Online Communication for Team Creativity in Tech Companies: Barriers and Tool Design

Yue Chen[1], Man Wu[2], and Qin Gao[2](✉)

[1] East China University of Science and Technology, Shanghai 200237, China
[2] Tsinghua University, Beijing 100084, China
gaoqin@tsinghua.edu.cn

Abstract. Teams in tech companies collaboratively solve creative problems, and this team creative process increasingly occurs online. Despite many innovative tool designs to support collaborative creativity, many teams did not adopt them. This study aimed to identify the barriers to adoption and teams' needs for collaborative creativity support. We clarified the team creative process in practice by individual in-depth interviews with 15 employees in 12 different high-tech companies in China. The results suggested that the teams frequently shared information via communication tools or face to face, and many of them acknowledged the benefits of collaboration in team creativity. However, most of them ideated and evaluated ideas or solutions individually. The reasons for the low collaboration level included the features of their tasks, a lack of technical and managerial support for collaboration in the ideation and evaluation phase, and a lack of motivation for team creativity. Based on these findings, we outlined implications for designing tools to support team creativity and demonstrated a prototype of a communication tool with creative support features.

Keywords: Team creativity · Collaboration · Communication tools · Creativity support tools

1 Introduction

Technological innovation increasingly relies on teamwork, and creativity and innovation are generated from social interaction and information exchange [1, 2]. To solve problems without solutions, team members can collaboratively generate novel and useful ideas or solutions of, for example, products, services, processes, or steps [3]. This cognitive process is called creative problem-solving, and the outcome is called team creativity. Such a process is common in research, technology product development, and creative teams.

Modern teams inevitably office and perform creativity tasks online. Many research teams and technology companies are distributed geographically. Due to the COVID19 pandemic, increasing teams in research and technology companies work collaboratively on online communication applications, such as Slack, WeChat, and Feishu. However, on the one hand, these communication tools lacked support for team creativity. On the

P.-L. P. Rau (Ed.): HCII 2022, LNCS 13313, pp. 13–28, 2022.
https://doi.org/10.1007/978-3-031-06050-2_2

other hand, although many studies have proposed innovative designs of collaborative creativity support tools (CSTs) and proved their effectiveness, many of these tools have not been adopted by real teams yet.

Therefore, this paper aims to identify the reasons why teams adopt CSTs or not by studying their current team creative process. We individually interviewed 15 employees working in the teams in high-tech companies in China, including both new and small companies and big companies on the list of Fortune Global 500. We clarified their team creative process and use of communication tools and CSTs to further identify the barriers and their potential needs for these tools. Finally, we discussed and proposed a design of communication tools integrated with CST features to support team creativity.

2 Literature Review

2.1 Team Creative Process

The creative process usually consists of four phases: problem analysis, ideation, evaluation, and implementation [4]. In the problem analysis phase, individuals analyze and understand the current situation, and then find and formulate specific problems to be solved. In the ideation phase, individuals generate many new alternative ideas. In the evaluation phase, individuals evaluate and select among the alternative ideas. Finally, the chosen idea or solution will be implemented. This process is not linear or static but dynamic and recursive [5].

The ideation phase may distinguish creativity tasks from other problem-solving tasks, and many creativity research and CST designs focus on the ideation phase. Researchers suggested that the cognitive process of ideation is to establish semantic connections between existing knowledge [5, 6]. In the ideation phase, individuals have more divergent thinking, which is imaginative and less critical, opposite to convergent thinking. They also use various strategies to promote ideation, such as analogical reasoning and expansion or combination of existing ideas [7, 8].

At the team level, the creative process involves not only the cognitive process mentioned but also the social and motivational process [9]. The social process is the interactions among team members, such as information sharing and discussion. On the one hand, information flow among team members can increase the quality and flexibility of ideation and enhance team creativity [10, 11]. On the other hand, communication may also negatively affect ideation by increasing, for example, cognitive load, social loafing, and social anxiety [12, 13]. The motivational process is setting or maintaining members' motivation levels. Both intrinsic and extrinsic motivation can promote team creativity, but research suggests that intrinsic motivation is more important in the ideation phase [14]. These processes of team creativity can be affected group, task, and situational variables, including group members' features (e.g., knowledge and skills), group structure (e.g., group size and diversity), group climate (e.g., trust and conflict), and external demand (e.g., task structure and support for creativity) [9].

2.2 Creativity Support Tools

Creativity support tools/systems (CSTs/CSSs) are information systems that support creative processes such as product design, and ideation [15]. These tools are usually designed with the guidance of creativity theories and are widely used in the situations such as team creativity tasks, knowledge management, art design and decision making [16–18].

CSTs can be generally categorized into individual or team types [15]. At the individual level, Wang and Nickerson [18] conducted a literature-review study and proposed a design framework for individual CSTs. The framework suggested four types of features, including:

1. Motivating features by affective or achievement approaches.
2. Supports for the whole creative process, including task process control.
3. Supports for divergent thinking, such as stimulation for new ideas, memory retrieval facilitation, working memory assistance (e.g., by data visualization), and application of creativity techniques.
4. Supporting convergent thinking, such as labeling and classification support for evaluation.

Team-level CSTs can be generally categorized into four types [16, 19]: idea management systems, group support systems, computer-assisted creativity systems, and virtual team members.

Idea management systems are the systems that support collecting, evaluating, and selecting ideas. An example frequently used in video conferencing is the collaborative whiteboard applications, such as Mural of Microsoft Teams, which allows team members to co-edit shared whiteboards and post-it notes during online meetings. Another widely used tool is collaborative mind maps, such as Mind Master. Researchers have also proposed innovative designs to better organize and present ideas for evaluation, such as IdeaHound [20].

Group support systems are the systems that support team creativity by facilitating communication and coordination. For example, Sundholm et al. designed iLounge, a smart meeting room for co-located creative collaboration [21]. Kim et al. designed an application for collaborative prototyping, where distributed team members could collaboratively edit their prototypes and asynchronously interact with each other [22].

Computer-assisted creativity systems are the systems that assist the implementation of creative techniques as a coach. A major type is electronic brainstorming systems, such as Momentum [23]. These systems can apply brainstorming techniques to reduce the problems such as peer pressure, social loafing, and production blocking. Besides brainstorming, some systems incorporate other creative techniques, such as peripheral micro tasks [24], to facilitate ideation.

Virtual team members are the artificial intelligence that can help monitor human cognitive processes, simulate human creativity, or generate ideas like human team members. For example, AI conversational robots can play the role of facilitators, organize and coordinate complex tasks for team collaboration [25].

3 Method

3.1 Participants

We interviewed 15 employees individually. As shown in Table 1, they aged from 26 to 33 (M = 28.73, SD = 2.21). Six of them were females, and nine of them were males. They worked in 12 different technology companies. Six of the companies were in the IT industry. Other companies included manufacturing, transportation, finance, and the energy industry. Six of the participants (40%) worked in the R&D department. Their team size ranged from 3 to 30, with most between 6 and 10 (N = 8, 53%). All the teams had been formed for more than a year, and nine of them (60%) had been formed for more than two years. Most participants (N = 12, 80%) worked in a relatively stable team with low turnover rates. Eight participants (53%) worked in a fully co-located team. Some team members in the other seven teams (47%) worked in other cities in China.

Table 1. Summary of the participants.

Participants	Age	Gender	Industry	Department	Team size	Team was formed	Team turnover	Location
P1	26	F	IT, Big tech	R&D	7–8	<= 2 years	High	DT
P2	33	F	IT, Big tech	PD	7–8	<= 2 years	Low	DT
P3	31	F	IT, Small tech	PD	10	<= 2 years	High	DT
P4	25	M	IT, Unicorn	R&D	3–5	<= 2 years	High	DT
P5	29	F	TC, Big tech	R&D	7–8	>2 years	Low	CO
P6	27	F	IT, Unicorn	IT	20–30	>2 years	Low	CO
P7	28	M	IT, Big tech	IT	10	>2 years	Low	DT
P8	27	M	TP, tech	PD	3	>2 years	Low	CO
P9	28	F	TC, Big tech	R&D	17	<= 2 years	Low	DT
P10	27	M	IT, Big tech	R&D	12	>2 years	Low	CO
P11	32	M	IT, Small tech	R&D	5	>2 years	Low	CO

(*continued*)

Table 1. (*continued*)

Participants	Age	Gender	Industry	Department	Team size	Team was formed	Team turnover	Location
P12	28	M	FN, Large enterprise	PD	21	>2 years	Low	CO
P13	31	M	EG, Large enterprise	Testing	10	>2 years	Low	CO
P14	29	M	EG, Large enterprise	Testing	10	<= 2 years	Low	CO
P15	30	M	EG, Large enterprise	Testing	6	>2 years	Low	DT

Gender: F = female, M = male; Industry: IT = information technology, TC = telecommunication company, TP = transportation, FN = finance, EG = energy industry; Department: R&D = research and development, PD = product development, IT = information technology; Location: CO = co-located; DT = distributed but most members were co-located.

3.2 Data Collection

The individual interviews were semi-structured. We asked the following aspects during three different phases (i.e., problem analysis, ideation, and evaluation):

1. What was their team's typical team process in the three stages?
2. How did they use communication tools, and what was the impact of communication tools?
3. What did other creativity support tools their teams adopt?
4. What were the factors affecting the process and the potential challenges?

Each interview lasted for around one hour and was audio-recorded and transcribed to texts later.

3.3 Data Analysis

The interview scripts were analyzed by thematic analysis [26] with NVivo 12. The scripts were coded iteratively for three rounds. In the first round, two researchers read the scripts and initially open-coded for each research question. In the first round of coding, researcher A generated 50 codes, and researcher B generated 54 codes, with 36 (69%) same or similar codes. Then, the two researchers discussed and generated an initial codebook. In the second round, researcher A modified and generated 54 codes, whereas researcher B generated 56 codes, with 51 (93%) same or similar codes. They finally discussed and generated a revised codebook with 54 codes. In the final round, Researcher A coded all the scripts.

4 Results

4.1 Team Creative Process

The teams generally experienced the team creative process as suggested in the literature, but we found differences in detailed phases. Overall, the creative process was more individual rather than collaborative, especially in the ideation and evaluation phases. However, team members shared much information in all the phases.

Problem Analysis. Their problems originated from the following sources: (1) team members' discovery (N = 11), (2) requests from other departments (N = 10), (3) feedback from the marketing department (N = 7), and (4) frontiers topics in their industry. After identifying a problem, most participants would analyze it individually (N = 7) or collaboratively (N = 4) with other members before reporting to the leaders. In this phase, though many participants analyze problems individually, most teams shared information, such as literature, knowledge, advice from experts, and reports about competitive products, by communication tools (N = 6) and face to face (N = 4).

Ideation. More than half of the participants (N = 8) said they usually generated ideas individually, and these ideas were evaluated and chosen by leaders later. Five participants said they generated ideas both individually and collaboratively. Only two participants (P14 and P15) said they generated ideas mainly in team meetings. The possible reason for less collaboration was that most teams explicitly decomposed their tasks, and each team member only concentrated on his/her own work. For example, P12 said,

> *"We usually think and work individually… I will discuss with my leader only after I have figured out what to do, why to do so, and the logic." [P12, 28, male, finance industry]*

For the same reason, only four participants said their teams brainstormed together and two of them said they seldomly brainstormed. The participants also gave negative comments on brainstorming. For example, P2 said many brainstormed ideas were not feasible and could not be implemented by their algorithms. P9 felt brainstorming was inefficient. In fact, the teams of the four participants did not conduct brainstorming carefully. For example, P2 said:

> *"We brainstormed many times, but people chatted about irrelevant topics most of the time. We do not have a good moderator to control the process. If anyone comes out to be a moderator voluntarily, many other people will disagree with him/her. As a result, brainstorming is not an effective approach for our team." [P2, 33, female, IT industry]*

Evaluation and Documentation. More than half of the participants (N = 9) said their ideas were evaluated mainly by their leaders though they could comment on the alternative ideas. Five participants said the ideas were evaluated by first their teammates and then their leaders. Overall, the evaluation and final decision were mainly made by leaders. After the project was finished, most teams would package and document their experience, the creative process, and the final products or solutions for further knowledge sharing in both teams and organizations. These documents were stored on cloud drives or wiki platforms and could be retrieved by categories and keyword tagging. However, many team members were not motivated to organize the information of the whole project and write the documents. As mentioned by P7,

> *"Many people are not motivated to document their projects carefully because documentation takes too much time and effort. Most people cannot be bothered to do it (because they have many other jobs)." [P7, 28, male, IT industry]*

4.2 Communication Tools and Creativity-Support Tools

During the team creative process, the participants communicated with their team members via the following media: face-to-face communication, communication applications on smart devices, audio or video conferencing, emailing, phone calls, and short message service of mobile phones.

Table 2. Use of different media during team creative process.

Media	Number (percentage) of participants		
	Rarely use	Sometimes use	Frequently use
Face to face	0	2 (13%)	13 (87%)
Communication applications	1 (7%)	1 (7%)	13 (87%)
Audio or video conferencing	5 (33%)	2 (13%)	8 (53%)
Emailing	6 (40%)	0	9 (60%)
Phone calling	7 (47%)	0	8 (53%)
SMS on mobile phones	15 (100%)	0	0

As shown in Table 2, besides the face-to-face approach, the most frequently used media was communication applications such as WeChat, Feishu, and DingTalk in China. Their teams usually used these applications (1) to post notifications (N = 8), (2) when they could not meet face to face (N = 6), and (3) to carefully edit and convey complex messages (N = 3). Many participants said the communication applications were effective because:

1. They could record their discussions and any important information in these applications (N = 8).
2. They could accurately communicate with others (N = 5).
3. The applications were efficient (N = 2).

They usually use a mix of synchronous and asynchronous interaction approaches. They especially appreciated the editability and the data persistency of text-based communication applications, as well as the quick responses of synchronous video/audio-based approaches. As P7 said,

> *"We usually prepare and post a document on DingTalk (an application), and then have a call to discuss based on the document. The document can also be a record for accountability or contribution in the future." [P7, 28, male, IT industry]*

Regarding creativity support tools, most participants (N = 10) used mind map applications, especially in the problem analysis phase, but they usually drew maps individually. Five participants also used collaborative writing applications during the team creative process, such as Shimo and the collaborative writing function in Feishu. For example, P4 said their team kept a shared document in which team members could post their problems anytime. The problems in the document were discussed during their weekly meetings. In addition, some organizations provided creative training to help employees' ideation (by P5).

Some teams also used communication tools or knowledge sharing tools for peer review of ideas. For example, P4 said,

> *"Our team members can post their ideas every time they come up with an idea. The idea can be reviewed and liked by others. If an idea is liked many times, probably it will be feasible." [P4, 25, male, IT industry]*

As mentioned in Sect. 4.1, most shared knowledge was stored on cloud drives or wiki platforms. For example, P9's team collaboratively edited team wikis of previous projects. P7's organization kept a "knowledge base" website where teams could share their knowledge and documentation. Their organization sometimes held competitions to motivate employees and teams to contribute.

4.3 Challenges of Team Creative Process

Team Cognition. Five participants said their team members were diverse in majors and understood a problem from different perspectives. The different understandings, or the low level of shared mental model, may lead to conflicts among team members, as P2 and P8 mentioned. The conflicts sometimes could be intensified by personal emotions, as P15 said. In this situation, team members usually ask their leaders to moderate and make decisions. As P8 said, "*When we could not persuade each other, they would ask the leader to make decisions.*"

Besides the shared mental model, three participants also mentioned barriers in building transactive memory systems. They said team members did not know much about others' expert knowledge domain or trust others' expertise. For example, P6, who majored in algorithms, said she could not evaluate the suggestions from people in other majors such as product design. However, P15 said their team members knew other members' expertise though they were experts in diverse domains, indicating a higher level of transactive memory systems. It may have also contributed to their higher level of collaboration in the creative process.

Social Factors. As the literature suggests, the development of team cognition and creativity require communication and social interactions. This importance of social interactions was also recognized by most participants. For example, P2 compared her previous team and current team to highlight the importance of social interactions (especially for transactive memory systems):

> *"My current team members are really social and like to interact with each other. We frequently meet and share information. On the contrary, my previous team members did not interact with each other much. For this reason, I did not know what others were doing, and the team efficiency was unsatisfying." [P2, 33, female, IT industry]*

However, as mentioned in Sect. 4.1, most participants tended to work individually and lacked interactions with their team members in the phases of ideation and evaluation.

Motivation. Some participants said they felt less motivated to contribute to team creativity. The major reason was the limited time for their work and projects mentioned by six participants. As P10 said, *"most requirements from other departments were very urgent."* Therefore, the participants tended to use their familiar problem-solving approaches to finish the tasks. The second reason was the lack of intrinsic motivation mentioned by five participants. Especially when the problem was difficult, team members took many efforts, but the outcomes may not meet their expectations, or they may not receive positive feedback (P5 and P8).

5 Discussion and Design Implications

5.1 Findings

This study conducted 15 interviews with employees in R&D, product development, and other departments of 12 tech companies in China. We found that **in most teams, ideation and evaluation was an individual rather than collaborative cognitive process**, with the following phenomena:

1. Most teams lacked communication and collaboration in the ideation and evaluation phases. It could impede the development of team cognitions, including shared mental models and transactive memory systems, which were beneficial to team creativity.
2. Most teams used various communication tools and knowledge-sharing platforms throughout the creative process, but few of them used collaborative CSTs. Many team members used mind maps individually but hardly shared them with others.

The interviews identified several reasons for the less collaborative ideation and evaluation. **First, a major reason was the urgent and well-decomposed features of their tasks.** Most teams had to immediately solve the problems to ensure the achievement of their organizations. To increase efficiency, most teams also explicitly broke their tasks into subtasks and distributed them to individual members, and the team leader would evaluate and make the final decision later. Therefore, members only concentrated on their own creative problem-solving tasks. This result was probably related to our sampling. Most participants of this study majored in science, technology, engineering, and mathematics, and most of them worked as engineers. Many tasks for them can be easier to break into subtasks and distribute than the tasks for other employees who worked on, for example, community supports and creative design.

Second, many teams lacked support (both technical and managerial support) for collaboration in the ideation and evaluation process. In fact, many participants acknowledged the benefits of communication and collaboration, as suggested in the literature about how team cognitions affected team creativity (e.g., [27, 28]). They also frequently shared information in the early phases and packaged documentation in the last documentation phase, indicating that their individual creative works relied on the team's explicit knowledge. However, in the ideation phase, many of them did not have efficient and convenient approaches to exchange information and could not conduct brainstorming well. It also took many efforts and time to organize documents for sharing at the end. As a result, many participants said that they had some difficulties in understanding others' expertise, thoughts, and activities; they could not collaboratively generate new ideas (i.e., collaborative ideation recommended by the literature [29, 30]).

Third, Several Teams were not Motivated for Higher Team Creativity. On the one hand, due to the limited time of their tasks, some participants had to consider how to deliver their solutions on time more than creativity. On the other hand, some of them rarely got positive feedback from team creativity; they felt that team creativity consumed much time and effort, but the input-output ratio was unsatisfying. Overall, the findings and reasons were covered by the previous research of team creative process and factors (e.g., [9]), but were highlighted by this study in the context of high-tech companies in China.

5.2 Design Implications

These findings of interviews suggested the following implications for the design of tools to support team creativity in tech companies. First, **integrate communication tools with collaborative CST features**, especially for tech companies in China. As mentioned in Sect. 5.1, many teams lack supports for collaborative ideation. They rarely use collaborative CSTs but frequently use communication tools. Therefore, teams can be easier to accept communication tools with CST features than other collaborative CSTs. Ideally, these features require less effort from team members but can significantly promote interactions and collaboration during the ideation phase. For example, the idea management features in collaborative CSTs [16, 19] can be embedded into group chatting, which means the ideas can be automatically gathered from the chatting messages or audio/video-recorded data.

Second, **mix synchronous and asynchronous interactions in the ideation and evaluation phases and increase data persistency**. As suggested by the interviews and consistent with the theory of media synchronicity [31], team members need synchronous interactions to get quicker response and reach mutual understanding and asynchronous interactions to prepare and elaborate their messages. Some team members even simultaneously use two types of approaches to discuss complex new ideas.

Team members also need functions to track their discussion later for accountability or contribution identification, which was also identified in previous research about collaborative writing [32]. Our study suggests that this could be a reason why team members choose to discuss via online applications instead of the face-to-face way. Though online applications naturally preserve users' interaction data, the awareness of members' contributions can be further enhanced by features such as reputation systems or integrative dashboards of contribution.

Third, **design features to motivate and facilitate social interactions and information exchange in the ideation and evaluation phases**. The interviews suggested several potential approaches. One approach to increase motivation is the aforementioned features that enhance the awareness of contribution and reputation. Previous social media research suggests that users may generate knowledgeable content to satisfy their needs for self-achievement and better reputations [33]. Similarly, communication tools may motivate team members to discuss more by the features highlighting their creative contribution to the team and organization. Another approach is reducing the efforts of social interactions by, for example, unfocused interaction features, such as one-click liking. These features can promote social interactions and gather voting data for later evaluation.

5.3 A Design to Support Communication and Team Creativity

Due to the low adoption of CSTs but frequently used communication tools, we explored the potential design to integrate communication tools with CST features to support team creativity in tech companies. Based on the findings of interviews, we determined the following design goals:

1. Cognitive goals: With the tool, users can easily and efficiently know others' ideas, share knowledge and the development of each idea, and, based on that, generate and evaluate new ideas.
2. Social goals: The tool can facilitate users to interact with others, increase their awareness of other members' contribution to team creativity, and create a social norm for sharing and collaboration.
3. Motivation goals: The tool can increase users' willingness to participate in the collaborative creative process.

For these goals, we proposed three major features on mobile devices. First, in the group chatting interface (which is available in most communication applications), users can chat and share information with their team members anytime, as shown in Fig. 1. Second, these chatting messages can be tagged, replied and liked by team members. In other words, the messages can be threaded. As shown in Fig. 2, members can tap a threaded message to check all the relevant information about this message, including the context, social interactions, and other threads with the same tag. Members can add different tags, such as ideas, previous cases useful to the current creativity task, and user requirements, as shown in Fig. 3. These two features may promote interactions during ideation and evaluation phases, support team cognitions, and create a collaborative atmosphere. They may also increase data persistency, highlight members' contributions, and thus increase motivation. Third, members can check the team badges and individual badges, as shown in Fig. 4. These features may create a social norm of both competition and cooperation and motivate team members, especially in ideation and evaluation phases.

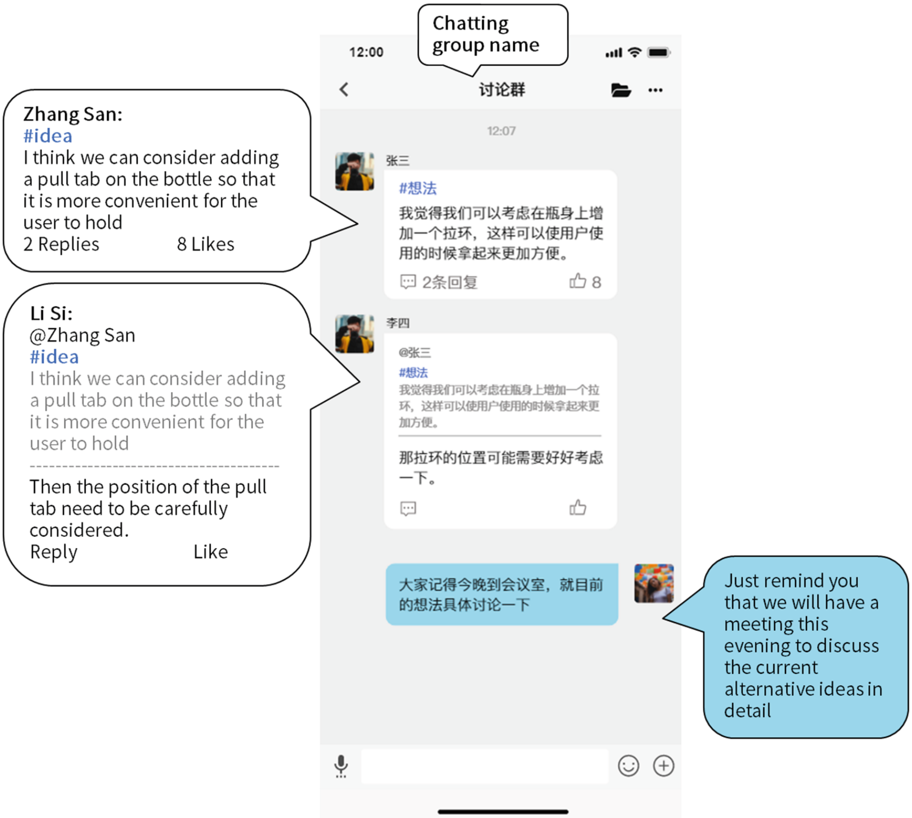

Fig. 1. Interface for group chatting. The group members can chat or have threaded conversations.

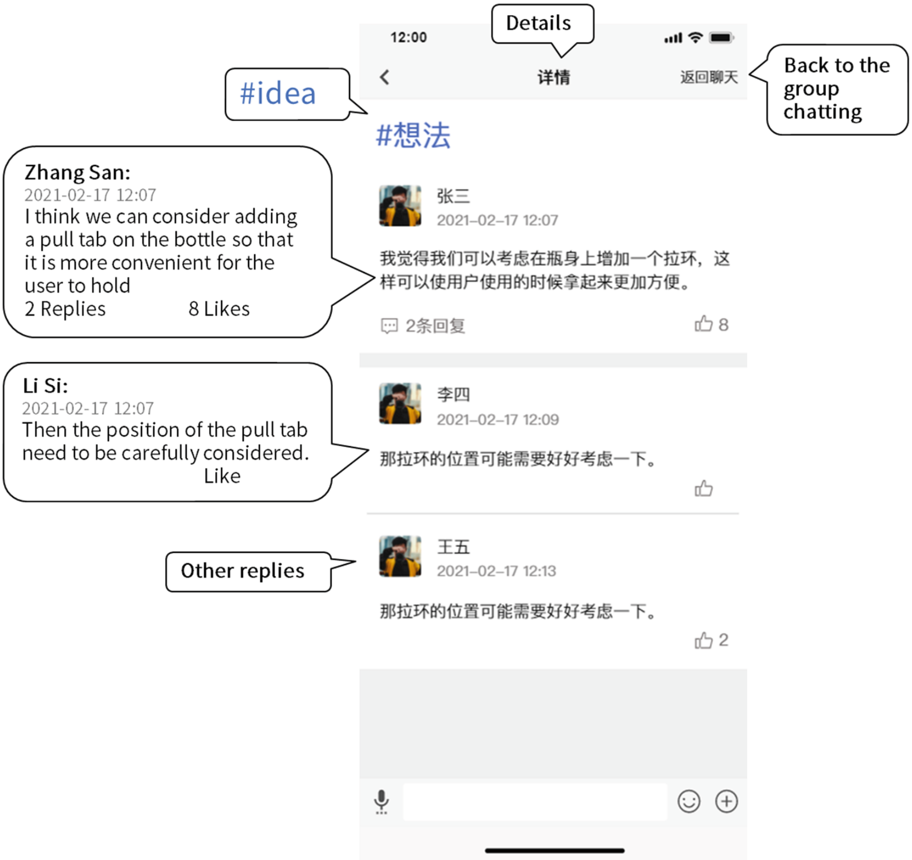

Fig. 2. Details of a threaded conversation.

5.4 Limitations

The major limitation was the sampling. Although we covered various types of tech companies in China, most participants worked as researchers or engineers. The features of their tasks can be different from those of other departments, such as community support and user experience design. Future research may enroll employees of other jobs in tech companies. In addition, based on the interviews, we proposed a design prototype, but it needs further evaluation.

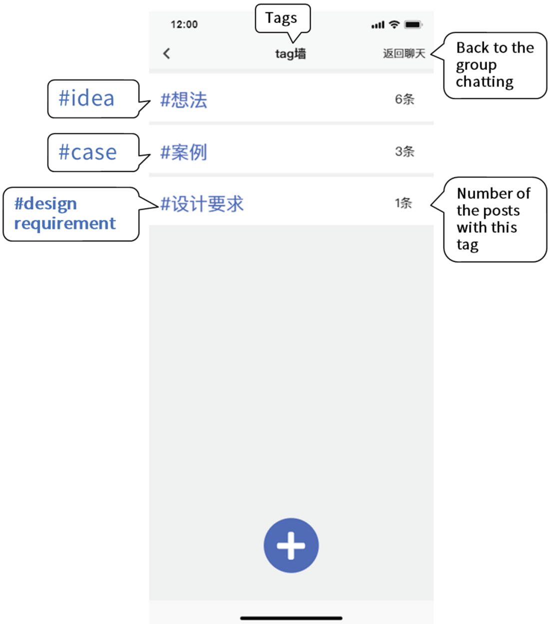

Fig. 3. The list of tags such as ideas and cases.

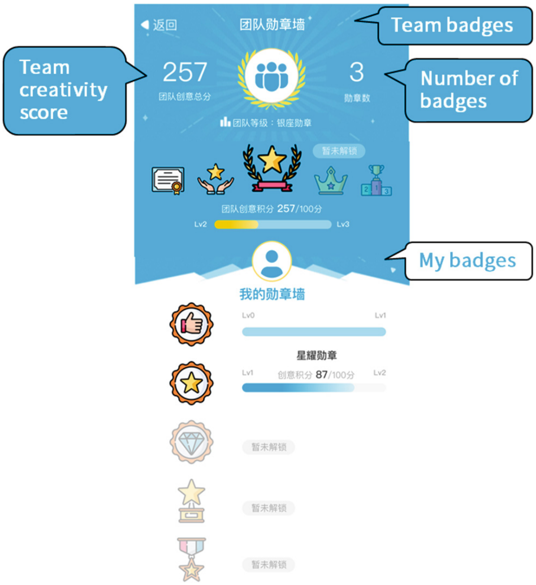

Fig. 4. Badges for both the team and individual users.

6 Conclusion

This study conducted in-depth interviews with 15 employees in high-tech companies in China and provided empirical data on the team creative process. The results suggested that most teams ideated and evaluated ideas or solutions individually instead of a collaborative process though they needed to share information throughout the creative process. The major reasons were the task features, a lack of support for collaboration in the ideation and evaluation phase, and a lack of motivation for team creativity. Finally, based on the interviews, we outlined implications for design to support team creativity and proposed a prototype of a communication tool with creative support features.

References

1. Sawyer, R.K., DeZutter, S.: Distributed creativity: how collective creations emerge from collaboration. Psychol. Aesthetics Creativity Arts **3**, 81 (2009)
2. Wuchty, S., Jones, B.F., Uzzi, B.: The increasing dominance of teams in production of knowledge. Science **316**, 1036–1039 (2007)
3. Shin, S.J., Zhou, J.: When is educational specialization heterogeneity related to creativity in research and development teams? Transformational leadership as a moderator. J. Appl. Psychol. **92**, 1709 (2007)
4. Howard, T.J., Culley, S.J., Dekoninck, E.: Describing the creative design process by the integration of engineering design and cognitive psychology literature. Des. Stud. **29**, 160–180 (2008). https://doi.org/10.1016/j.destud.2008.01.001
5. Lubart, T.I.: Models of the creative process: past, present and future. Creat. Res. J. **13**, 295–308 (2001)
6. Amabile, T.M.: How to Kill Creativity. Harvard Business School Publishing, Boston (1998)
7. Ward, T.B.: Cognition, creativity, and entrepreneurship. J. Bus. Ventur. **19**, 173–188 (2004)
8. Zeng, L., Proctor, R.W., Salvendy, G.: Creativity in ergonomic design: a supplemental value-adding source for product and service development. Hum. Factors **52**, 503–525 (2010)
9. Paulus, P.B., Dzindolet, M.: Social influence, creativity and innovation. Soc. Influ. **3**, 228–247 (2008)
10. Brown, S.L., Eisenhardt, K.M.: Product development: past research, present findings, and future directions. Acad. Manag. Rev. **20**, 343–378 (1995)
11. Drach-Zahavy, A., Somech, A.: Understanding team innovation: the role of team processes and structures. Group Dyn. Theory Res. Pract. **5**, 111 (2001)
12. Kratzer, J., Leenders, O.T.A., van Engelen, J.M.: Stimulating the potential: creative performance and communication in innovation teams. Creativity Innov. Manag. **13**, 63–71 (2004)
13. Maaravi, Y., Heller, B., Shoham, Y., Mohar, S., Deutsch, B.: Ideation in the digital age: literature review and integrative model for electronic brainstorming. RMS **15**(6), 1431–1464 (2020). https://doi.org/10.1007/s11846-020-00400-5
14. West, M.A., Sacramento, C.A., Fay, D.: Creativity and innovation implementation in work groups: the paradoxical role of demands. Creativity Innov. Organ. Teams 137–159 (2006)
15. Frich, J., MacDonald Vermeulen, L., Remy, C., Biskjaer, M.M., Dalsgaard, P.: Mapping the landscape of creativity support tools in HCI. In: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems, pp. 1–18 (2019)
16. Gabriel, A., Monticolo, D., Camargo, M., Bourgault, M.: Creativity support systems: a systematic mapping study. Think. Skills Creat. **21**, 109–122 (2016). https://doi.org/10.1016/j.tsc.2016.05.009

17. Remy, C., MacDonald Vermeulen, L., Frich, J., Biskjaer, M.M., Dalsgaard, P.: Evaluating creativity support tools in HCI research. In: Proceedings of the 2020 ACM Designing Interactive Systems Conference, pp. 457–476 (2020)
18. Wang, K., Nickerson, J.V.: A literature review on individual creativity support systems. Comput. Hum. Behav. **74**, 139–151 (2017)
19. Lubart, T.: How can computers be partners in the creative process: classification and commentary on the special issue. Int. J. Hum.-Comput. Stud. **63**, 365–369 (2005). https://doi.org/10.1016/j.ijhcs.2005.04.002
20. Siangliulue, P., Chan, J., Dow, S.P., Gajos, K.Z.: IdeaHound: improving large-scale collaborative ideation with crowd-powered real-time semantic modeling. In: Proceedings of the 29th Annual Symposium on User Interface Software and Technology, pp. 609–624 (2016)
21. Sundholm, H., Artman, H., Ramberg, R.: Backdoor creativity: collaborative creativity in technology supported teams. Presented at the 6th International Conference on the Design of Cooperative Systems, Hyères, France, 11–14 May 2004 (2004)
22. Kim, T.S., Kim, S., Choi, Y., Kim, J.: Winder: linking speech and visual objects to support communication in asynchronous collaboration. In: Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, pp. 1–17 (2021)
23. Bao, P., Gerber, E., Gergle, D., Hoffman, D.: Momentum: getting and staying on topic during a brainstorm. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 1233–1236 (2010)
24. Girotto, V., Walker, E., Burleson, W.: The effect of peripheral micro-tasks on crowd ideation. In: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, pp. 1843–1854 (2017)
25. Tavanapour, N., Theodorakopoulos, D., Bittner, E.A.C.: A conversational agent as facilitator: guiding groups through collaboration processes. In: Zaphiris, P., Ioannou, A. (eds.) HCII 2020. LNCS, vol. 12206, pp. 108–129. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-50506-6_9
26. Braun, V., Clarke, V.: Using thematic analysis in psychology. Qual. Res. Psychol. **3**, 77–101 (2006)
27. Ali, A., Wang, H., Khan, A.N.: Mechanism to enhance team creative performance through social media: a transactive memory system approach. Comput. Hum. Behav. **91**, 115–126 (2019)
28. Santos, C.M., Uitdewilligen, S., Passos, A.M.: Why is your team more creative than mine? The influence of shared mental models on intra-group conflict, team creativity and effectiveness. Creativity Innov. Manag. **24**, 645–658 (2015)
29. Nijstad, B.A., Stroebe, W.: How the group affects the mind: a cognitive model of idea generation in groups. Pers. Soc. Psychol. Rev. **10**, 186–213 (2006)
30. Paulus, P.B., Brown, V.R.: Toward more creative and innovative group idea generation: a cognitive-social-motivational perspective of brainstorming. Soc. Pers. Psychol. Compass **1**, 248–265 (2007)
31. Dennis, A.R., Fuller, R.M., Valacich, J.S.: Media, tasks, and communication processes: a theory of media synchronicity. MIS Q. **32**, 575–600 (2008)
32. Wang, D., Tan, H., Lu, T.: Why users do not want to write together when they are writing together: users' rationales for today's collaborative writing practices. Proc. ACM Hum.-Comput. Interact. **1**, 1–18 (2017). https://doi.org/10.1145/3134742
33. Ahmed, Y.A., Ahmad, M.N., Ahmad, N., Zakaria, N.H.: Social media for knowledge-sharing: a systematic literature review. Telematics Inform. **37**, 72–112 (2019)