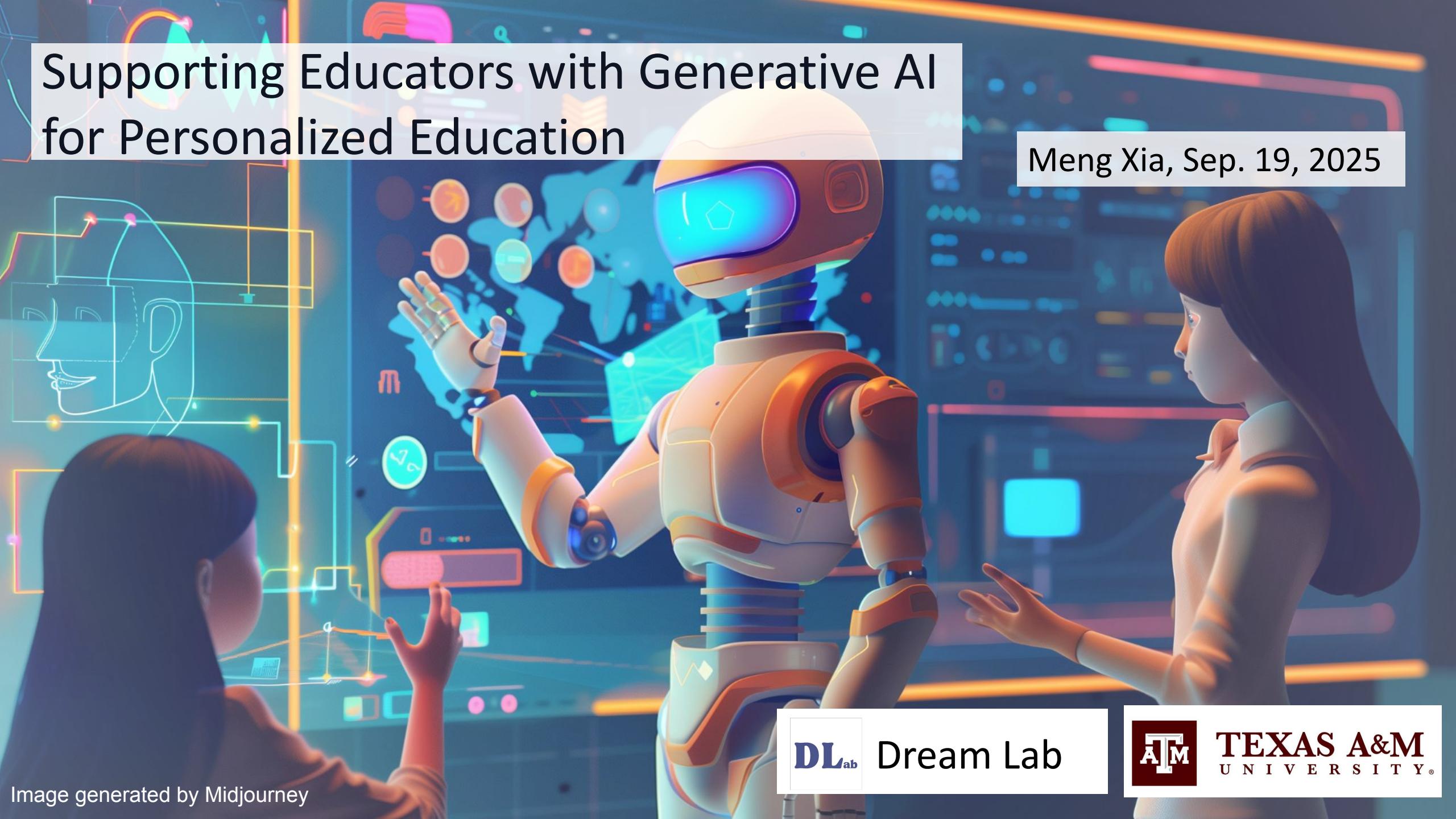


Supporting Educators with Generative AI for Personalized Education

Meng Xia, Sep. 19, 2025



Dream Lab



TEXAS A&M
UNIVERSITY®

Why personalization?



Non-cognitive

Motivation

(D'Mello, Lehman, Pekrun, & Graesser, 2014)

Self-regulation skills

(Aleven & Koedinger, 2002)

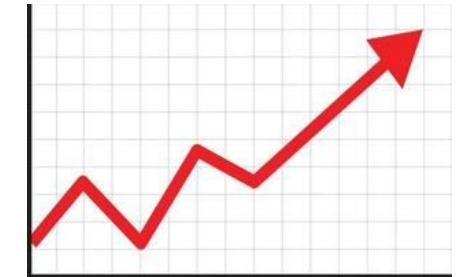
Cognitive

Knowledge

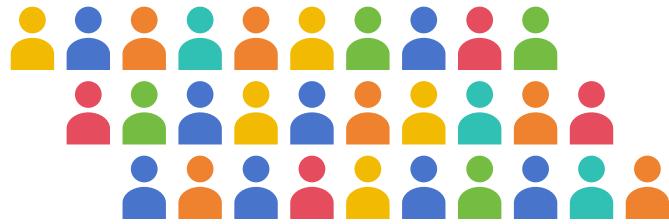
(Koedinger, Stamper, McLaughlin, & Nixon, 2013;)

Problem-solving strategies, errors

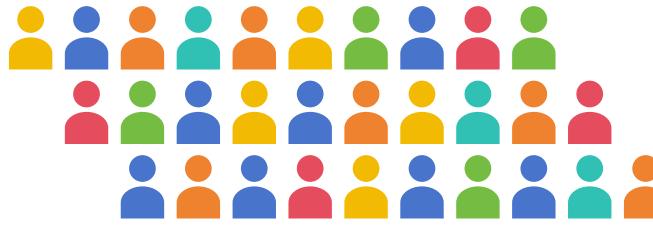
(Adams et al., 2014)



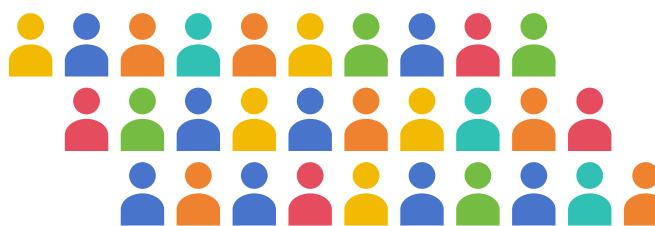
Personalization is a Foundational Education Challenge



- Large amount of students
- No enough qualified teachers

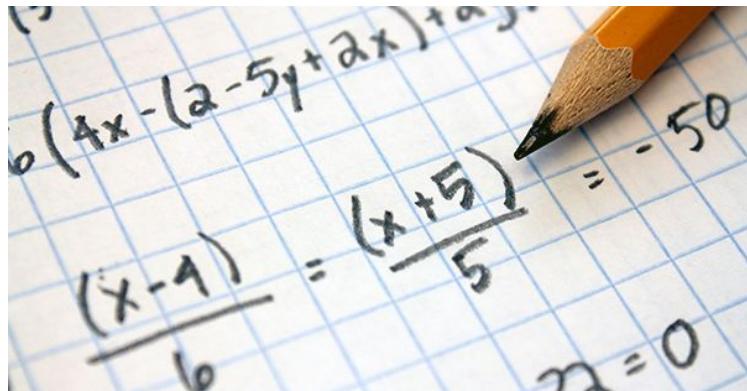


Personalization is a Foundational Education Challenge



- Large amount of students
- No enough qualified teachers
- Hard to analyze students' multimodality unstructured data
-

Generative AI is popular

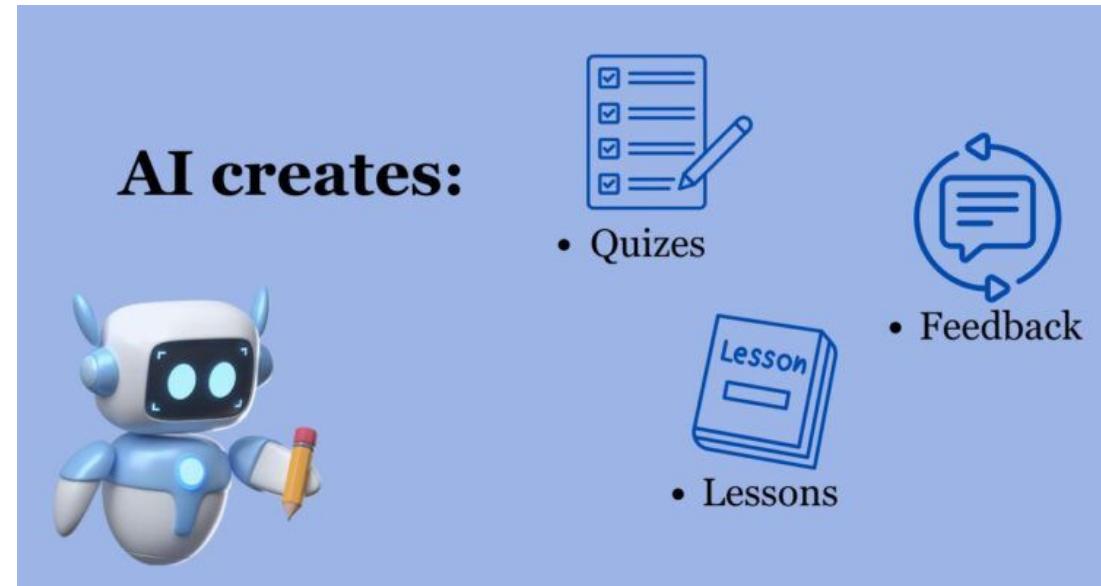


Midjourney

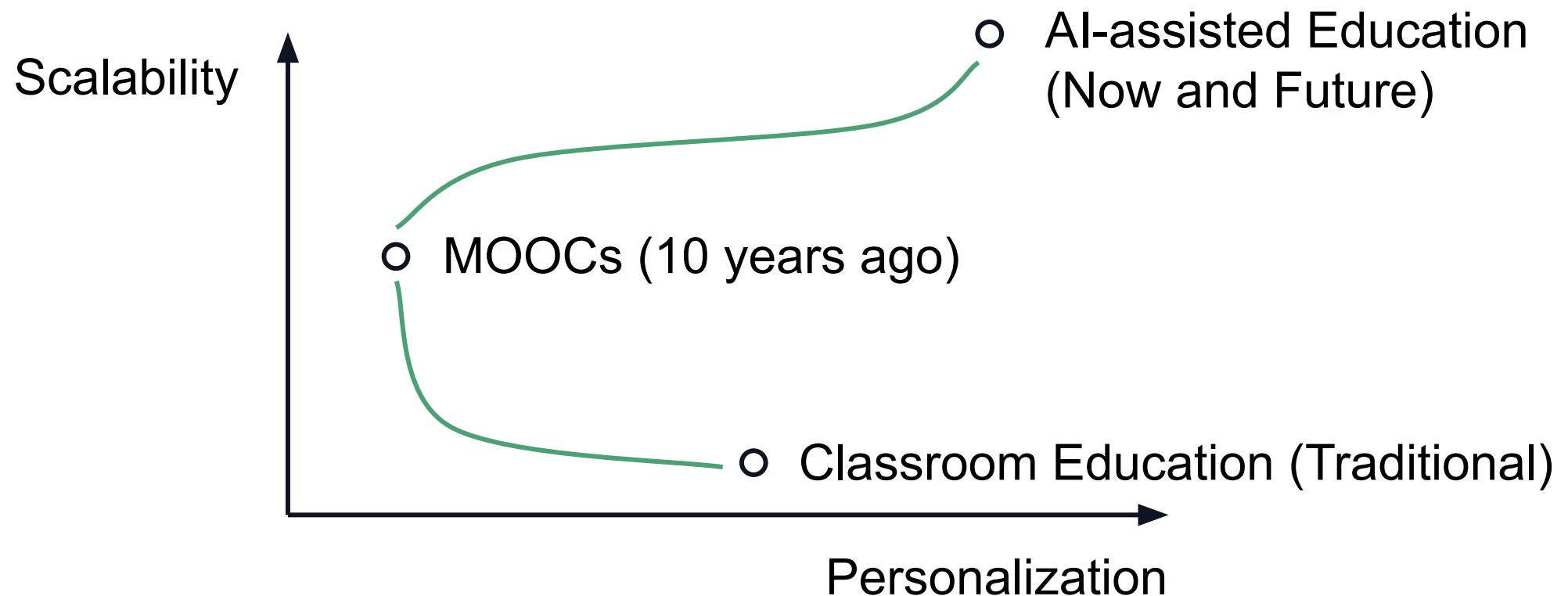


Generative AI's Characteristics

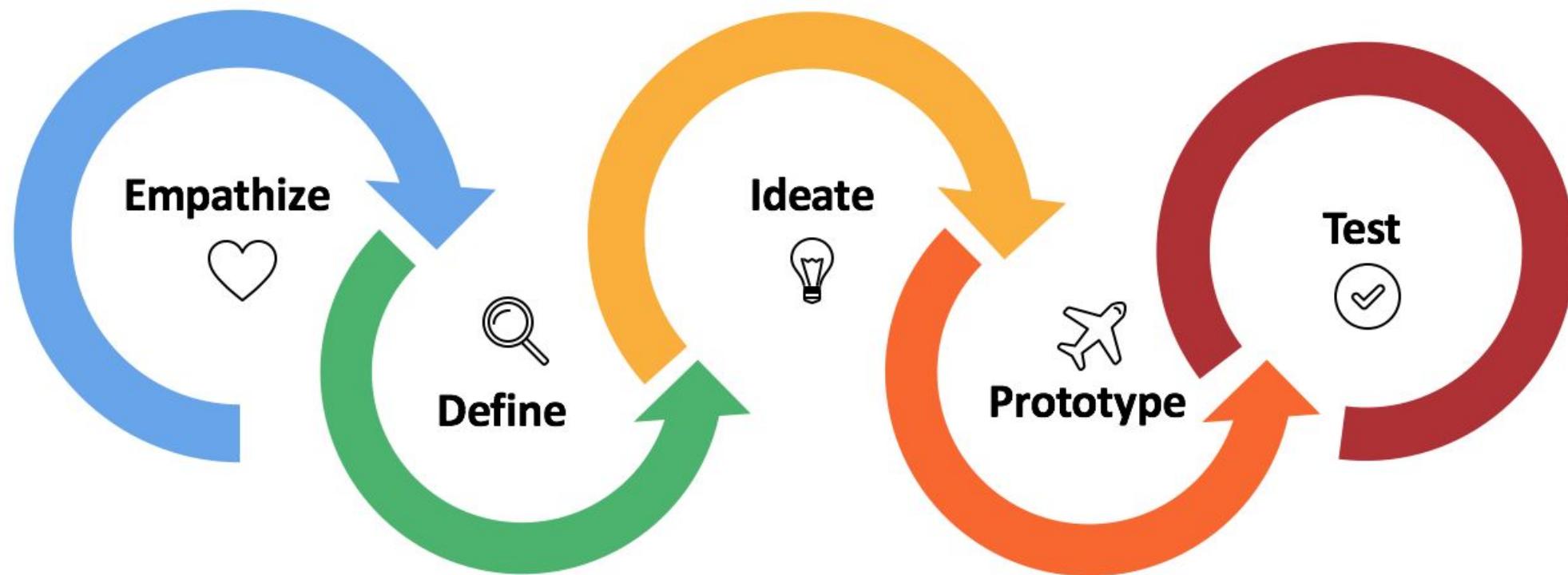
- Understand unstructured data (e.g., text, image)
- Generate context-aware content



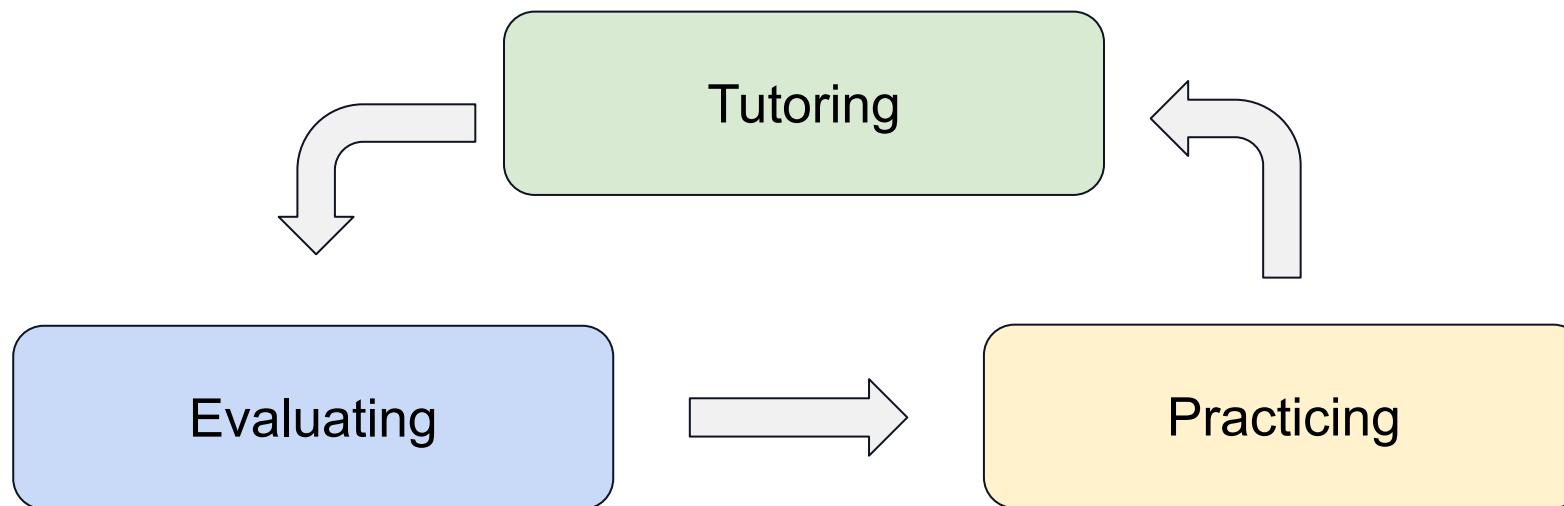
Vision for education: Personalization @ Scale



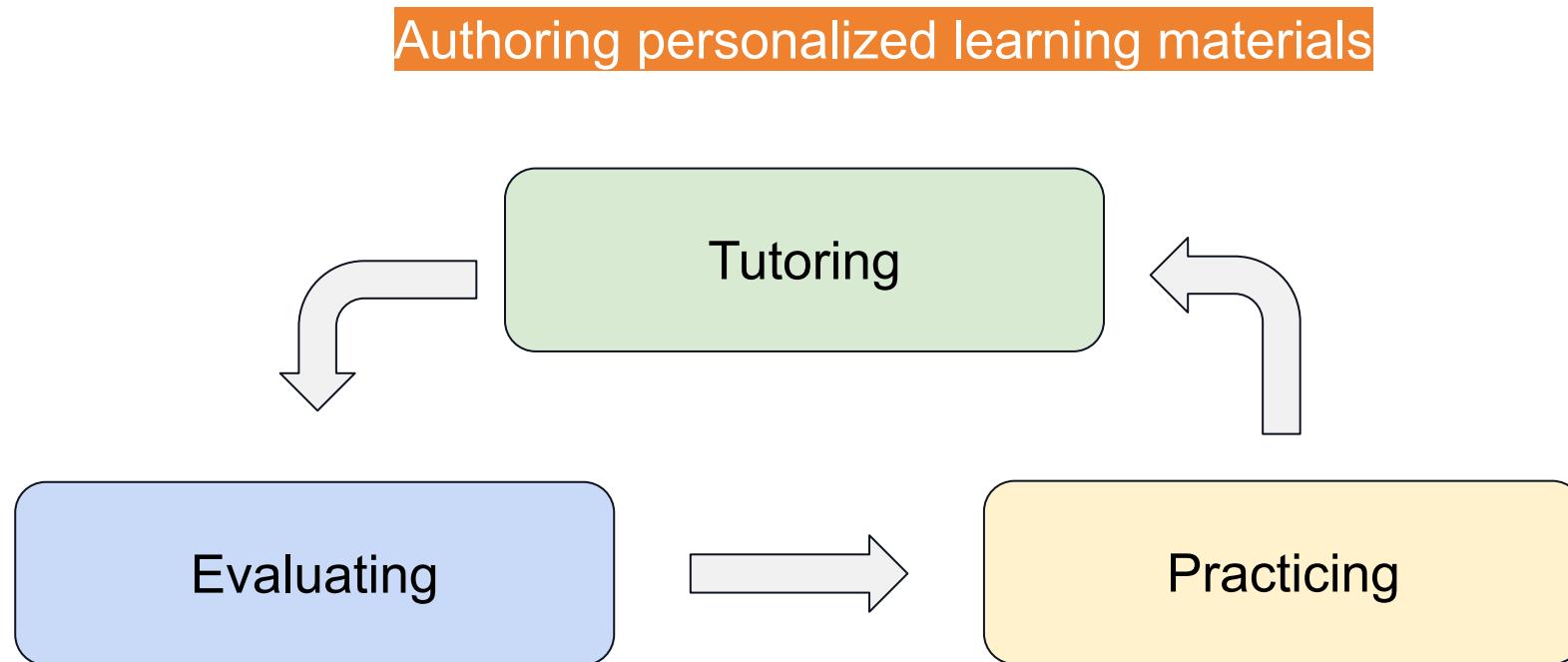
User-Centered Design Process



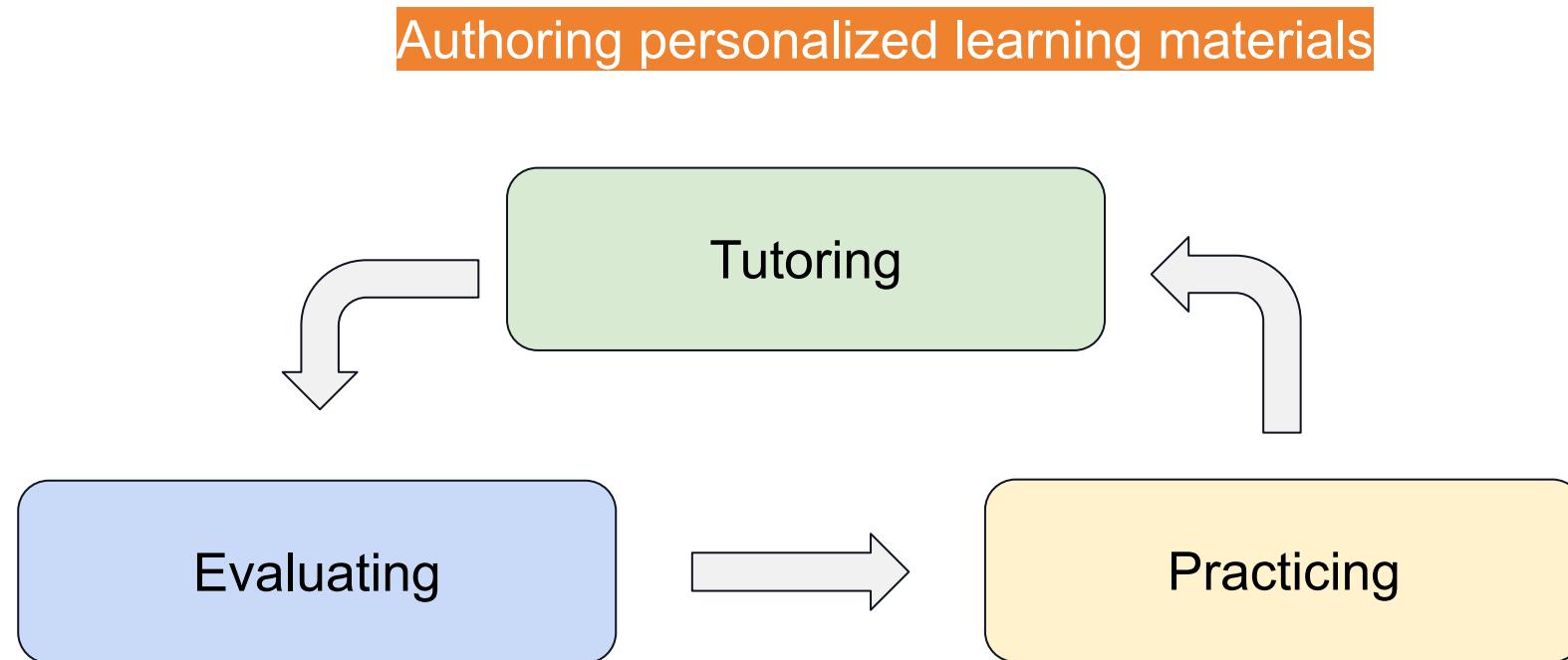
Educators' Tasks



Generative AI's opportunities for Personalization

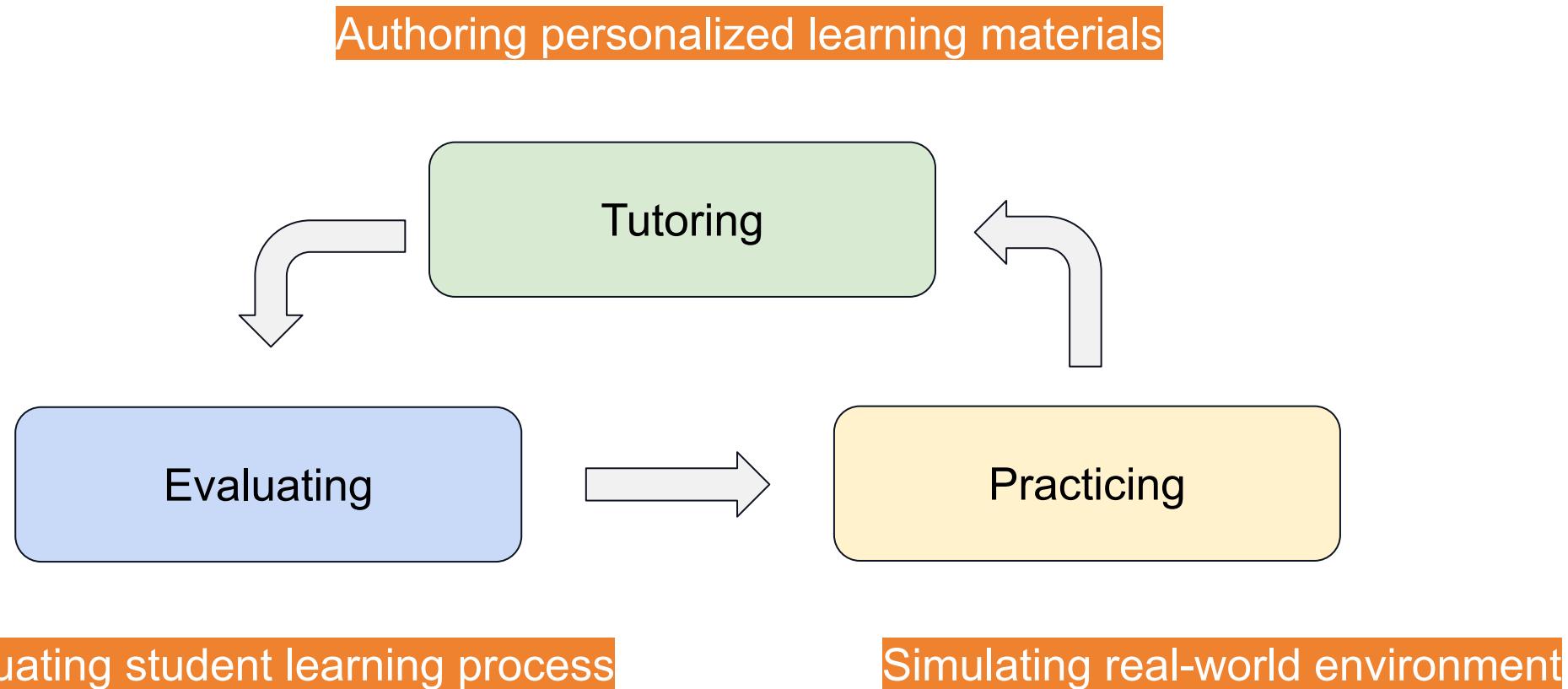


Generative AI's opportunities for Personalization

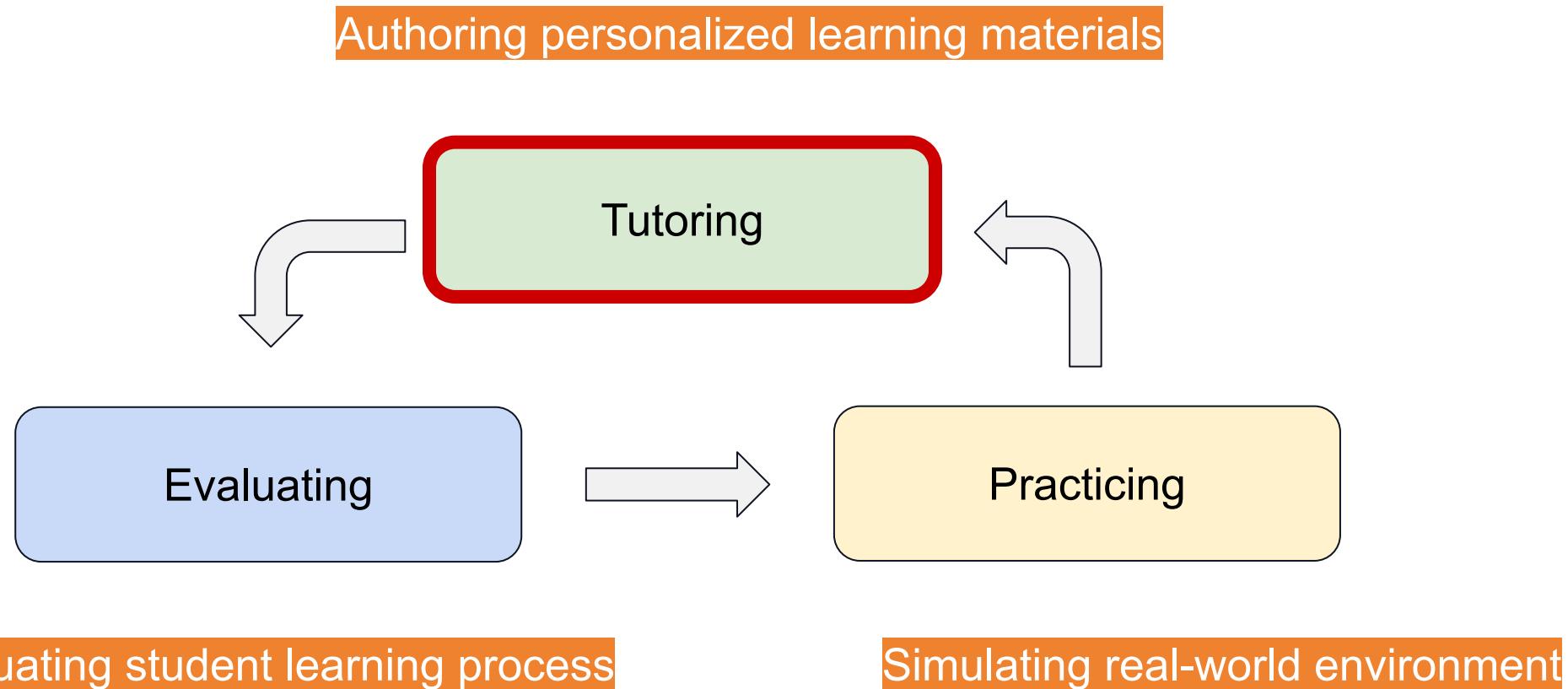


Evaluating student learning process

Generative AI's opportunities for Personalization



Generative AI's opportunities for Personalization



A Sample View

Model

Sample Question

Figure

Upload

Feature View

Question Features

- Context Complexity: Length of Context (low, medium, high)
- Cognitive Complexity: Domain-specific (Yes, No)
- Hints/Guidance: Analyze (Yes, No)

Chart Features

- Chart Type: Bar Chart
- Data Complexity: Num. Data (low, medium, high)
- Visual Encoding: Color, Shape

Distractor Features

- Num. Distractors: 3
- Plausibility: low, medium
- Similarity w. Answers: low, medium

Knowledge Features

- Task Type: Retrieve Value, Find Extreme
- Misleader Type: Data-Visual Disproportion
- Design Principles: NA

Generate/Update

B Generated Question

C1

25.0% Group 1
Major Dist.: CS: 5
Grade Dist.: Master: 5
Age: 24-26

35.0% Group 2
Major Dist.: CS: 7
Grade Dist.: Junior: 5
Age: 17-18

20.0% Group 3
Major Dist.: Design: 2
Grade Dist.: Senior: 4
Age: 22-24

20.0% Group 4
Major Dist.: Business: 2
Grade Dist.: Senior: 2
Master: 2
Age: 23-27

Learning Traits: C.T., C.D., R.V., F.C./T., I.R., W.M., F.C., F.E., P.A.

Knowledge Points: R.V., F.C./T., I.R., W.M., F.C., F.E., P.A.

Generated Question

The chart displays the number of tickets sold for a concert during the first week of September. What is the number of concert tickets sold on Sep 03 as a proportion of that on Sep 02?

Concert Tickets Sold Over Four Days

A: About 37.5%
B: About 66.7%
C: About 50%
D: About 200%

Hint: Pay attention to the Y-axis scale.

Explanation: The inappropriate Y-axis scale distorts the visual representation. Although the tickets sold on September 3 (around 14,000) are approximately 66.7% of those sold on September 2 (around 21,000), the bar height misleadingly suggests a value closer to 50%.

Question Revision

Update

C2

C3

C4

C5

C6

C7

C Simulation View

Student Groups

Group 1: 25.0% (Major Dist.: CS: 5, Grade Dist.: Master: 5, Age: 24-26)

Group 2: 35.0% (Major Dist.: CS: 7, Grade Dist.: Junior: 5, Age: 17-18)

Group 3: 20.0% (Major Dist.: Design: 2, Grade Dist.: Senior: 4, Age: 22-24)

Group 4: 20.0% (Major Dist.: Business: 2, Grade Dist.: Senior: 2, Master: 2, Age: 23-27)

Learning Traits: C.T., C.D., R.V., F.C./T., I.R., W.M., F.C., F.E., P.A.

Knowledge Points: R.V., F.C./T., I.R., W.M., F.C., F.E., P.A.

D Agent Profile View

e.g., students mostly are a computer science background, with some design and business. They have limited foundational knowledge, and average learning traits

Agents Profiles

Update

E Agent Setting View

Demographic Settings

e.g., a class of 20 students, with roughly 50% from a CS background, 25% from Engineering, and 25% from Design, aged 18-30, at both undergraduate and master's levels...

Demographic Attributes

Major: Majority are CS undergraduates, with a small number of Business master's students, ages 18-30.

Grade: Age

Default Setting: majority are CS undergraduates, with a small number of Business master's students, ages 18-30.

Learning Traits Settings

e.g., the Students generally have average logical reasoning and critical thinking skills typical of college students, with relatively lower visual processing and working memory.

Learning Traits

Logical Reasoning: Visual Processing, Critical Thinking: Working Memory

Default Setting: normal distribution of each traits among the students

Knowledge Points Settings

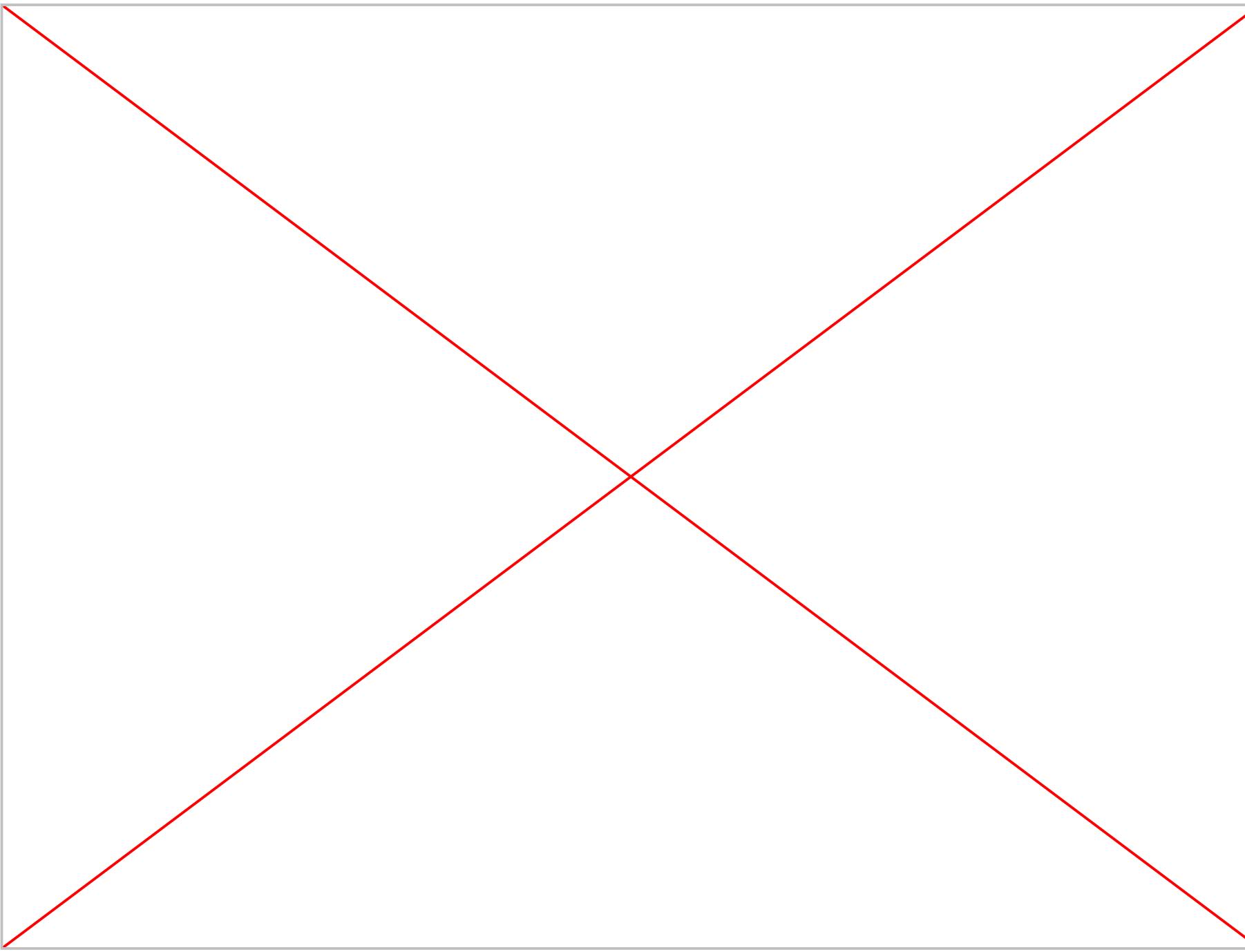
e.g., the students generally have basic skills and understanding of "Retrieve Value" and "Find Extreme," but show limited understanding of "Characterize Distribution."

Knowledge Points

Retrieve Value: Determine Range, Find Extreme: Characterize Distribution, Find Anomalies: Make Comparisons, Find Clusters: Find Correlations/ Trends

Default Setting: normal distribution of student understanding for each knowledge point

Count: Generate



Student Chat:

a

Nice to meet you, Teacher! I am Ruffle.
Thank you so much for helping me study biology. I love to learn!

Hello! I'm eager to learn about cell biology. Could you please explain what the phrase "form follows function" means in this context?

The structure of cell components and organelles evolved to support their specialized functions.

Thank you for your explanation! So, "form follows function" in cell biology means the structure of cell components and organelles supports their specialized functions.

Could you provide an example to illustrate this concept?

b

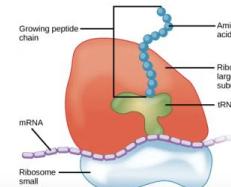
Organelles in Eukaryotic Cells

"Form follows function" is a philosophy that many industries follow. In architecture, this means that buildings should be constructed to support the activities housed within them. For example, a skyscraper should include several elevator banks. A hospital should have an easily accessible emergency room.

Our natural world also utilizes the principle of form following function, especially in cell biology. The structure of cell components and organelles evolved to support their specialized functions. For example, in the pancreas there are cells that are responsible for producing digestive enzymes, which are specific types of proteins that help with food digestion. In these cells, ribosomes, the organelle responsible for protein synthesis, are found in high numbers. Here the form (high number of ribosomes) follows the function (protein production). Apart from ribosomes, cells have numerous other organelles. These organelles are specialized compartments inside the cells, and similar to the organs in your body, each organelle has a unique role. In this lesson, we will dive into several examples of organelles and discuss their specific functions.

Ribosomes

Ribosomes are the cellular structures responsible for protein synthesis. They may group together into clusters (polyribosomes) or individual ribosomes may float freely in the cytoplasm. They may be attached to the plasma membrane's cytoplasmic side or the endoplasmic reticulum's cytoplasmic side and the nuclear envelope's outer membrane. Ribosomes are large protein and RNA complexes, each consisting of two subunits, one large and one small (Figure 1). Ribosomes receive their "orders" for protein synthesis from the nucleus where the DNA transcribes into messenger RNA (mRNA). After transcription, the mRNA exits the nucleus and travels to the ribosomes located in the cytoplasm. The ribosomes then translate the code provided by the sequence of the nitrogenous bases in the mRNA into a specific order of amino acids linked together to form proteins. Amino acids are the building blocks of proteins.



The diagram shows a ribosome with two subunits: a large subunit (red) and a small subunit (blue). A mRNA strand (purple) is being read by the ribosome, with amino acids (represented by blue circles) being added to a growing peptide chain (represented by a blue line).

Professor: Request Help

Please help the student learn the material.

Student: Please help me learn the material!

Professor: Please help!

Student: Please help!

Professor: Please help!

Ruffle&Riley: Insights From Designing and Evaluating a LLM-Based Conversational Tutoring System

Robin Schmucker, Meng Xia, Amos Azaria, Tom Mitchell

AIED 2024

How can LLMs benefit ITSs?

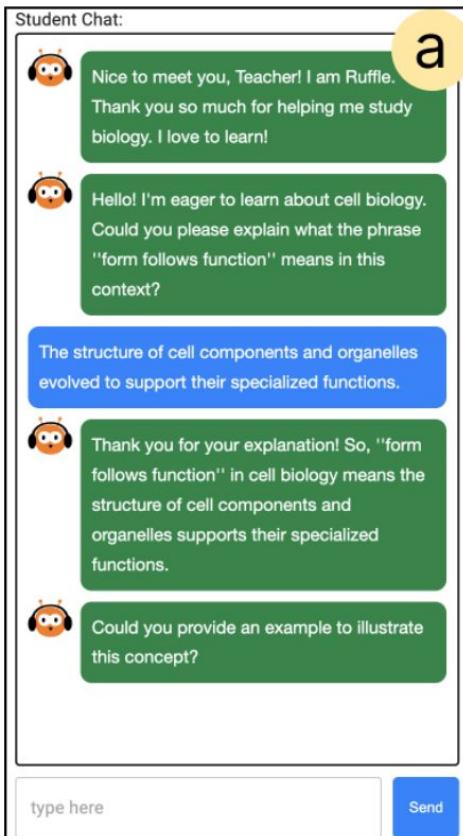
LLMs can provide components to ITS designers:

- By generating lesson texts
- By generating question and hints
- By adding automatic grading capabilities
- By adding question answering capabilities
- ...

What would it take to generate an **entire** ITS?

Ruffle&Riley: User Interface

Free-form
dialog



*Pre-existing
textbook content*

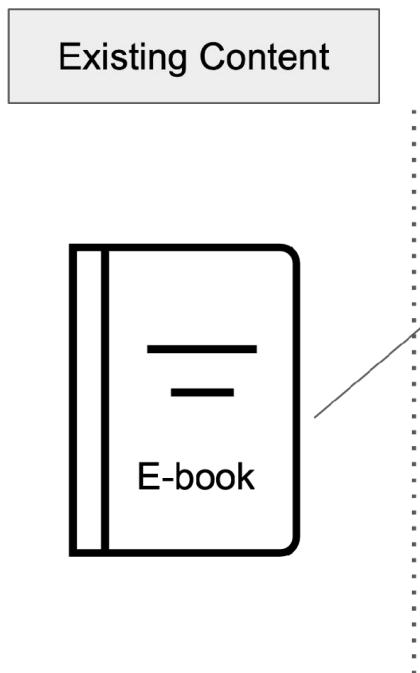
*Intelligent
Feedback*

*On demand
assistance*

*Misconcept.
Correction*

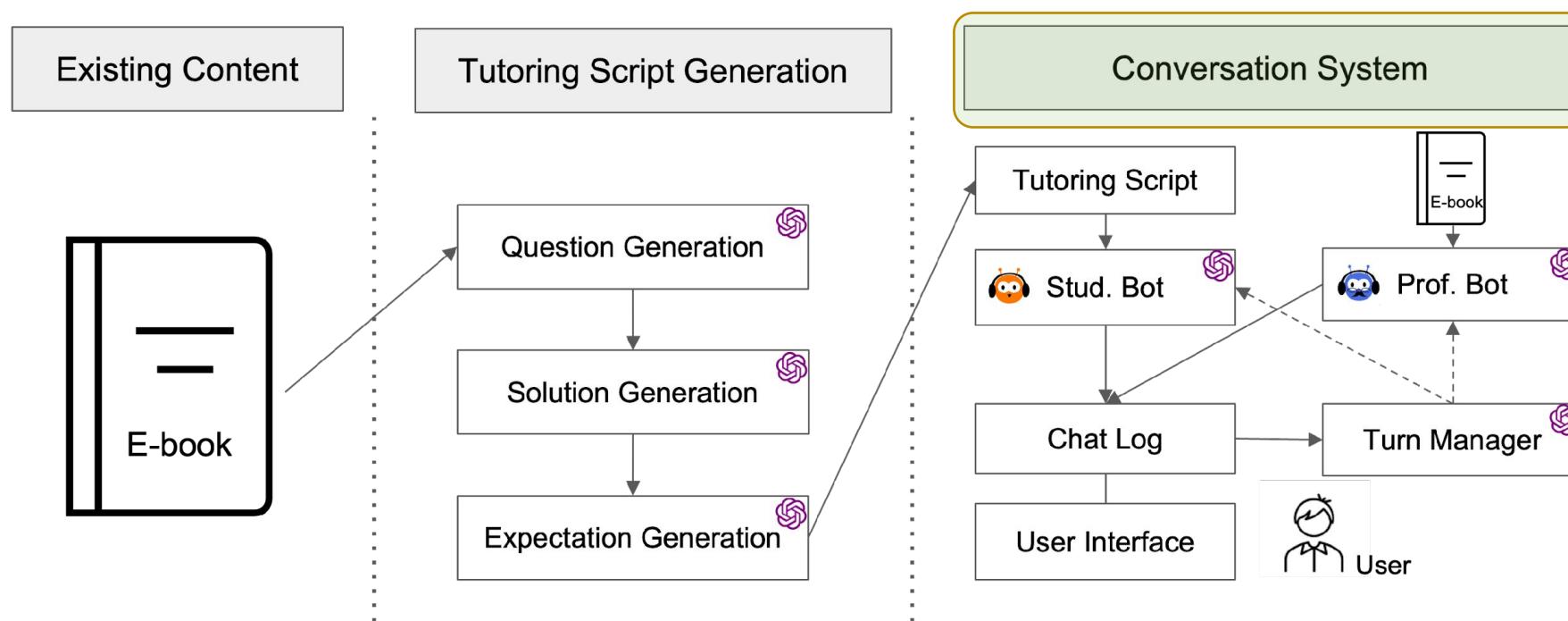
User Interface

*Facilitate tutoring **script generation** and **orchestration***



System Architecture

*Facilitate tutoring **script generation** and **orchestration***



System Architecture

Ruffle&Riley: User Interface

Free-form dialog

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Could you provide an example to illustrate this concept?

type here

Send

Professor: **Request Help**

Ruffle: Please help the student learn the material.

Organelles in Eukaryotic Cells

Pre-existing textbook content

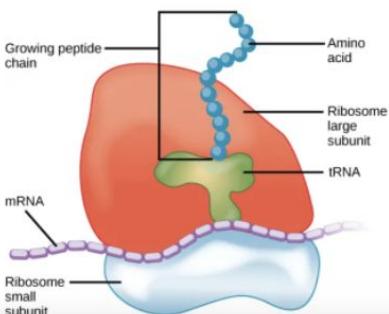
b

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Our natural world also utilizes the principle of form following function, especially in cell biology. The structure of cell components and organelles evolved to support their specialized functions. For example, in the pancreas there are cells that are responsible for producing digestive enzymes, which are specific types of proteins that help with food digestion. In these cells, ribosomes, the organelle responsible for protein synthesis, are found in high numbers. Here the form (high number of ribosomes) follows the function (protein production). Apart from ribosomes, cells have numerous other organelles. These organelles are specialized compartments inside the cells, and similar to the organs in your body, each organelle has a unique role. In this lesson, we will dive into several examples of organelles and discuss their specific functions.

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User Interface

Intelligent Feedback

I don't know.

No worries at all! If you could request help from the professor, that would be fantastic. I'm really interested in understanding this concept better with an example.

On demand assistance

Professor: **Request Help**

Of course! You could use the example of ribosomes in the pancreas cells. These cells have a high number of ribosomes because they are responsible for producing digestive enzymes, a type of protein. Here, the form (high number of ribosomes) follows the function (protein production).

Misconcept. Correction

Enzymes that are produced by mitochondria

Revision required

type here

Send

Professor: **Request Help**

It seems there's a small mistake in your response. Mitochondria are actually responsible for producing ATP, not enzymes. Could you please revise your response?

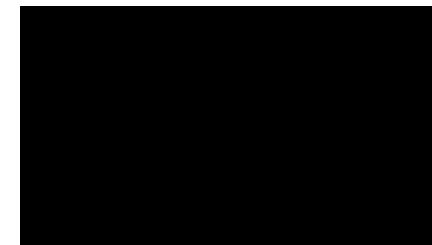
Findings of user study

Learning Experience Survey

Conditions	Learning Experience (1-strongly disagree, 7-strongly agree)						
	Engagement	Understanding	Remembering	Interruption	Coherence	Support	Enjoyment
Reading	4.33 ± 0.52	-	-	-	-	-	-
Teacher Q/A	5.0 ± 0.53	4.43 ± 0.65 *	4.43 ± 0.65 *	2.71 ± 0.64	5.43 ± 0.53	4.57 ± 0.57 *	3.71 ± 0.52 *
LLM Q/A	4.8 ± 0.47	4.4 ± 0.4 *	4.33 ± 0.42 *	2.67 ± 0.45	4.8 ± 0.43 *	4.0 ± 0.44 *	4.0 ± 0.44 *
Ruffle & Riley	5.81 ± 0.3	5.81 ± 0.24	5.76 ± 0.22	2.19 ± 0.34	6.1 ± 0.21	5.9 ± 0.26	5.62 ± 0.31

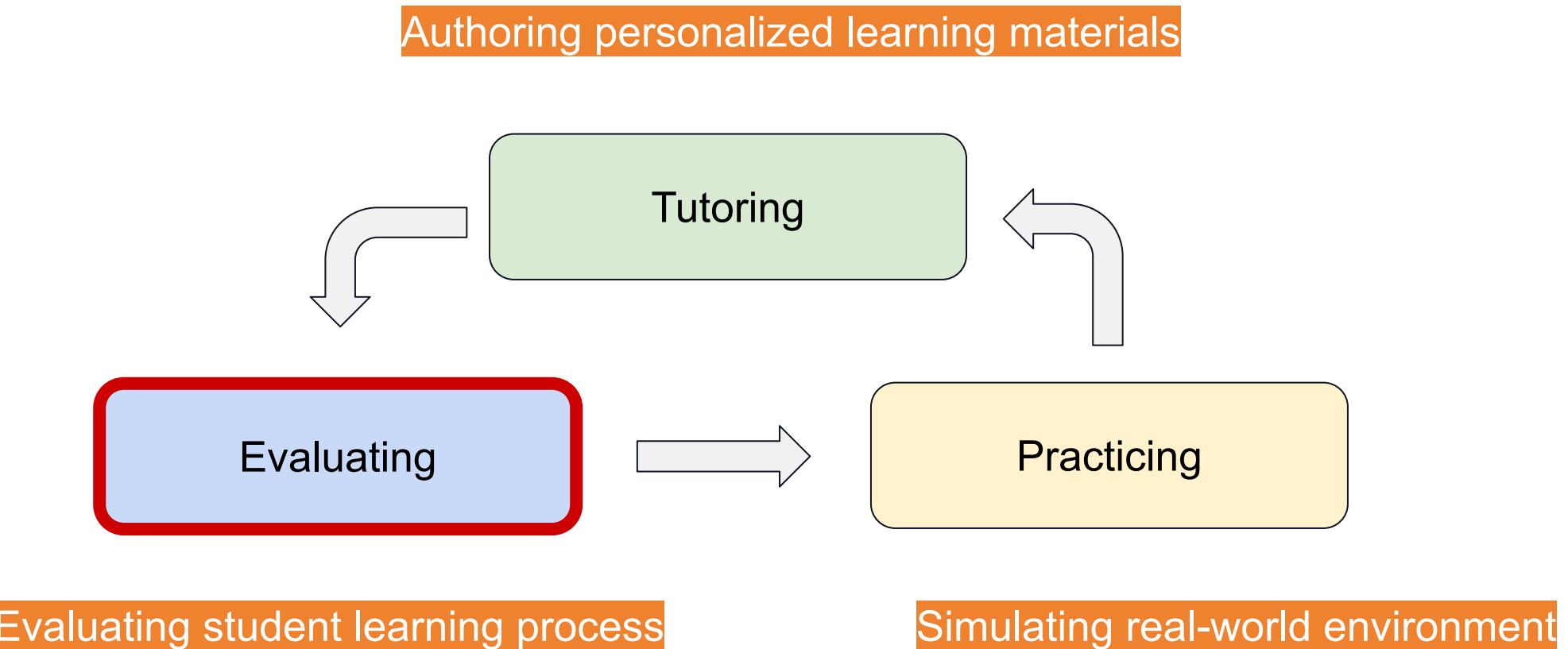
Symbol “*” marks $p < 0.05$

Ruffle&Riley: User Interface



<https://github.com/rschmucker/ruffle-and-riley>

Generative AI's opportunities for Personalization



CPVis: Evidence-based Multimodal Learning Analytics for Evaluation in Collaborative Programming

Gefei Zhang, Shenming Ji, Yicao Li, Jingwei Tang, Jihong Ding,
Meng Xia*, Guodao Sun, Ronghua Liang

CHI 2025



Background



Challenges

- Viewing Students' Code is A Pain
- Student work is often assessed only by the final solution
- Difficulty in understanding students' engagement in problem-solving

```
a = [1, 5, 9, 10, 13]
b = [4, 6, 8, 11, 14, 15]
c = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
d = [1, 2, 3, 4, 5, 6, 7, 8, 9]
e = [3, 4, 5, 6, 7, 8, 9, 10]
f = [1, 5, 9, 10, 13]
g = [4, 6, 8, 11, 14, 15]
h = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
i = [1, 2, 3, 4, 5, 6, 7, 8, 9]
j = [3, 4, 5, 6, 7, 8, 9, 10]
k = [1, 5, 9, 10, 13]
l = [4, 6, 8, 11, 14, 15]
m = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
n = [1, 2, 3, 4, 5, 6, 7, 8, 9]
o = [3, 4, 5, 6, 7, 8, 9, 10]
p = [1, 5, 9, 10, 13]
q = [4, 6, 8, 11, 14, 15]
r = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
s = [1, 2, 3, 4, 5, 6, 7, 8, 9]
t = [3, 4, 5, 6, 7, 8, 9, 10]
u = [1, 5, 9, 10, 13]
v = [4, 6, 8, 11, 14, 15]
w = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
x = [1, 2, 3, 4, 5, 6, 7, 8, 9]
y = [3, 4, 5, 6, 7, 8, 9, 10]
z = [1, 5, 9, 10, 13]
aa = [49, 38, 65, 97, 76, 13, 27, 55, 4]
aa.sort()
print(aa)

for i in range(100, 1000):
    j = i // 100
    k = i // 10 % 10
    l = i % 10
    if i == j ** 3 + k ** 3 + l ** 3:
        print(i)

for n in f:
    for b in e:
        for c in a:
            for d in a:
                if b ** n + c ** n + d ** n == 100 * b + 10 * c + d:
                    print(100 + j * 10)

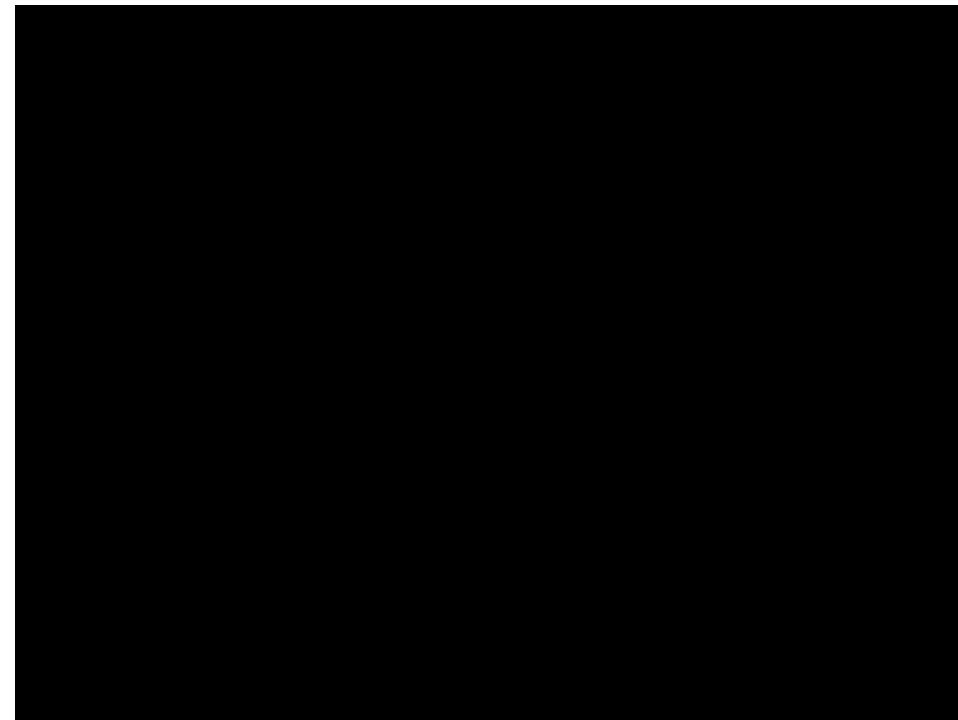
a = [1, 5, 9, 10, 13]
b = [4, 6, 8, 11, 14, 15]
c = a + b
c.sort()
```

Dataset

21 groups, 3 students per group in one class session (five coding problems)

- audio
- video
- screen sharing
- codes

System demo



Generative AI's Roles

CPVis

A Filter View

Searching Group: 10

Fail Pass Moderate Good Excellent Non Teacher Scaffold Teacher Scaffold

A1 A scatter plot showing student performance (Fail, Pass, Moderate, Good, Excellent) and scaffold usage (Non Teacher Scaffold, Teacher Scaffold) for Group 10. Students are numbered 1 through 23.

A2 A legend for Driver (red), Navigator (green), and Monitor (blue). Below it are two flower icons: one for Group 10 and one for Group 18.

A3 A comparison section titled "Most Similar" and "Most Different" showing flower icons for Group 18, Group 6, Group 20, and Group 3.

B Content View

B1 Codes

```

a=[1,2,3,5,6,9,5,5,6,2,4,3,2,7,9]
x=int(input("Please enter a number:"))
if x in a:
    for i in a:
        if a.count(x) > 0:
            a.remove(x)
    print('After deletion the list a becomes:'.format(x))
    print(a)
else:
    print('This element is not an element of list a!')

```

Score: 4.85 / 5

- Code Integrity (35%)
 - Score: Excellent (5)
 - Explanation: The code is largely structured and well-organized.

B2 Student projection & Group pattern

Group 10: 4.48 Q1 Q2 Q3 Q4 Q5

Group 18: 4.21 Q1 Q2 Q3 Q4 Q5

B1a

```

a=[1,2,3,5,6,9,5,5,6,2,4,3,2,7,9]
x=int(input("Please enter a number:"))
if x in a:
    while x in a:
        a.remove(x)
    print(a)
else:
    print("This element is not an element of list a!")

```

Score: 4.5 / 5

- Code Integrity (35%)
 - Score: Good (4)
 - Explanation: The code is well-structured and readable, but using `eval()` for input poses security risks and potential issues with malicious or poorly formatted data. A safer approach is to use `int()` for input conversion.

B3a

Group 10 Group 18 Question Discussion Shared Mental Model Collaborative Programming Situation Awareness Teacher Scaffold

Prediction Percentage (%)

B3b

Cognitive Engagement Behavioral Engagement

1001 1002 1003

B3c

Behavior: High-control cognitive scaffolding Percentage: 100% Explanation: Instructor provided detailed explanation and coding instructions.

B3d

C Detail View

Group 10

Group 18

Group 18

Group 10

Question 5

0000 (2006.0-2011.0): 1 X, for X, you you. You're saying not to use a list, right?

1002 (2012.0-2015.0): It's because this symbol inside can't take a list.

1000 (2015.0-2055.0): 1 Oh oh, then you just do it this way, here it's not a comma, it's a dot. The dot isn't two Ns, oh, don't need this anymore, just add a colon, right? And then don't use a here, and then just print a below, print a, print parentheses with a, parentheses, with a, press F to run it. Confirm, confirm, dot format dot.

Group 18

Question 1

1801 (0.0-16.00): I remember last time there was, oh here it is, create a new one, just capture it directly, let's start with the first one.

1801 (16.00-23.00): One of the recordings is not included in it.

1803 (24.00-35.00): Okay, let me check, the first one is, is this being recorded?

1801 (37.00-42.00): Oh no, it hasn't started yet, forgot to record.

1801 (46.00-56.00): Good thing you reminded me

Categories	Communication behaviors	Definitions	Examples
Question Discussion	Material reading [68]	Students read the distributed material together.	“Let's go over the handout the teacher gave us.”
	Question allocation [78]	Students explicitly assign a question to others or proactively self-allocates a task.	“You debug the code, I'll write the test cases.”
	Question planning [78]	Students list several questions remaining to be done to provoke subsequent question allocation.	“We still need to write the test cases debug the code.”
	Question understanding [58]	Students explore programming with peers without providing detailed descriptions of Python coding.	“There's a problem. This one hasn't been modified.”
	Information sharing [78]	Students proactively share information that no one asked.	“I found a better algorithm that improves efficiency.”
Shared Mental Model	Information request [78]	Students ask someone else a question to obtain information.	“How should this function work?”
	Responding to request [78]	Students provide information in response to a asked question.	“This function takes two arguments.....”
	Acknowledgement [78]	Students acknowledge receipt of information from others.	“Okay”, “I agree”, “Got it”
	Debugging [68]	Students are debugging the final code.	“There's a bug here, I need to double-check the values”
Collaborative Programming	Python coding [58]	Students provide detailed explanations of programming.	“You switch to the function remove”
	Print and evaluate code[58]	Students write and test code in a cyclical process, continuously writing and testing.	“Let me run the code to see the results and then tweak it.”
	Escalation [78]	Students ask for assistance from the instructor either verbally.	“I think we need to ask the teacher about this.”
Situation Awareness	Unrelated chat among students [58]	Students engage in unrelated conversations with peers.	“What are the other groups doing?”
	Difficult-to-reconcile conflicts [68]	Students encounter conflicts that are challenging to resolve.	“We've been debating which way to implement this”

Figure 1: Collaborative programming coding schemes, along with their definitions and examples.

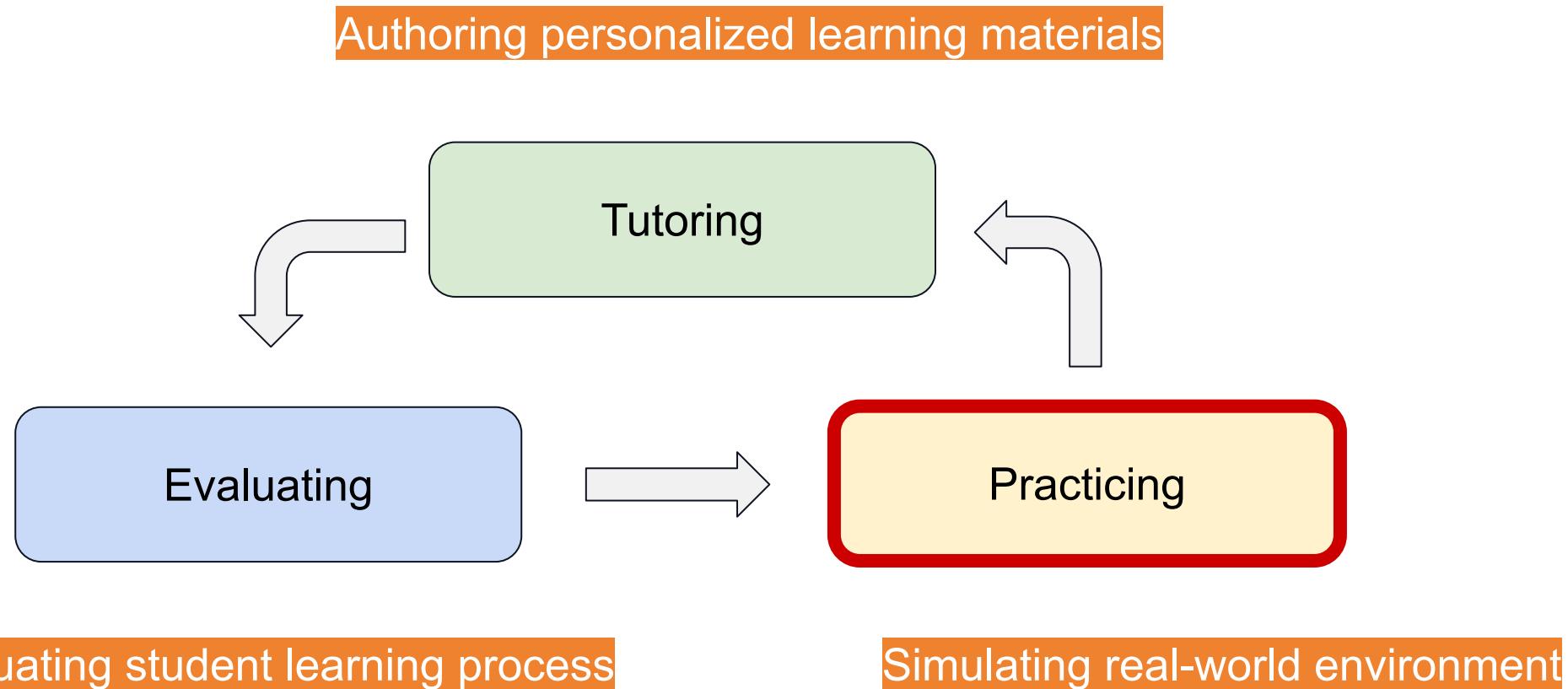
Evaluation

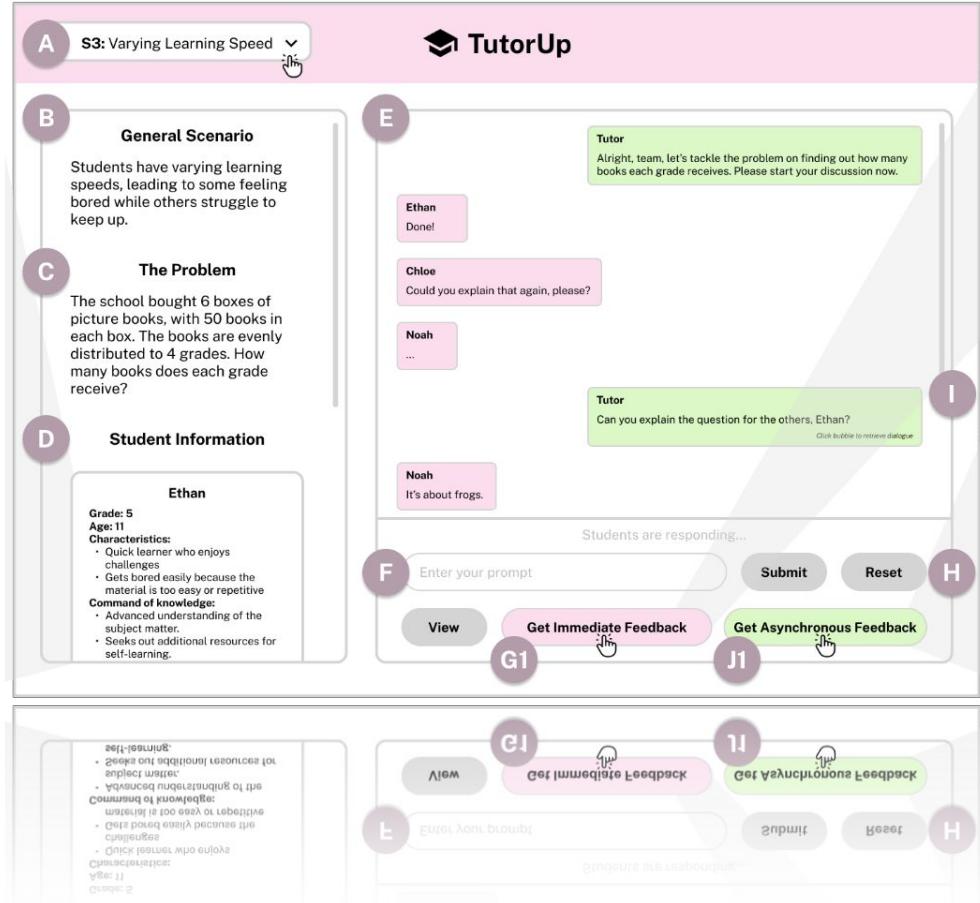
We evaluated LLMs' performance in code quality by comparing it to human-labeled (two experienced educators, I1, and I2) results.

The results showed that I1 and I2 reached **93.43% agreement**, while ChatGPT-4o's annotations matched I1 and I2's annotations with **85.62% and 89.32%** consistency, respectively.

ChatGPT-4o's accuracy was relatively lower in classifying collaborative programming behaviors (90.32%) and code quality (93.43%) but higher in identifying student roles (96.54%) and teacher scaffolding (97.42%).

Generative AI's opportunities for Personalization





TutorUp: What If Your Students Were Simulated? Training Tutors to Address Engagement Challenges in Online Learning

Sitong Pan, Robin Schmucker, Bernardo Garcia Bulle Bueno, Salome Aguilar Llanes, Fernanda Albo Alarcón, Hangxiao Zhu, Adam Teo, **Meng Xia***

CHI 2025

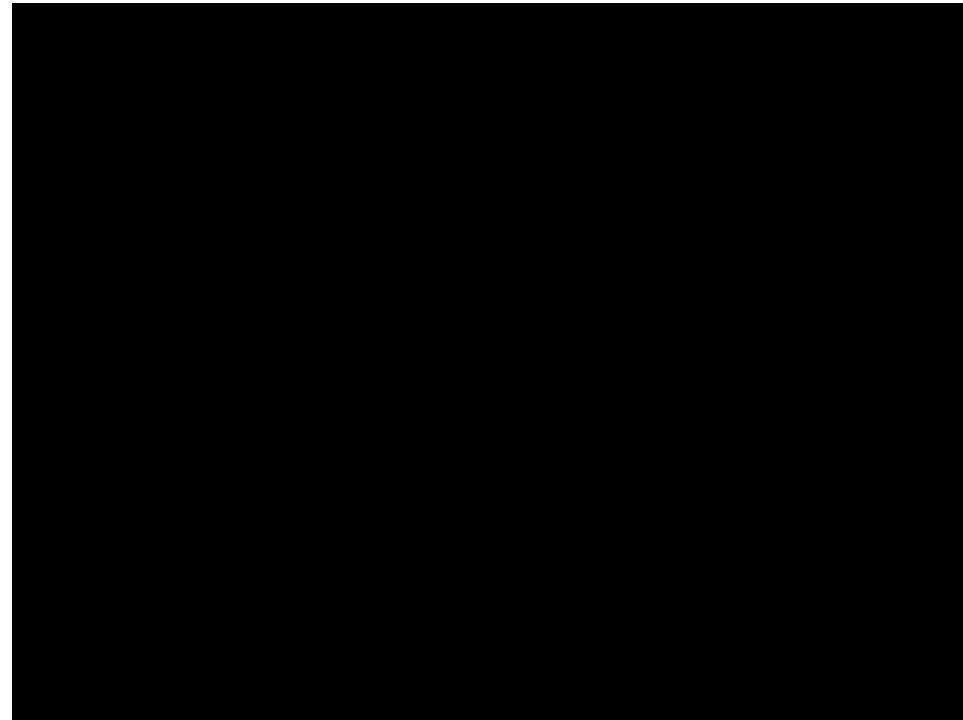
Engaging students is challenging in online learning



Identity Challenging Scenarios

Based on a formative study involving two surveys ($N1 = 86$, $N2 = 102$) on student engagement challenges, we summarize scenarios that mimic real teaching situations:

- Lack of Interest and Engagement
- Lack of Confidence
- Varying Learning Speeds
- Fatigue and Focus Issues



Pre-service Teaching Training

(under review)

The image shows a screenshot of a teaching simulation software interface. The top navigation bar includes 'Personalization', 'Simulation', 'Reflection', and 'Settings' (indicated by a circled 'H'). The main area is divided into several sections:

- Teacher:** Shows a grid of student icons with names: Michael, Maria, Daniel, Jenny, Erin, Sophia, Tyler, Hannah, William, Chloe, Samuel, Ashley, Julian, Sarah, Kevin, Jason, Grace, and Olivia. A callout 'D' points to the first student, with instructions: "Click to select/deselect individual students, double-click to select/deselect all. Hover over each student to see their information (engagement, math level, argumentation)."
- Current Settings:** Grade Level: Middle School, Math Topic: Variables, Class Description: Eighty students with moderate engagement are about one-third active. Argumentation is limited, as most answers lack justification. Mathematical understanding is solid in basic algebra but weaker when applying concepts to real contexts.
- Reflection:** A callout 'I' contains the text: "Yes, that's right. A variable is a letter that can stand for a number. But it's not always just one fixed number. The value can change depending on the situation." Below this is a message from "Hannah": "Oh, so it can be like anything?"
- Messaging:** A callout 'J' shows a message input field "Enter your message here" and a "Send" button. A callout 'K' points to a "Get Suggestions" button.
- Teaching Suggestions:** A callout 'L' contains the text: "The students need to connect the concept of a variable to specific examples or contexts to deepen their understanding." Below this is a list of "Suggested Questions":
 1. Can you think of a situation where a variable might represent different numbers?
 2. How would you use a variable to represent an unknown quantity in a math problem you're familiar with?
- Bottom Grid:** Shows a second grid of student icons with names: Daniel, Keira, Noah, Grace, Olivia, William, Chloe, Samuel, Ashley, Julian, Sarah, Kevin, Jason, Grace, and Olivia. A callout 'M' points to the first student in this grid.

A

Personalization

Simulation

9

Reflection

H

B

C

▲ Settings

Teacher

D

Neutral Happy Question Confused Thinking

Click to select/deselect individual students, double-click to select/deselect all.
Hover over each student to see their information (engagement, math level, argumentation).

E



Michael



Maria



Daniel



Jenny



So it's like the letter can be different numbers?



Erin

Chole
Engagement: High
Math Level: Intermediate
Argumentation: Statement only



Sophia



Tyler



Hannah



William



Chole



Samuel



Ashley



Julian



Sarah



Kevin



Jason



Grace



Olivia

I

Teacher

Yes, that's right. A variable is a letter that can stand for a number. But it's not always just one fixed number. The value can change depending on the situation.

J

Oh, so it can be like anything?

Hannah

So it's like the letter can be different numbers?

K

Enter your message here

Send

L

💡 Teaching Suggestions

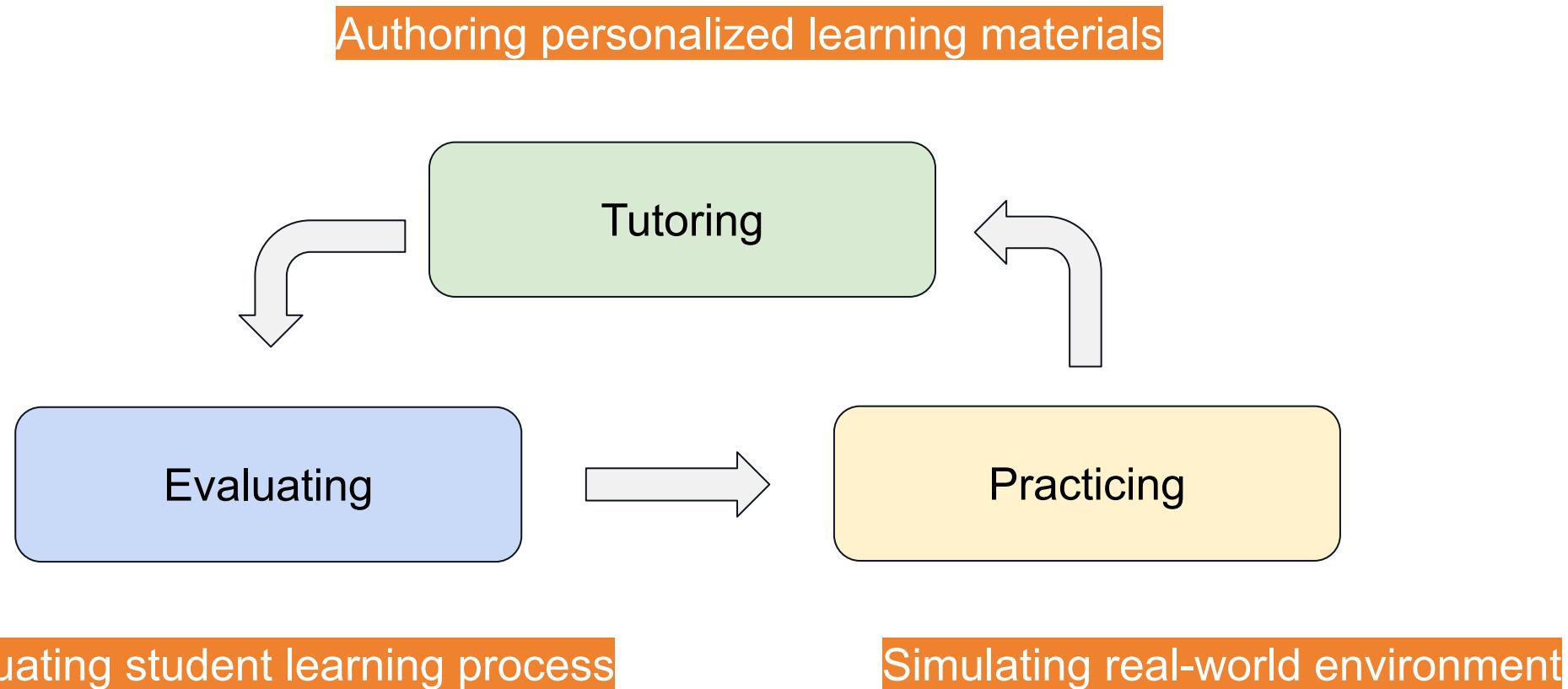
The students need to connect the concept of a variable to specific examples or contexts to deepen their understanding.

M

Suggested Questions:

1. Can you think of a situation where a variable might represent different numbers?
2. How would you use a variable to represent an unknown quantity in a math problem you're familiar with?

Generative AI's opportunities for Personalization



What are the Generative AI's challenges?

- Improper use of AI (e.g., overreliance)
- Hallucination, content inaccuracy
- Lack of pedagogical guidance

StuGPTViz: A Visual Analytics Approach to Understand Student-ChatGPT Interactions

Zixin Chen, Jiachen Wang, **Meng Xia***, Kento Shigyo,
Dingdong Liu, Rong Zhang, Huamin Qu

VIS 2024



Background: An inevitable trend in using LLMs



ChatGPT



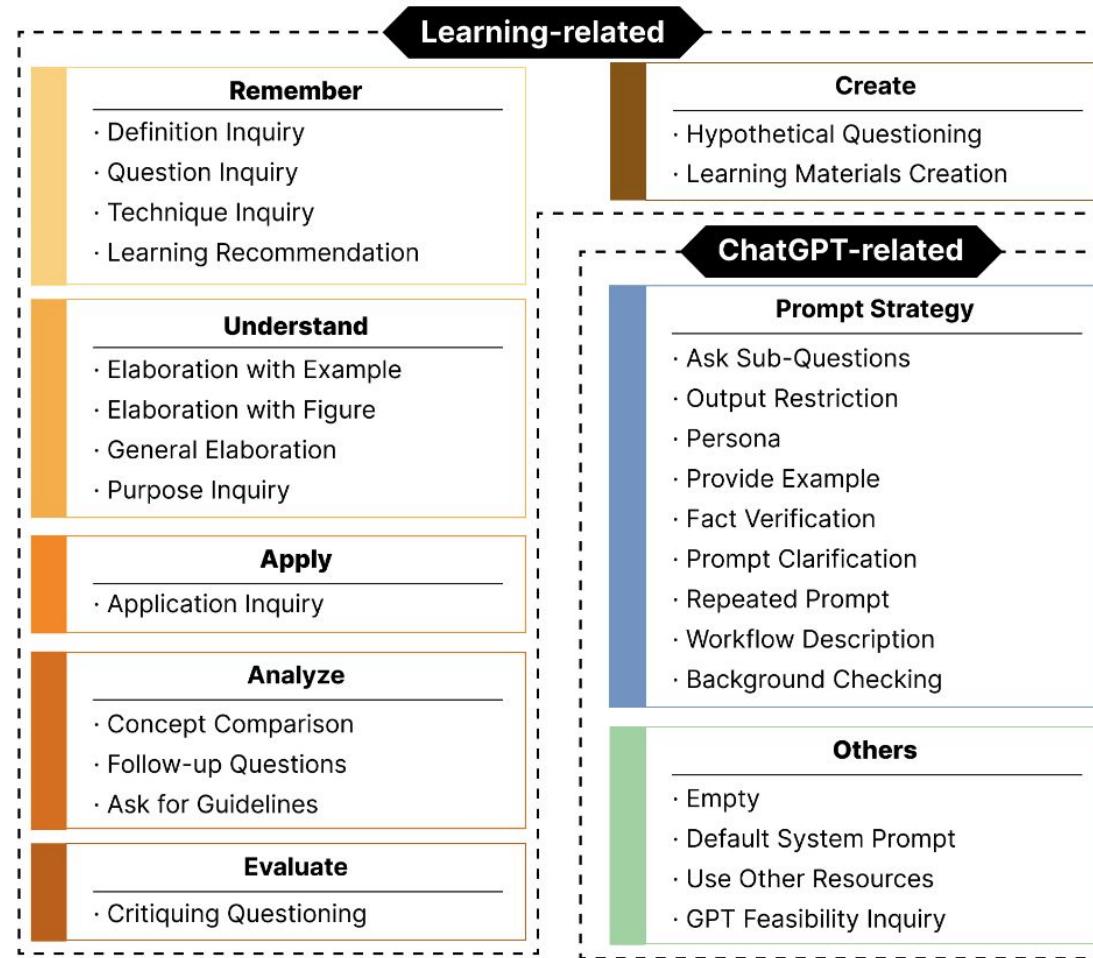
Concerns from instructors:

- How about the performance of these advanced AI tools?
- Using these advanced AI tools, can students practice higher-order thinking (e.g., independent thinking)?
- How can we better design tasks and guide students to use these advanced AI tools?

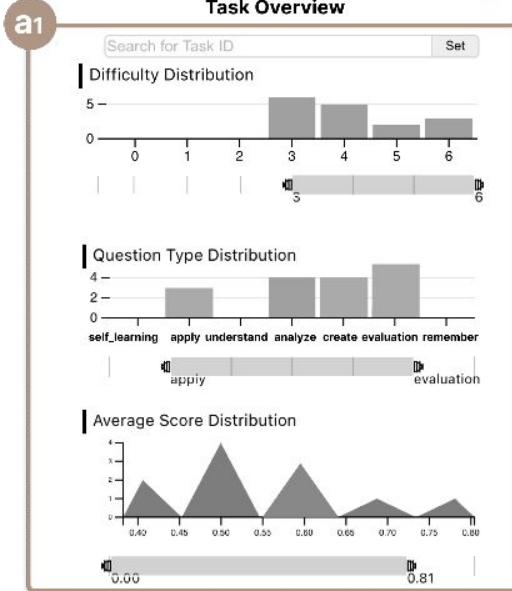
Integration of ChatGPT in Education

- We integrated ChatGPT into the curriculum of a postgraduate data visualization course for computer science majors in the first semester of 2024.
- Each in-class exercise session, we conducted the experiment during the last 40 minutes of the lecture, included a 10-minute self-learning segment with ChatGPT, a 25-minute task completion segment, and a 5-minute conversation log upload phase.
- 744 unique conversations with 2507 turns after filtering out the empty conversations and those unrelated to the learning tasks

Dataset Creation with Pedagogical Insights

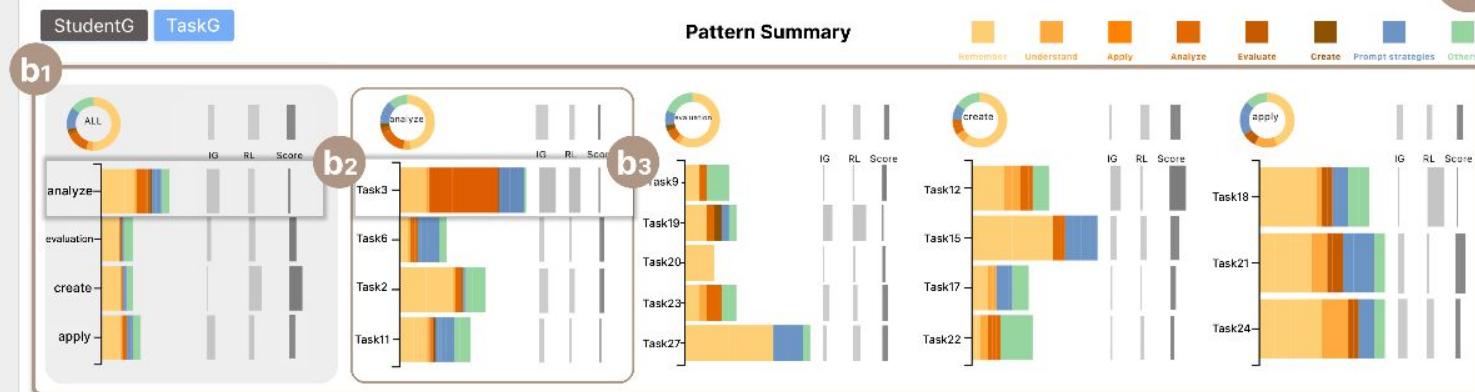


Filter View



A

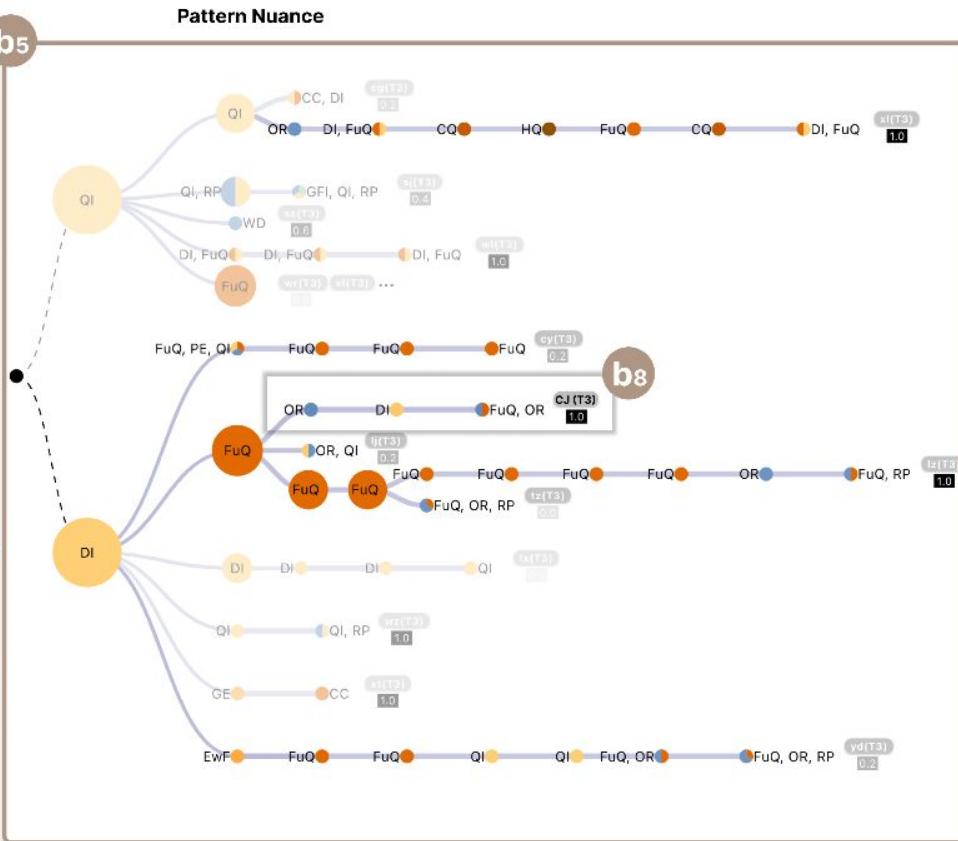
Pattern View



b4

L...	Pattern	C...	Avg.
1	{ Follow up Questions }	17	0.806...
1	{ Question Inquiry }	16	0.5615...
1	{ Definition Inquiry }	12	0.326...
2	Follow up Questions → Follow up Questions	8	0.589...
2	{ Follow up Questions Definition Inquiry }	7	0.870...
1	{ Output Restriction }	7	0.828...

b5



B

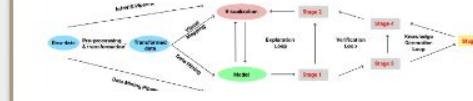
Detail View

Task Description

This diagram illustrates the updated Visual Analytics Pipeline (named the knowledge generation model), which involves a series of operations, representations, and analytical stages. Using GPT's assistance, please identify and fill in the blank nodes which associated Analytical Stages (1 to 5) in the process.

Analytical Stages

Stage 1 is [Stage_A]
Stage 2 is [Stage_B]
Stage 3 is [Stage_C]
Stage 4 is [Stage_D]
Stage 5 is [Stage_E]



| Student Answer

Finding, Action, Insight, Hypothesis, Knowledge

Raw Conversation



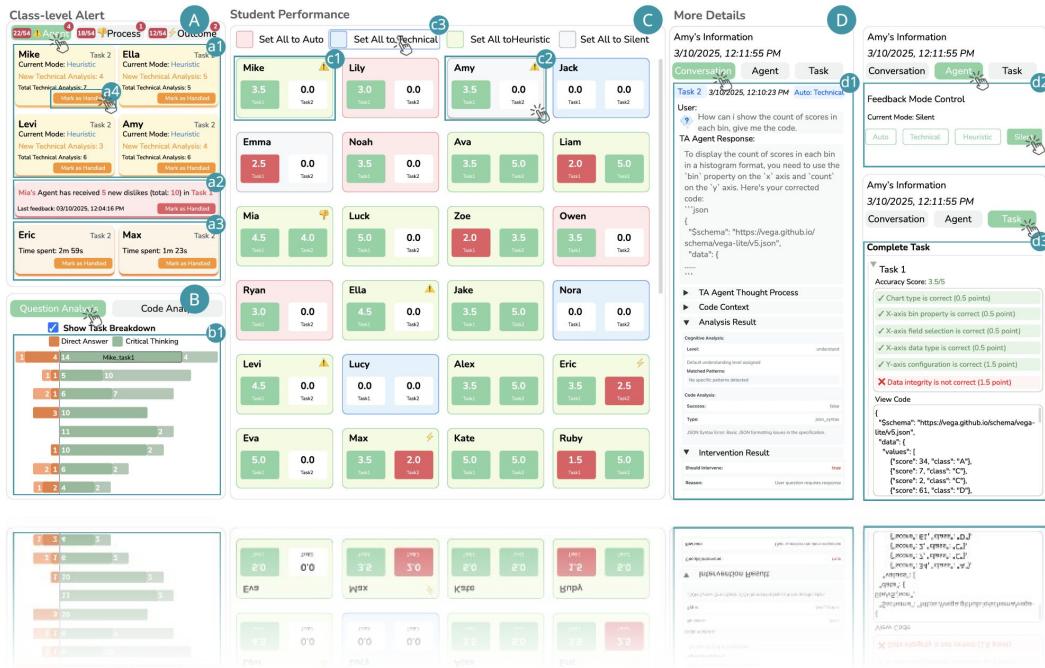
Do you know the diagram of updated visual analytics pipeline



Yes, the updated visual analytics pipeline typically consists of the following stages: 1. Data acquisition and integration 2. Data cleaning and preprocessing 3. Data transformation and feature extraction 4. Data mining and analysis 5. Visualization and exploration 6. Knowledge representation and reasoning 7. Decision making and action. This pipeline is iterative and interactive, allowing analysts to refine their understanding of the data and adjust their analysis and visualization approaches as needed.

Evaluation and Result

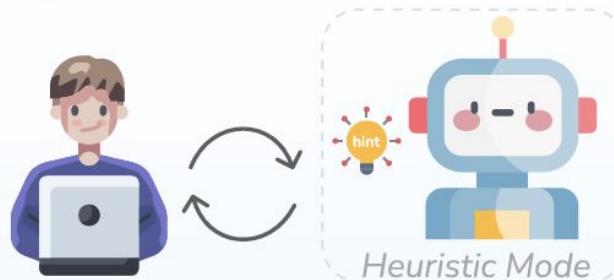
- Students' learning perspective:
More than 90% students enjoy using ChatGPT in their learning process
- ChatGPT performance:
Strong positive correlation between the IG (information gain) metric and experts' judgment of ChatGPT's response quality
- Expert interviews:
“The ability to discern students' overall cognitive level at a glance is highly appreciated.”
“The workflow's logical progression and the interconnection of each view were particularly impressive, enabling a diverse analytical focus through a unified procedure.”



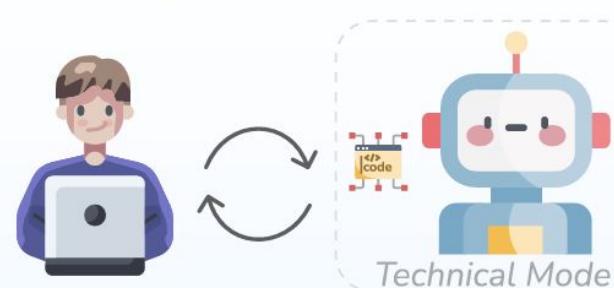
Real-time Classroom Orchestration for Students, AI, and Instructor

CHI 2026 (under review)

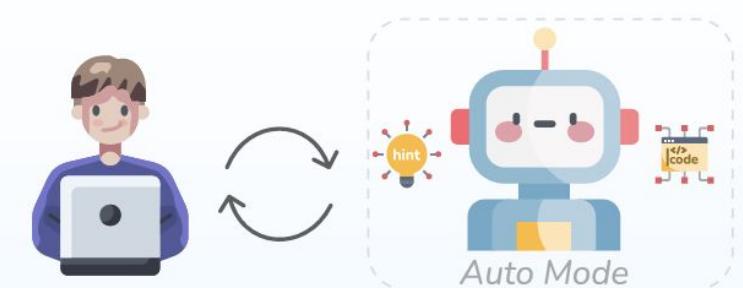
⌚ At the beginning of the class



⌚ 10 mins later



⌚ 20 mins later



⌚ Alert: Some students' progress are low

Analyze, Visualize and Alerts student-agent interaction to the instructor in real-time.



Class-wide Adjustment:

Set all agents to Heuristic Mode

Individual Student Adjustment:

Set these students' agent to
Technical Mode

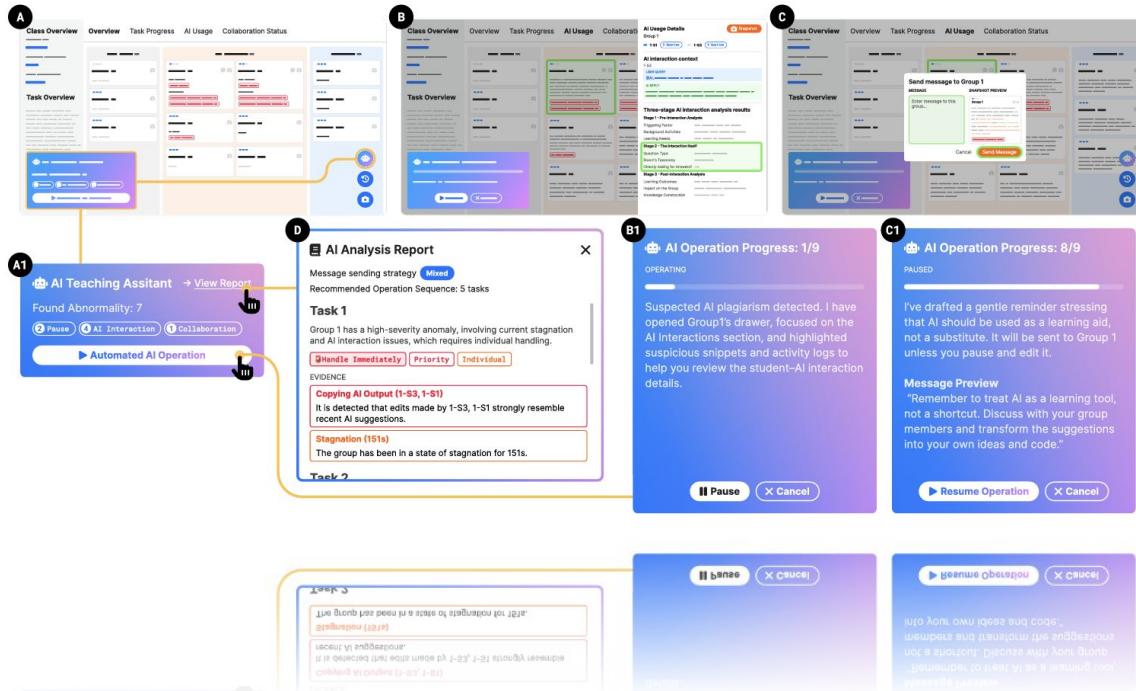
Class-wide Adjustment:

Set all agents to Auto Mode

Instructors adjust the Agent's feedback mode based on timing and interface insights.

Real-time Classroom Orchestration for Groups, AI, and Instructor

CHI 2026 (under review)



A

B

C

A1

D

B1

C1

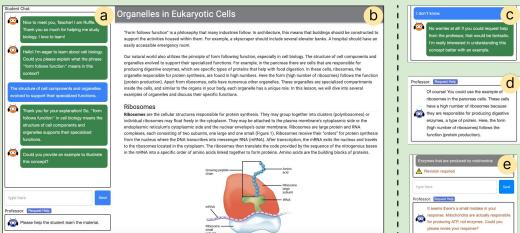
A1

D

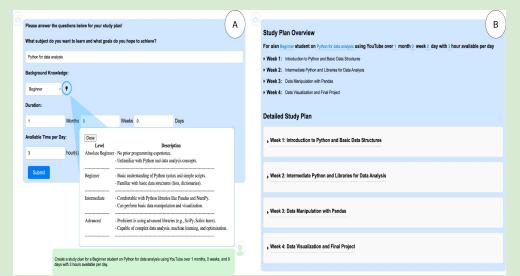
B1

C1

Tutoring



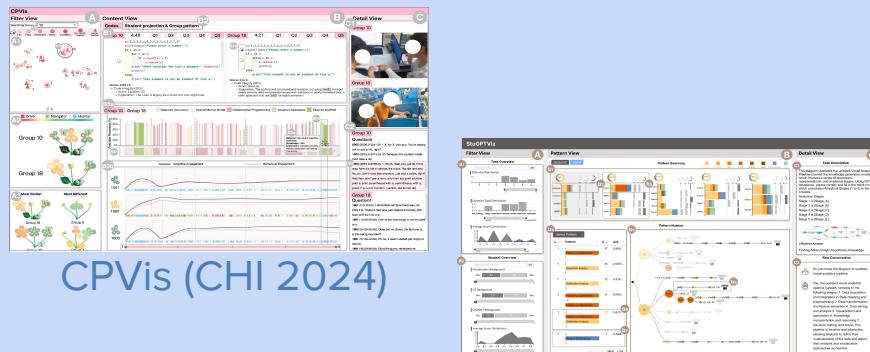
Ruffle&Riley (AIED 2024)



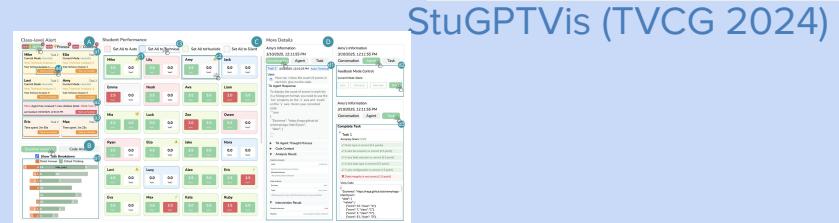
PlanGlow (L@S 2025)

(under review)

Evaluating



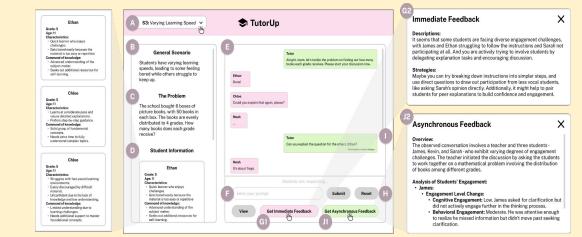
CPVis (CHI 2024)



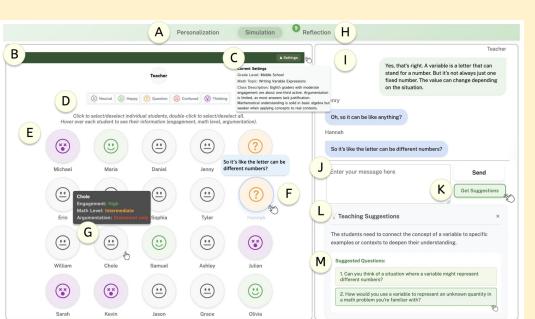
StuGPTVis (TVCG 2024)

(under review)

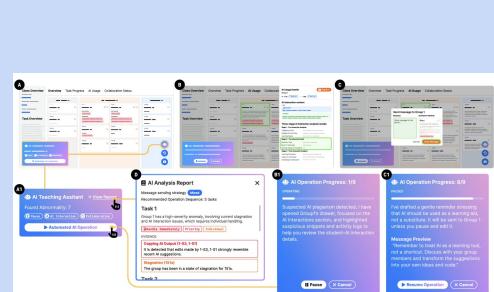
Practicing



TutorUp (CHI 2025)



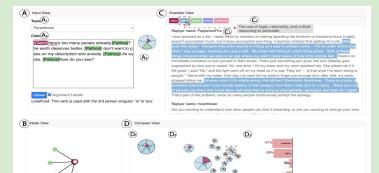
VizDOSstudio (under review)



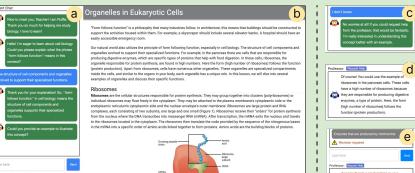
AI Assistant (under review)

(under review)

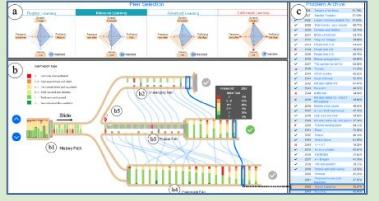
Tutoring



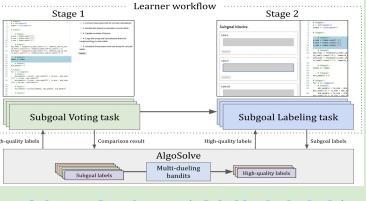
Persua (CSCW 2022)



Ruffle&Riley (AIED 2024)



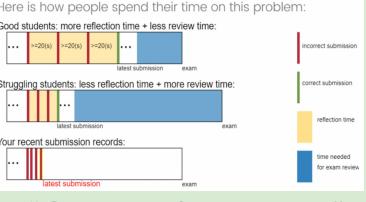
Peerlens (CHI 2019)



AlgoSolve (CHI 2022)



PlanGlow (L@S 2024)



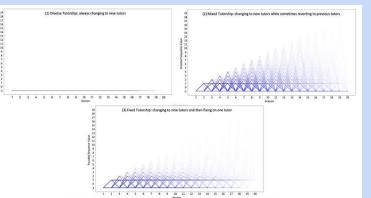
“Gaming the system” (L@S 2020)

(under review)

Evaluating



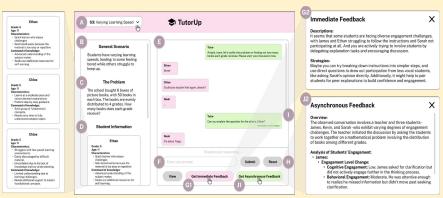
RLens (L@S 2022)



Distributed Tutorship (LAK 2022)



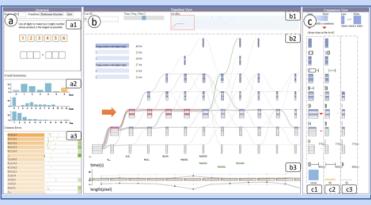
SolutionVis (AIED 2023)



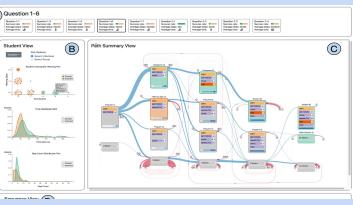
TutorUp (CHI 2025)



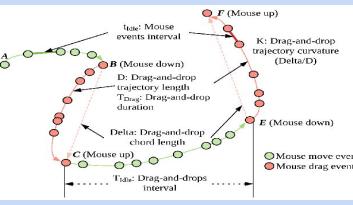
Mobile MOOCs (CHI 2022, Best Paper Award)



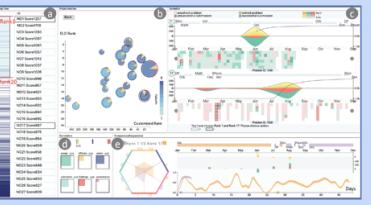
QLens (TVCG 2021)



BlockLens (L@S 2022)



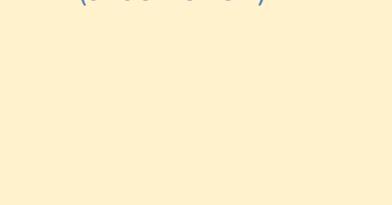
Predication (LAK 2020)



SeqDynamics (EuroVIS 2020)



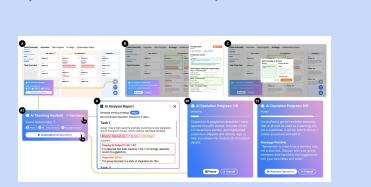
StuGPTVis (TVCG 2024)



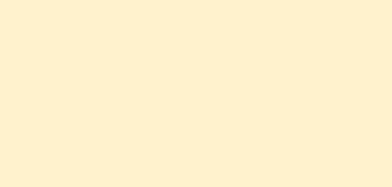
Visual Analytics K-12 (VIS 2019, Best Poster Award)



CPVis (CHI 2024)

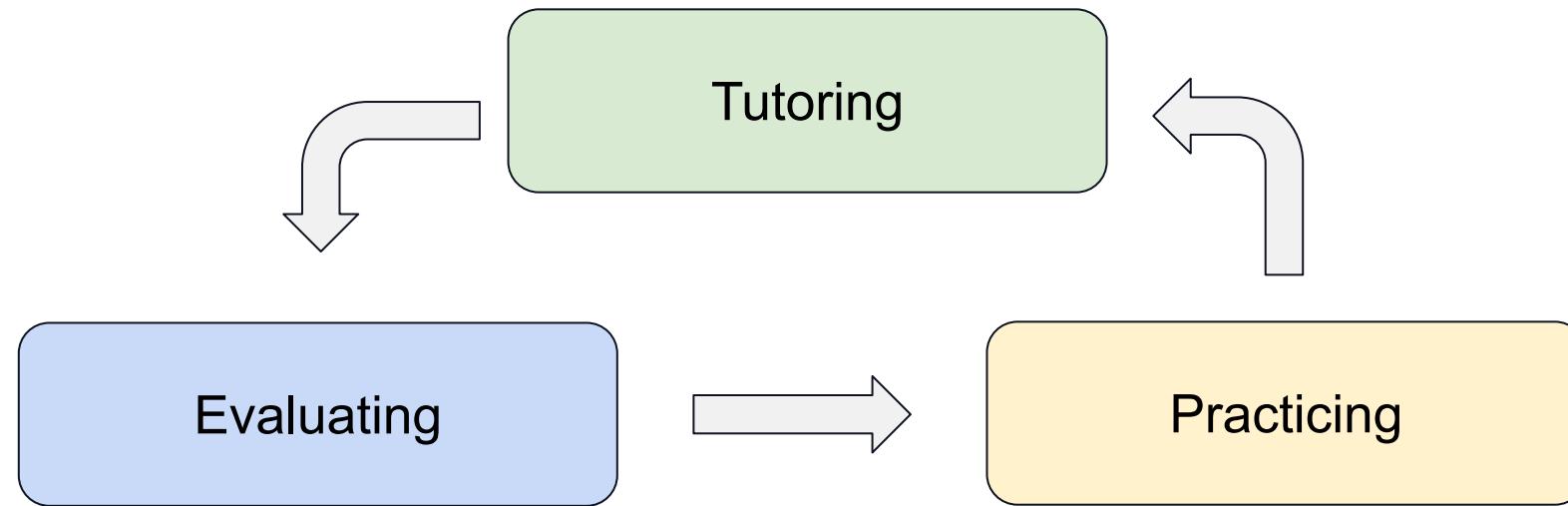


(under review)



(under review)

(under review)



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Dream Lab



TEXAS A&M
UNIVERSITY

Use **visual analytics**, AI, and other **human-AI interaction techniques** and research metaphors to **upskill** educators and learners to better utilize data and AI for **Personalization@Scale!**