The Nature of Online Discussions: Structure, Content, and Discourse in Whole Class vs. Small Groups [Pre-print]

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online learning, online discussions, class discussions, social network analysis

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INTRODUCTION

INTERACTION is an important part of learning in both face-to-face and online contexts. Social interaction is instrumental in motivating learners and promoting satisfaction with online courses (Sung & Mayer, 2011). Furthermore, interaction among learners supports the learning process (Rovai, 2002).

An activity commonly used to increase interaction, especially in asynchronous online courses, is discussion forums. Beyond their social benefits, discussion forums help students understand course objectives, provide real-world applications, and can be used to promote student engagement (Wickershaw & Dooley, 2006). Although instructor feedback can help increase student engagement, peer feedback is equally important (Salter, 2015).

The concept of social presence is related to whether participants feel they are interacting with real people when they are online. In other words, social presence is the degree of feeling emotionally connected to another person through computer mediated communication (Sung & Mayer, 2011). Social presence is important because computer-mediated communications can feel less personal than face-to-face communication, and a lack of personal interaction can lead to a decrease in sense of community (Rovai, 2002).

Community size in computer-mediated environments strongly influences learning activities; too few or too many members can lead to a decrease in sense of community. For instance, small group activities can promote a sense of community (Akcaoglu & Lee, 2016) by helping students make connections with each other (Rovai, 2002). Online discussions are more effective when they are small-group discussions; smaller groups encourage students to raise questions and engage with the material to a deeper level than larger groups (Hamann, 2012).

Researchers have found that students perceived participating in small group discussions (versus whole class discussions) in fully asynchronous online courses to be more sociable, and students felt a higher degree of social presence (Akcaoglu & Lee, 2016). Although we know the impacts of small group activities on perceptions of social presence, we know less about the cognitive outcomes of this instructional approach. That is, it is possible that small groups can also influence the content of student discussions in positive ways.

Moreover, although previous research has investigated students' perceptions of social presence, we do not know if, in fact, a small group intervention leads to changes in the structure of the social network. Therefore, in this study, we seek to answer two research questions:

- **RQ1.** How did the social network structures differ between small and large group discussion?
- **RQ2.** What are the linguistic differences between the content of the posts while in small vs. large groups?

METHODS

Participants

DATA were collected from two groups of students (n = 33) enrolled in the same course on "Assessment and Data Analysis in Teaching" at a comprehensive university in the southeastern region of the United States. The course was offered in two consecutive semesters, Fall 2014 and Spring 2015. Both the content and the instructor of the course remained the same for both iterations.

Procedures

TO TEST both discussion formats, for weeks 1–4, the class participated in whole-class discussions in Weeks 1–4 and in a randomly-generated small group for Weeks 5–8. Discussions were based on one course topics; prompts asked students to summarize their learning from the week's materials and reflect on how it related to their practice.

Measures and Data Analysis

AFTER the courses were completed, the primary instructor exported the discussion forums as text data containing the content of posts and responses, the discussion format, and information regarding senders and receivers.

We used sender-receiver information (i.e., posts and responses) to investigate the social network structures. We used social network analysis (SNA) measures defined by Kadushin (2012) including reciprocity (i.e., the likelihood of mutual connections), transitivity (i.e. how clustered interactions are), in-degree (i.e., how connected participants are through receiving responses), density (i.e., how many actual interactions there are relative to all possible interactions), and diameter (i.e., how disconnected the furthest two participants are).

In addition to the SNA measures, we analyzed the text data to investigate if there were linguistic differences. We used the Linguistic Inquiry and Word Count (LIWC; Pennebaker et al., 2022) software to analyze text and extract information about the language used, such as the number of words but more importantly the content and nature of the text. LIWC works by comparing the text data to previously validated constructs in its dictionary. By calculating the word occurrence in those construct categories, a data frame is created with values for each construct for each text entry. The definitions of the categories can be seen in Figure 1 (see also the LIWC-22 manual: https://bit.ly/liwc22-manual).

RESULTS

RQ1. Network Structure

AS EXPECTED, the small group design led to compact and well-defined groups (Figure 2). Importantly, this design helped students overcome the complicated format of the whole class discussions, which also tended to lead to isolation of some members, despite the seemingly large number of participants. In other words, more, at least for some members, meant less interaction.

Our SNA measures also confirmed these findings (Figure 3). The small group formation led to large increases in reciprocity (i.e., mutuality) and transitivity (i.e., amount of clustering), while in-degree, density, and diameter decreased slightly.

Category	Description	Examples
WC	Total word count	-
Analytic	Metric of logical, formal thinking	-
Clout	Language of leadership, status	-
Authentic	Perceived honesty, genuineness	-
Emotional Tone	Degree or positive (negative) tone	-
WPS	Words per sentence	-
Big Words	Percent words 7 letters or longer	-
Dic	Percent words captured by LIWC	-
Linguistic	Words including pronouns, function words, etc.	the, to, and, I
Drives	Words indicating power, affiliation, achievement	we, our, work, us
Cognition	Words indicating thinking processes, such as tentativeness	how, because, make, why
Social	Words that refer to social processes such as politeness	care, help, thank, please
Culture	Words that refer to politics, ethnicity, etc.	united states, govern*, congress*, senat*
Lifestyle	Words that refer to leisure, home, work, religion	work, home, school, working
Physical	Words that refer to health, wellness, etc.	medic*, food*, patients, eye*
Perception	Words that refer to attention, feeling, etc.	see, look, eye*, saw
Conversation	Words that refer to assent, fillers, etc.	yeah, oh, yes, okay

Figure 1: LIWC Category descriptors and examples

RQ2. Content and Discourse

IN ADDITION to differences in social network structure resulting from small group formation, we also investigated the linguistic differences caused by this implementation. First, we investigated the frequency of words that were used in the whole class vs. small group discussions (Figure 4). Beyond content-specific words (e.g., essay, rubrics), we observed several words that indicated socio-emotional involvement in small group discussions, such as new, favorite, feel, like, can, think, and agree.

Second, our LIWC analyses also highlighted differences in the linguistic features used during small group discussions versus whole class discussions (Figures 5 and 6). Notably, small group discussions showed statistically significantly higher LIWC measures of Tone, Words per Segment (WPS), Dictionary words (Dic), Linguistic, Drives, Social; while the LIWC measures for Authentic, Big Words and Cognition where higher for whole class discussions.

DISCUSSION AND CONCLUSION

OUR PURPOSE in this study was to investigate the differences triggered by formatting asynchronous class discussions in whole class versus small group formats. Specifically, although previous research has suggested that small group discussions lead to increased student perceptions of social presence and sociability (Akcaoglu & Lee, 2016), we did not know if this would also lead to differences in the structure of the social networks, as well as the content and nature of student posts. Our results indicated that a small group discussion format led to more mutual and clustered interactions with more socio-emotional involvement, longer messages, and higher measures of Tone, Dic, Linguistic, Drives, Social, and significantly lower Big Words and Cognition, which may indicate that in larger group settings there was more academic talk perhaps to impress peers.

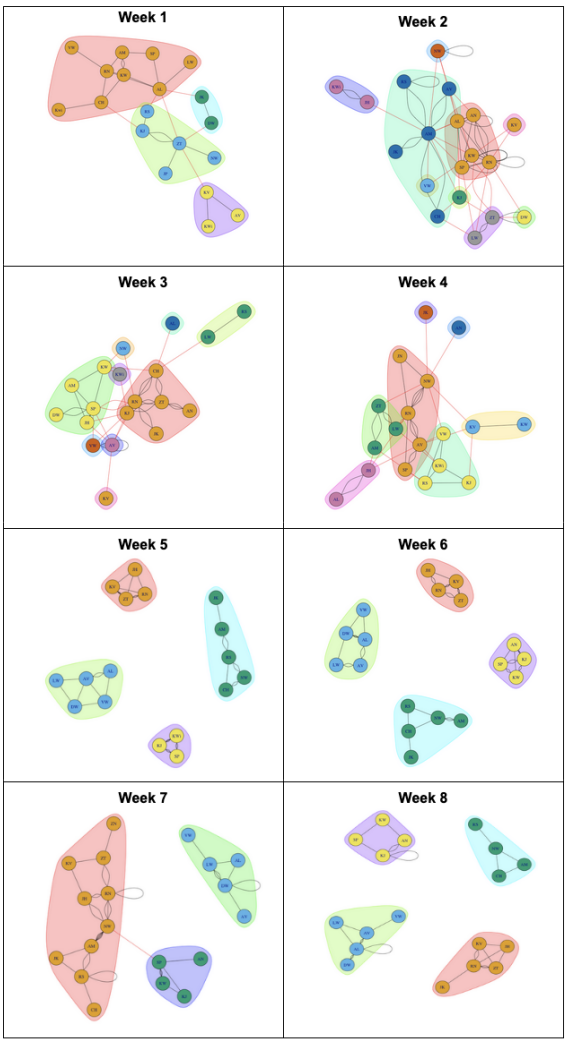

Figure 2: Network structure across 8 weeks (Weeks 1-4: Whole Class, Weeks 5-8: Small group)

	Whole		Small	
	Mean	**SD**	**Mean**	**SD**
# of posters	18.8	0.5	18	0.8
# of posts	42.5	13.1	36.8	5.4
Reciprocity	32.02	12.4	51	11.0
Transitivity	22.9	10.2	58.9	19.5
In-degree	2.3	0.7	2.04	0.3
Density	12.8	3.8	12.04	1.8
Diameter	5.75	1.3	4	1.4

Figure 3: Descriptive statistics for the social network variables

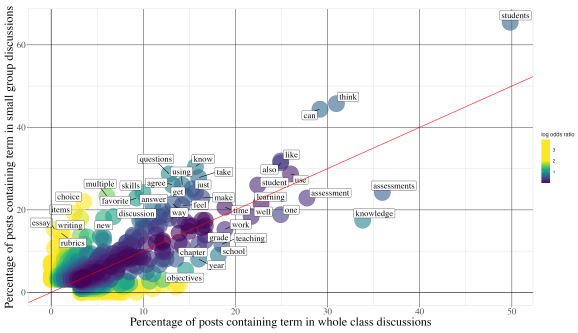

Figure 4: Difference in the frequency of words between small vs. whole group discussions

	t	df	*p*	Cohen's *d*
Word Count	0.828	502	0.408	0.074
Analytic	-1.292	502	0.197	-0.116
Clout	1.543	502	0.123	0.138
*Authentic	-1.984	502	0.048	-0.178
*Tone	2.467	502	0.014	0.221
*WPS	2.552	502	0.011	0.229
*Big Words	-4.743	502	< .001	-0.425
*Dic	3.797	502	< .001	0.341
*Linguistic	4.122	502	< .001	0.370
*Drives	4.554	502	< .001	0.408
*Cognition	-4.029	502	< .001	-0.361
*Social	3.007	502	0.003	0.270
Culture	1.371	502	0.171	0.123
Lifestyle	0.895	502	0.371	0.080
Physical	-0.280	502	0.780	-0.025
Perception	1.745	502	0.082	0.157
Conversation	-1.158	502	0.247	-0.104

Notes: Positive *t*-values indicate tests favoring small group format.
* denotes statistically significant differences between groups

Figure 5: Paired-samples t-test results for the LIWC variables

	Small		Whole	
	Mean	**SD**	**Mean**	**SD**
Analytic	45.8	27.1	49.0	27.4
Clout	45.5	31.0	41.3	30.6
Authentic	58.8	31.9	64.4	30.4
Tone	58.8	31.1	51.9	30.7
WPS	16.6	5.5	15.1	6.9
Big Words	21.5	6.5	26.2	13.9
Dic	90.6	8.0	87.9	8.2
Linguistic	72.2	8.9	68.3	11.8
Drives	5.5	4.5	3.9	3.4
Cognition	17.3	6.7	21.1	12.6
Affect	4.9	5.2	4.0	4.6
Social	13.0	8.4	11.0	5.9
Culture	0.6	1.2	0.5	1.3
Lifestyle	6.6	4.1	6.3	4.9
Perception	6.3	3.7	5.7	4.1
Physical	0.4	0.9	0.4	1.1
Conversation	1.0	2.2	1.3	3.2

Figure 6: Descriptive statistics for the LIWC variables

The higher means for certain measures during small group discussions means that a small group asynchronous discussion format not only leads to increased student perceptions of social presence, but is also associated with students' writing more words, and being more personable. These results confirm previous findings (Akcaoglu & Lee, 2016) and these findings add a new dimension showing us the positive changes the group size brings to the network structure and the linguistic features used by the students.

This small intervention addresses some of the weaknesses perceived in online teaching. For instance, Online learning has been criticized for the lack of social presence and the feeling of isolation, leading to higher dropout rates and lower satisfaction compared to traditional learning contexts (Sung & Mayer, 2011).

Although this study advances our understanding beyond previous research, there are additional research questions that should be addressed in future work. For instance, is this effect also visible in other age groups (e.g., undergraduate students, K-12 online teaching), or if reversing the intervention (small group $\rightarrow$ whole class) would lead to better outcomes (e.g., benefit better from the advantages of whole class discussions after forming initial strong relations in small groups).

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