

## Are Your Top Social Annotation Friends Also Your Offline Group Members?

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**Abstract:** Previous research has highlighted homophily (i.e., the tendency to interact with similar others) in online social networks, but its presence in social annotation activities, particularly influenced by group affiliations, remains underexplored. The current research addresses this gap by analyzing the online interactions of 93 undergraduates in a learning media course on Perusall. Findings reveal students' preference for interactions within the same offline groups during social annotations, contributing to a deeper understanding of homophily in hybrid settings. These insights are vital for enhancing student engagement in hybrid learning environments and promoting more effective interactions.

### Objectives and significance

Homophily is the tendency for individuals to connect with others who share similar traits, such as gender, race, and educational backgrounds (Aiello et al., 2012). Research has shown that homophily exists not just in physical interactions but also in online environments (Aiello et al., 2012). However, how offline characteristics affect online networks remains a topic for ongoing investigation. In higher education, students increasingly engage in social annotation by highlighting and commenting on course materials, responding to peers, and negotiating meanings and building knowledge (Zhu et al., 2023). Tools like Perusall facilitate this process by offering flexibility and supporting hybrid learning, free from time and space constraints. Previous studies indicate that social annotation enhances higher-order skills such as collaboration and critical thinking (Chen, 2019), boosts engagement and motivation, and provides additional benefits like automated grading (Li & Li, 2023). As social annotation often involves assigning readings as pre-class preparation and consolidating with in-depth in-class discussions, understanding the influences of offline characteristics on students' online interactions is crucial. This study will probe into offline group affiliation-based homophily in social annotations to provide educators with insights to foster more effective student interactions.

### Methods

#### Participants and learning environment

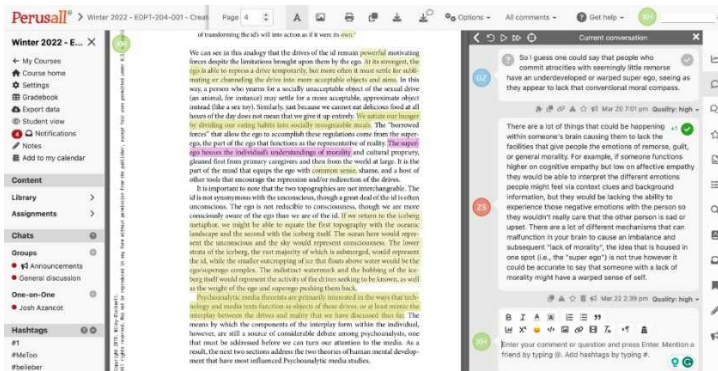
The research included 97 undergraduates (47 female,  $M_{age}=20.67$ ) enrolled in a learning media course at a North American university during the winter semester (weeks 17 to 13) of 2022. The participant demographic was primarily White (59 participants), with 5 Chinese, 3 South Asian, 2 Southeast Asian, 1 Black, 1 Filipino, 1 Japanese, 1 Korean, and 1 Latin American student. Additionally, 3 participants identified themselves as other racial backgrounds, and the others did not disclose their race. The students were organized into 16 groups, typically with six members each. They were tasked with annotating ten readings for seven weeks using Perusall, a digital social annotation tool. Four students withdrew from the course, resulting in a final sample size 93.

Perusall serves as an interactive platform for collectively annotating and discussing designated readings. It allows students to participate in the annotation process by adding comments or posing questions about the readings, as illustrated in Figure 1. In this study, students were required to actively annotate ten readings by creating their own annotations and engaging with others' annotations through comments.

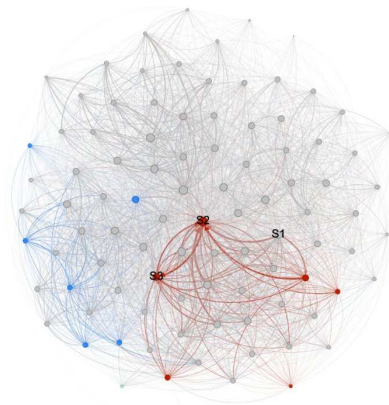
#### Data collection and analysis

Participants' asynchronous social annotations of assigned readings were collected from Perusall's log files. Over seven weeks, participants made a total of 7,482 social annotations. For example, as Figure 1 displays, GZ and ZS subsequently annotated the passage "The super-ego houses the individual's understandings of morality". This sequence suggests that ZS read GZ's annotation before commenting. We constructed a social network graph based on such connections (see Figure 2). NetworkX, a Python library, was employed to plot a social network graph representing the interactions within the 7,482 social annotations.

**Figure 1**  
Example of Annotations in the Persuall platform



**Figure 2**  
The Social Annotation Network Graph



We identified each student's social best friend –the neighbor with the highest degree in the network graph. Since most groups had six students, we also identified each student's top five social annotation friends and examined the co-membership with the student's offline group affiliations. Identifying social best friends is a prevalent method to analyze student interaction patterns in online and offline learning contexts. This study examined whether students tended to interact with their offline group members. As a baseline measure, we computed the likelihood of a student's best friend or top five friends in the same offline group by chance. The probability that two randomly selected students belong to the same group can be calculated as follows: Each of groups  $G_1, \dots, G_{14}$  has 6 students, Group  $G_{15}$  has 5, and Group  $G_{16}$  has 4. Student name is  $S$ , and their best friend is  $F$ .  $P[S \text{ and } F \text{ are in the same group}] = (\sum_{i=1}^{14} P[S \text{ and } F \text{ are in group } G_i]) + P[S \text{ and } F \text{ are in group } G_{15}] + P[S \text{ and } F \text{ are in group } G_{16}] = 14*6/96*5/92+5/93*4/92+4/93*3/92=5.28\%$ . Similarly, the chance that at least one of a student's top five friends is from the same group is calculated, which is about 24.22%.

## Results and discussions

This study showed that 20.43% of students had their best social annotation friend from their offline group, and 67.74% had at least one offline groupmate among their top five friends. These probabilities suggest a greater likelihood of students interacting with their offline group peers in online social annotations. These results indicate the homophily phenomenon in social annotations based on offline group affiliations. Our findings indicate a trend where students prefer engaging with peers from their offline groups during online social annotation, reflecting observations that offline socialization boosts online community engagement and a sense of belonging (Ke et al., 2011). This is likely due to the comfort and familiarity developed through face-to-face interactions, which lowers social barriers and promotes participation. Such interactions, often grounded in shared academic aims and experiences, as Nussbaum et al. (2009) noted, facilitate the extension of classroom discussions and collaboration towards common objectives in online settings. This emphasizes the influence of offline group dynamics on online collaboration, enriching our comprehension of hybrid learning environments.

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