

Building Trust and Social Networks Through Online Cross-Class Peer Tutoring

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Abstract: Online peer tutoring faces challenges such as diminished trust and reduced student interactions, indicating the importance of the social and emotional aspects in computer-supported collaborative learning. This study examined the impact of interaction quality on students' trust and the potential for expanding social networks through a cross-class peer tutoring system in junior high math extracurricular activities. The findings indicate that interaction quality enhanced students' trust, particularly among low-engaging students, highlighting the importance of fostering high-quality interactions and supporting low-engaging students. The system also helped students form cross-class connections, suggesting its potential to be used in remote learning.

Keywords: Social and emotional aspect, trust, social networks, computer-supported collaborative learning (CSCL), peer tutoring

1. Introduction

Social and emotional aspects greatly influence students' well-being and learning performance (Erstad et al., 2024). In collaborative learning (CL), affective states (Liang et al., 2021) and social networks (Cho et al., 2007) shape students' learning experiences and outcomes (Huang & Lajoie, 2023). Trust, for instance, is essential for quality interaction (Siméone & Eneau, 2009), while social links in CL can enhance students' learning outcomes (Cho et al., 2007).

With technological advances, computer-supported collaborative learning (CSCL) has become an emerging field in education (Stahl et al., 2006). However, not all forms of learning can easily adapt to online environments. For instance, peer tutoring faces challenges online, including building trust or fostering interactions between students (Łodej & Łodej, 2023).

These challenges highlight the need to focus on the social and emotional aspects of computer-supported peer tutoring. This study examined how the peer help system (Jiang et al., 2024), a cross-class peer tutoring system, supports students in building trust and social networks in CSCL. Two research questions were proposed:

- RQ1: Does interaction quality affect students' trust between peers?
- RQ2: To what extent can the peer help system expand students' social networks?

2. Methods

2.1 Experiment and System

An experiment using the peer help system was conducted in math extracurricular activities at a Japanese junior high school from November to December 2024. The participants were 120 first-year students from three classes, with one excluded due to a lack of consent. 84 students engaged in the peer help activity (60 askers, 66 helpers). After the experiment, 98 students completed a survey on system perceptions, including 73 students who engaged in the peer help activity (51 askers, 58 helpers). RQ1 analyzed data from 50 askers who completed the survey, with one excluded due to missing engagement data.

The peer help system is a recommendation-enhanced peer tutoring system that enables learners to ask and answer questions with their peers self-directedly (Jiang et al., 2024). The system uses learners' individual knowledge proficiency data from the Open

Knowledge and Learner Model (OKLM) (Takii et al., 2024) to recommend helpers. The names of the recommended helpers are anonymized, only their knowledge graphs being shown. After askers receive replies, they can evaluate helpers based on their helpfulness.

2.2 Variables and Measurements

RQ1 examined the relationship between interaction quality and trust via linear regression (1). Interaction quality was the average peer evaluation score given by askers, ranging from 1 to 4, where 4 represents the most helpful. Trust was the percentage of helpers the asker wanted to keep engaging with among all interacted helpers, using the survey question: “Among all the helpers who have responded to you in the peer help system, how many would you like to continue interacting with?” Learning engagement served as a moderator to test if the relationship varied by its level. It was measured by the total of students’ operations on an e-book platform, scaled with Min-Max normalization, with outliers ($1.5 \times \text{IQR}$) replaced by median.

$$\text{Trust}_i = \beta_0 + \beta_1 \cdot \text{Interaction Quality}_i + \beta_2 \cdot \text{Learning Engagement}_i + \beta_3 \cdot \text{Interaction Quality}_i \cdot \text{Learning Engagement}_i + \varepsilon_i \quad (1)$$

RQ2 investigated if students could broaden their relationships using social network analysis. A connection was established when the helper replied to the asker’s question. Additionally, students’ class affiliations were used to evaluate cross-class connections.

3. Results

3.1 Trust Enhancement

RQ1 investigated whether the interaction quality enhances trust and whether engagement moderates this effect. Interaction quality positively impacts trust ($\beta_1=0.1467$, $p<.01$), and the moderator showed a significant and negative influence ($\beta_3=-0.3138$, $p<.05$), suggesting the effect of interaction quality on the trust between peers was stronger for low-engaging students.

3.2 Social Networks Expansion

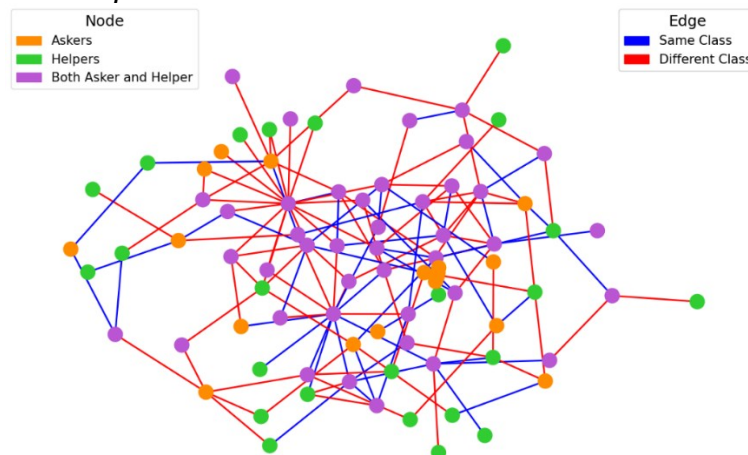


Figure 1. Students’ social networks in the peer help system

RQ2 investigates whether the peer help system expanded students’ social networks (Figure 1). Among all students, 67.23% of students were non-isolated, and the average degree was 2.336. On average, 62.51% of students’ connections were with peers from different classes.

4. Conclusion and Discussion

The study examined students’ social and emotional aspects of learning in the peer help system. RQ1 results indicate that interaction quality enhanced trust, aligning with prior research that a

high-quality relationship is the basis of trust (Jochems, 2016). The effect was stronger for low-engaging students, underscoring the importance of improving interaction quality to foster trust, especially among them. Future research could identify factors enhancing interaction quality and support teachers in recognizing low-engaging students in CSCL.

RQ2 results suggest the peer help system can expand students' social networks, with over half establishing connections. 62.51% of connections were with peers from different classes, indicating that the anonymized recommendation reduced selection bias and promoted cross-class connections. As social networks facilitate the exchange of knowledge and support in CSCL, expanding and diversifying connections can broaden their learning (Cho et al., 2007). This system can be applied to remote learning in the future, enabling students to build connections across geographical boundaries to expand their learning.

Nevertheless, this study has several limitations. First, it focused solely on trust as an emotional factor, and future research could explore broader emotions. Second, as interaction quality was self-report, and objective measures (e.g., content analysis) could improve validity. Last, the context was a K-12 math extracurricular activity. Future research could implement the system into real remote learning contexts to further validate its effectiveness.

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