

Investigating Student Discourse in Large Enrollment Chemistry Course Active Learning Environments

Renée Cole[♦], Vicente Talanquer[^], Gregory Rushton^{*}, Lisa Shah[^]

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Hannah Nennig[♦], Nicole States[♦], Michael Macrie-Shuck[^], Shaga Fateh^{*}, Demet Kirbulut^{*}, Joshua Reid^{*}, Adan Fatima[^], Ahmad Syed[^]

[♦] University of Iowa, [^]University of Arizona, ^{*}Middle Tennessee State University, [^]Stony Brook University

Guiding Questions

1. What patterns of student engagement characterize different college general chemistry learning environments?
2. How does the expected cognitive level of in class activities affect student engagement in different college general chemistry learning environments?

The ultimate goal is to identify critical features of task design and implementation that support the productive engagement of students in different contexts.

Data Collection

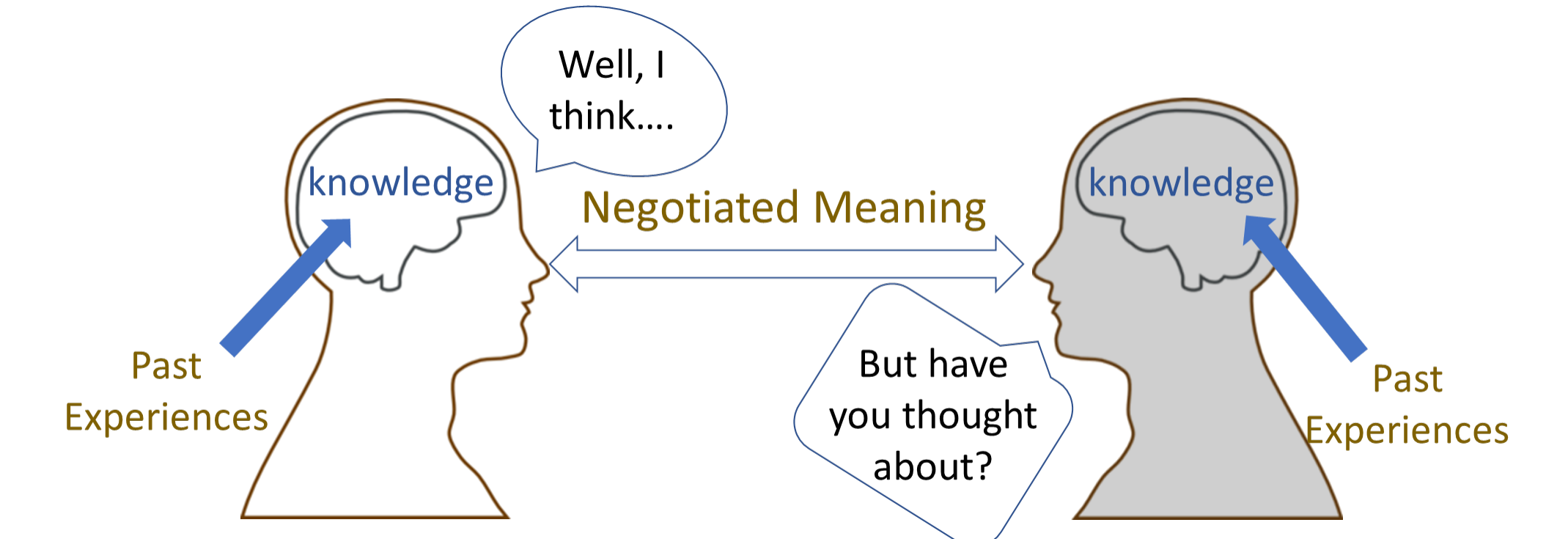
Course materials and recordings of student interactions were collected and analyzed for a variety of learning environments

Research Site	Learning Environment	Class Size	Groups (students) Observed	Tasks Analyzed	Episodes Analyzed
Stony Brook University	Discussion (POGIL)	~150	6 (18)	84	128
University of Iowa	Discussion (worksheets)	~28	2 (6)	72	86
	Lecture (Traditional)	~250	2 (6)	62	104
Middle Tennessee State University	Lecture (POGIL)	~24	2 (9)	87	178
University of Arizona	Lecture (Chemical Thinking)	~220	10 (45)	114	517

Theoretical Framing

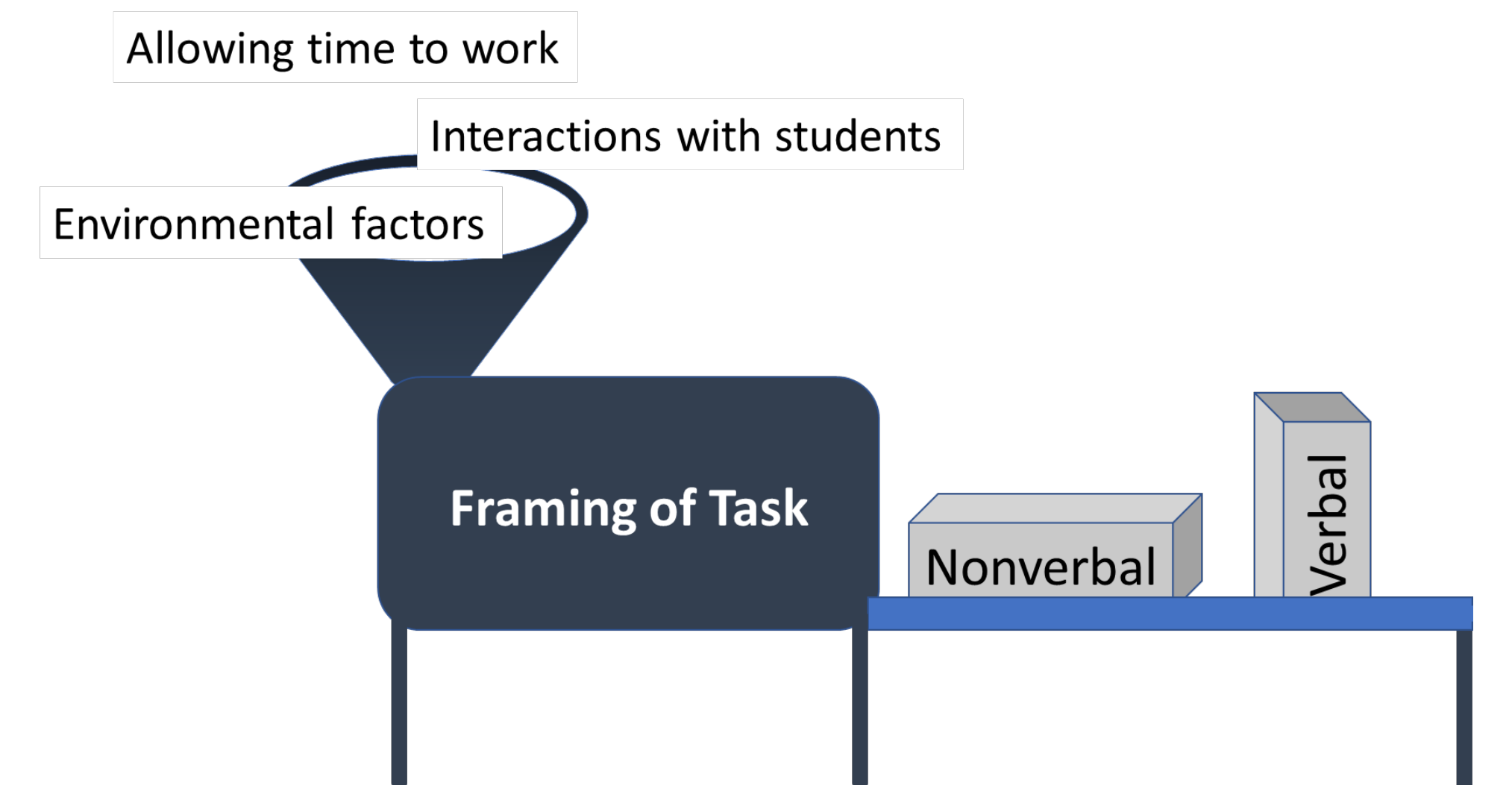
Social Constructivism

- Influences the analysis of how student groups collaboratively form knowledge.

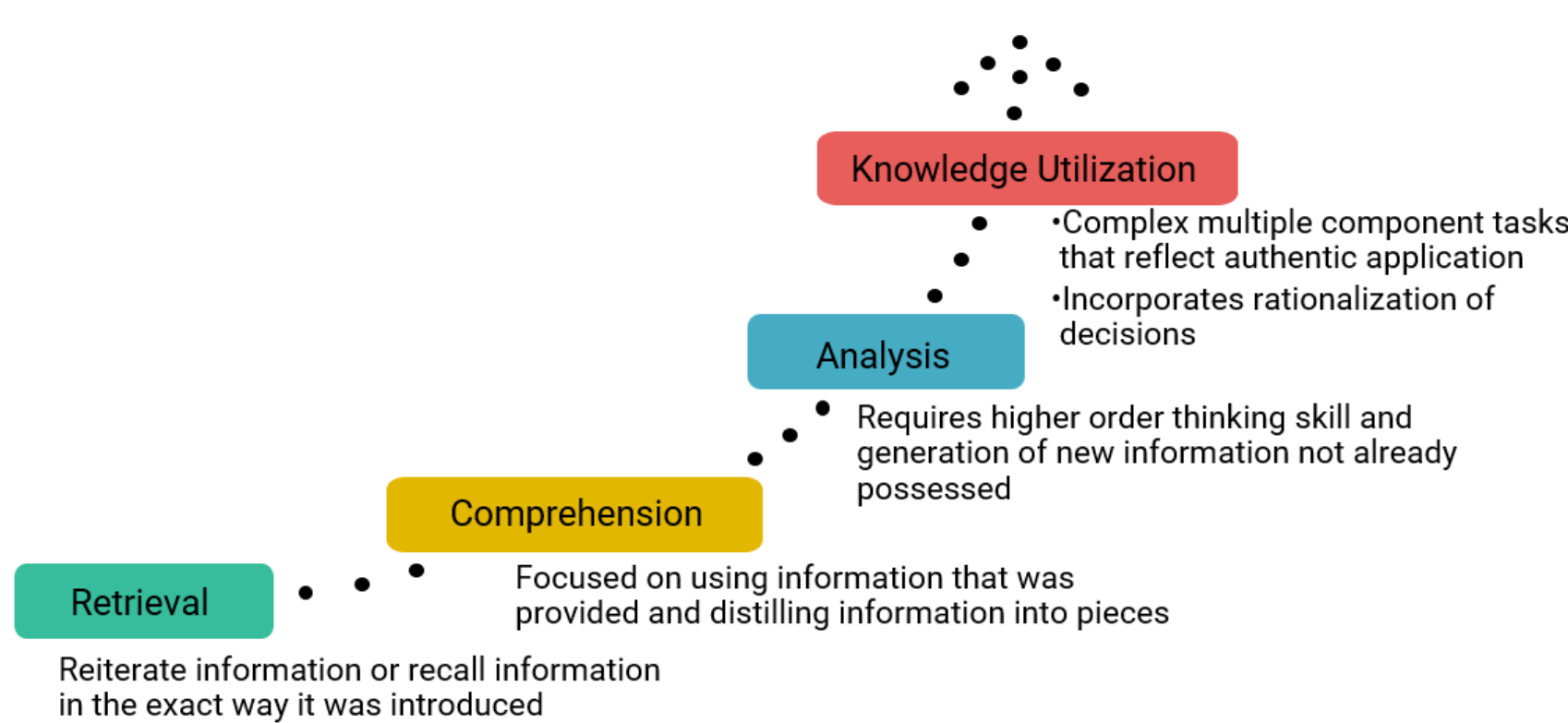


Epistemological Framing

- Influences the analysis of learning environments and their effects on participation.

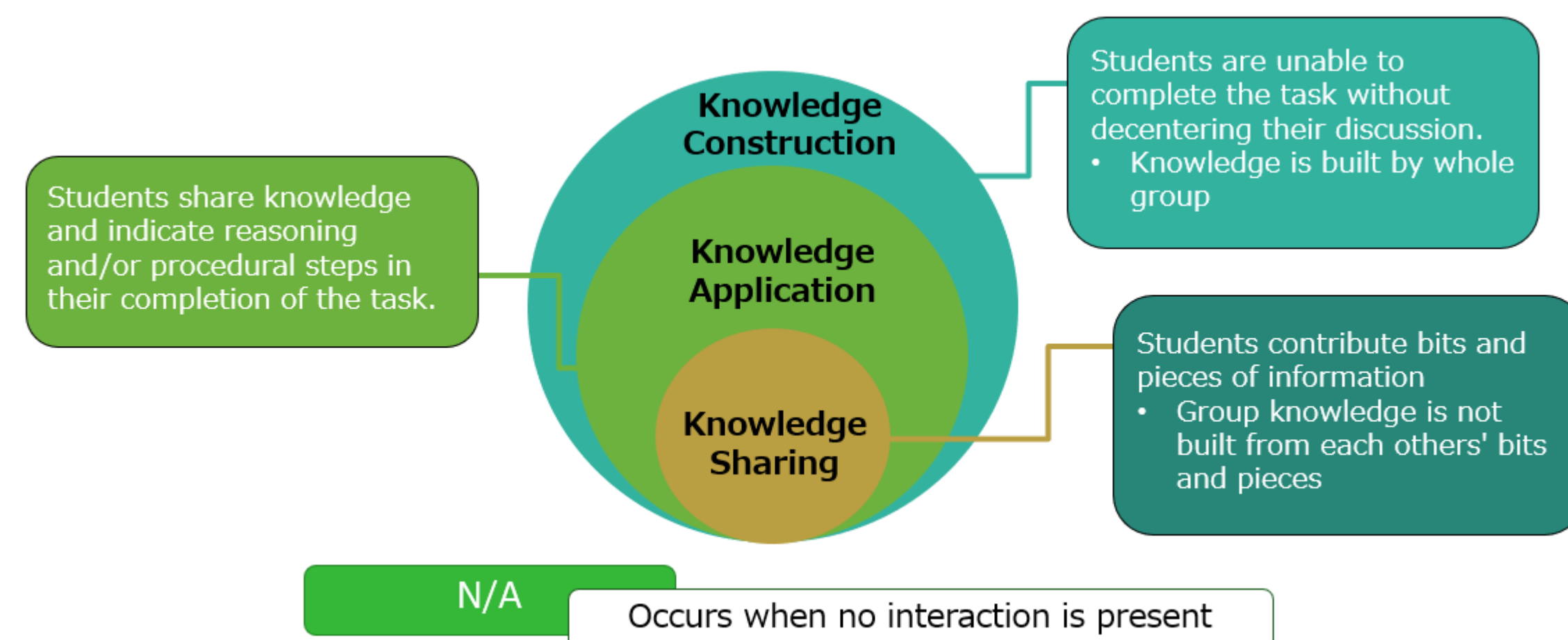


Marzano's Taxonomy categorizes questions in terms of cognitive complexity

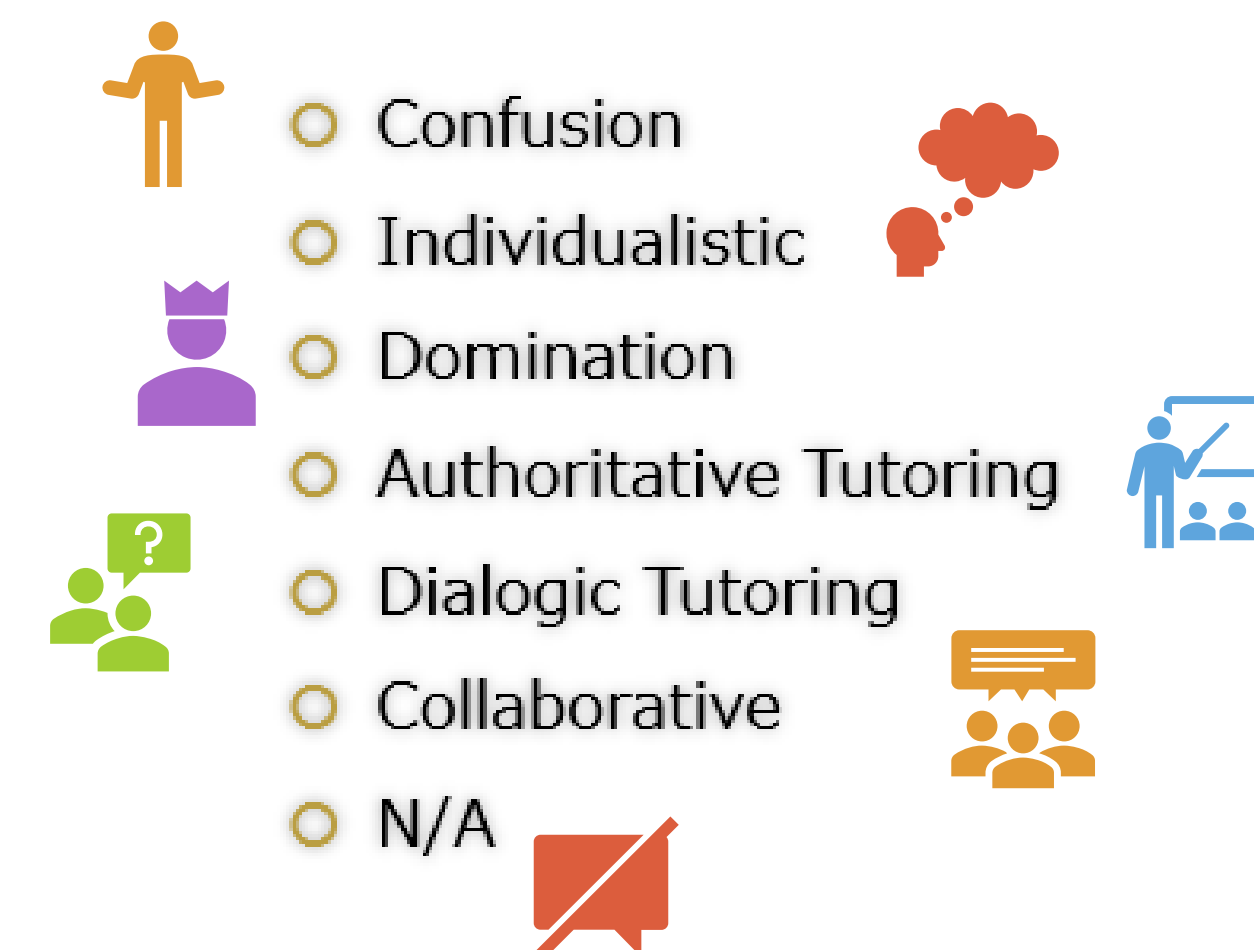


Analytical Frameworks

Knowledge dynamics describe how students build knowledge in order to complete a task



Social processing describes the way students interact while completing the task



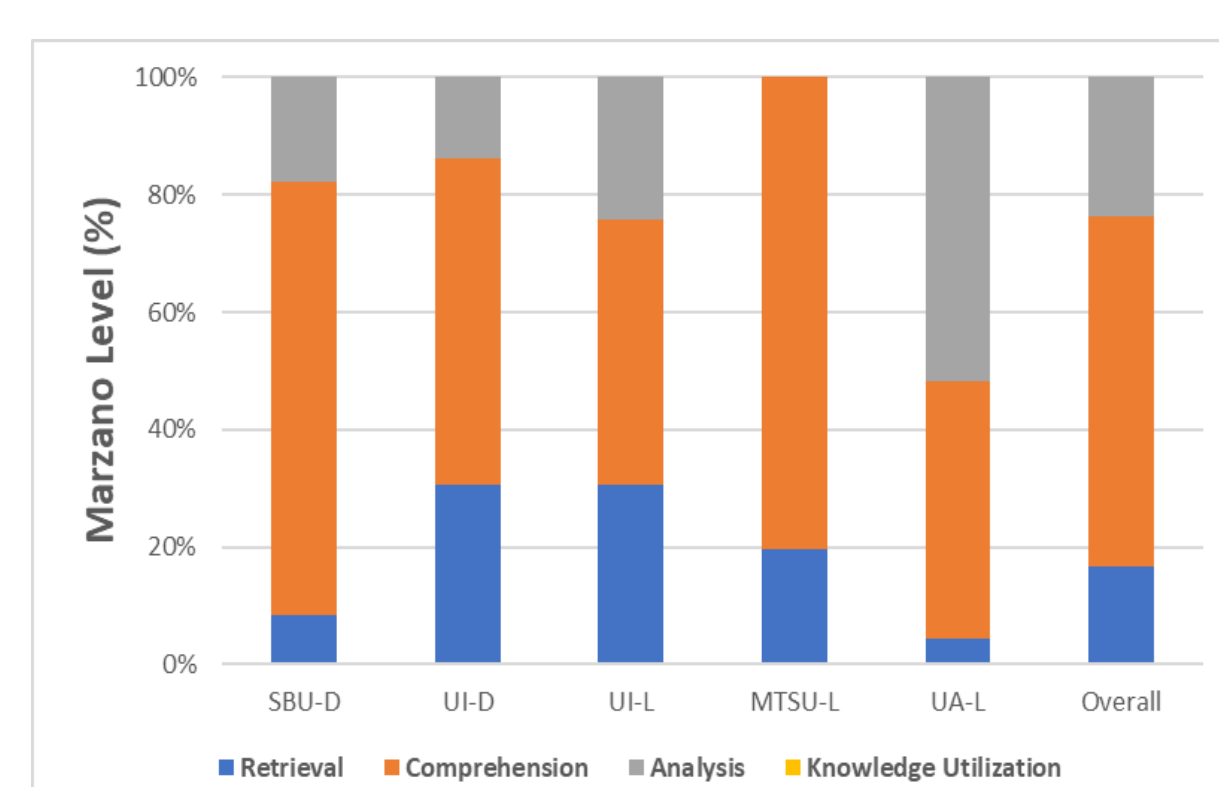
Broader Impacts & Implications

Instructors should carefully consider the learning environment they are fostering

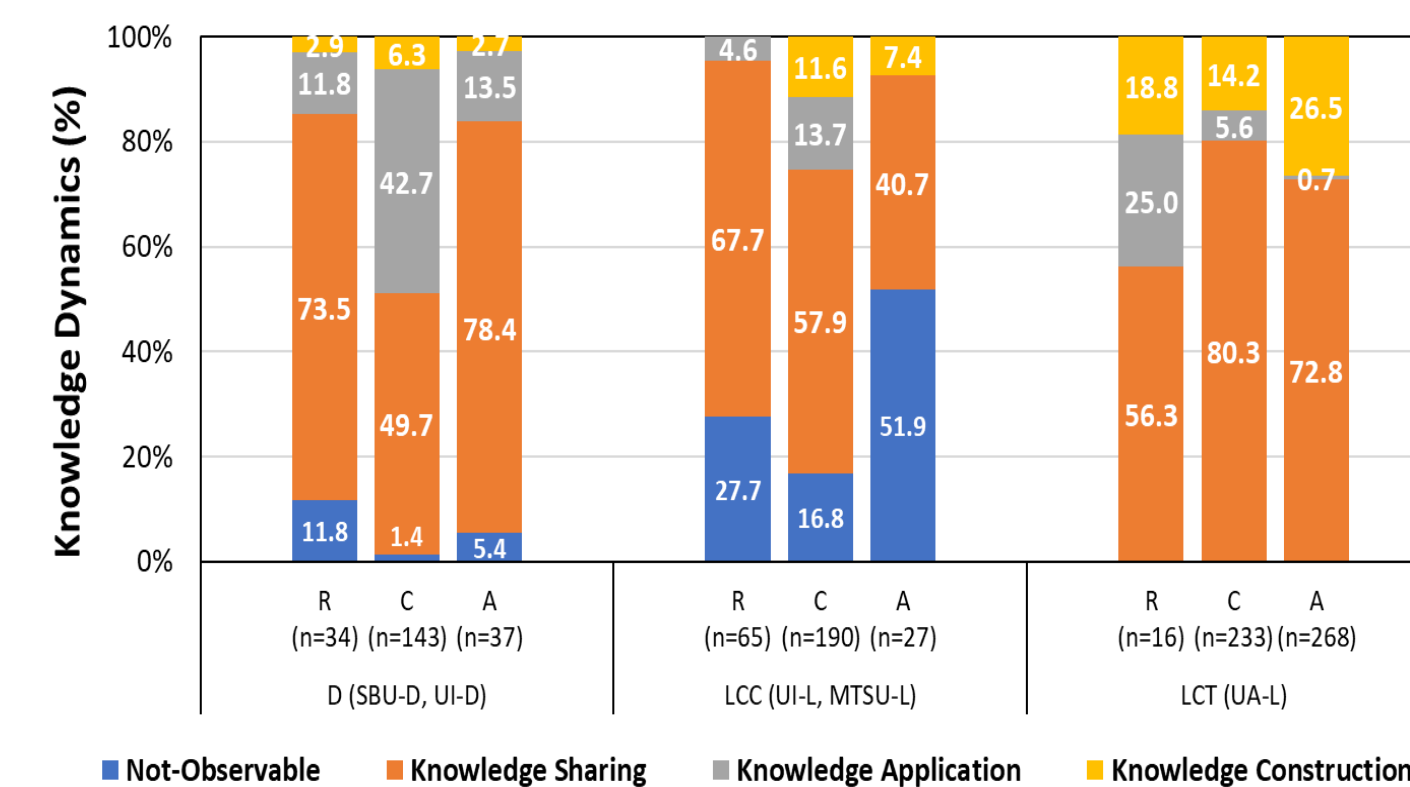
- ❖ Ask more high-cognitive level questions
- ❖ Encourage students to ask questions and re-evaluate responses
- ❖ Encourage students to push for reasoning or reject an initial idea
- ❖ Explore the messages the classroom setting and facilitation are sending to students
- ❖ Align instructional tasks and assessments to the intended outcomes

Results of Analysis

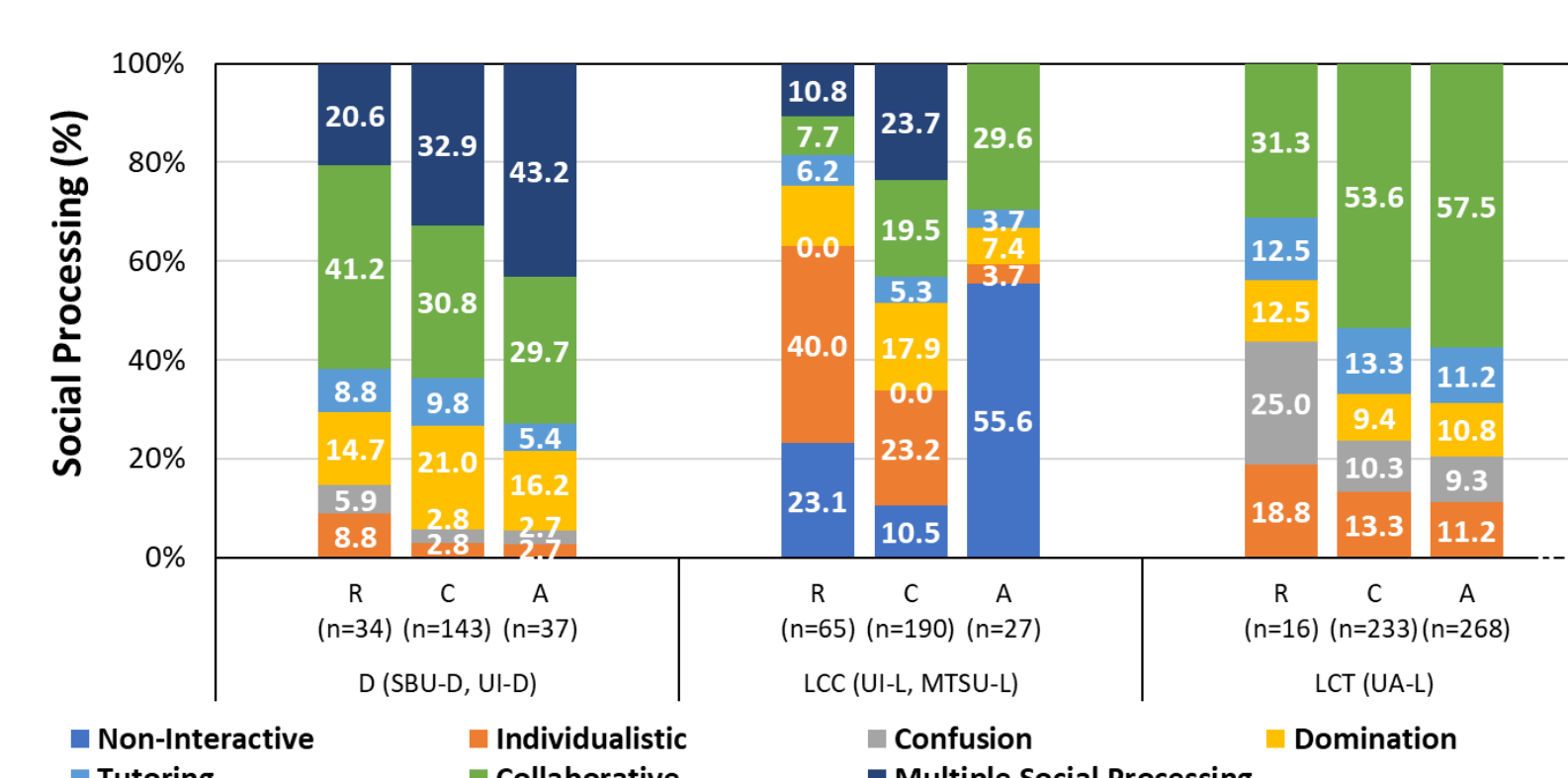
The types of questions at most sites tended to emphasize lower cognitive levels



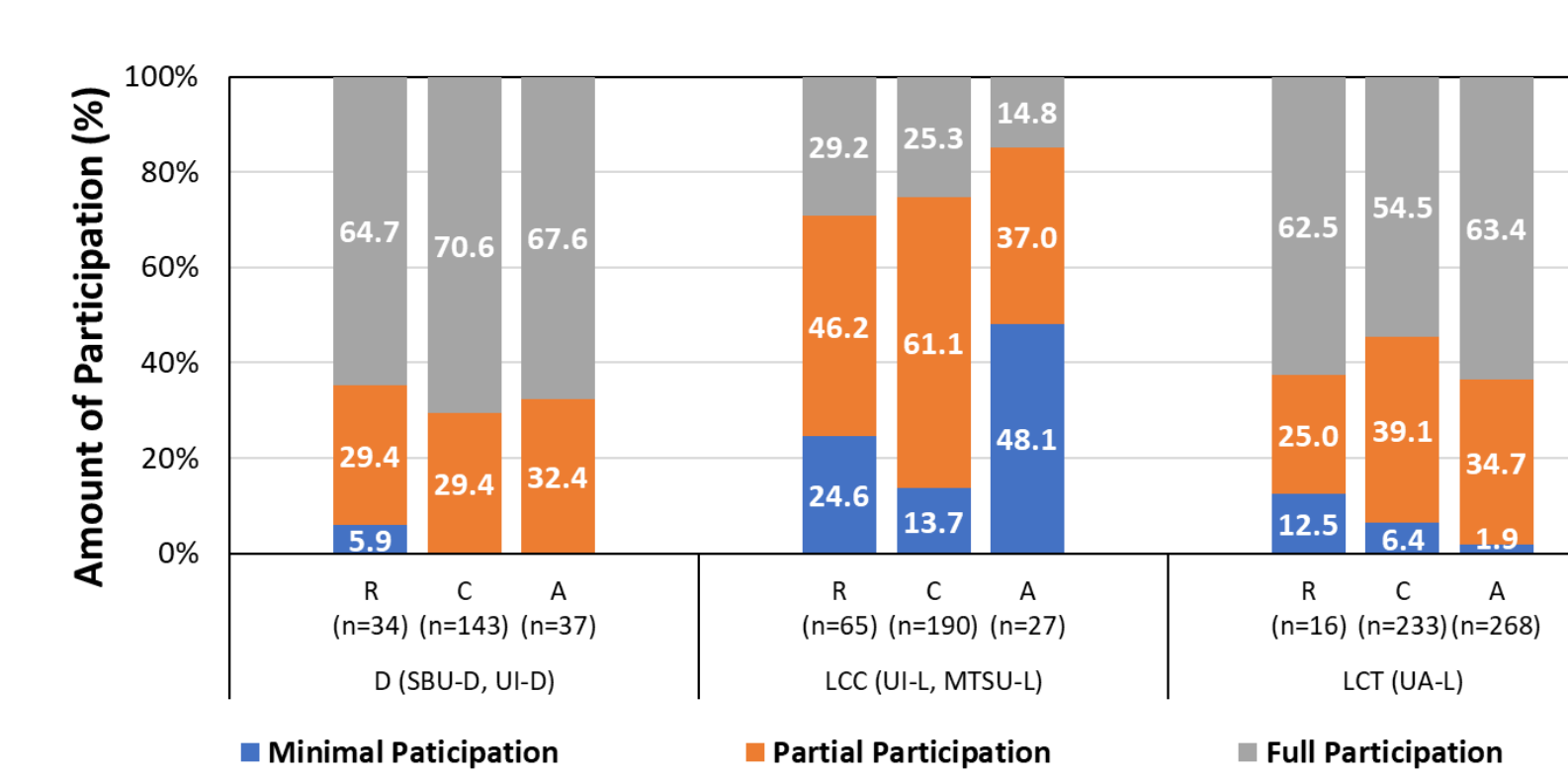
Knowledge sharing is the most common knowledge dynamic



Social processing differs by the instructional environment and nature of task



The learning environment influences the degree of group participation



Joshua Reid, Zubeyde Demet Kirbulut Gunes, Shaghayegh Fateh, Adan Fatima, Michael Macrie-Shuck, Hannah Nennig, Fabrizio Quintanilla, Nicole States, Ahmad Syed, Renee Cole, Gregory Rushton, Lisa Shah, Vicente Talanquer; "Investigating Patterns of Student Engagement during Collaborative Activities in Undergraduate Chemistry Courses," *Chemistry Education Research and Practice*, 23, 173-188 (2022).

Acknowledgments

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