

# Investigating social construction of knowledge during asynchronous discussions

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# SOCIAL LEARNING IN ASYNC MATH COURSES

- ▶ Very few studies on fully online mathematics courses have been published (Trenholm et al., 2019).
- ▶ Math viewed as a more challenging topic to teach online as opposed to text-based topics such as English (Engelbrecht & Harding, 2005).
- ▶ Discussions are not widely used in fully asynchronous courses – 39% of instructors surveyed used at least 1 discussion. Average instructor response rate to discussion post was 4.6 days (Trenholm et al., 2015).



# SOCIAL LEARNING IN ASYNC NON-MATH COURSES

- ▶ Webb et al. (2004) found that participation in asynchronous discussion forums positively correlated to learners' grades [*context: Information Technologies*].
- ▶ Schellens & Valcke (2005, 2006) found that asynchronous discussion forums attained a higher proportion of higher phases of knowledge creation [*context: Psychology and Educational Sciences*].
- ▶ Problem-based learning is difficult in asynchronous discussion forums (Hong et al., 2003; Kortemeyer, 2006) [*context: Physics and Statistics, respectively*].



# RESEARCH QUESTIONS

- ▶ What types of knowledge are constructed during asynchronous math discussions?
- ▶ How do students co-construct knowledge during asynchronous math discussions?
- ▶ How does design of discussion questions impact knowledge construction?
- ▶ How does instructor comments impact students' co-construction of knowledge?



# THEORETICAL FRAMEWORK - ASSUMPTIONS

Weinberger & Fischer (2006) Argumentative Knowledge Construction framework

- ▶ Learners construct arguments in interaction with their learning partners in order to acquire knowledge about argumentation as well as knowledge of content under consideration.
- ▶ Tetra-dimensional analysis: Participation, Epistemic, Argument, Social Modes of Co-Construction.



# THEORETICAL FRAMEWORK - OVERVIEW

## Social Modes

- ▶ Externalization
- ▶ Elicitation
- ▶ Quick Consensus Building
- ▶ Integration-oriented Consensus Building
- ▶ Conflict-oriented Consensus Building

## Argument

- ▶ Single arguments (simple, qualified, grounded, grounded & qualified, non-argumentative)
- ▶ Line of argumentation (argument, counterargument, integration, non-argumentative)

## Epistemic

### *Construction of...*

- ▶ Problem Space
- ▶ Conceptual Space
- ▶ Problem ↔ Conceptual Space
- ▶ Problem ↔ Prior Knowledge
- ▶ Non-Epistemic Activities

## Participation

- ▶ Quantity
- ▶ Heterogeneity



# TARGET POPULATION

Category	% Pop.
Undergraduate	75%
Part-time (U)	73%
Age 25/over	82%
Active Military	60%
Veterans	24%
Male	86%
White	55%
Hispanic	12%
African American	9%
Asian	3%



# METHODOLOGY AND DATA ANALYSIS

**Data:** Collect discussion responses to 3 topics in a Calculus 1 course.

**First Pass:** Code along the Argumentative Knowledge Construction framework.

**Second Pass:** Open code for interaction of instructor, other types of knowledge constructed, and other themes/dimensions that may be used to modify the Argumentative Knowledge Construction framework.



# PILOT DISCUSSION QUESTION

**Situation:** Torty and Harry are competing in a 100m sprint race. Torty's average speed on any 5-second interval is always less than Harry's average speed on any 5-second interval, but Torty wins the race! (*Note: For consistency, let's say they keep running after 100 meters so that their speeds can always be calculated by looking forward in time, but we stop the race at 100 meters*)

**Prompt:** Discuss as a group (using the definitions of constant and average rate of change) how it is possible that Torty wins the race.



# QUESTIONS WE HAVE FOR YOU

- ▶ Is there any relevant literature we have overlooked?
- ▶ Are there other types of knowledge students may co-construct in an asynchronous discussion?
- ▶ Are there exemplary synchronous discussion activities that we may use/convert to an asynchronous environment **in Calculus 1?**
- ▶ Anticipations on how the study population may affect the study design/results?
- ▶ What do you think about our pilot discussion question?



# QUESTIONS YOU HAVE FOR US



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