

# Human-AI Interaction for Personalized Online Learning

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April 10, 2024



TEXAS A&M UNIVERSITY  
Department of Computer  
Science & Engineering

# Online Learning has become widespread



A Coding Exercises Platform



A MOOCs platform (massive open online courses)



A videotelephony software



An online discussion forum

Virtual teacher (Chatbot)

# Learning at scale, flexible locations and times

## Scale



## Space



## Time

CLASS TIMETABLE			
	9.00-9.30	9.30-10.30	11.00-1.00
MON	SPORT	MATHS	LITERATURE
TUE	SPORT	LITERATURE	ENGLISH
WED	SPORT	SCIENCE	COMPUTING
THU	SPORT	ENGLISH	HISTORY
FRI	SPORT	SCIENCE	COMPUTING
			GEOGRAPHY



**Machine Learning Specialization**  
#BreakIntoAI with Machine Learning Specialization. Master fundamental AI concepts and develop practical machine learning skills in the beginner-friendly, 3-course program by AI visionary Andrew Ng

★★★★★ 4.9 7,331 ratings

Andrew Ng +3 more instructors [TOP INSTRUCTORS](#)

**120,420 already enrolled**



# Learning at scale, flexible locations and times

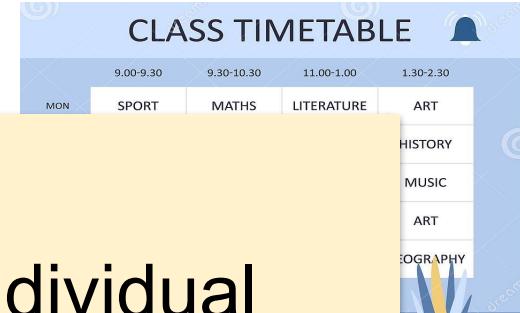
## Scale



## Space



## Time



Make learning tailored to individual students a grand challenge!

Machine Le

#BreakIntoAI with Machine Learning and develop practical machine learning program by AI visionary Andrew Ng

★★★★★ 4.9 7,331 rating

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# Why personalized learning?



## Non-cognitive

motivation

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

self-regulation  
skills

(Aleven & Koedinger, 2002)

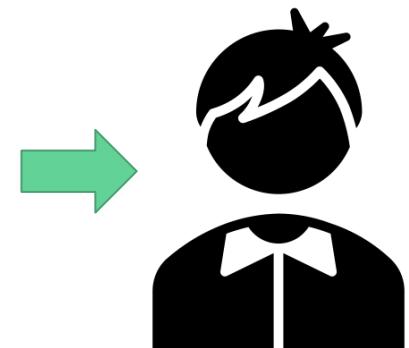
## Cognitive

knowledge

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

problem-solving  
strategies, errors

(Adams et al., 2014)



# Learning at scale, flexible locations and times

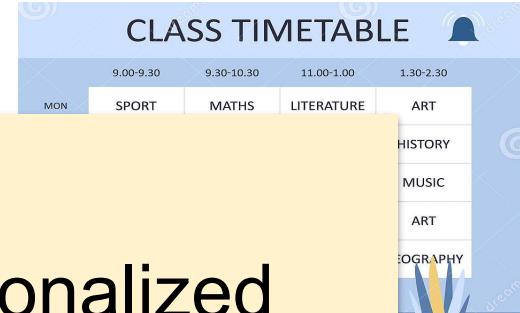
## Scale



## Space



## Time



How could we achieve personalized online learning?

Machine Le

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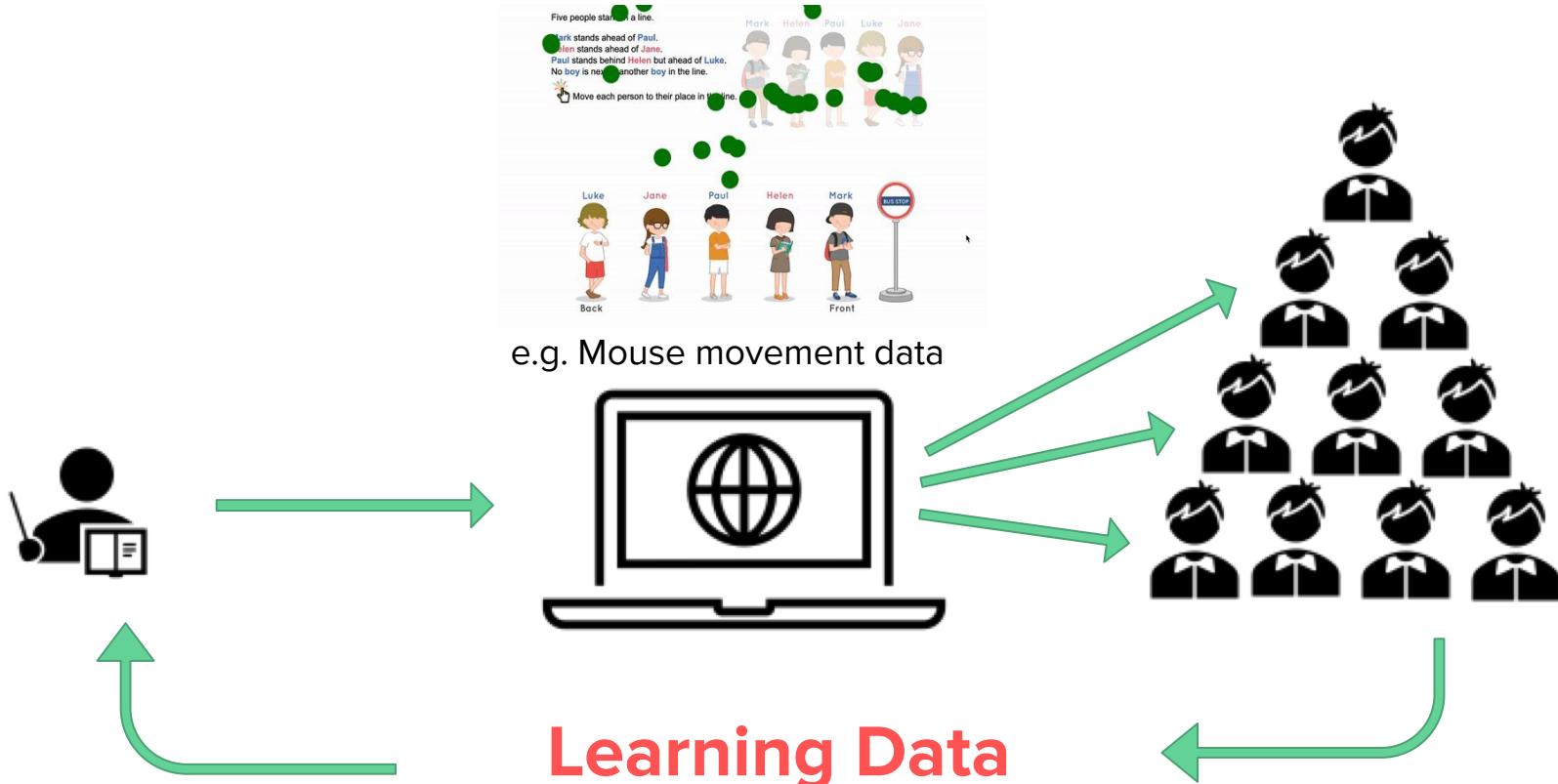
Andrew Ng +3 more instructors

[TOP INSTRUCTORS](#)

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# Learning Data is a Communication Channel



# Online Learning Platforms and Data



coursera

zoom

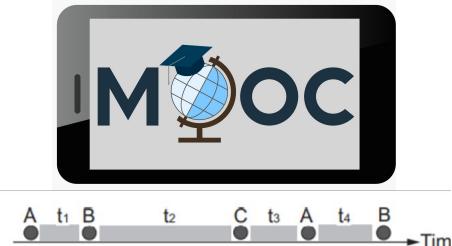


reddit



ChatGPT

#	Title
✓ 1249	Minimum Remove to Make Valid Parentheses
✓ 1762	Buildings With an Ocean View
✓ 1570	Dot Product of Two Sparse Vectors
✓ 1650	Lowest Common Ancestor of a Binary Tree III
✓ 426	Convert Binary Search Tree to Sorted Doubly Linked List



Problem-solving data

Click-stream data



Video and audio communication data



Online discussion data

# Research Goal

*Help **learners and educators** to **find insights** from learning data and use the **insights** to **make decisions** for achieving **personalized online learning**.*

# Related Work on Learning Analytics

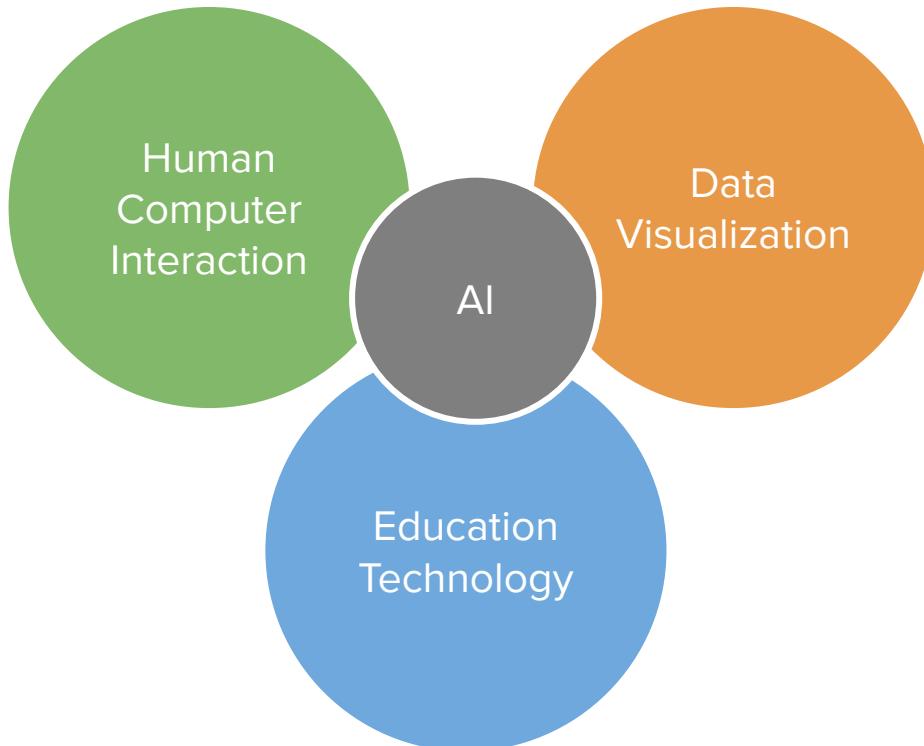
- Focus more on cognitive skills instead of non-cognitive variables (e.g., motivations, self-regulation skills)

Learning factor analysis (Cen et al., 2006) Performance factor analysis (Pavlik et al., 2009)

- Algorithms' outputs are not easy to interpret

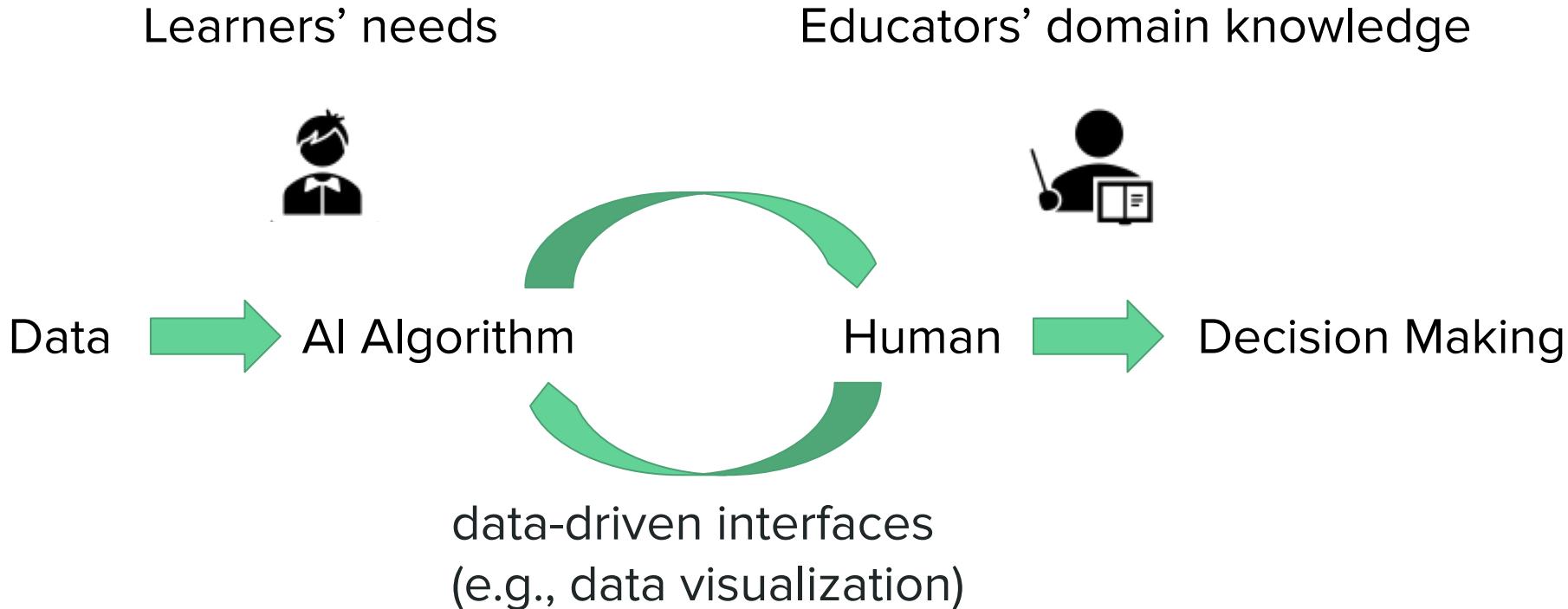
Deep knowledge tracing (Piech et al., 2015) Explanatory models for educational data (Liu et al., 2017)

# My Approach



*Design and build  
**human-centered**  
**data-driven systems** for  
achieving **personalized**  
**online learning**.*

# Why *human-centered* data-driven systems?



# Challenges

- **Learners have different aspects** that change over time
- **Learners and educators are not data analysts**
- Different learning scenarios:
  - Learning data is **voluminous and heterogeneous**
  - Learners and educators have **different tasks**



## Educators (design loop)



## Learners (learning loop)

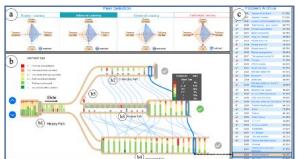
### Planning

### Performing Data

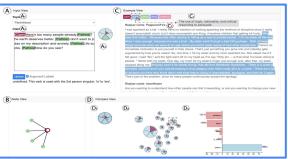
### Reflecting

### Understanding and Analyzing

### Redesigning



Peerlens (CHI 2019)



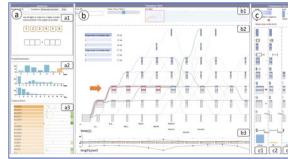
Persua (CSCW 2022)



RLens (L@S 2022)



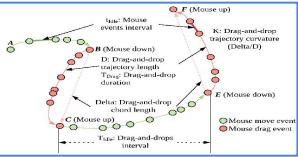
StuGPTVis (TVCG 2024)



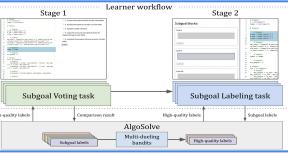
QLens (TVCG 2021)



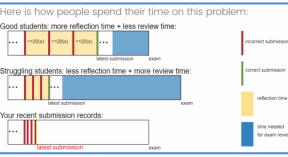
SolutionVis (AIED 2023)



Prediction (LAK 2020)



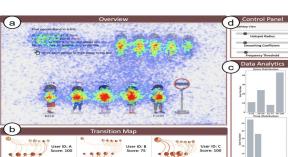
AlgoSolve (CHI 2022)



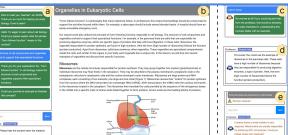
"Gaming the system" (L@S 2020)



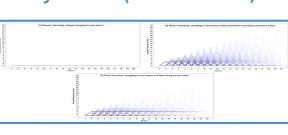
Mobile MOOCs (CHI 2022, Best Paper Award)



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



Ruffle&Riley (AIED 2024)



Distributed Tutorship (LAK 2022)



SeqDynamics (EuroVIS 2020)



BlockLens (L@S 2022)



## Educators (design loop)



## Learners (learning loop)

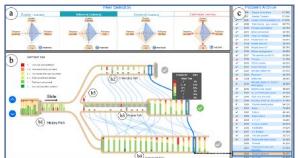
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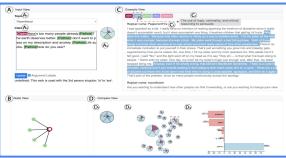
### Reflecting

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Peerlens (CHI 2019)



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RLens (L@S 2022)



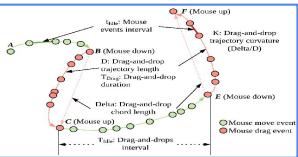
StuGPTVis (TVCG 2024)



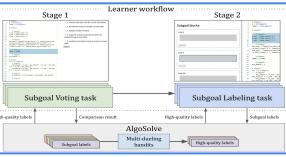
QLens (TVCG 2021)



SolutionVis (AIED 2023)



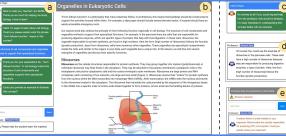
Prediction (LAK 2020)



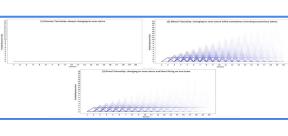
AlgoSolve (CHI 2022)



"Gaming the system" (L@S 2020)



Ruffle&Riley (AIED 2024)



Distributed Tutorship (LAK 2022)



SeqDynamics (EuroVIS 2020)



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Educators (design loop)



Learners (learning loop)

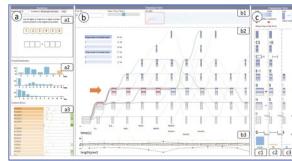
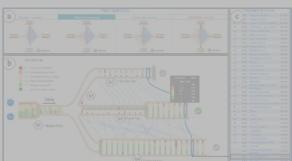
Planning

Performing  
Data

Reflecting

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Redesigning



Peerlens (CHI 2019)

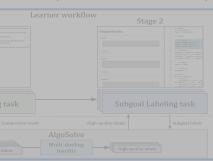
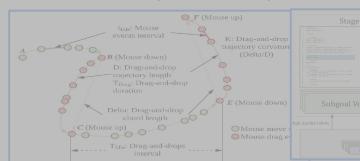
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RLens (L@S 2022)

StuGPTVis  
(TVCG 2024)

QLens (TVCG 2021)

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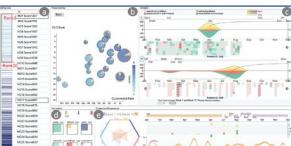
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Visual Analytics K-12 (VIS  
2019, Best Poster Award)

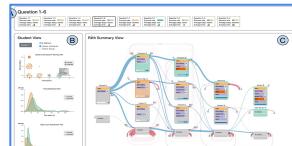


Ruffle&Riley (AIED 2024)

Distributed Tutorship (LAK  
2022)



SeqDynamics (EuroVIS  
2020)



BlockLens (L@S 2022)



## Educators (design loop)



## Learners (learning loop)

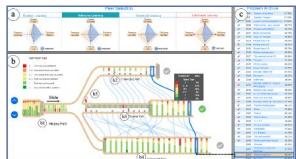
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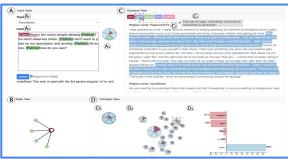
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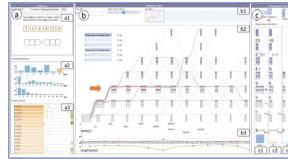
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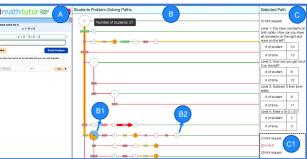
RLens (L@S 2022)



StuGPTVis (VIS 2024, under review)

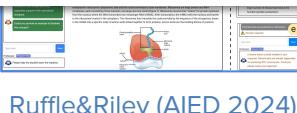


QLens (TVCG 2021)



SolutionVis (AIED 2023)

How data can be used for learners to plan, perform, and reflect on their learning?



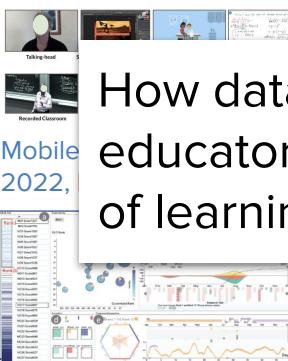
Ruffle&Riley (AIED 2024)



Distributed Tutorship (LAK 2022)



SeqDynamics (EuroVIS 2020)



BlockLens (L@S 2022)

How data can be used for educators to improve the design of learning materials?



Educators (design loop)



Learners (learning loop)

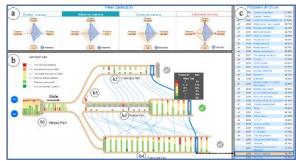
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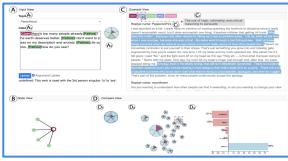
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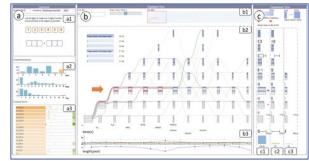
Redesigning



Peerlens (CHI 2019)



Persua (CSCW 2022)



QLens (TVCG 2021)



StuGPTVis (TVCG  
2024)

How data can be used for learners to plan, perform, and reflect on their learning?

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Educators (design loop)



Learners (learning loop)

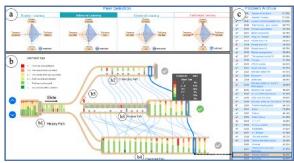
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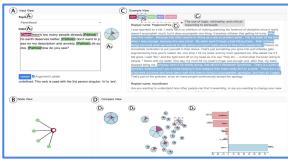
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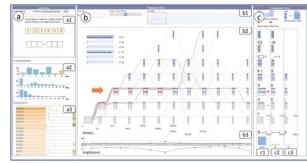
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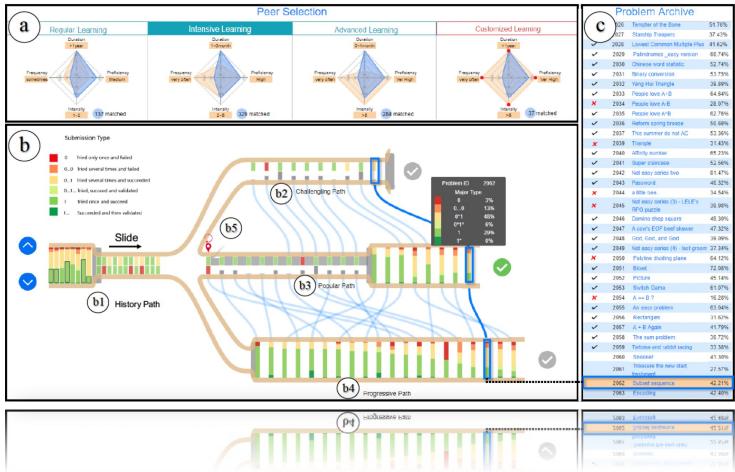
StuGPTVis (TVCG  
2024)

How data can be used for learners to **plan**, perform, and reflect on their learning?

# PeerLens: Peer-inspired Interactive Learning Path Planning in Online Question Pool

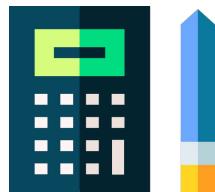
Meng Xia, Mingfei Sun, Huan Wei, Qing Chen, Yong Wang,  
Lei Shi, Huamin Qu, Xiaojuan Ma

CHI 2019



# What is an online question pool?

- A collection of questions for learners to practice their knowledge online



Math



Programming



Driving license

# Motivation

Pro. ID	
1000	A + B Problem
1001	Sum Problem
1002	A + B Problem II
1003	Max Sum
1004	Let the Balloon Rise
1005	Number Sequence
1006	Tick and Tick
1007	Quoit Design
1008	Elevator
1009	FatMouse' Trade
1010	Tempter of the Bone
1011	Starship Troopers

## Questions Pools:

- No pre-determined syllabus
- A lengthy list indexed by their problem IDs
- Hidden intents

## Learners:

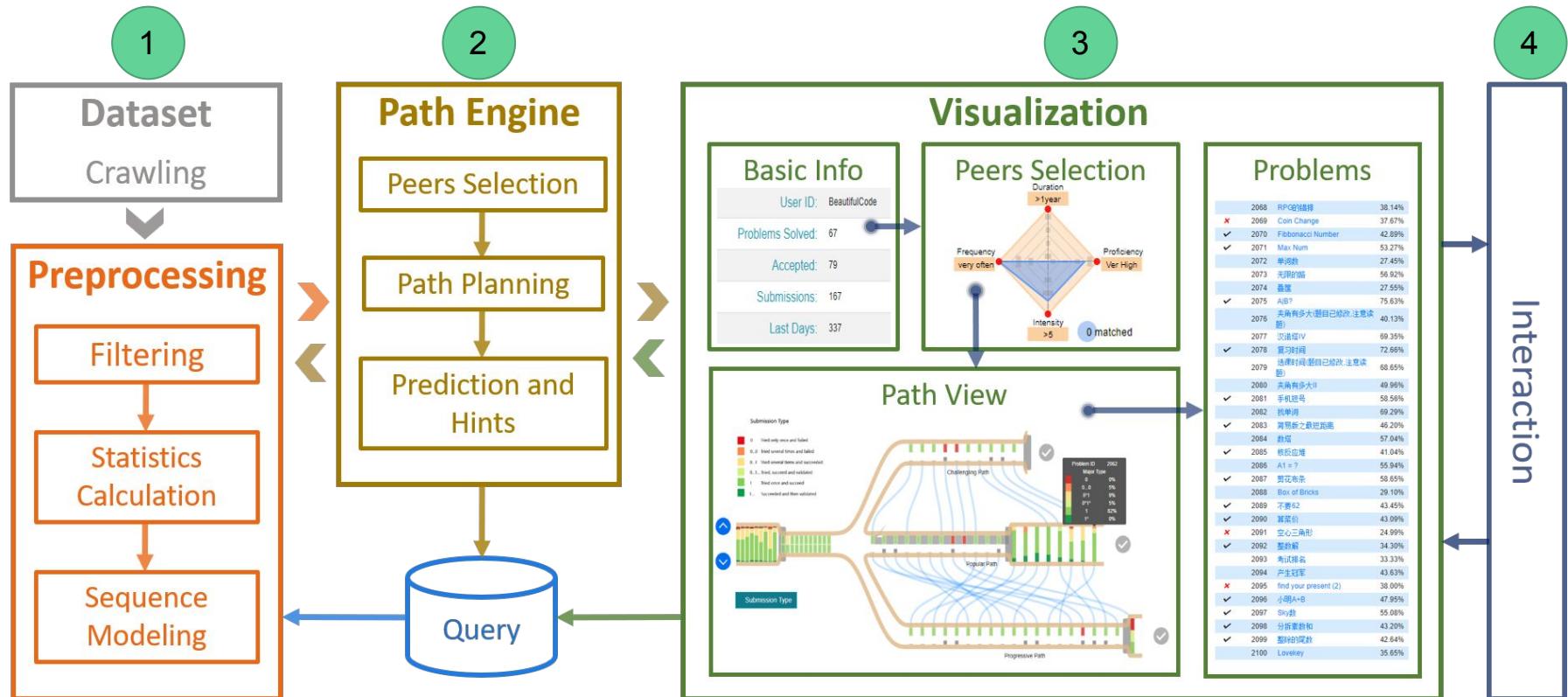
- Different learning scenarios
- One learner's learning scenario may be changing

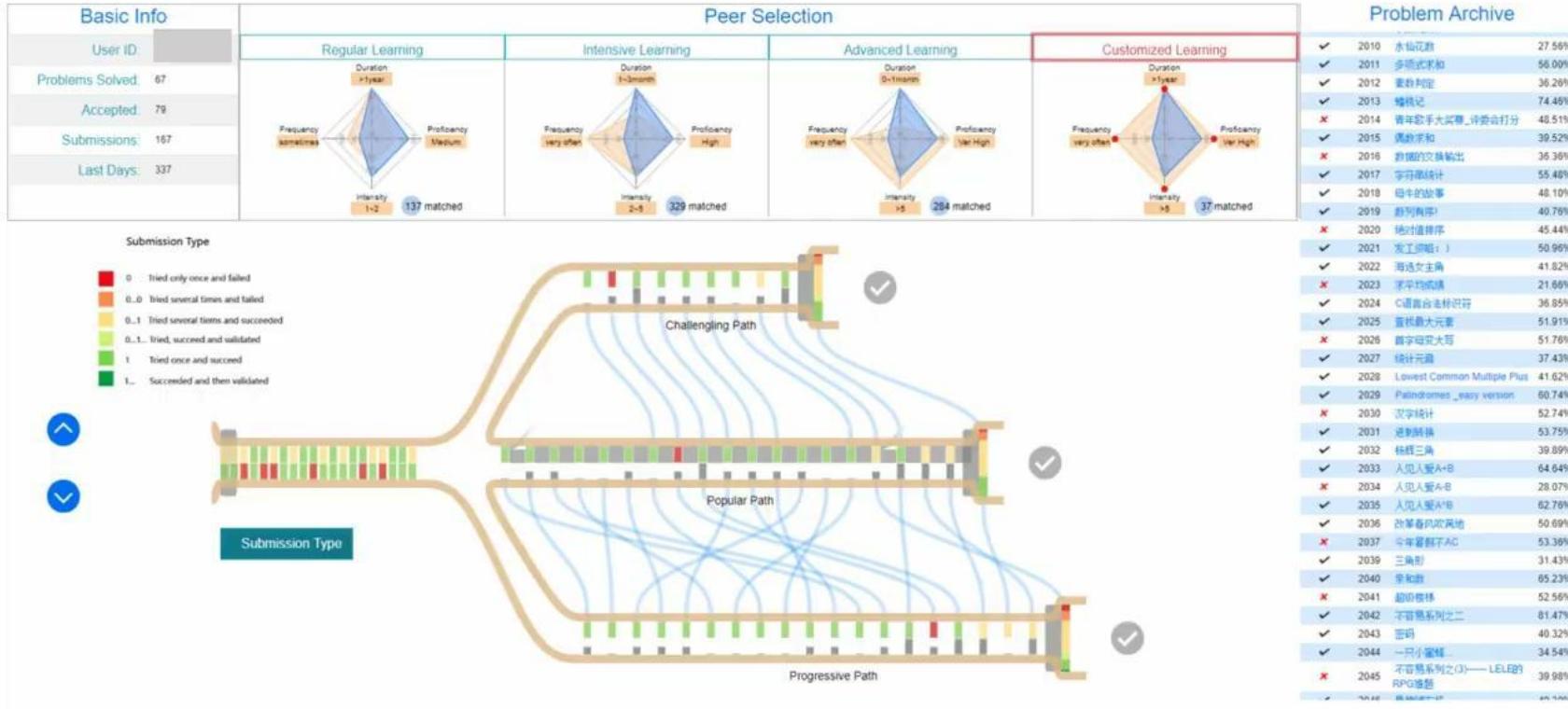
**What to do next? What sequence to follow?**

# A user-centered design process

- Participants: question pool designers and question pool users
- Requirements gathering iteratively for three months
  - R1: **Find peers** for a target learning scenario.
  - R2: **Compare with peers'** performance to understand the gap.
  - R3: Offer flexible learning **path suggestions with explanations**.
  - R4: Provide **convenient interaction and intuitive visual designs**.

# PeerLens System overflow





# Evaluation

RQ1: Is peer data useful?

RQ2: Is visualizing more suggestions helpful for planning compared to only one path?

RQ3: Does visualizing more suggestions using the proposed visualizations increase complexity?

# Evaluation: Controlled User Study

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15...33 34 35 36 37 38  
 39 40 41 42 43 44 45 46 47 48 49 50

Search: [ ] In Title ▾ Go

Pro. ID	Problem Title	Ratio(Accepted/Submissions)
1000	A + B Problem	30.56%(240770/787844)
1001	Sum Problem	25.38%(143110/563922)
1002	A + B Problem II	19.47%(84152/432201)
1003	Max Sum	23.76%(70413/296345)
1004	Let the Balloon Rise	39.72%(59043/148661)
1005	Number Sequence	25.25%(51499/203970)
1006	Tick and Tick	26.73%(6080/22750)
1007	Quoit Design	26.52%(17197/64856)
1008	Elevator	54.79%(46878/85565)
1009	FatMouse' Trade	34.85%(33070/94883)
1010	Tempter of the Bone	26.68%(39786/149139)

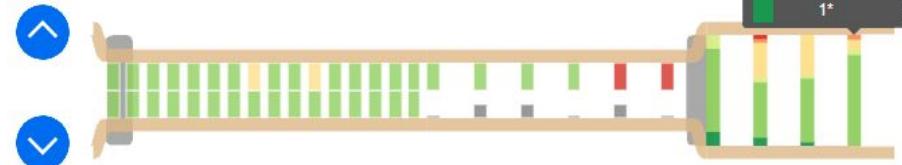
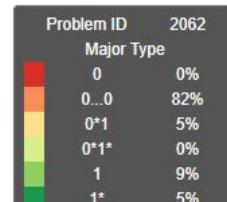
Baseline system (List View)

18 CS students:

- determine the starting question under a specific learning scenario
- find the next question to solve given an existing historical learning path

Submission Type

- 0 Tried only once and failed
- 0..0 Tried several times and failed
- 0..1 Tried several times and succeeded
- 0...1... Tried, succeed and validated
- 1 Tried once and succeed
- 1... Succeeded and then validated

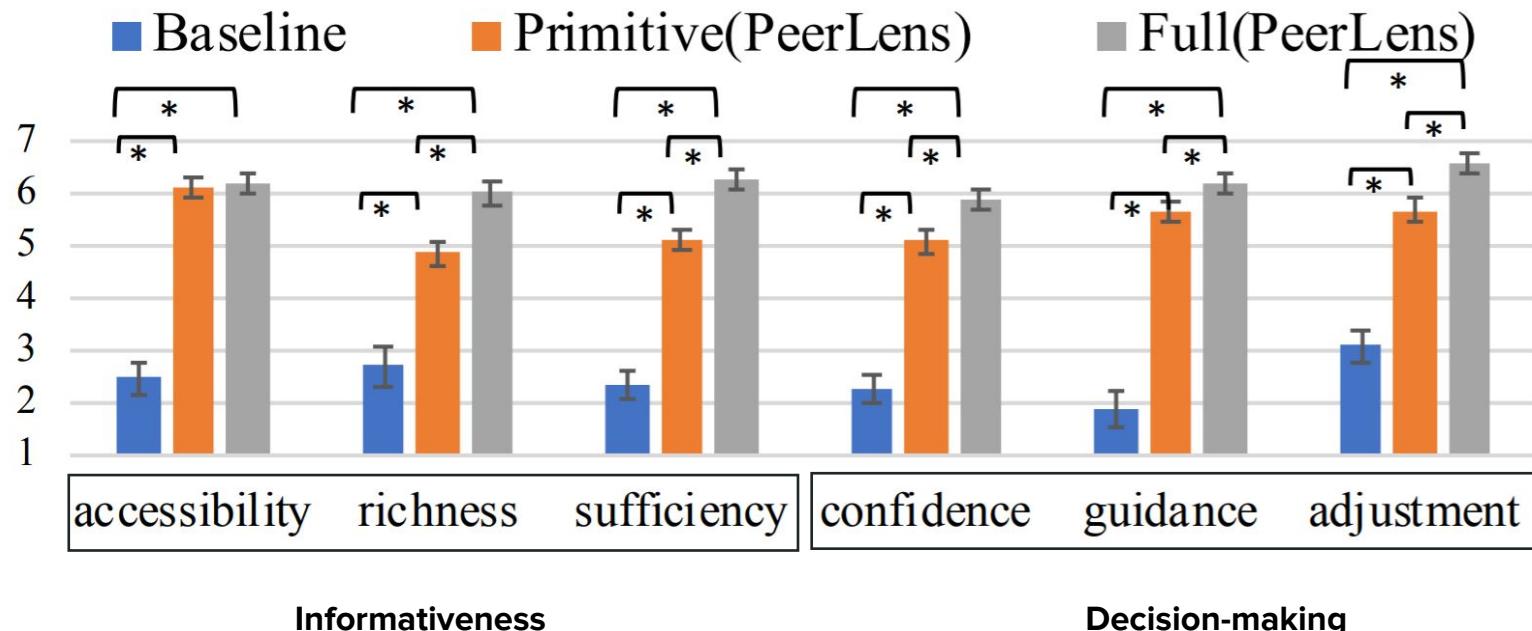


Primitive PeerLens (Only provide one path)

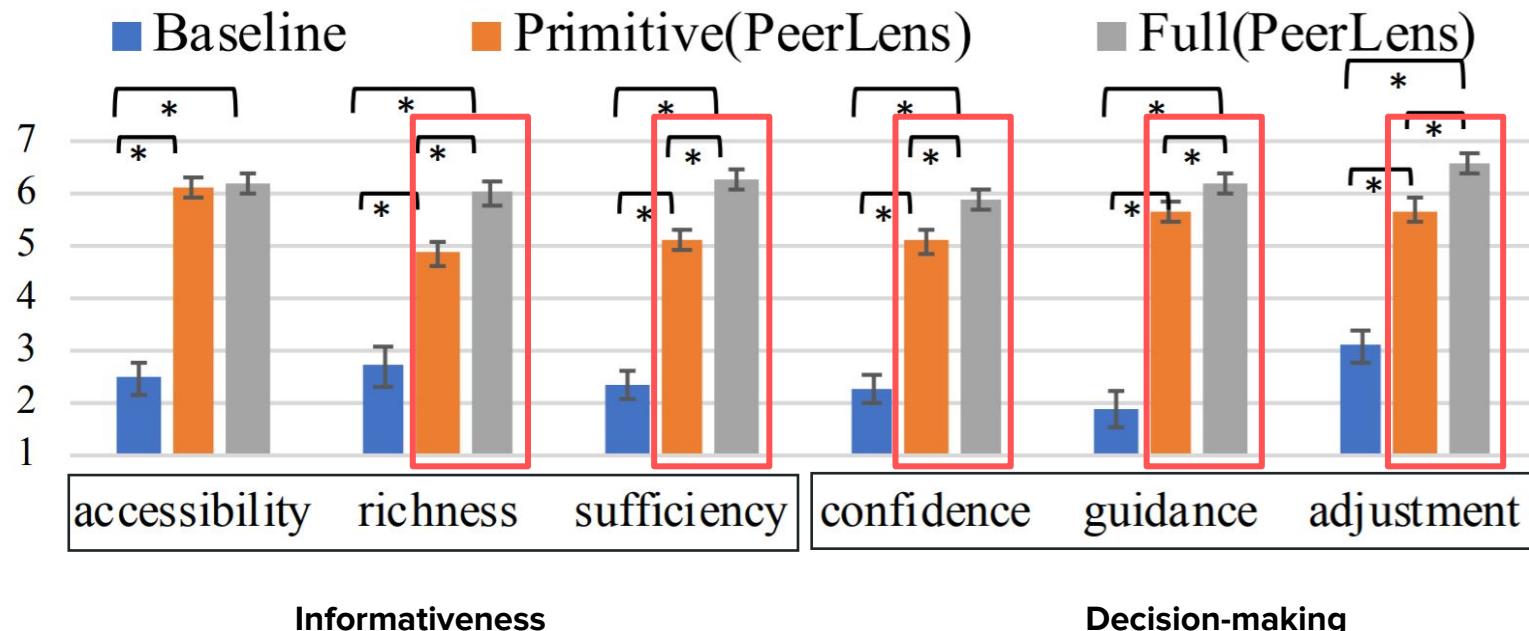
# Evaluation: Questionnaires

Informativeness	Q1	The information needed to plan a learning path is easy to access.
	Q2	The information needed to plan a learning path is rich.
	Q3	The information is sufficient to plan a learning path.
Decision making	Q4	The system was helpful for me to find a proper learning path for a specific learning scenario.
	Q5	I am confident that I find a suitable learning path for the learning scenario.
	Q6	The system helps make adjustment according to previous performance.
Visual design	Q7	The learning path design is intuitive.
	Q8	The learning path design helps me understand the suggested path.
	Q9	It was easy to learn the system.
System Usability	Q10	It was easy to use the system.
	Q11	I would like to recommend this system to others.

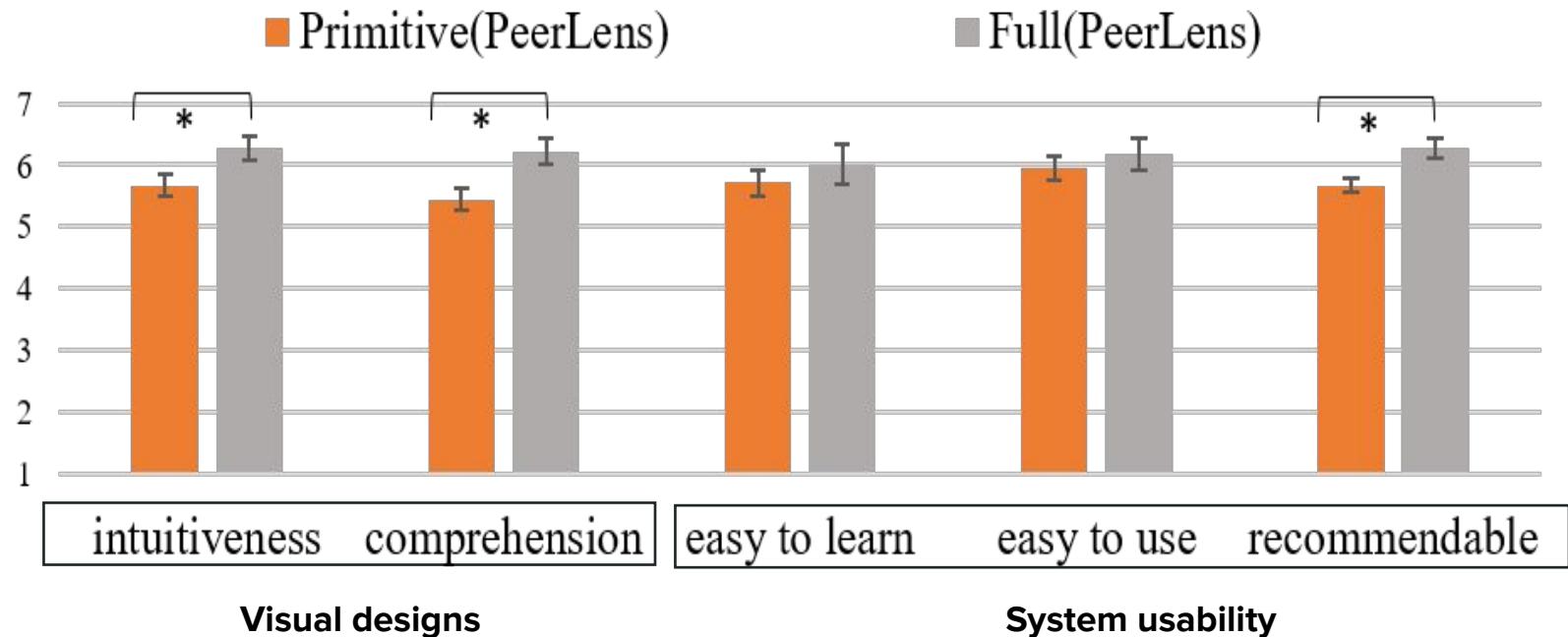
# Results: Using peer data is useful (RQ1)



## Results: Visualizing more suggestions is useful (RQ2)



Results: Visualizing more suggestions using the proposed visualizations did not increase the complexity (RQ3)





Educators (design loop)



Learners (learning loop)

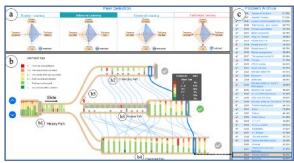
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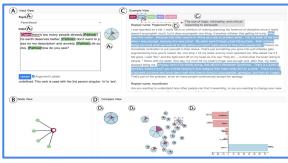
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Understanding  
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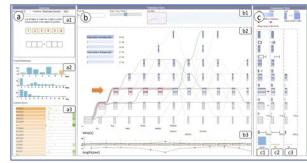
Redesigning



Peerlens (CHI 2019)



Persua (CSCW 2022)



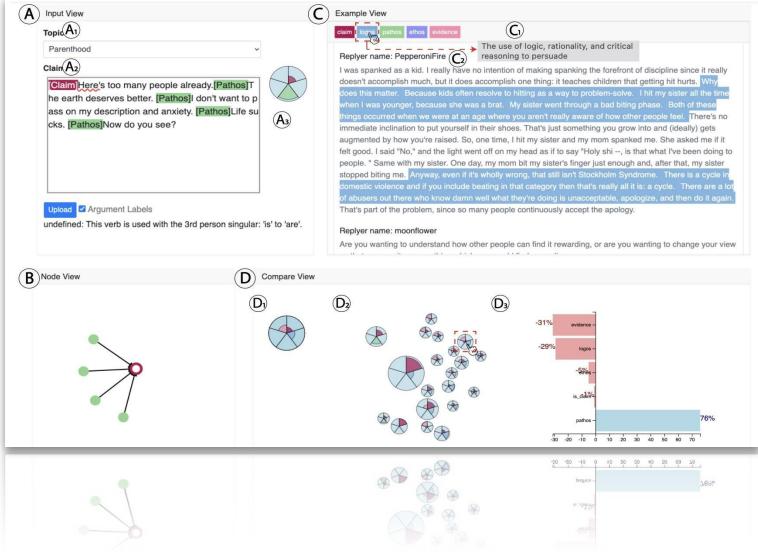
QLens (TVCG 2021)



StuGPTVis (TVCG  
2024)

How data can be used for learners to plan, **perform**, and reflect on their learning?

# Persua: A Visual Interactive System to Enhance the Persuasiveness of Arguments in Online Discussion



Meng Xia, Qian Zhu, Xingbo Wang, Fei Nie, Huamin Qu, Xiaojuan Ma

CSCW 2022

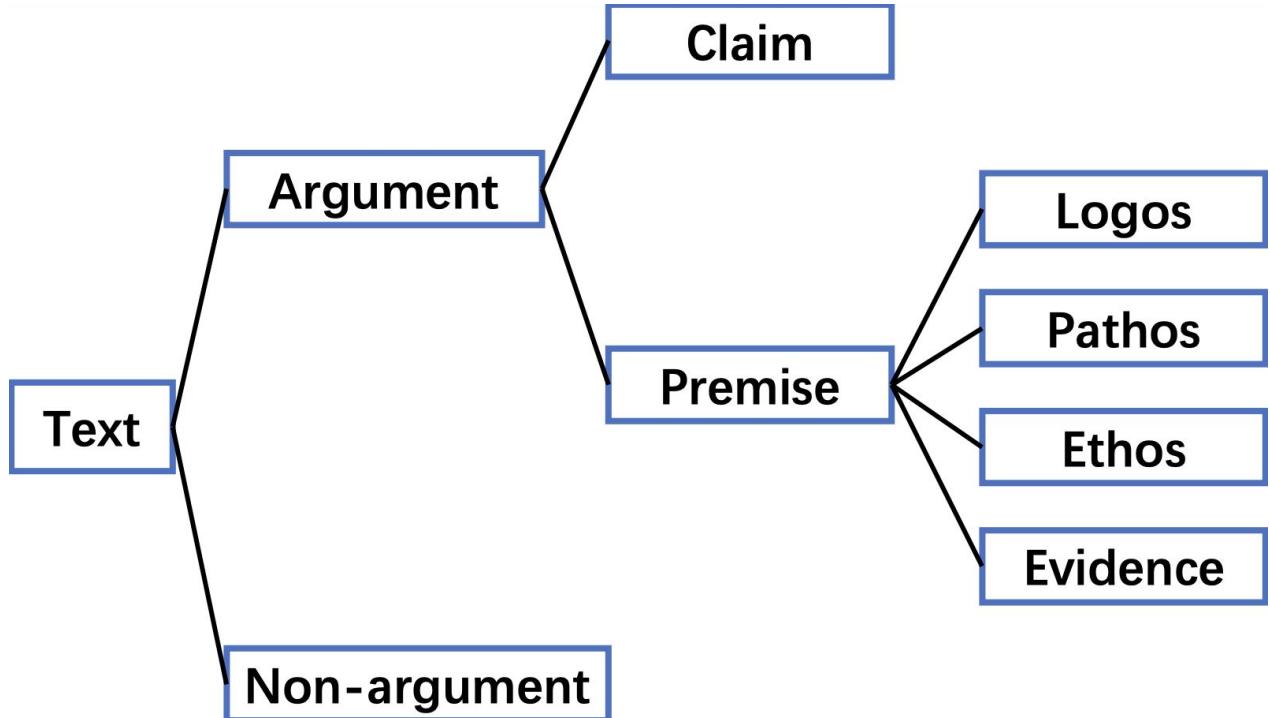
# Background

- **Real-time adaptive feedback**
- **Critical thinking skills, e.g., arguments writing**, a major element of learning framework 2030 by the Organization for Economic Co-operation and Development (OECD)

# Taxonomy of Argument Components



Semi-structured  
interviews with **five**  
**domain experts** on  
debating competitions



Classical persuasive strategies of Aristotle, and Rapp, 2002 and Carlile et al., 2018

Rapp, Christof. "Aristotle's rhetoric." (2002).

Carlile, Winston, et al. "Give me more feedback: Annotating argument persuasiveness and related attributes in student essays." *Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*. 2018.

# Persua

**A** Input View

**Topic A<sub>1</sub>**  
Parenthood

**Claim A<sub>2</sub>**

[Claim] Here's too many people already. [Pathos] The earth deserves better. [Pathos] I don't want to pass on my depression and anxiety. [Pathos] Life sucks. [Pathos] Now do you see?

**A<sub>3</sub>**

**C** Example View

claim loops pathos ethos evidence

Replyer name: PepperoniFire **C<sub>1</sub>** → The use of logic, rationality, and critical reasoning to persuade

I was spanked as a kid. I really have no intention of making spanking the forefront of discipline since it really doesn't accomplish much, but it does accomplish one thing: it teaches children that getting hit hurts. Why does this matter. Because kids often resolve to hitting as a way to problem-solve. I hit my sister all the time when I was younger, because she was a brat. My sister went through a bad biting phase. Both of these things occurred when we were at an age where you aren't really aware of how other people feel. There's no immediate inclination to put yourself in their shoes. That's just something you grow into and (ideally) gets augmented by how you're raised. So, one time, I hit my sister and my mom spanked me. She asked me if it felt good. I said "No," and the light went off on my head as if to say "Holy shi --, is that what I've been doing to people." Same with my sister. One day, my mom bit my sister's finger just enough and, after that, my sister stopped biting me. Anyway, even if it's wholly wrong, that still isn't Stockholm Syndrome. There is a cycle in domestic violence and if you include beating in that category then that's really all it is: a cycle. There are a lot of abusers out there who know damn well what they're doing is unacceptable, apologize, and then do it again. That's part of the problem, since so many people continuously accept the apology.

Replyer name: moonflower

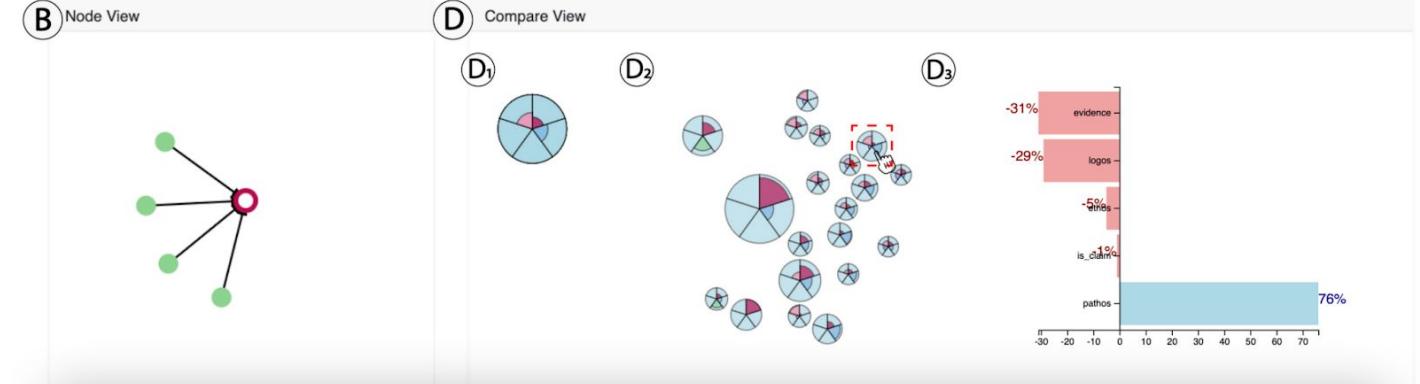
Are you wanting to understand how other people can find it rewarding, or are you wanting to change your view

**B** Node View

**D** Compare View

**D<sub>1</sub>** **D<sub>2</sub>** **D<sub>3</sub>**

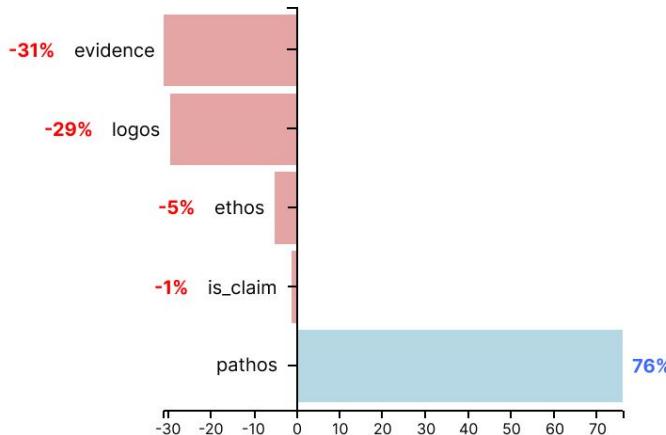
Argument Type	Percentage
evidence	-31%
logos	-29%
ethos	-5%
is claim	12%
pathos	76%



# Case Study

Before:

[Claim] Here's too many people already. [Pathos] The earth deserves better. [Pathos] I don't want to pass on my depression and anxiety. [Pathos] Life sucks. [Pathos] Now do you see?



**C** Example View

claim logos pathos ethos evidence

Replier name: PepperoniFire **C2** → The use of logic, rationality, and critical reasoning to persuade

I was spanked as a kid. I really have no intention of making spanking the forefront of discipline since it really doesn't accomplish much, but it does accomplish one thing: it teaches children that getting hit hurts. Why does this matter. Because kids often resolve to hitting as a way to problem-solve. I hit my sister all the time when I was younger, because she was a brat. My sister went through a bad biting phase. Both of these things occurred when we were at an age where you aren't really aware of how other people feel. There's no immediate inclination to put yourself in their shoes. That's just something you grow into and (ideally) gets augmented by how you're raised. So, one time, I hit my sister and my mom spanked me. She asked me if it felt good. I said "No," and the light went off on my head as if to say "Holy shi --, is that what I've been doing to people." Same with my sister. One day, my mom bit my sister's finger just enough and, after that, my sister stopped biting me. Anyway, even if it's wholly wrong, that still isn't Stockholm Syndrome. There is a cycle in domestic violence and if you include beating in that category then that's really all it is: a cycle. There are a lot of abusers out there who know damn well what they're doing is unacceptable, apologize, and then do it again. That's part of the problem, since so many people continuously accept the apology.

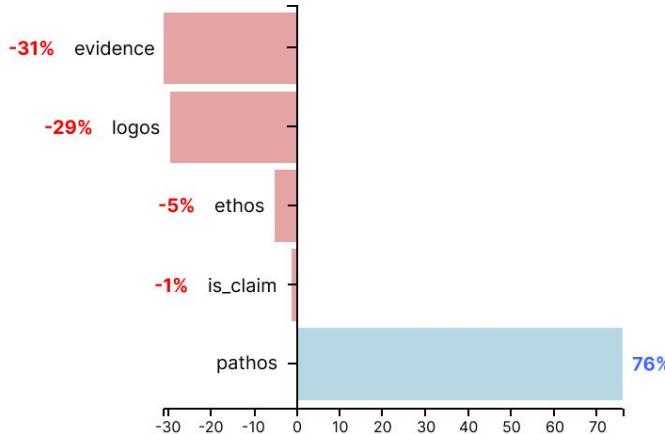
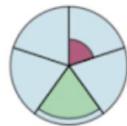
Replier name: moonflower

Are you wanting to understand how other people can find it rewarding, or are you wanting to change your view

# Case Study

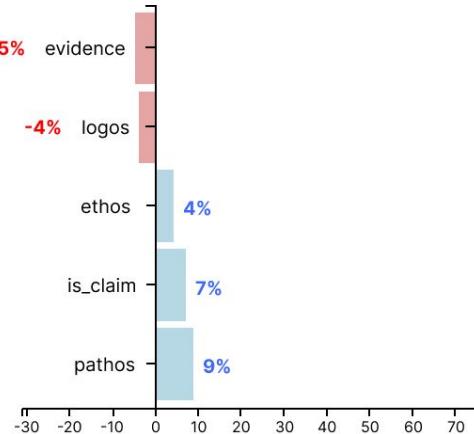
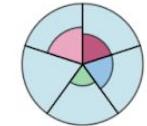
Before:

[Claim] Here's too many people already. [Pathos] The earth deserves better. [Pathos] I don't want to pass on my depression and anxiety. [Pathos] Life sucks. [Pathos] Now do you see?



After:

[Claim] There is no need to have children. [Logos] [Evidence] The world population is dramatically increasing, leading to more consumption of the natural resources. [Pathos] [Evidence] In addition, I saw my uncle's children fight with each other. [Logos] [Evidence] Some people even abuse children. [Claim] Thus, I disagree with having children.





Educators (design loop)



Learners (learning loop)

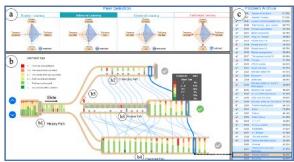
Planning

Performing  
Data

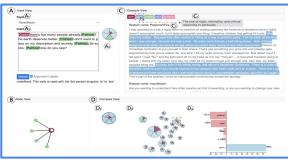
Reflecting

Understanding  
and Analyzing

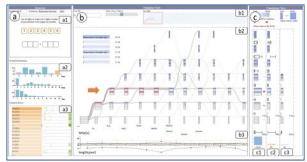
Redesigning



Peerlens (CHI 2019)



Persua (CSCW 2022)



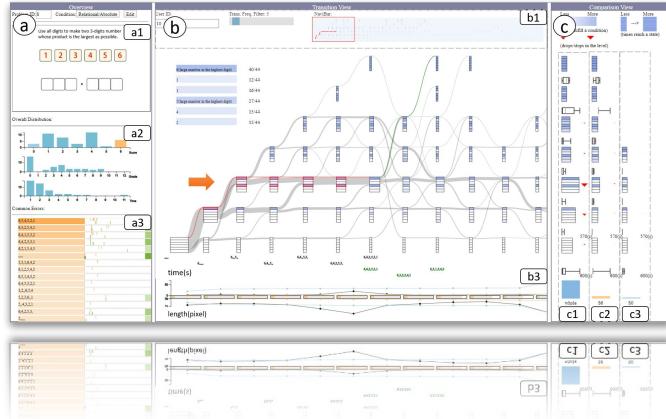
QLens (TVCG 2021)



StuGPTVis (TVCG  
2024)

How data can be used for  
educators to improve the design  
of learning materials?

# QLens: Visual Analytics of Multi-step Problem-solving Behaviors for Improving Question Design



Meng Xia, Reshika Palaniyappan Velumani, Yong Wang, Huamin Qu,  
Xiaojuan Ma

TVCG 2021

# A Multi-step Problem

Five people stand in a line.

Mark stands ahead of Paul.

Helen stands ahead of Jane.

Paul stands behind Helen but ahead of Luke.

No boy is next to another boy in the line.

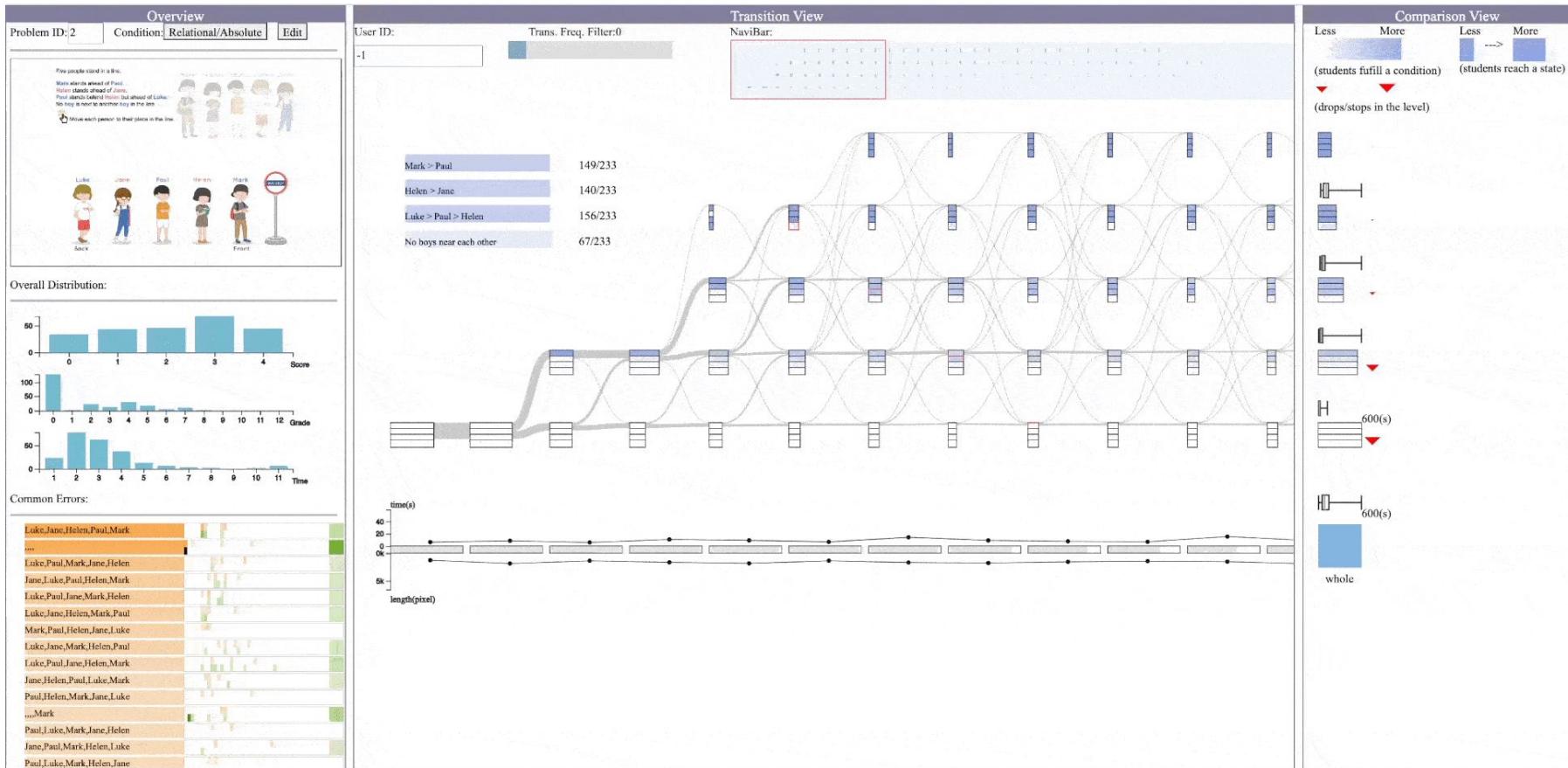


Move each person to their place in the line.



Back

Front



**Mark** stands ahead of **Paul**.

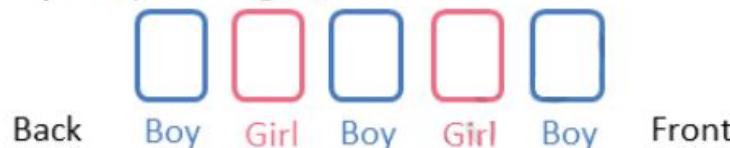
**Helen** stands ahead of **Jane**.

**Paul** stands behind **Helen** but ahead of **Luke**.

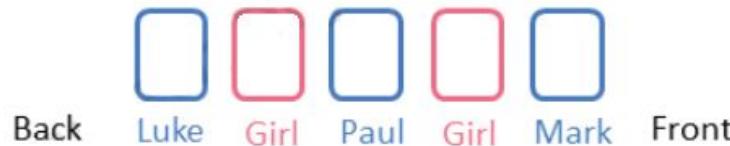
No **boy** is next to another **boy** in the line.

Consider the condition with the most restrictions: "No boy is next to another boy in the line."

There are only 3 **boys** and 2 **girls**, so we have



"Mark stands ahead of Paul", "Paul stands ahead of Luke". Therefore,



"Helen stands ahead of Jane". Therefore,





Our collaborator, TrumpTech, uses QLens to improve questions design. The company serves more than **500 schools** in Hong Kong.

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



Under review

VIS 2024

# Motivation

To empower students to fully leverage the capabilities of ChatGPT in educational scenarios, **understanding students' interaction patterns with ChatGPT** is crucial for instructors.



You

what is data visualization?



ChatGPT

Data visualization is the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to see and understand trends, outliers, and patterns in data.



Data visualization is important because it allows humans to comprehend complex datasets more easily, helping to identify correlations, anomalies, and trends that might not be apparent in raw data. It's widely used in various fields such as business, science, healthcare, finance, and more to communicate insights, make informed decisions, and discover new knowledge.



# Problem

However, this endeavor is challenging due to **the absence of datasets** focused on student-ChatGPT conversations and the **complexities in identifying and analyzing the evolutional interaction patterns** within conversations.



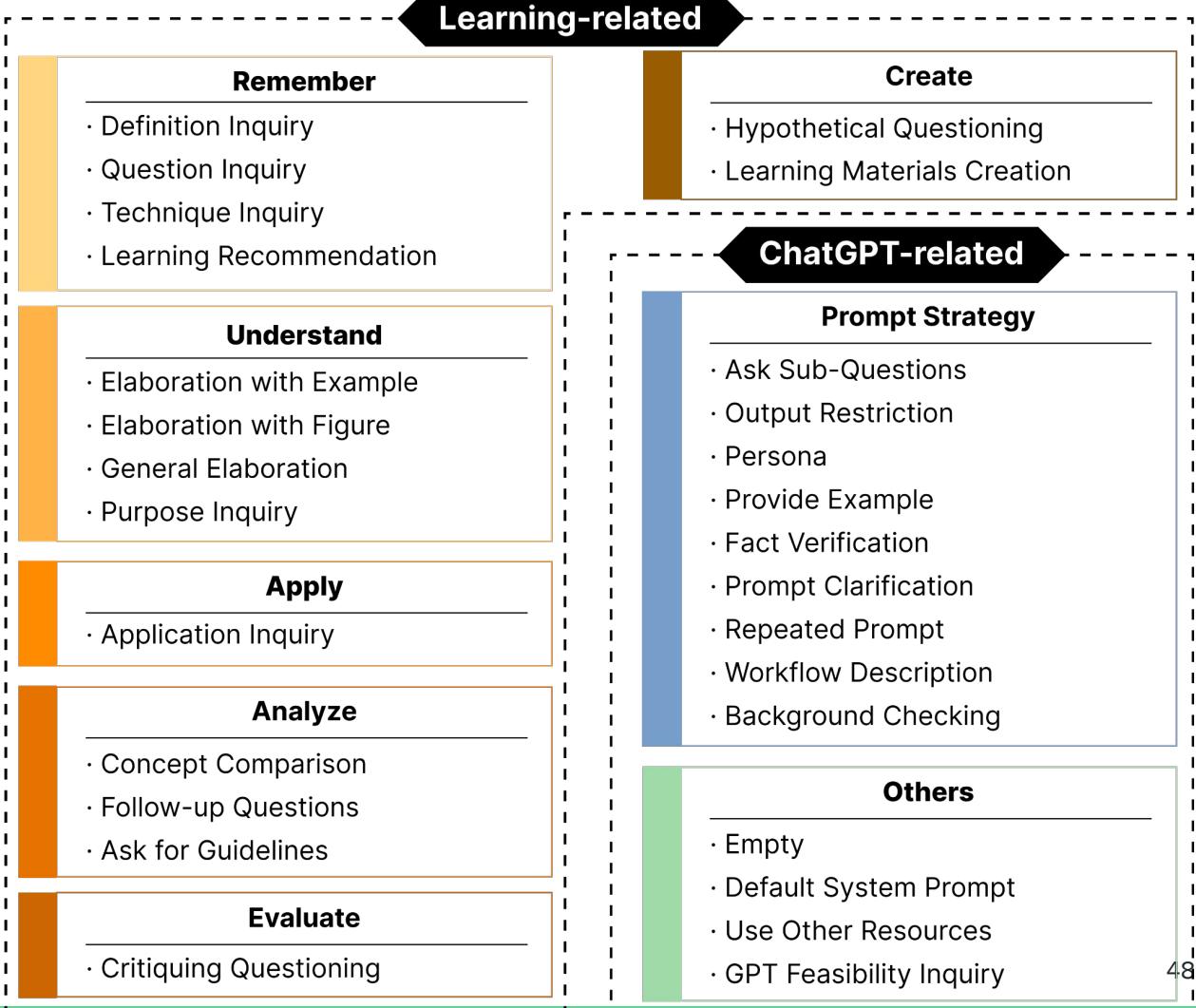
The image shows a sequence of five overlapping rectangular boxes, each containing a snippet of text from a ChatGPT conversation. The snippets are as follows:

- You**: what is data visualization?
- ChatGPT**: Data visualization is the graphical representation of information elements like charts, graphs, and maps, data visualization and understand trends, outliers, and patterns in data.
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- You**: what is data visualization?
- ChatGPT**: Data visualization is the graphical representation of information elements like charts, graphs, and maps, data visualization and understand trends, outliers, and patterns in data.

Below the fifth box is a cartoon illustration of a person with dark hair and glasses, wearing a light green shirt and grey pants, with their hand near their chin in a thoughtful pose. A small thought bubble above them contains a tangled black line.

# Context

- Graduate-level data visualization
- 48 students
- 10 exercise

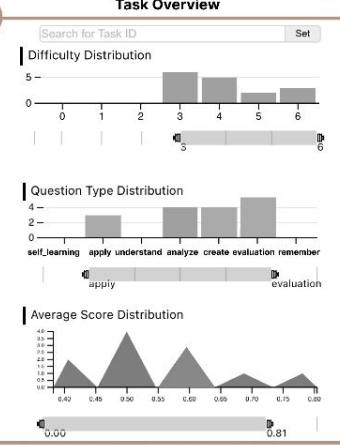


# StuGPTViz

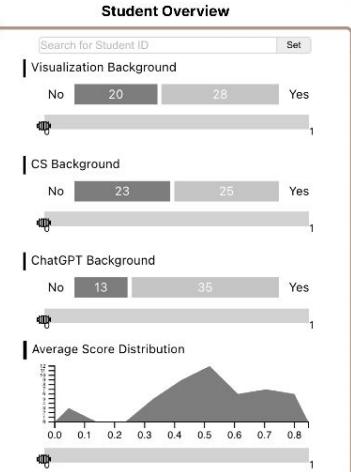
## Filter View

**A**

### Task Overview

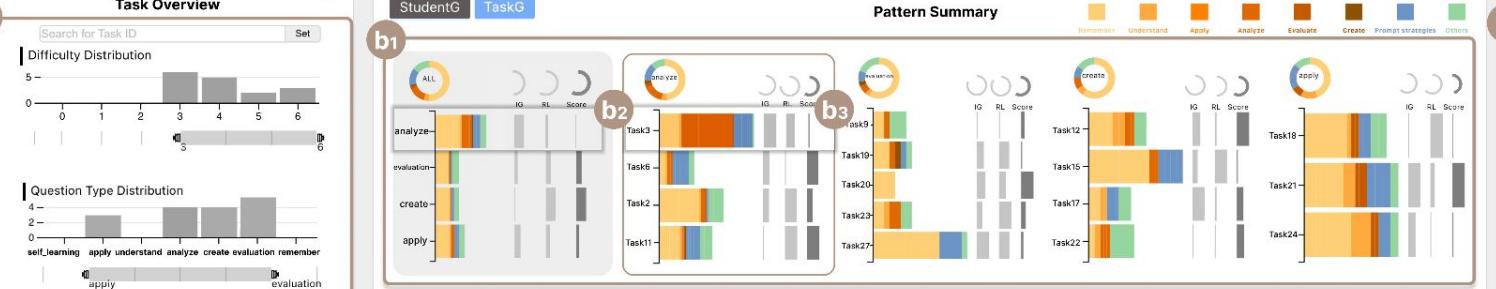


**a2**



### Pattern View

StudentG TaskG



1

### Detail View

**C**

#### 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]



##### I Student Answer

Finding,Action,Insight,Hypothesis,Knowledge

#### Raw Conversation

**C2**

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.



Educators (design loop)



Learners (learning loop)

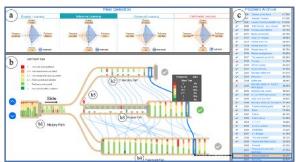
Planning

Performing  
Data

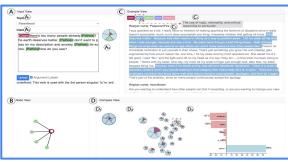
Reflecting

Understanding  
and Analyzing

Redesigning



Peerlens (CHI 2019)



Persua (CSCW 2022)



RLens (L@S 2022)



StuGPTVis (TVCG 2024)



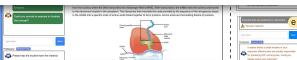
QLens (TVCG 2021)



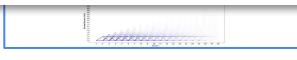
SolutionVis (AIED 2023)

Pre

Enable **learners and educators** to **find insights** from learning data and use the insights to **make decisions** for achieving **personalized online learning**.



Ruffle&Riley (AIED 2024)



Distributed Tutorship (LAK 2022)



SeqDynamics (EuroVIS 2020)



BlockLens (L@S 2022)

# Future HAI in Education

- More Comprehensive
- More Actionable
- More Effective
- More Context-aware

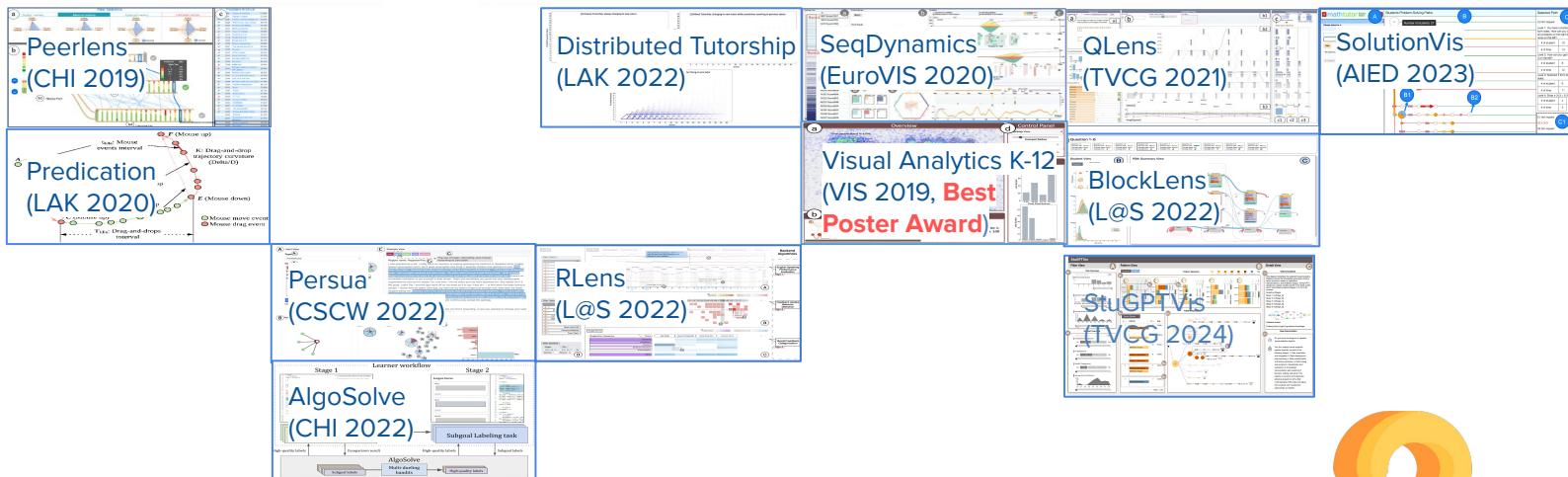
# More Comprehensive



Educators (design loop)



Event Sequence



Text

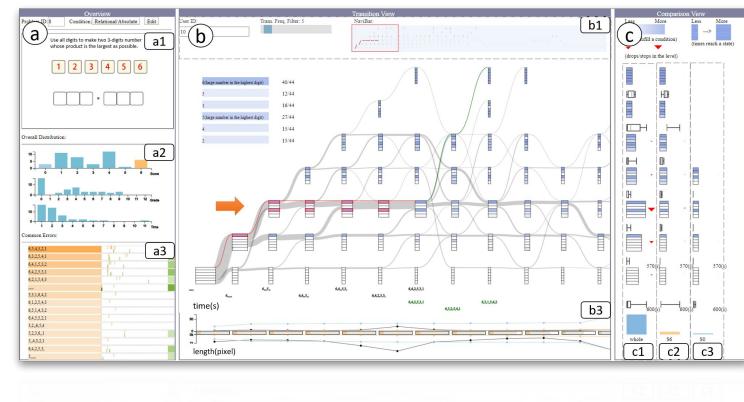
Code

Video



Mobile MOOCs (CHI 2022, Best Paper Award)

# More Actionable



QLens: Learning analytics

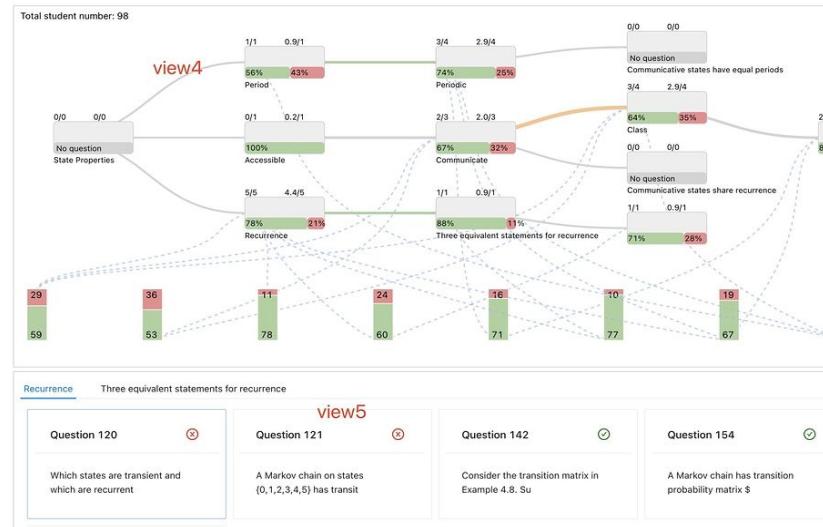
**Teacher-AI collaboration:** data-driven optimization for learning materials

The figure shows the CTAT (cognitive tutor authoring tools) interface, which includes several panels:

- Left Panel:** Shows a file tree with "Fraction Addition Data" selected, containing sub-items like "CognitiveModel", "FinalBPDs", and "new-1-4-plus-1-6m.bpd".
- Middle Panel:** A graph titled "Graph Properties new-1-4-plus-1-6m.bpd X" showing nodes and edges. Nodes include 1, 2, 3, 4, 5, 6, 1.firstNumGiven, 1.secNumGiven, 1.secDenGiven, 2.firstDenGiven, 3, 4.secDenGiven, 5, and 5.firstDenConv, 12. Edges represent relationships between these nodes.
- Right Panel:** A "Perform the Fraction Addition Problem" interface. It shows "Given Fractions" (1/4 + 1/6) and "Converted Fractions" (1/12). Buttons for "Next", "Done", and "Reset" are present. Below this, there are sections for "Skills" (Create new skill), "Hints" (Hint Level 1: Please enter "12" in the highlighted field), and "Links" (Link ID: 5, FirstClientID: 12).

CTAT (cognitive tutor authoring tools):  
Learning design

# More Effective



Multiple Rounds Conversations/Interactive Knowledge Map

Other data

**Learner-AI collaboration:** Long-term monitoring and accompany

# More Context-aware - *Immersive Online Learning*



## Learning in VR?

- **Cinematography Education** on a Soundstage in VR (ongoing, poster, VR 2023)
- VR Story for **Awareness of Covid Spread Threats** (Zhu et al., IJHCI 2023)
- Towards an Understanding of Asymmetric **Collaborative Visualization on Problem-solving** (Tong et al., VR 2023)

## Learning in AR?

- Exploring Interactions with Printed Data Visualizations in Augmented Reality (Tong et al., TVCG 2023, **Honorable Mention Award**)

Other opportunities, e.g., **on-the-go learning**, digital twin campus?



# Future Education for HAI

- Fairness
- Accountability
- Transparency
- Social responsibility

# Human-AI Interaction in other domains?

- Autonomous Driving
- Roburt Surgery
- Sports

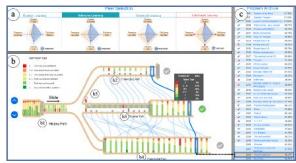
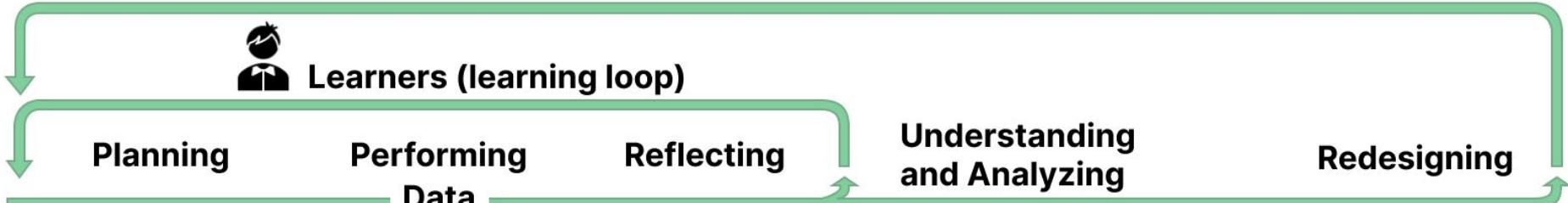




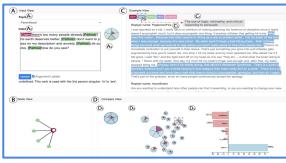
Educators (design loop)



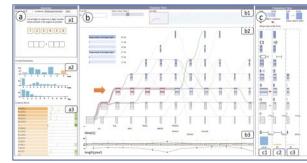
Learners (learning loop)



Peerlens (CHI 2019)



Persua (CSCW 2022)



QLens (TVCG 2021)



StuGPTVis (TVCG 2024)

## Human-AI Interaction for Personalized Online Learning

### Welcome to join our lab!

Personal page: <https://www.xiameng.org> Email: [mengxia@tamu.edu](mailto:mengxia@tamu.edu)



TEXAS A&M UNIVERSITY

Department of Computer  
Science & Engineering