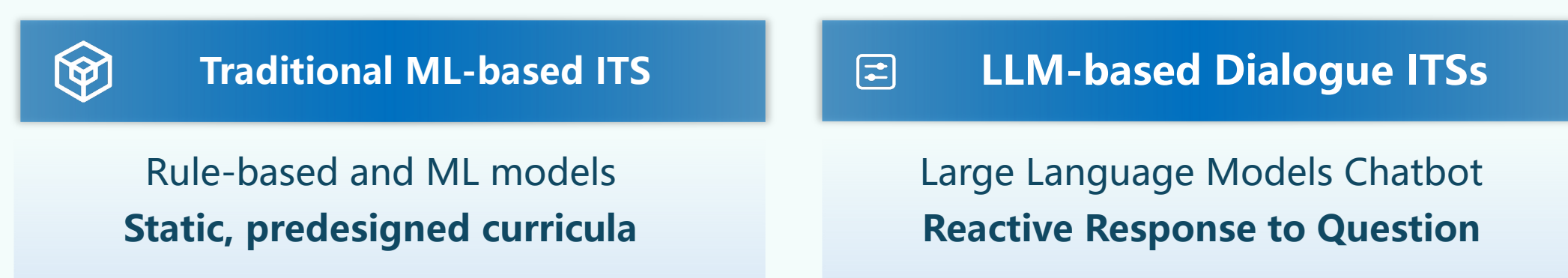
GenMentor: LLM-powered Multi-agent Framework for Goal-oriented Learning in Intelligent Tutoring System

Tianfu Wang, Yi Zhan, Jianxun Lian, Zhengyu Hu,
Nicholas Jing Yuan, Qi Zhang, Xing Xie, Hui Xiong

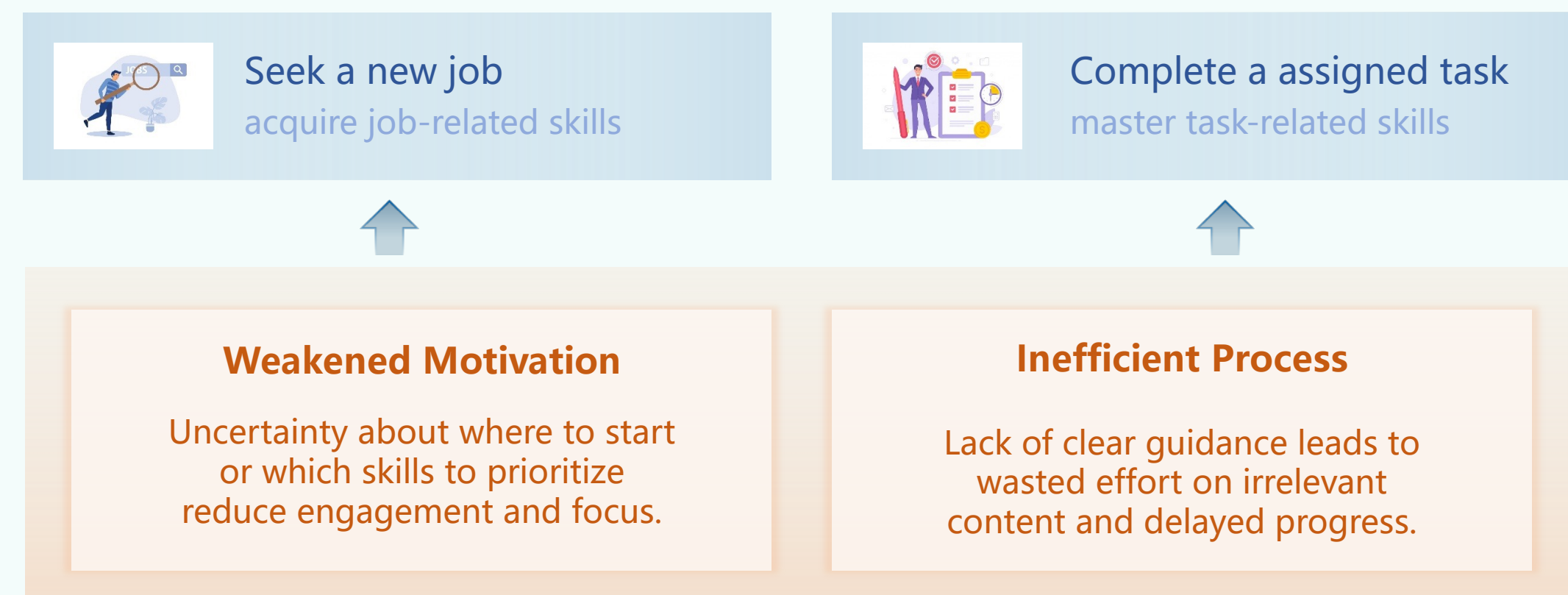


Goal-oriented Learning aims to proactively guide learners to achieve their specific goals

Limitations of Traditional ITSs

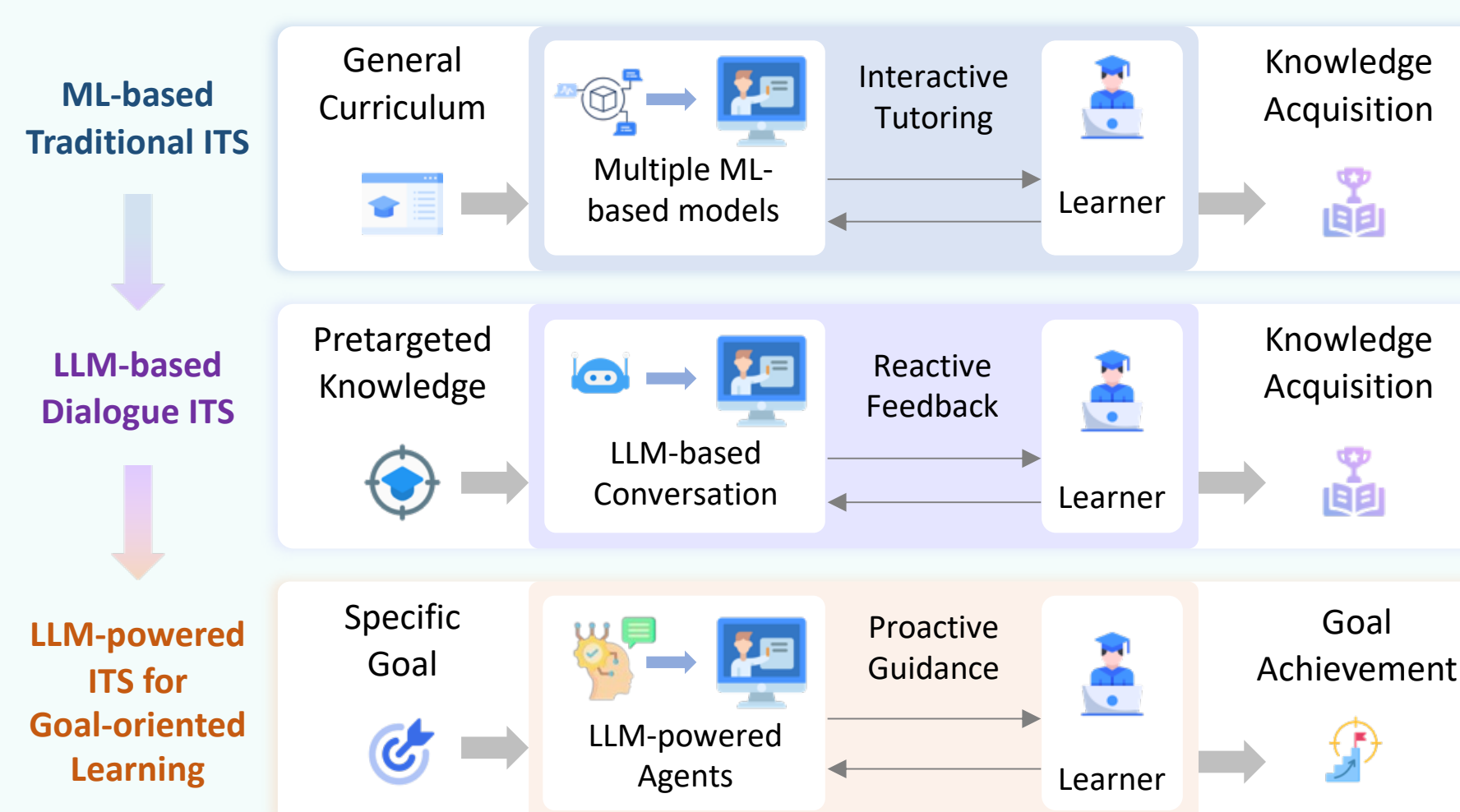


Professional Learning Needs



Goal-oriented Learning

Our approach emphasizes efficient goal achievement through personalized skill identification, adaptive learning paths, and targeted content delivery.



Challenges

Skill Gap Identification

Accurately mapping learner goals to required skills.

Adaptive Learner Modeling

Continuous profiling of comprehensive learner status.

Personalized Resource Delivery

Adapts pathways and resource to evolving learner needs.

GenMentor: Goal-oriented & LLM-power ITS

Skill Gap Identification

Necessity & Completeness

Identifies the skills gap between the learner's current knowledge and the skills required to achieve their goals

- Custom goal-to-skill mapping dataset with CoT tracks
- Fine-tune LLM for Enhanced goal alignment

Adaptive Learner Modeling

Comprehensiveness & Adaptation

Continuously update learner profiles by incorporating interaction data to track dynamic learner's status

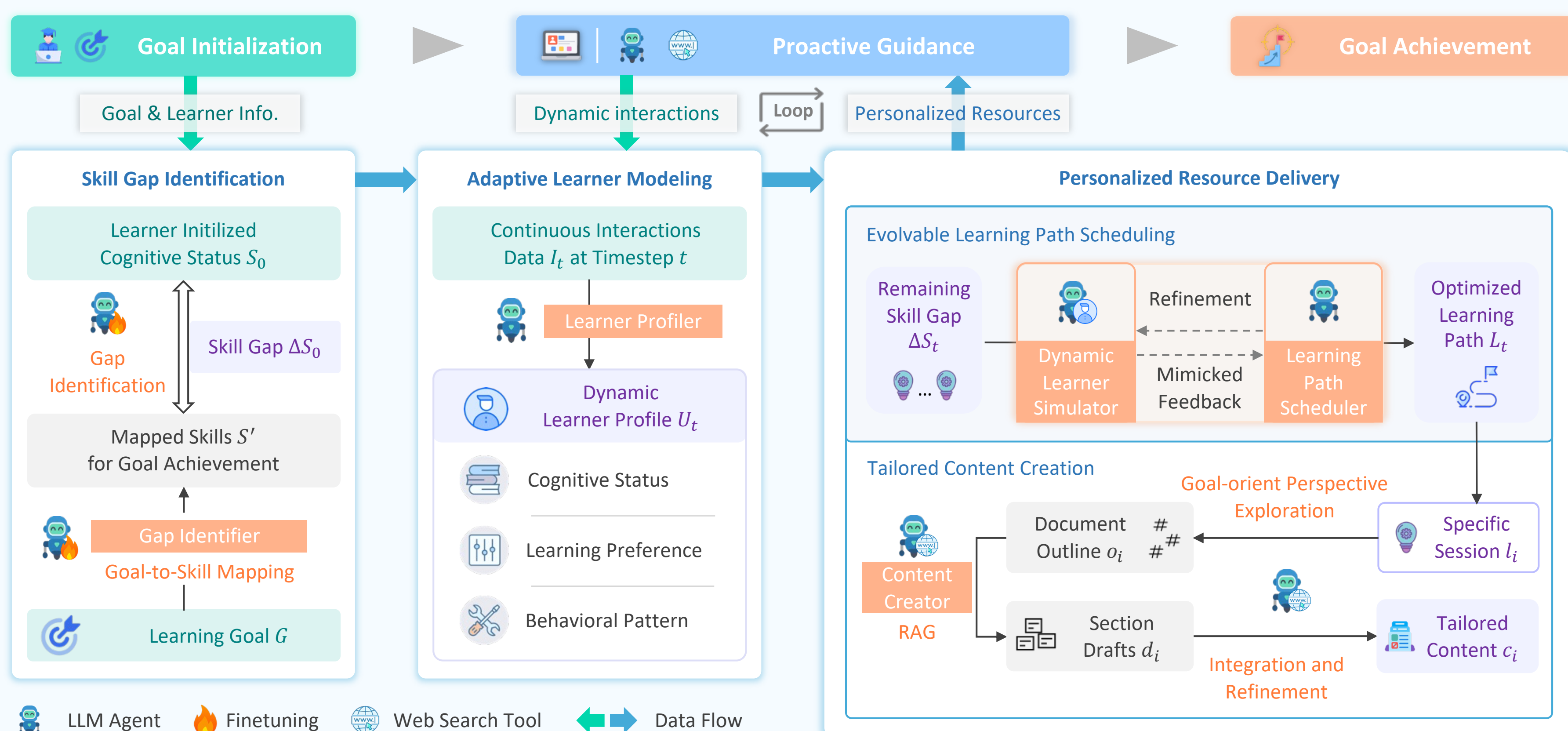
- Cognitive Status & Learning Preference & Behavioral Pattern
- Dynamic update of learner profile with newly interactions

Personalized Resource Delivery

Personalized & Goal-targeted

Dynamically schedules an engaging learning path and delivers tailored learning content

- Evolving path optimization method via Learner feedback
- Tailor content with exploration-draft-integration mechanism

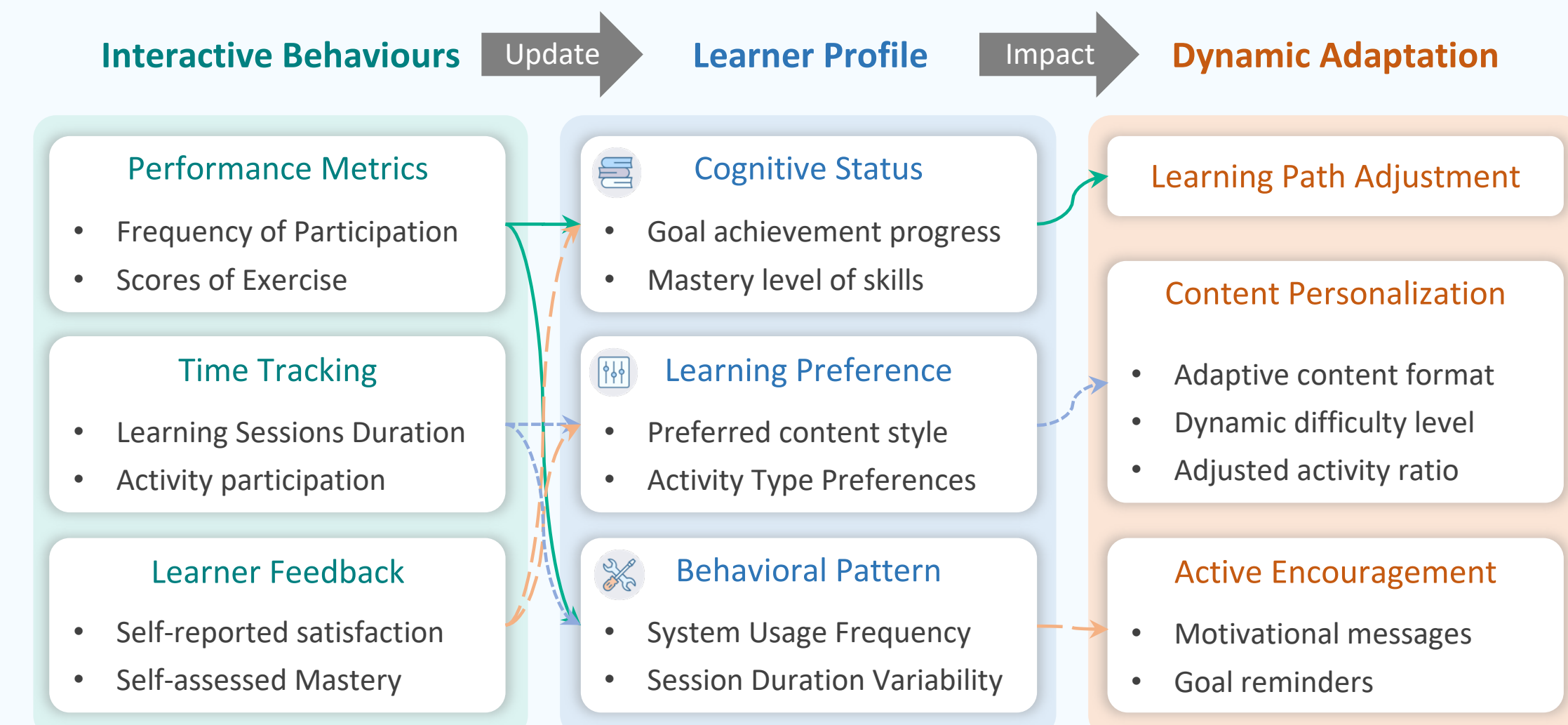


Clear Motivation

provide learning guidance
Improved goal achievement

Learning Efficiency

Personalized Learner Profile
Customized Learning Content



An illustration of dynamic learner modeling

Experiment & Deployment

Experimental Implementation

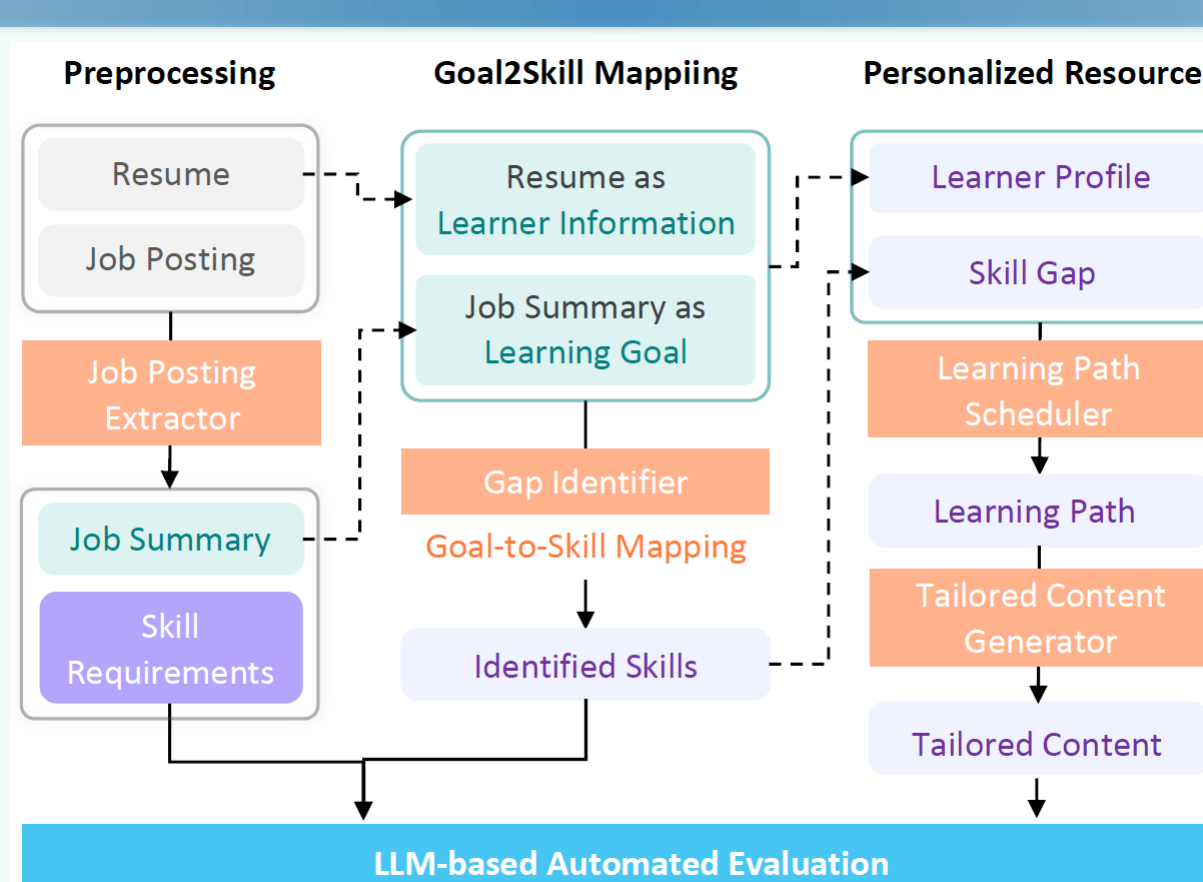
LLMs Used:
GPT-4o (2024-08-06) & LLaMa 3.2 (3B)

Web Tool: Bing Search

Fine-Tuning: Azure AI Studio

RAG Embedding: Text-embedding-3-small

LLM-based Automated Evaluation



A. Evaluating Goal-to-skill Mapping

B. Evaluating Learning Path

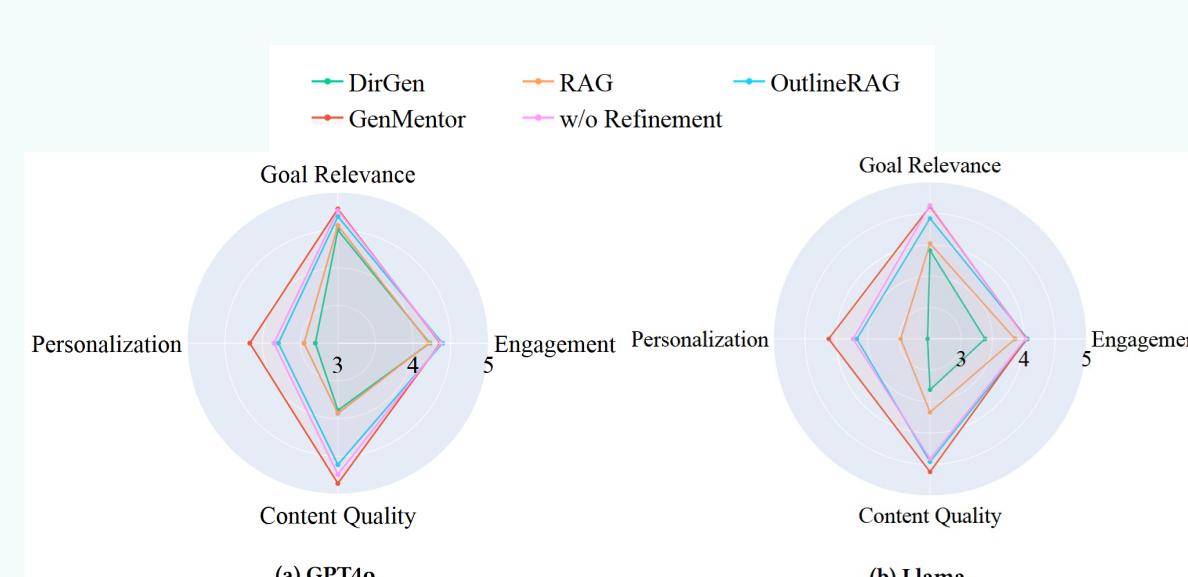
C. Evaluating Learning Content

Table 2: Evaluation results on Learning Path.

	Progression	Engagement
GPT4o	DirPrompt	3.95
	CoTPrompt	4.38
	GenMentor	4.56
Llama	DirPrompt	3.94
	CoTPrompt	4.07
	GenMentor	4.09

Table 1: Evaluation results on goal-to-skill mapping.

	Recall	Precision	Goal Alignment
GPT4o	DirPrompt	0.42	0.31
	CoTPrompt	0.48	0.39
	GenMentor	0.67	0.63
Llama	DirPrompt	0.37	0.35
	CoTPrompt	0.45	0.38
	GenMentor	0.63	0.61



Practical Deployment in Microsoft

20 employees from diverse professional fields
10 tech professionals (e.g., engineers, researchers)
10 non-tech professionals (e.g., product managers, HR)

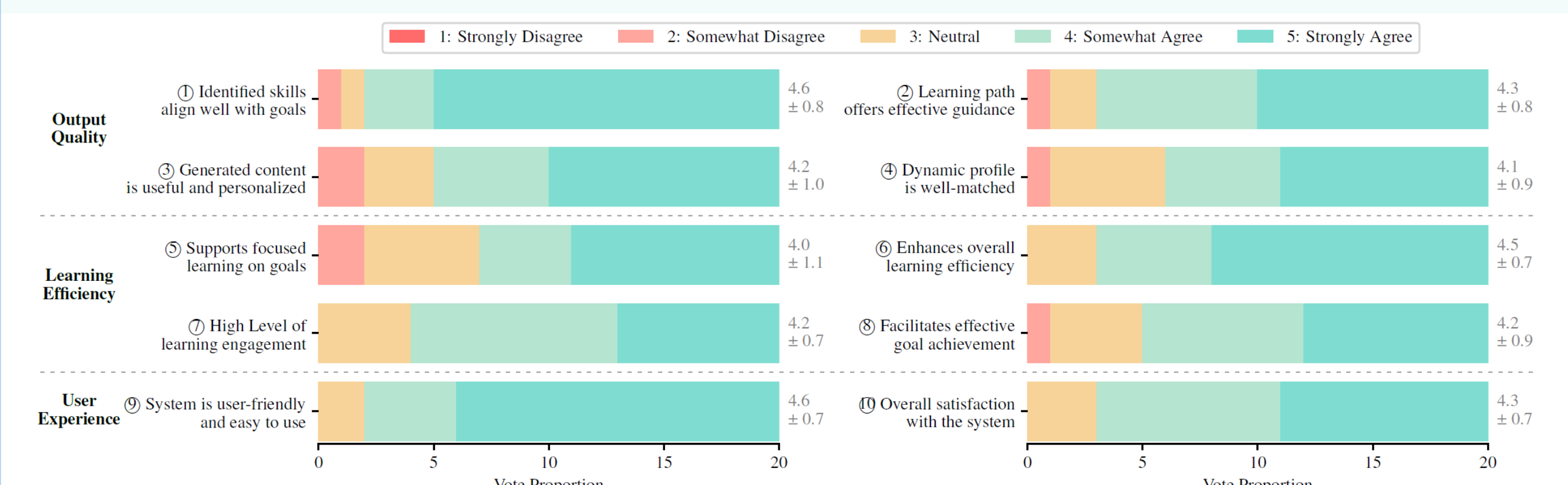


Figure 6: Questionnaire results from 20 participants (questions shortened for clarity). Gray texts are means and std. deviations.

Learning Experience

Clear learning guidance
Improved goal achievement

System Design

Intuitive interface
High user satisfaction

Professional Impact

Enhanced skill acquisition
Efficient goal completion