

Examining the Influence of Perceived Team Closeness and Members' Thinking Style on Collaborative Information Behaviors

Abstract. Teams with collaborative information seeking tasks use different collaboration strategies to accomplish a common goal. Many factors, including team structures and relationships among team members, affect their strategies. In this research, we conducted a user experiment to explore the influence of perceived team closeness and member's thinking style on the team's online collaboration strategy as well as on members' five types of information behaviors, including planning, information seeking, information sharing, information using and communication. We found that members with high closeness tend to develop collaboration strategies and arrange schedule arrangement but tend to reject a strong leader, while groups with low closeness are more likely to have collaboration defects and led by the team leaders. Members with an external thinking style tend to view group records and use group results, while those with internal thinking styles do not develop information-sharing strategies. Groups with an external thinking style tend to have one leader, while groups with internal thinking tend to collaborate under multi-leadership. These results help to understand further the influence of perceived team closeness and member's thinking style on a small team's collaborative information seeking and sensemaking strategy and team members' behavior. These results shed light on the relationship between group composition and performance, providing design implications for the improvement of online collaboration tools.

Keywords: Collaborative information behavior, group closeness, knowledge collaboration, information seeking and use.

1 Introduction

Accompanied with the elaborative division of labor, the increasing complexity of the task and the rapid development of information technology, online collaboration has been new normality, which involves members' information seeking, sharing information, transforming and recreating knowledge (Faraj et al., 2017). The collaborative process of seeking and using information together is crucial to many tasks. Among other factors, the relationship

among team members (Bloom et al., 2013) can affect the efficiency of participation and interaction among team members in collaboration (Kim et al., 2011).

Previous researches had explored the influence of member's intimacy, emotion (Yuan & Zhao, 2015), types of the community (Wu & Xue, 2014), expectations of results (Chiu et al., 2006), collaboration capability (Qiu & Wu, 2012) on their collaborative information seeking behaviors or collaborative sensemaking. How members perceive the relationships with others in the team (perceived closeness) and the internal vs. external thinking styles might affect the team's collaboration strategy and members' collaborative behaviors in groups, which was fewer studies in previous research. This study conducted a user experiment, using widely validated measures of perceived team closeness and member's thinking styles, to explore the influence of perceived team closeness and member's thinking style on the team's online collaboration strategy as well as on members' collaborative information behaviors.

This paper is organized as follows: we first review related literature, then describe the user experiment that recorded and analyzed teams' collaborative behaviors with different perceived closeness levels and members with external vs. internal thinking styles. We then put forward a coding scheme of collaborative behaviors we generated and analyzed the influence of team perceived closeness and member's thinking styles on their collaborative behaviors and collaborative strategies. We conclude with a summary of findings and discussions of limitations and future work.

2 Related Research

2.1 Collaborative Information Seeking Behavior

Collaborative information behavior differs from individual information behavior concerning how individuals interact with each other, the complexity of the information need, and the role of information technology (Reddy & Jansen, 2008). A situated model embedded within the organizational context was developed to identify three phases: problem formulation, collaborative information seeking, and information use. Moreover, information sharing and evaluation, and collaborative sensemaking are common to all the phases (Karunakaran et al., 2013).

Collaborative information seeking needs to be figured as an information retrieval process (Koschmann & Stahl, 1998), including collaborative planning, collaborative information searching, sharing of information and collaborative decision making (Mohammad Arif et al., 2015). Recently several tools (e.g., Knowledge Community (Tan & Chan, 2008), Coagmento (Mitsui et al., 2018), Moodle (Sun et al., 2017)) have been designed to support awareness and division of labor across collaborators. Moreover, these studies often found that the division of labor and knowledge sharing is critical for collaborative information seeking (Colum Foley & Alan F Smeaton, 2010). Sharing and understanding knowledge effectively is considered one of the foundations of any group activity (Yao et al., 1999),

which also reflects the significance of collaborative sensemaking during the process of collaborative information seeking (Colum Foley & Alan F Smeaton, 2010).

2.2 Collaborative Sensemaking

The collaborative sensemaking process usually starts from structuring the task through the iterative effort to search and share and finally synthesize information into a shared representation (Tao & Tombros, 2017a). Furthermore, it usually occurs when there is “ambiguity of available information, role-based distribution of information, and lack of expertise.” To achieve collaborative sensemaking, group members need to prioritize the correlation information by sharing needs or understanding a particular situation. They also need to transfer information between people to form a consistent sensemaking trajectory (Paul & Reddy, 2010). Finally, group members must have a holistic awareness of the overall situation, that is, activities awareness, including changes to shared plans and evaluations, and dependencies among different tasks (Carroll et al., 2003).

2.3 Collaboration Strategies and Team Closeness

A collaborative task consists of two parts, “collaborating alone” (i.e., continuing a search across time or devices) and “collaborating together” (i.e., involve multiple people with different services). Users can be described along two axes when they collaborate alone: “initiative (whether the user was active or passive) and stage (whether the strategy applies to the storage or retrieval of the search context).” When users collaborate together, they tend to use divide-and-conquer or brute force methods, the former involved explicit coordination and planning, the latter people search separately and results were merged afterward (Morris, 2007). The divide-and-conquer method can be divided into three types: parallel (i.e., divide the task into subtasks so that all collaborators work at the same time), sequential (i.e., divide the task into successive phases in time and have them done by different collaborators) and reciprocal (i.e., assign tasks to different collaborators and they communicate throughout the process) (Sharples, 1993). Colum Foley and Alan F. Smeaton (2010) had proved that a bias between the division of labor and sharing of knowledge, which require users to search for their task while coordinating group works, will lead to the cognitive overload of users, indicating that appropriate collaboration strategy is of great significance.

The method of small-scale user experiment is widely applied to study the influencing factors of collaborative information behavior and collaboration sensemaking of users, such as the perception of task, situational awareness, affective Information (Nahl, 2004), community type (Zhang & Wang, 2010), collaborative capability (Ai et al., 2010), time constraint (Weenig & Maarleveld, 2002), task type (Kim & Soergel, 2005; Tao & Tombros, 2017b) and so on. Besides, interpersonal familiarity was essential to the organization's cognitive and affective identification, thus facilitating users' contributions to collaborative behavior (Gibson, 2018; Sguera et al., 2020). The thinking styles proposed by Sternberg (1999) indicated that the scope of thinking styles could be divided into internal and external styles. People with internal thinking styles tend to be task-oriented, lacking interpersonal awareness and favoring individual work. While people with an external thinking style are

likely to be extroverted, people-oriented and preferring working in groups. The relationship between two potential factors, teams' closeness and members' thinking style, that may affect organizational identification and collaborative information behavior will be tested in the following research.

3 Methodology

3.1 Participants and tasks

We recruited 24 graduate students to participate in this quasi-experiment, including 18 females and 6 males. Participants were paid 150 yuan for a 2-hour session. In the recruitment questionnaire, using the scores measured by the Chinese version of the Thinking Style Scale (Dai, 2010), which was translated from the Sternberg-Wagner Thinking Style Inventory (TSI)(Sternberg & Wagner, 1992), the participants were divided into four external and four internal three-person groups. All participants were experienced in information seeking and had participated in cooperative group tasks.

The participants were required to complete two tasks at least one day apart from each other. One task is a problem-solving task and the other is a learning task. The task sessions lasted from 45 minutes to 1 hour. Each group was instructed to prepare a 15-minute presentation on the given topics.

In 2016, Shenzhen Qvod Technology Co., Ltd. was prosecuted by the Haidian District People's Court of Beijing for spreading pornographic materials for profit. The court took the initiative to open the judicial system through the Internet and live-streamed the case's whole process. The "Qvod case" once triggered a heated public debate on the Internet, known as the Internet's first case in 2016.

1. Please sort out the case history of the Qvod case: list the main events in chronological order.
2. There are some legal disputes in the Qvod case. Please propose a solution to improve relevant policies and regulations.

Example Problem Solving Task

3.2 Data collection

Firstly, the closeness of members in the group was measured by the Relationship Closeness Inventory (Berscheid, Snyder, & Omoto, 1989). Furthermore, the following table provides an overview of each group's closeness and collaborative tendency. There are two groups: external groups and high closeness, external groups and low closeness, internal groups and high closeness, internal groups and low closeness.

Table 1. Team perceived closeness and member's thinking styles of different groups.

Group	Perceived closeness	Thinking style	Member ID	Thinking style of members
A	High	Internal	A-1	Internal
			A-2	Internal
			A-3	External
B	High	External	B-1	External
			B-2	External
			B-3	External
C	Low	Internal	C-1	Internal
			C-2	Internal
			C-3	Medium
D	Low	External	D-1	External
			D-2	External
			D-3	External
E	Low	Internal	E-1	Internal
			E-2	External
			E-3	Internal
F	High	External	F-1	External
			F-2	External
			F-3	External
G	Low	External	G-1	External
			G-2	External
			G-3	External
H	High	Internal	H-1	Internal
			H-2	External
			H-3	Internal

Before the task, the participants will be introduced to the experimental requirements and provided 10 minutes to familiarize themselves with the Youdao cloud's operation. Moreover, all the collaboration among the team members needs to be completed in the Youdao cloud. During the task, all group has two tasks and the task order of the two groups of each type was different to eliminate the interference of task order on the results. Each group was

given 45 minutes to complete a task. At the end of each task, the participants were asked to interview the group's collaborative strategies briefly. During the period, the participants need to use a computer with a user research software, Morea, communicate and collaborate through a collaboration software, Youdao cloud. Any search method can be used during the process, and the final results are edited in the Youdao cloud.

Eight three-person teams completed two tasks separately. We obtained 48 screen recording video data that recorded the task's completion process, which was the basis of the following analysis of the influence of perceived team closeness and member's thinking styles on collaborative information behaviors.

3.3 Data analysis

Based on the grounded theory, six videos of two tasks in group A were selected to complete descriptive coding of participants' behavior, communication content and interview records. The concept in descriptive coding was classified to construct the behavior framework, coding system and coding standard basing on current theories in the research field of collaborative information behavior. If new behavior classification was found in the subsequent coding process, they would be added to the behavior framework and coding system and the previous coding will be updated. Through the coding of 48 videos, it is found that the small-scale online collaboration mainly includes five types of behaviors: collaborative planning, collaborative information seeking, information sharing, information using and communicating.

Table 2. Coding table of collaborative information behaviors

Behaviors		Behaviors		Behaviors
Collaborative Planning	P1	Strategies development	P11	Collaborative strategies development
			P12	Information seeking strategies development
			P13	Information sharing strategies development
			P14	Information using strategies development
			P15	Integration strategies development
Collaborative Information Seeking	P2	Division of tasks		
	P3	Division of labor		
	P4	Schedule arrangement		
	Q1	Retrieval tool selecting	Q21	Inputting retrieval term
			Q22	Source of retrieval term
			Q23	Content of retrieval term
			Q24	Clicking on the URL
			Q25	The type of URL being clicked on (including encyclopedias, news, articles, websites, knowledge communities, blogs)
	Q3	Helping others' retrieval	Q31	Retrieval term inputting
			Q32	Source of retrieval term
			Q33	Content of retrieval term
			Q34	Clicking on the URL
			Q35	The type of URL being clicked on (including encyclopedias, news, articles, websites, knowledge communities, blogs)
Information Sharing	L1	Information seeking strategies sharing	L11	Retrieval tool sharing
			L12	Retrieval experience sharing
			L13	Background knowledge sharing
	L2	Content of Information seeking sharing	L21	Retrieval term sharing
			L22	Retrieval content sharing
			L23	URL sharing
			L24	Relevant information sharing
	L3	Group records viewing	L31	Chat history viewing
			L32	Operation history viewing
			L33	History notifications viewing

Behaviors		Behaviors		Behaviors
Information Using	U1	Personal results editing		
	U2	Using the information shared by group members	U21	Using retrieval tools shared by group members
			U22	Using retrieval words shared by group members
			U23	Clicking on the URL shared by group members
			U24	Viewing the information shared by group members
	U3	Using group results	U31	Group results viewing
			U32	Group result integrating
			U33	Group results editing
Communicating	C1	Speaking to group members		
	C2	Determinizing means of communication		
	C3	Conflict of decision making occurs		
	C4	Conflict of decision making solved		
	C5	No response/response delayed		

Findings

3.4 The overall distribution of collaborative behaviors of the groups

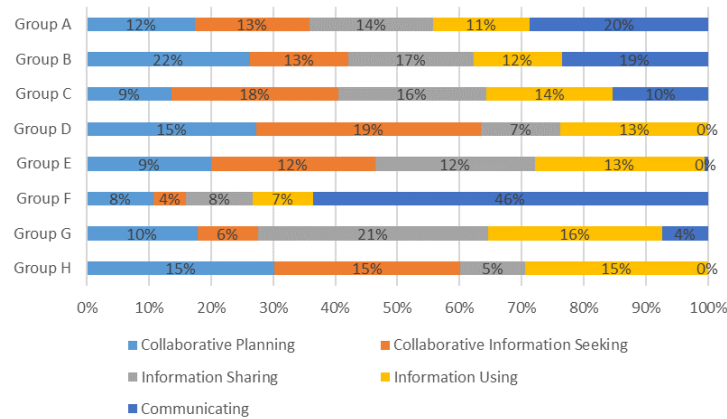


Fig. 1. The proportion of different collaborative information behaviors in each group.

As can be seen above, the frequency of information Using behavior (1307 times) is the most, followed by the Collaborative Information Seeking (1018 times), and the frequency of collaborative planning (193 times) is the least.

3.5 Influence of the team's perceived closeness

Since the collected samples did not confirm the hypothesis of the normal distribution, Spearman Correlation Coefficient, which will be referred to as r_s below was adopted to analyze the participants' collaborative information behavior under different team closeness and thinking styles.

The closeness members perceived in the team is positively correlated with their frequency of collaborative planning (P, $r_s=0.295$, $p=0.042$), strategies development (P1, $r_s=0.305$, $p=0.035$), collaborative strategies development (P11, $r_s=0.33$, $p=0.022$) and schedule arrangement (P4, $r_s=0.322$, $p=0.025$). Meanwhile, their closeness is negatively correlated with their frequency of relevant information sharing (L24, $r_s=-0.29$, $p=0.045$).

When the effects of member's thinking styles were controlled, partial correlation coefficients were then used to test the closeness's influence on members' collaborative behaviors. The result shows that the member's perceived closeness is positively correlated with their frequency of collaborative strategies development (P11, $r_s=0.293$, $p=0.048$) and schedule arrangement (P4, $r_s=0.375$, $p=0.01$).

3.6 Influence of member's thinking style

Spearman Correlation Coefficient was also adopted to test the impact of member's thinking styles on collaborative information behavior. And the result shows that the member's internal thinking style is negatively correlated with the frequency of group results editing (U33, $r_s=-0.321$, $p=0.026$). While when the influence of team perceived closeness was controlled, the member's internal thinking style is negatively correlated with the frequency of information sharing strategies development (P13, $r_s=-0.305$, $p=0.037$).

As for the result of external thinking style, it is negatively correlated with the frequency of retrieval term inputting (Q21, $r_s=-0.375$, $p=0.009$), clicking on the URL (Q34, $r_s=-0.334$, $p=0.021$) and helping others' retrieval (Q3, $r_s=-0.334$, $p=0.02$), while positively correlated with the frequency of chat history viewing (L31, $r_s=0.299$, $p=0.039$), group records viewing (L3, $r_s=0.3$, $p=0.038$) and group results editing (U33, $r_s=0.312$, $p=0.03$). Moreover, when the influence of team perceived closeness was controlled, the member's external thinking style is negatively correlated with the frequency of retrieval term inputting (Q21, $r_s=-0.301$, $p=0.04$), retrieval term inputting for others (Q31, $r_s=-0.379$, $p=0.009$), helping others' retrieval (Q3, $r_s=-0.316$, $p=0.03$) and using retrieval tools shared by group members (U21, $r_s=-0.351$, $p=0.016$). And it is positively correlated with member's frequency of chat history viewing (L31, $r_s=0.351$, $p=0.041$).

3.7 Patterns of collaboration

Among all the knowledge collaboration behaviors of users, collaboration planning, information retrieval for others, information sharing, editing group achievements and communication are categories that can reflect the degree of group collaboration. By analyzing the team's frequency of collaborative behavior and the observation of the experimental process, our study found that online knowledge collaboration of small-scale users has a fixed mode, which can be divided according to the division of labor of the group.

Through the qualitative analysis of team members' behaviors and the quantitative analysis of video encoding data, the mode of collaboration can be divided into four types: collaboration under strong leadership, division of labor under the leadership, collaboration under multi-leadership and spontaneous division of labor. The quantitative data division of each type is shown in Figure 2.

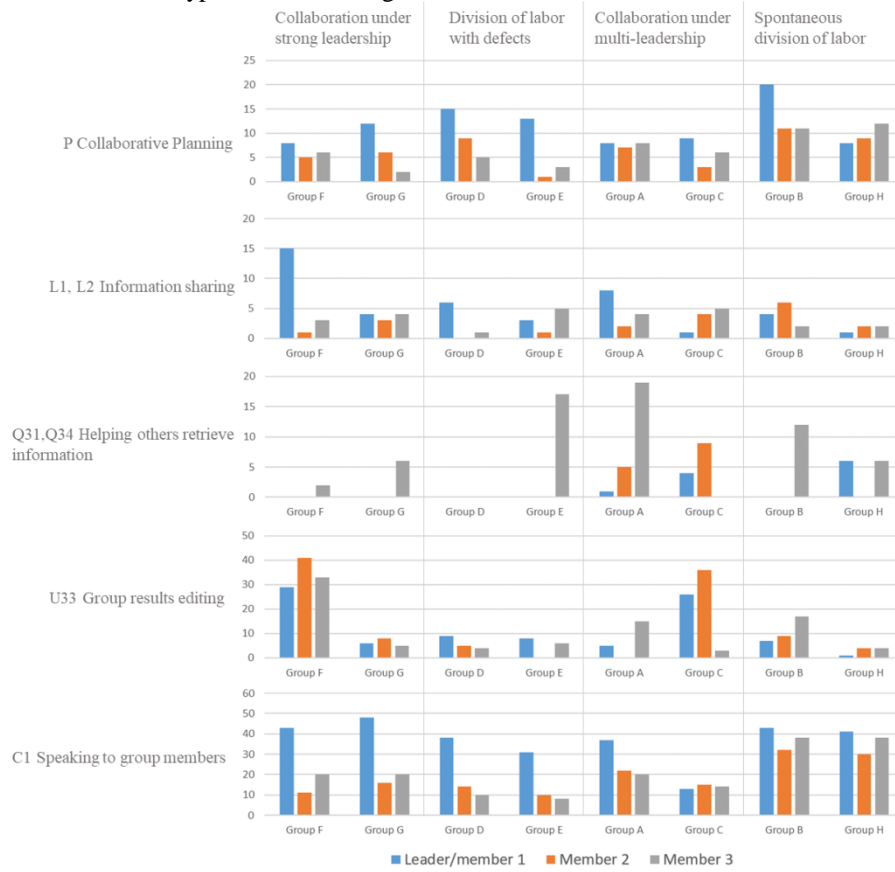


Fig. 2. Frequency statistics of partial collaborative information behaviors that can reflect the mode and pattern of collaboration

Collaboration under the strong leadership

In a group with leadership and close collaboration, one group member acts as the leader to spontaneously lead the collaborative process. The leader communicates actively, takes the initiative to share information, division of labor with defects, and puts forward framework after the collaboration began, controls schedule among the collaboration procedures and integrates group outcome at the end of the collaboration. Moreover, other group members participate in the collaboration under the leader's leadership, having fewer behaviors mentioned above. There are few group interactions and exchanges,

but the collaboration efficiency is high. The representative groups were group F and G, which were both have more members with external thinking style. While the team perceived closeness of group F is high, and of group G is low.

Incomplete division of labor

Like the first type, the division's mode under leadership has a group member acting as the team leader spontaneously, who leads the task decomposition, but has relatively less interaction with the group members, and members complete the tasks individually after the division. Among such groups, information sharing behavior, editing group achievement, and communication behavior are significantly less than the first mode groups. Moreover, the contribution of several members to group collaboration is minimal and almost negligible. Group D and E symbolize this mode, both having low team perceived closeness. While group D has an external thinking style and group E has an internal thinking style.

Collaboration under multi-leadership

There is not just one group leader in the group with a spontaneous division of labor and collaboration. Members all spontaneously find and fill their significant roles. Some members arranged collaborative plans, some members helped others carry out information retrieval and results editing; some actively share task-related information; the others maintain continuous attention to task progress. The specific groups were group A and C. Both of them have more members with internal thinking style. While the team perceived closeness of group A is high, and of group C is low.

Spontaneous division of labor

Unlike the former modes, this mode has no prominent leader, which spontaneously arranges collaboration strategy or actively communicates. On the contrary, the frequency of behaviors mentioned in figure 2 of each member is almost the same. Moreover, the task was equally apportioned among group members. Group B and H represent this kind of mode. Both of them have high team perceived closeness. Group B has more members with an external thinking style, and group H has more members with an internal thinking style.

It can be seen that team perceived closeness has a significant impact on groups' mode of collaboration. Groups with low closeness are more likely to have collaboration defects, which results in lower participation of some members and produce a task collaboration mode led by the team leader, regardless of whether the number of leaders is one or more. While groups with high closeness are more likely to reject the presence of a strong leader. Moreover, the member's thinking style also has a vital influence on the mode of group collaboration. Groups with more external thinking styles tend to have a leader, while groups with more members with internal thinking tend to collaborate under multi-leadership. Nevertheless, no matter what the groups' closeness and thinking style, there are more groups in leadership mode than those in leaderless mode.

4 Conclusions

Through the quantitative and qualitative analysis of the video of user experiments, it was found that the small-scale online knowledge collaboration of users mainly includes

five types of collaborative behaviors: collaborative planning, collaborative information seeking, information sharing, information using and communicating. The previous four types are consistent with the typical stage division of online collaborative behaviors (Garrison, 2007; Onrubia & Engel, 2009; Tao & Tombros, 2013, 2017b), while communicating is a vital link to integrate and implement them, which had been omitted for a long time but indeed possessed a significant fraction in online collaborative behaviors. Information using can be found in participants' most frequent behaviors by analyzing each type of behavior's frequency, which is followed closely by collaborative information seeking. Moreover, collaborative planning behaviors has the lowest frequency.

The higher the perceived closeness of a member, the more collaborative planning behaviors he has, especially the development of collaborative strategy and schedule behaviors, but the less information sharing. After controlling for the impact of thinking style, the results showed that team members' behaviors of collaboration strategy development and schedule arrangement were positively correlated with team perceived closeness. After controlling the impact of team-perceived closeness, members' internal thinking style is negatively correlated with members' behaviors of information sharing strategies development. Moreover, the more external a member's thinking style was, the less likely he was to help others' retrieval, but the more likely he was to view group chatting history.

The mode of the collaboration can be divided into four types: collaboration under strong leadership, incomplete division of labor, collaboration under multi-leadership and spontaneous division of labor. Groups with low closeness are more likely to have collaboration defects, which results in lower participation of some members, and are more likely to be led by the team leaders. However, groups with high closeness tend to reject the presence of a strong leader. Groups with more external thinking styles tend to be led by a leader, while groups with more members with internal thinking tend to collaborate under multi-leadership. Nevertheless, in general, there are always more groups that are in leadership mode than those that are in leaderless mode. Team perceived closeness and the leadership of a member (Pérez, 2017) affect the collaboration mode a lot.

5 Discussion

There are some limitations in this study due to the experimental design and software. Although the experiment strictly controlled the closeness, collaborative tendency and knowledge background of participants, it had not balanced the ratio of male to female, educational level, which may affect the experimental results to some extent. Furthermore, there are only two group samples for each type of experimental group. The small sample size may affect the experimental results due to individual differences, and the universality of the research conclusion is problematic.

Although the team is required to use knowledge collaboration software, YouDao cloud, for the convenience of observation and data collection, software itself has still caused some obstacles to the collaboration. The message notification of the YouDao

cloud is not timely because the new message notification is only inside the YouDao cloud. Participants will not see them outside the particular web. Therefore the communication for group members has certain hysteresis. Furthermore, due to the low stability of the user research software Morae, group H's second task data could not be read in the experiment. To retrieve the data, we had to recontact the three members of group H for the second experiment.

The future study can explore the impact on the quality of small-scale knowledge collaboration results of closeness and group members' collaborative tendency. Future research can further expand the sample sizes and conduct relevant research on large-scale online knowledge collaboration from the perspective of the research object. From the research methods, a website or mobile app can be taken to research by using quantitative research methods such as the log method and qualitative research methods such as the questionnaire method and interview method.

References

- Ai, H., Kumar, R., Nguyen, D., Nagasunder, A., & Rosé, C. P. (2010). Exploring the effectiveness of social capabilities and goal alignment in computer supported collaborative learning. *International Conference on Intelligent Tutoring Systems*,
- Blooma, M. J., Kurian, J. C., Chua, A. Y. K., Goh, D. H. L., & Lien, N. H. (2013). Social question answering: Analyzing knowledge, cognitive processes and social dimensions of micro-collaborations. *Computers & Education*, 69(nov.), 109-120.
- Carroll, J. M., Neale, D. C., Isenhour, P. L., Rosson, M. B., & McCrickard, D. S. (2003). Notification and awareness: synchronizing task-oriented collaborative activity. *International Journal of Human-Computer Studies*, 58(5), 605-632.
- Chiu, C.-M., Hsu, M.-H., & Wang, E. T. (2006). Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories. *Decision support systems*, 42(3), 1872-1888.
- Dai, X. (Ed.). (2010). *Handbook of Commonly used Psychological Assessment Scale*. People's Military Medical Publishing House.
- Faraj, S., Jarvenpaa, S. L., & Majchrzak, A. (2017). Knowledge Collaboration in Online Communities. *Organization Science*, 22.
- Foley, C., & Smeaton, A. F. (2010). Division of labour and sharing of knowledge for synchronous collaborative information retrieval. *Information Processing and Management: an International Journal*.
- Foley, C., & Smeaton, A. F. (2010). Division of labour and sharing of knowledge for synchronous collaborative information retrieval. *Information processing & management*, 46(6), 762-772.
- Garrison, D. R. (2007). Online Community of Inquiry Review: Social, Cognitive, and Teaching Presence Issues. *Online Learning*, 11(1).
- Gibson, K. R. (2018). Can I tell you something? How disruptive self-disclosure changes who “we” are. *Academy of Management Review*, 43(4), 570-589.

- Karunakaran, A., Reddy, M. C., & Spence, P. R. (2013). Toward a model of collaborative information behavior in organizations. *Journal of the American Society for Information Science & Technology*, 64(12), 2437-2451.
- Kim, J., Kwon, Y., & Cho, D. (2011). Investigating factors that influence social presence and learning outcomes in distance higher education. *Computers & Education*, 57(2), 1512-1520.
- Kim, S., & Soergel, D. (2005). Selecting and measuring task characteristics as independent variables. *Proceedings of the American society for information science and technology*, 42(1).
- [Record #358 is using a reference type undefined in this output style.]
- Mitsui, M., Liu, J., & Shah, C. (2018). Coagmento: Past, present, and future of an individual and collaborative information seeking platform. *Proceedings of the 2018 Conference on Human Information Interaction & Retrieval*,
- Mohammad Arif, A. S., Du, J. T., & Lee, I. (2015). Understanding tourists' collaborative information retrieval behavior to inform design. *Journal of the Association for Information Science and Technology*, 66(11), 2285-2303.
- Morris, M. (2007). Collaborating alone and together: Investigating persistent and multi-user web search activities. *Proc. Int. ACM SIGIR Conf. on Research and Development in Information Retrieval (SIGIR'07)*.
- Nahl, D. (2004). Measuring the affective information environment of web searchers. *Proceedings of the American society for information science and technology*, 41(1), 191-197.
- Onrubia, J., & Engel, A. (2009). Strategies for collaborative writing and phases of knowledge construction in CSCL environments. *Computers & Education*, 53(4), 1256-1265.
- Paul, S. A., & Reddy, M. C. (2010). Understanding together: sensemaking in collaborative information seeking. *Proceedings of the 2010 ACM conference on Computer supported cooperative work*,
- Pérez, O. H. (2017). Collaborative Information Behaviour in Completely Online Groups: Exploring the Social Dimensions of Information in Virtual Environments. *Qualitative & Quantitative Methods in Libraries*.
- Qiu, J., & Wu, D. (2012). User's collaborative information retrieval behavior and system evaluation -- from the perspective of task type and collaborative capability. *Modern library and information technology*, 9, 62-68.
- Sguera, F., Bagozzi, R. P., Huy, Q. N., Boss, R. W., & Boss, D. S. (2020). What We Share Is Who We Are and What We Do: How Emotional Intimacy Shapes Organizational Identification and Collaborative Behaviors. *Applied Psychology*, 69(3), 854-880.
- Sharples, M. (1993). Adding a Little Structure to Collaborative Writing. In D. Diaper & C. Sanger (Eds.), *CSCW in Practice: an Introduction and Case Studies* (pp. 51-67). Springer London. https://doi.org/10.1007/978-1-4471-2009-4_5
- Sternberg, R. J. (1999). *Thinking styles*. Cambridge university press.
- Sternberg, R. J., & Wagner, R. K. (1992). *Thinking Styles Inventory*.
- Sun, Z., Liu, R., Luo, L., Wu, M., & Shi, C. (2017). Exploring collaborative learning effect in blended learning environments. *Journal of computer assisted learning*, 33(6), 575-587.
- Tan, C., & Chan, Y.-Y. (2008). Knowledge community: A knowledge-building system for global collaborative project learning. *Proceedings of the IEEE*, 96(6), 1049-1061.

- Tao, Y., & Tombros, A. (2013). An exploratory study of sensemaking in collaborative information seeking.
- Tao, Y., & Tombros, A. (2017a). How collaborators make sense of tasks together: A comparative analysis of collaborative sensemaking behavior in collaborative information-seeking tasks. *Journal of the Association for Information Science and Technology*, 68(3), 609-622.
- Tao, Y., & Tombros, A. (2017b). How collaborators make sense of tasks together: A comparative analysis of collaborative sensemaking behavior in collaborative information-seeking tasks. *Journal of the Association for Information Science & Technology*, n/a-n/a.
- Weenig, M. W., & Maarleveld, M. (2002). The impact of time constraint on information search strategies in complex choice tasks. *Journal of Economic Psychology*, 23(6), 689-702.
- Wu, D., & Xue, X. (2014). Experimental study on collaborative information retrieval behavior in social environment. *Modern library and information technology*, 12, 1-9.
- Yao, K.-T., Neches, R., Ko, I.-Y., Eleish, R., & Abhinkar, S. (1999). Synchronous and asynchronous collaborative information space analysis tools. Proceedings of the 1999 ICPP Workshops on Collaboration and Mobile Computing (CMC'99). Group Communications (IWGC). Internet'99 (IWI'99). Industrial Applications on Network Computing (INDAP). Multime,
- Yuan, H., & Zhao, Y. (2015). Research on users' task perception and emotional state in collaborative searching behavior. *Library and Information work*, 59(17), 91-100.
- Zhang, P., & Wang, D. (2010). Users' roles and behaviors of study groups in online knowledge collaboration. *Journal of Library Science in China*, 7, 77-87.