Uncovering the Rich Club Phenomenon in an Online Class

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Abstract: Social interaction is key for learning. In this study on student interaction in a social learning environment, we identified two student groups with contrasting levels of social *prestige*—defined as the level of discursive attention one receives in relation to one's discursive activities. The higher-prestige group was found to form a densely connected "rich club" less likely to interact with the lower-prestige group. Further network analysis linked this phenomenon with the timing of students' relationship formation and weekly participation.

Introduction

Social interaction is an important element of learning. The present study explored a so-called "rich club phenomenon" in an online discussion environment. Members of the rich club have higher social *prestige*, are closely connected with each other, and are more capable of constraining information flows and idea exchanges. In this study, we applied social network analysis (SNA) to answer three questions: (1) To what extent did students demonstrate varied levels of prestige in their online discussion? (2) Can a rich club be observed in the network? (3) Which factors might explain the emergence of varied prestige or the rich club phenomenon?

Methods

The research context was an undergraduate, fully-online course participated by 20 undergraduate students. The course was taught on Yellowdig, a social learning platform with features similar to Facebook. On Yellowdig, students could contribute *pins* (similar to Facebook posts), which can be reacted to (e.g., "Like") or commented on. Compared to a traditional discussion forum, Yellowdig provides richer features for social learning.

Discussion data used to answer research questions included 274 pins, 514 comments, 36 mentions, and 74 reactions exported from Yellowdig. Conceptualizing prestige as the level of discursive attention one receives in relation to one's discursive activities, we constructed a social network based on their replies and divided students into two groups based on the ratio of weighted *indegree* to weighted *outdegree* in the network. We examined differences between the high- and low-prestige groups in a number of network measures and probed the possibility of a rich club phenomenon in the course. Finally, we examined temporal dynamics and ego networks to explore factors potentially contributing to the varied prestige and the rich club phenomenon.

Findings

Characterizing prestige in the reply network

To characterize prestige, students were divided into two groups according to the ratio of one's weighted indegree to weighted outdegree. The categorization resulted in two groups: Group A (n=8) constituted by students with a ratio greater than 1; and Group B (n=12) comprised of students with a ratio equal or smaller than 1. We found students from two groups initiated equivalent amount of interactions with equivalent number of peers, but Group A students received more replies than others, occupied more favorable network positions, and maintained stronger ties with peers they became connected with.

Uncovering the rich club phenomenon

To examine a possible "rich club" in the network, we focused on the direction of student interactions, breaking all interactions into four categories: A→A, B→B, A→B, and B→A. We found that Group A students seldom replied to Group B students (9.61%), even though Group B were actively initiating contact with them (37.77%); Group A students were essentially more likely to launch interactions with other Group A students (33.18%). These network characteristics provided initial evidence of a rich club phenomenon (Vaquero & Cebrian, 2013).

Explaining the emergence of prestige and the rich club

To address the third research question, we inspected two aspects—the timing of student posts and the temporal evolution of the network. For the timing of posts, we found most Group B students' pins were barely on time, whereas most Group A students posted their pins one day in advance. Group A students contributed their initial posts significantly earlier than Group B students (t(180)= -6.520, p<.001); the same happened for comments.

As for the temporal evolution of the network, we investigated how those four categories of interactions (i.e., A→A, B→B, A→B, and B→A) accumulated over the course. Figure 1 shows the saturation curves of four interaction types. As the curves indicated, Group A students did not only establish nearly 90% of all possible connections among themselves, they also built their connections quickly. Group B students were trying to connect with Group A throughout the course and made more than 80% of all possible B→A connections. However, they received much less attention from Group A students.
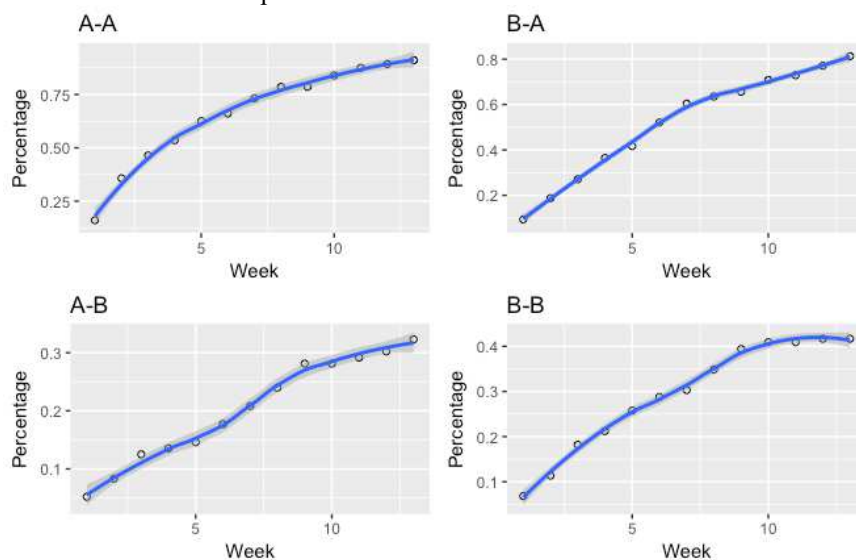

Figure 1. The saturation curves of four types of connections. The y-axis represents the percentage of accumulated unique ties in comparison with all possible ties for a connection type.

Analysis of temporal ego networks of all students told a complementary story at the local level. Comparisons found Group A students' ego networks had larger *network sizes* and lower *dyadic constraints* than Group B students. In other words, Group A students were immediately connected with more peers and they were more likely to broker or constraint others' connections. These findings indicated Group A students were not only better connected but also had stronger brokerage presence in their local neighborhoods.

Conclusions

Social participation figures as an important aspect of online learning. This study contributes to the literature, especially to the line of work on using online discussion to support student interactions. In this study, we divided an online class into two groups in light of an operationalization of social prestige based on SNA. Analysis of the directionality of student interactions showed students from the high-prestige group connected more frequently with similar prestige peers, and students from the low-prestige group received few interactions from the high-prestige group. Further analysis was conducted to explain these findings. Preliminary results pointed out the significance of temporality. The high-prestige group established inner-group connections much faster than the low-prestige group in the first four weeks; they also generally posted earlier in weekly discussions, leaving peers ample opportunities to react to their ideas.

Findings regarding network prestige and the rich club phenomenon build on prior work on student interaction patterns in online discussion (Dawson, 2010) and course communication (Vaquero & Cebrian, 2013). While earlier research using course performance data found low-performing students more likely to connect with similarly low-performing peers, this study found lower-prestige students in online discussion were willing to connect with higher-prestige peers, but their attempts were not reciprocated. The explicit recognition of such an engagement gap in online discussion, together tentative explanation of its emergence offered by the study, contributes to the literature and calls for future research and design efforts to mitigate this gap.

References

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