Exploring Relationships between Students' Discussion Patterns, Emotions, and Learning Outcomes in an Online Mathematics Course

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Introduction

Background of the study

Online Discussions

- Widely used in higher education settings
- Promote individual and group knowledge construction

- Do not always lead to productive interactions and knowledge construction
- Prior studies have focused on students' posting behaviors, rather than ***online speaking & listening*** behaviors

Students' Emotions

- Directly or indirectly influence their learning outcomes

- Especially in developmental mathematics courses, students' ***negative emotions and anxiety*** play a significant and negative role in performance

Introduction

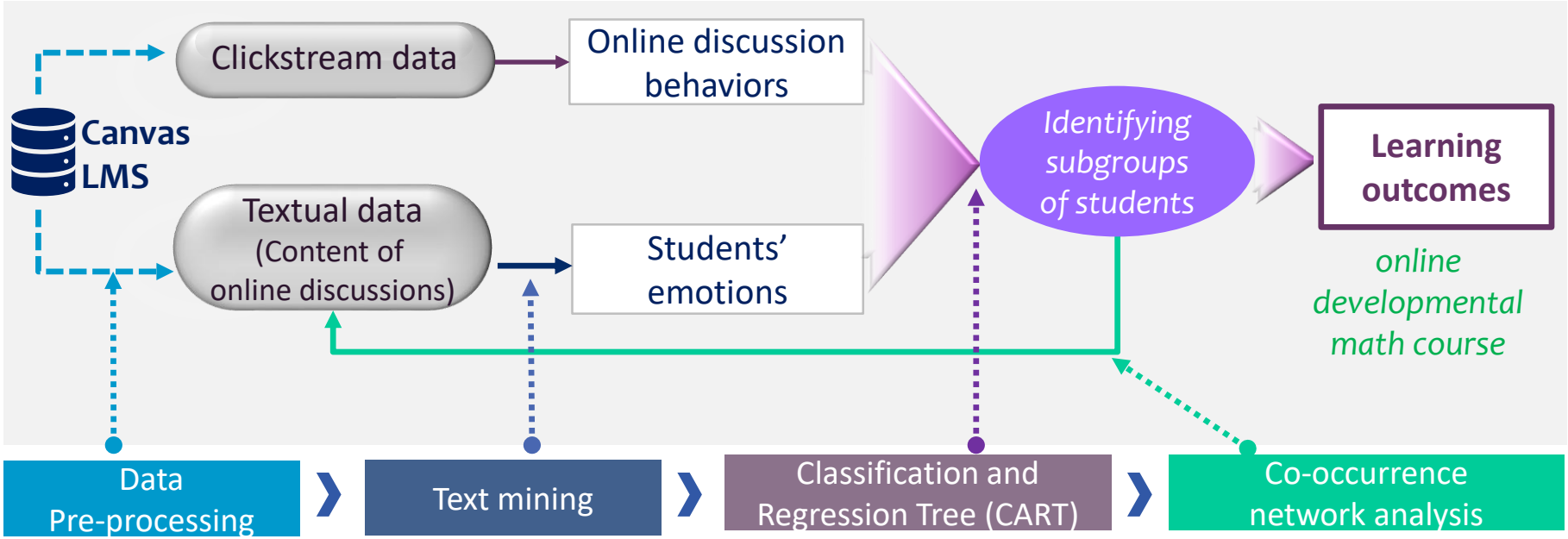
Research Purpose and Research Questions

RQ 1

What online **discussion behaviors** and **emotions** characterize different groups of students? How do these relate to student learning outcomes?

RQ 2

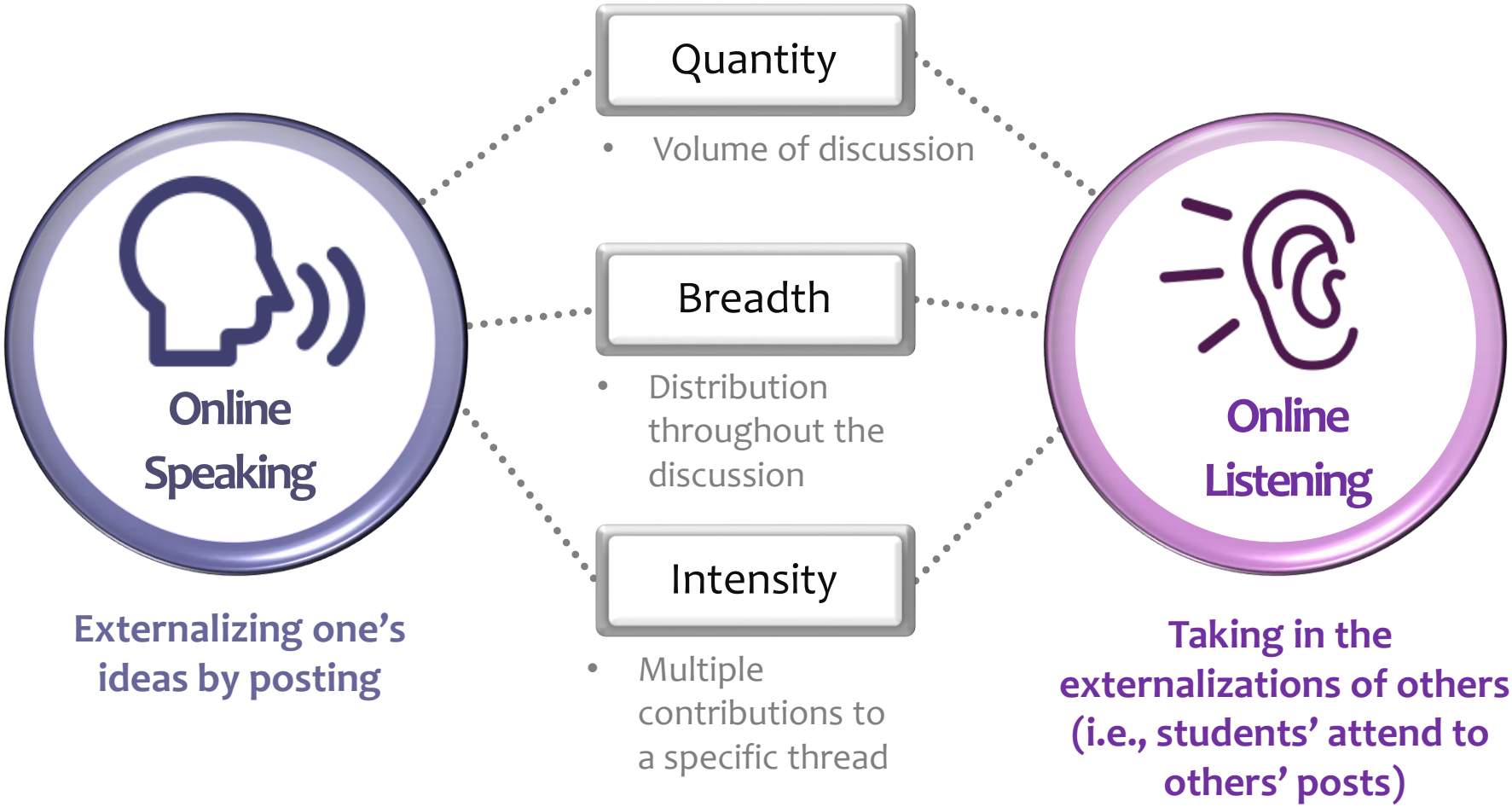
How does **the content of online discussions** vary within different groups of students? How do these relate to student learning outcomes?



Theoretical Framework

Online Discussion Behaviors

- A framework for examining engagement in online discussions (Wise et al., 2013; 2014)



Methods

Research context and participants

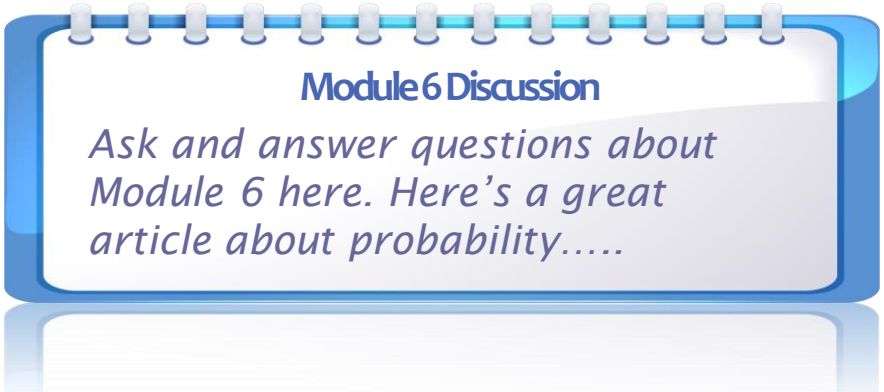
Canvas LMS used at a university located in the western U.S.

Online developmental math (statistics) course offered during Summer 2015

77 undergraduate students

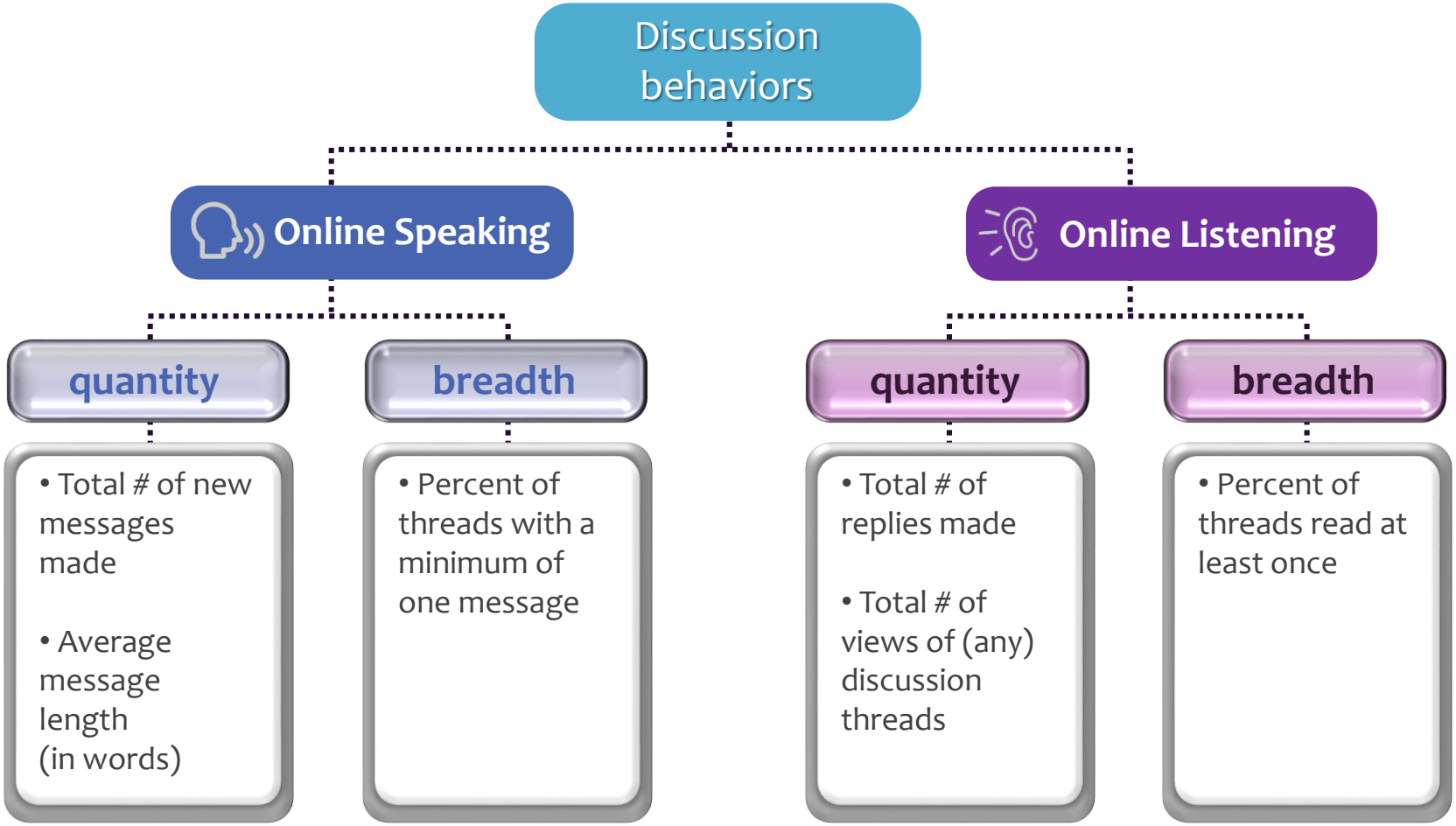
- **Online Discussions**
  - ***11 discussion board threads***
  - Participation points were awarded for posting messages (3% of final grades)
  - No required minimum # of postings
  - ***387 new messages & 430 replies*** (a total of 15,176 words)

- Example of the discussion prompt



Methods

Measure 1: Discussion behaviors



Methods

Measure 2: Students' emotions

- Measured with a dictionary-based text mining tool called "Linguistic Inquiry and Word Count (LIWC)" (Tausczki & Pennebaker, 2011)

Positive emotions	Negative emotions	Anxiety
% of positive emotion words within a message	% of negative emotion words within a message	% of words related to anxiety within a message
e.g.) love, nice, thank	e.g.) hurt, ugly, nervous	e.g.) worried, fearful

- Example
  Thanks for your help!
  - LIWC analysis results for positive emotions = 25.00 $\left(\frac{1 \text{ positive word ("thanks")}}{4 \text{ words}} * 100\right)$,
    for negative emotions = 0.00.

Methods

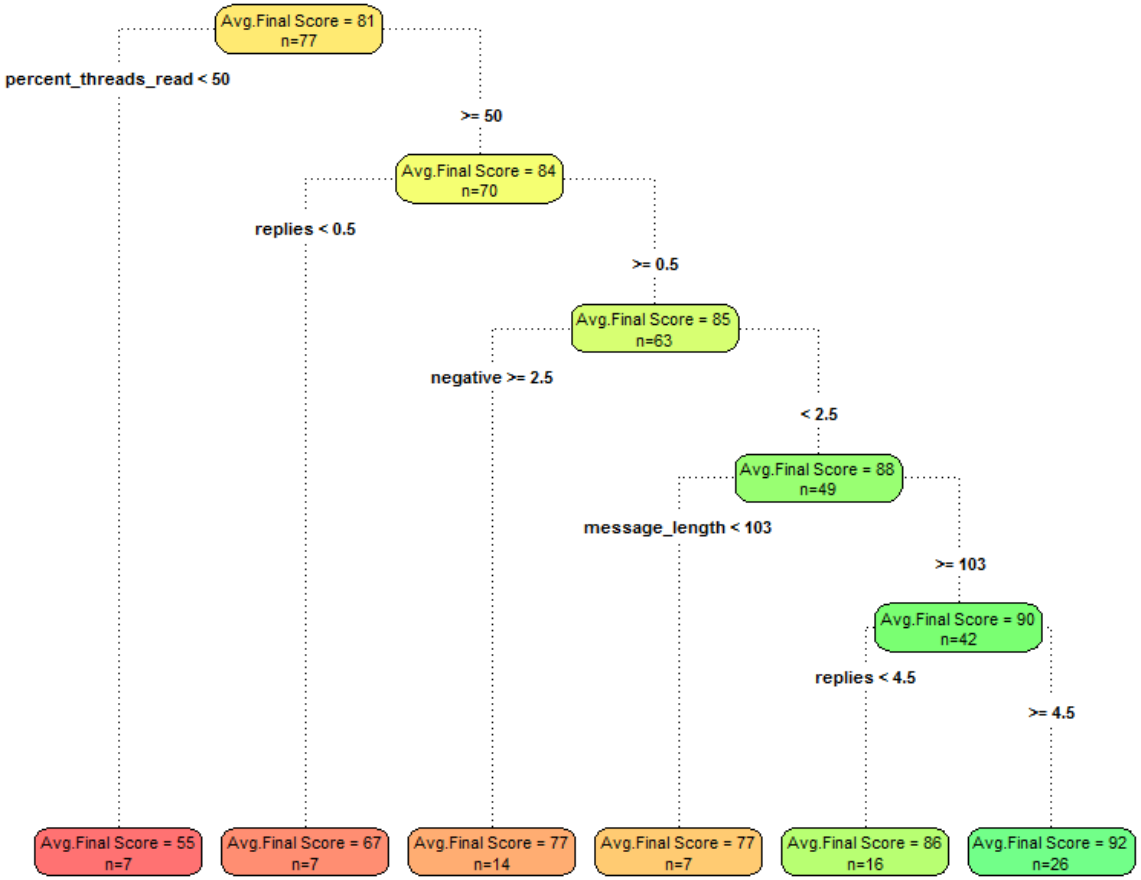
Data analysis

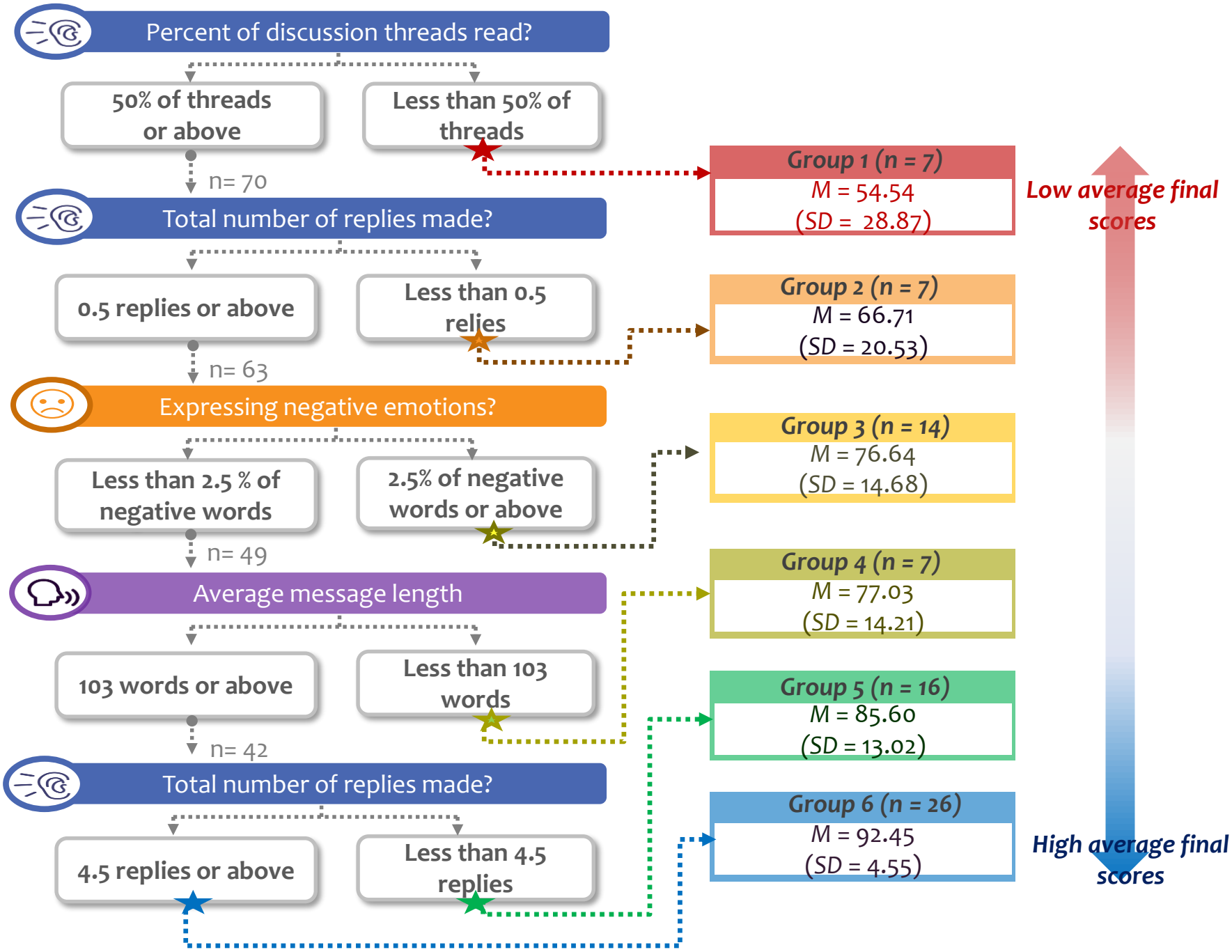
Research questions	*Data mining techniques*	*Tools*
RQ1. What **online discussion behaviors and emotions** characterize different groups of students? How do these relate to student	**Text mining**	**LIWC** http://liwc.wpengine.com
	Classification and Regression Tree (CART) • non-parametric decision tree method	**R studio**
RQ2. How does **the content of online discussions** vary within different groups of students? How do these relate to student learning outcomes?	**Co-occurrence network analysis**	**KH Coder** http://khc.sourceforge.net

Results

RQ 1. Online discussion behaviors, emotions and learning outcomes

- Results of the CART analysis predicting student final scores

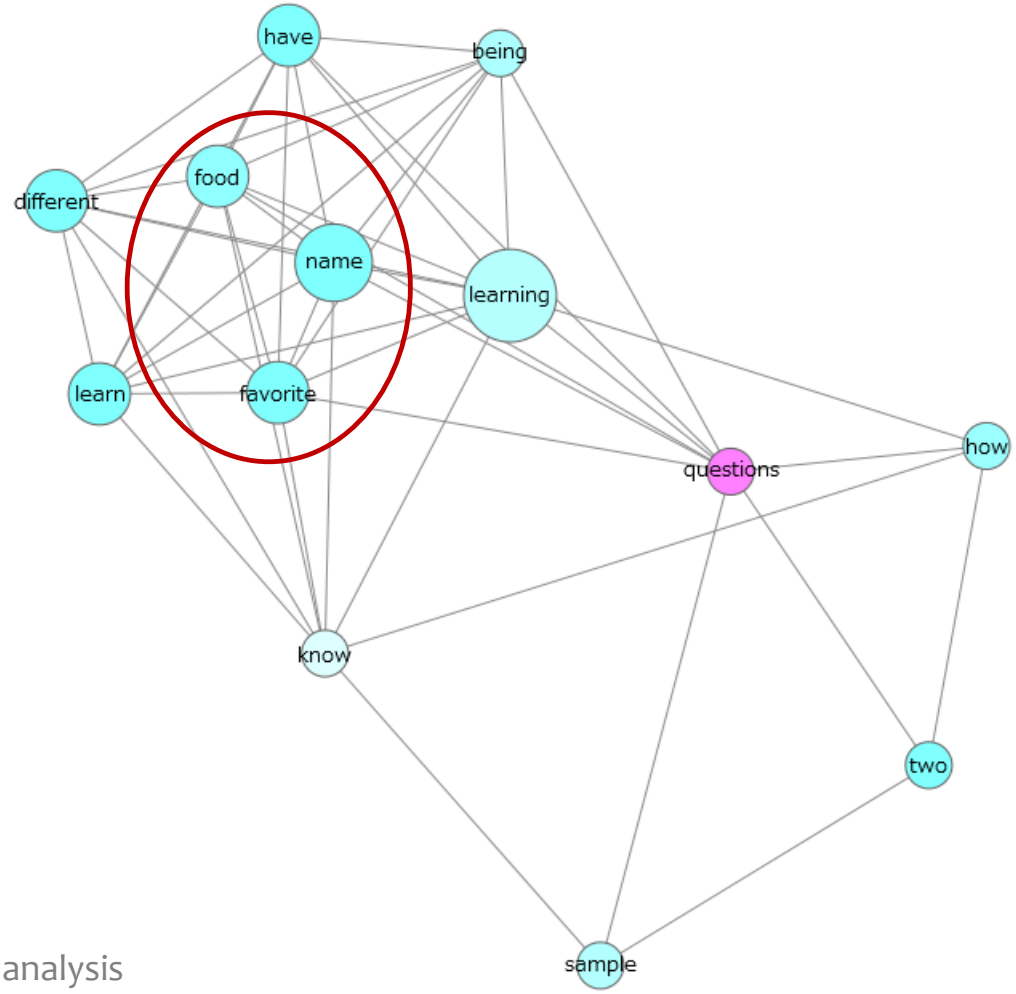



Percent of discussion threads read?
50% of threads or above
Less than 50% of threads
n= 70
Total number of replies made?
0.5 replies or above
Less than 0.5 relies
n= 63
Expressing negative emotions?
Less than 2.5 % of negative words
2.5% of negative words or above
n= 49
Average message length
103 words or above
Less than 103 words
n= 42
Total number of replies made?
4.5 replies or above
Less than 4.5 replies
Group 1 (n = 7)
M = 54.54
(SD = 28.87)
Group 2 (n = 7)
M = 66.71
(SD = 20.53)
Group 3 (n = 14)
M = 76.64
(SD = 14.68)
Group 4 (n = 7)
M = 77.03
(SD = 14.21)
Group 5 (n = 16)
M = 85.60
(SD = 13.02)
Group 6 (n = 26)
M = 92.45
(SD = 4.55)
Low average final scores
High average final scores

Results

RQ 2. The content of online discussions and learning outcomes

- Co-occurrence diagram for group 1



Group 1: Low participators

- The **lowest average final scores** (*M* = 55, *SD* = 28.87)

- Sparse content network
- **Content not relate to course topics**

- Size of the nodes: Frequency of the words
- Color: Centrality in terms of social network analysis (light blue to white to pink in ascending order of centrality value)

Results

RQ 2. The content of online discussions and learning outcomes

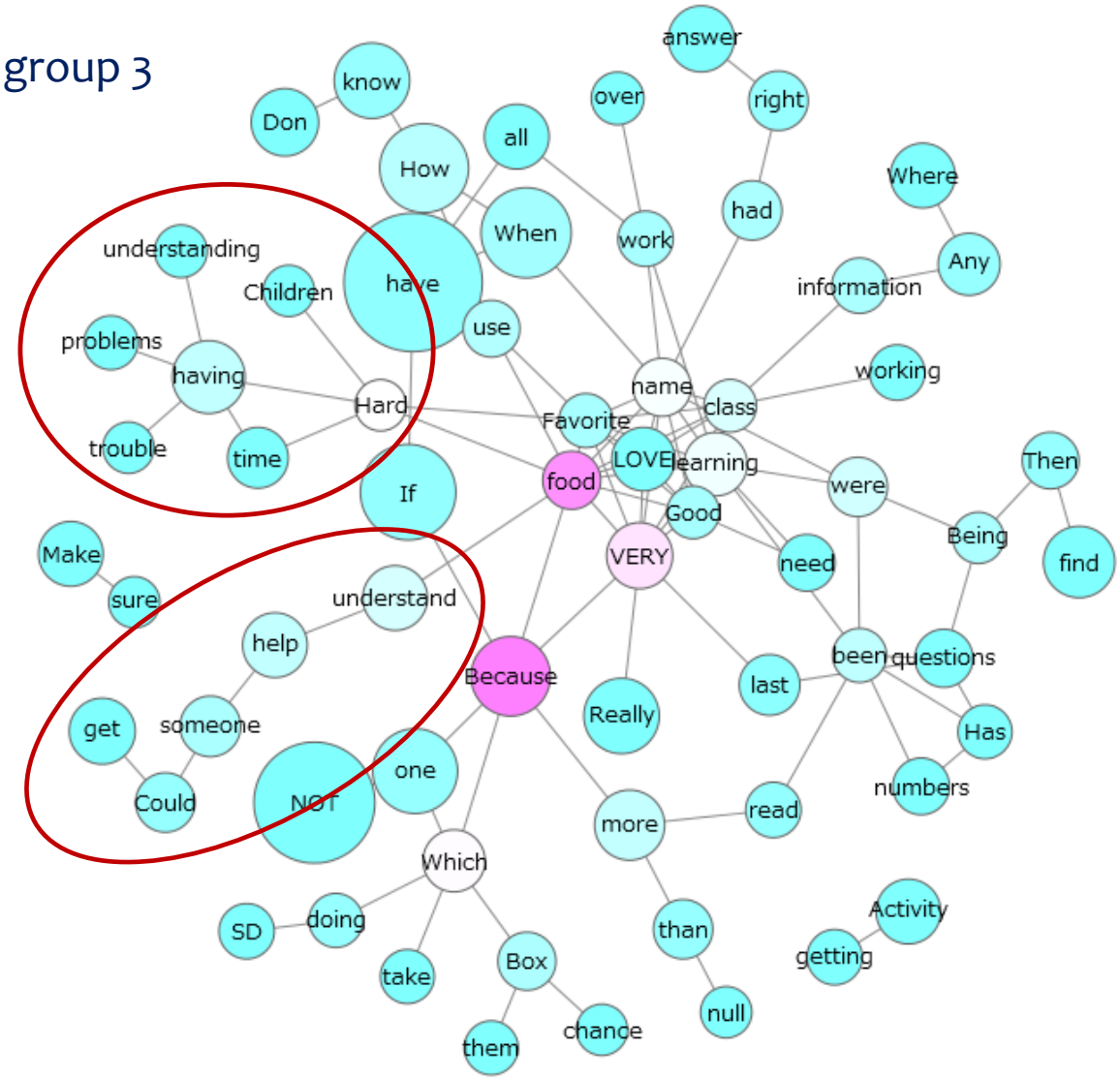
- Co-occurrence diagram for group 3

Group 3: Negative Viewers (n = 14)

- Average final scores (*M* = 76.64, *SD* = 14.68)

- The **highest average level of negative emotions, anxiety**, and the # of views

- Used the discussion boards to **express concerns or to ask questions**



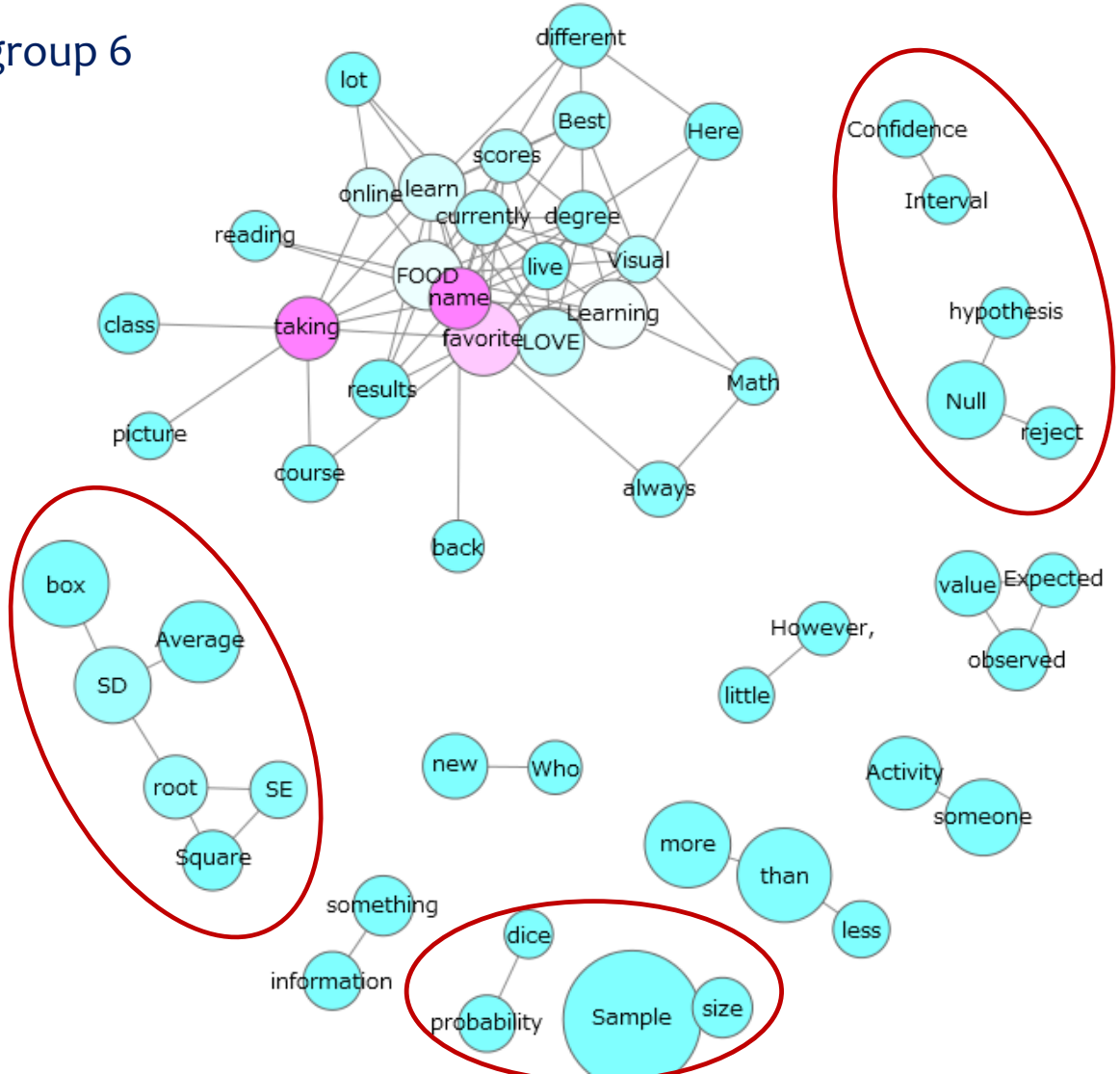
Results

RQ 2. The content of online discussions and learning outcomes

- Co-occurrence diagram for group 6

Group 6: Consistent Participators (n = 26)

- The **highest average final scores** (*M* = 92.45, *SD* = 4.55)
- Showed a higher level of online listening behaviors
- **Talked about specific course content**



Conclusion

Discussion Behaviors

- The most important variable in terms of predicting students' learning outcomes were related to **students' online listening behaviors**

Students' Emotions

- Results showed that **negative emotions** (but not positive or anxious) also played an important role.

Discussion Content

- The lower performing subgroups did not appear to talk about course content.
- The **highest performing subgroup**, however, **discussed specific course topics.**

Key Citations

Bonham, B. S., & Boylan, H. R. (2011). Developmental mathematics: Challenges, promising practices, and recent initiatives. *Journal of Developmental Education, 34*(3), 2.

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Thank you

Questions / Comments?

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