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What Draws Upvotes? Examining Relationships between Interpersonal Skills and Social Annotation Behaviors in Online Settings

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Abstract: In social annotation learning settings, upvotes serve as feedback and a source of motivation, social connection, and validation, yet factors influencing upvote patterns remain under-explored. This study examined relationships between upvote count and students' interpersonal skills, performance, and annotation behaviors. We analyzed 7,482 annotations from 93 undergraduate students using Perusall over seven weeks. We observed no strong correlations between the upvote count and students' interpersonal skills, automated evaluation score, reply count, or posting order.

Objectives and significance

Social annotation, which refers to a collaborative process in which instructors and students highlight, comment on, and discuss course materials (Novak et al., 2012), has become a transformative pedagogical approach to promote active learning and community-building in online learning. It fosters deeper reading engagement and comprehension by making thinking visible and creating opportunities for intellectual exchange (Zhu et al., 2020; Huang et al., 2024). Upvoting is a prevalent feature in social annotation platforms, enabling users to express approval and engage with peers' contributions (Li et al., 2024). Upvotes can serve as a powerful social signal that influences content visibility and shapes discourse. Previous studies indicate that upvotes in social annotation are associated with both content-related and interpersonal cues and can potentially shape students' learning experience and perceived learning outcomes (Huang et al., 2024). However, the empirical evidence about the factors behind these upvote count in online social annotation settings remains limited. The current study seeks to address this gap. Specifically, we focused on the following question: *What are the relationships between upvote count and students' interpersonal skills and social annotation behaviors?*

Study design and methods

This study was conducted during the Winter semester in an undergraduate learning media course at a North American university with 97 students (47 female; Age *Mean* = 20.67). Four students withdrew, yielding a final sample of 93. Students were assigned to 16 small groups and engaged in collaborative reading and discussion activities using Perusall, which allows students to asynchronously annotate course readings by highlighting text, posing texts, and replying. The platform also features automatic scoring that evaluates students' contributions based on criteria such as relevance, quality, and engagement. Over the seven-week activities, students were required to annotate ten readings. A total of 7,482 annotations were collected, including original annotations, replies, upvotes, timestamps, and system-generated scores.

To examine individuals' interpersonal competencies, we adapted an interpersonal skills survey based on Riggio's six dimensions (Lee et al., 2015). The survey consists of seven items measuring self-perceived behaviors such as empathy, open-mindedness, communication, conflict resolution, and adaptability, rated on a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). A total of 84 participants completed the survey.

To address the research questions, we examined the relationship among several key variables. Students' responses to the interpersonal skill surveys were used to measure their interpersonal skills. The content quality of their annotations was measured using Perusall's automated evaluation score. We also explored students' social annotation behaviors in terms of reply count and posting order. Reply count is the total number of replies an annotation received, and posting order refers to the time an annotation was posted. To identify the posting order,

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we retrieved the posting timestamp for each annotation within each set of reading materials, with the earliest social annotation marked as 1. In other words, if a document contains *n* annotations, the most recently posted annotation has the posting order *n*.

Results

To address the research question, we analyzed several relationships: (1) upvote count and the automated evaluation score provided by Perusall, (2) upvote count and the number of replies each annotation received, (3) upvote count and the posting order of each annotation, and (4) students' total upvote count and their interpersonal skill scores. Table 1 presents the results using Spearman correlation. Although the first three variables were statistically significant, all variables were weakly correlated with the upvote count. Posting order and interpersonal skills were negatively and weakly correlated with the upvote count.

Table 1

The Correlation between the Upvote Count and Automated Evaluation Score, Online Social Annotation Behaviors, and Interpersonal Skills

	Automated Score	Reply Count	Posting Order	Interpersonal Skills
Upvote count	.107*	.159*	-.050*	-.027

*: $p < 0.05$

Discussion and conclusion

This study examined factors influencing upvote patterns in social annotation by analyzing 7,482 annotations from 93 undergraduate students. Contrary to expectations based on social presence theory (Arbaugh et al., 2008), interpersonal skills showed weak negative correlations with upvote counts. Students with higher self-reported interpersonal competencies did not receive more peer recognition through upvotes. This result challenges assumptions about social dynamics in online learning environments (Chen et al., 2024). Similarly, Perusall's automated evaluation scores correlated only weakly with upvotes. This disconnection between algorithmic assessment and peer recognition suggests that students value different qualities in annotations than those captured by automated systems. Peer preferences appear to diverge from traditional academic quality metrics. The weak relationship between automated scores and upvotes also suggests caution in using peer feedback mechanisms for assessment purposes. Upvotes appear to reflect student interests rather than content quality, making them unsuitable as primary evaluation tools.

There are limitations to this work. Our findings were based on certain topics in that course and the generalization to other disciplines may be limited. Future research should explore the cognitive and emotional factors underlying topic preferences in upvoting behavior. Understanding why certain topics consistently attract more peer acknowledgement could inform more equitable discussion design. Moreover, investigating student motivations for upvoting through interviews or structured feedback would provide valuable insights into peer recognition patterns. Finally, researchers might explore whether instructor intervention can balance attention across different annotation types.

References

Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, J. C., & Swan, K. P. (2008). Developing a community of inquiry instrument: Testing a measure of the community of inquiry framework using a multi-institutional sample. *The Internet and Higher Education*, 11(3-4), 133-136.

Chen, F., Li, S., Lin, L., & Huang, X. (2024). Identifying temporal changes in student engagement in social annotation during online collaborative reading. *Education and Information Technologies*, 29(13), 16101-16124.

Huang, X., Zheng, J., Li, S., Zhu, G., Du, H., Zhong, T., ... & Lajoie, S. (2024). Investigating the effect of emotional tone on learners' reading engagement and peer acknowledgement in social annotation. *Australasian Journal of Educational Technology, 40*(6), 92-107.

Lee, D., Huh, Y., & Reigeluth, C. M. (2015). Collaboration, intragroup conflict, and social skills in project-based learning. *Instructional science*, 43(5), 561-590.

Li, S., Huang, X., Lin, L., & Chen, F. (2024). Exploring influential factors in peer upvoting within social annotation. *British Journal of Educational Technology*, 55(5), 2212-2225.

Novak, E., Razzouk, R., & Johnson, T. E. (2012). The educational use of social annotation tools in higher education: A literature review. The Internet and Higher Education, 15(1), 39-49.

Zhu, X., Chen, B., Avadhanam, R. M., Shui, H., & Zhang, R. Z. (2020). Reading and connecting: Using social annotation in online classes. *Information and Learning Sciences*, 121(5/6), 261-271.