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Chapter

Collaborative Creativity

Köping Olsson Bengt

Abstract

This chapter is based on the author's research on group creativity and educational initiatives in the private and public sectors as well as in higher education courses at an advanced level. The contribution is derived from both qualitative and quantitative methodological approaches to present in-depth knowledge of creative collaboration and competence as well as training of the necessary skills needed to activate both the prerequisites and predictors for creativity. Research shows correlations between experiences of flow in idea-generating group activities and group members' integrative social behavior. In addition, it is shown that training for increased divergent thinking also develops broadened attention, openness, and flexibility for perspective shifts. A conceptual framework is presented to construct a model of research design on collaborative creativity with the purpose of enabling comparisons between study's methodology and findings to continue developing this field of research with joint efforts. The chapter advances the view that the impact of activities training group-based creativity should be elevated in importance beyond individual brilliant ideas because creative collaboration develops abilities to take initiative, make decisions and interact constructively together.

Keywords: collaborative creativity, social interaction, synchronized flow, mindfulness and openness, fluency and flexibility, research design

1. Introduction

Creativity emerges in day-to-day practice in the space between what is and what is to come, it is, therefore, vital to define creativity as the collective realization of ideas in meaningful ways within social practices [1]. Coworkers' collaboration is important for developing workplaces, therefore we need to understand in what ways creativity in social groups can increase exchange and deepen the interaction quality.

With the aim of developing a conceptual framework for research at the group level, the concept of group idea was defined with inspiration from Mary Parker Follett (e.g., circular responses) [2] and Ludwig Fleck (e.g., thought collective) [3]. In studies on creative processes in social groups' interaction, exchange of ideas, and intersubjective knowledge development, the concept of group idea is central to understanding how emergent content and structures can covary for creativity productivity and performance. This chapter thus scrutinizes the function of and consequences for creativity in social interaction—the exchange between group members' different opinions and perspectives. This, in turn, contributes to better conditions and enable continuous development of knowledge and competencies in relation to both group and individual levels.

Conceptual frameworks for research on social groups' creative processes are often characterized as group dynamics [4–6]. What is denoted dynamics is the ongoing alteration between divergence and convergence as well as the thought ideal of iterations between individual level (group members) and the group level cohesiveness supporting the development of group ideas. However, these kinds of frameworks or models do not describe and explain what constitutes the collaborative situation/group-level state that makes the activities described in these models possible. That is, using the concept of “group dynamics” tends to establish another black box hiding what specific factors of social interaction enable collaborative creativity, for example, emergent outcomes characterized as original.

Instead, researchers (as well as practitioners!) should pay serious attention to creativity research where broadened thinking supports integration of different ideas and perspectives, as well as to social interaction, that is, intensity of dialog and quantity of exchange as drivers of self-organization and development of group maturity. After all, the purpose of developing divergent thinking may not primarily have the goal of efficient individual idea generation. What should be regarded as higher value and relevance of divergent thinking capabilities, is the activation of the so-called executive functions in relation to self-efficacy on an individual level and self-organization on group level.

Expressions such as ‘teams are made, not born’ are based on the belief that social interaction, dialog, exchange of views, and shifts in perspective can be trained and developed [7], that is, constructive integration of divergent propositions does not just happen “by itself”. In other words, groups' collaborative creativity can be strategically trained and given appropriate conditions (i.e., prerequisites). From the perspective of facilitation of creative collaboration, there are two prominent categories of inter-related prerequisites [8]: personal and behavioral characteristics. The level of these prerequisites should be considered in relation to each other as this correlation should guide the direction and scope of training.

Personal characteristics may for ethical reasons not be affected other than by the individual's initiative, for example, motivation to belong and contribute to the group's development. Behavioral characteristics such as attitudes, increased awareness, as well as aptitude, can be influenced through training and knowledge development [4].

In this chapter, the line of reasoning is structured in two main steps (1) that creativity enables social interaction and exchange, and (2) that social interaction drives creativity. **Figure 1** visualizes the potentially mutually reinforcing, iterative correlation between, interaction and creativity, conditioned by certain prerequisites that can be assessed and as well as other types of factors that can be trained and thus predict creativity.

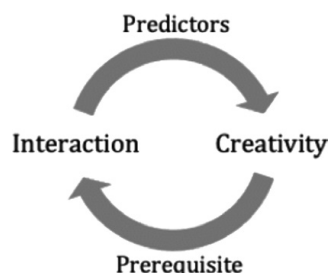


Figure 1.

Visualization of the iterative reinforcing correlation between interaction and creativity conditioned by certain prerequisites and predictors.

This chapter thus investigates how social interaction and exchange can be conceptualized in terms of creativity and what factors (predictors) in social interaction support creativity as well as what factors (prerequisites) emerge in creative processes that enable social interaction and establish the quality of creativity.

Formulated as research questions: *How can social interaction and exchange be understood in terms of creativity? By which research design can predictors and prerequisites for collaborative creativity be related, assessed, and analyzed?*

2. Collaborative creativity and interaction quality

Sternberg, Lubart, Kaufman, and Pretz [9] emphasized that creativity is important for society, but points out that research on problem-solving, abductive reasoning, cognitive flexibility, or functional fixation studies important aspects of creativity without using the word creativity.

Facilitation of creativity needs to activate both competencies, skills, and enabling conditions for creativity, as well as reconsider the effects of the creative activity, its reinforcing function, cognitively as well as socially, also in relation to what creativity accomplishes, the outcome of creativity [8]. Thus, the development of theory related reflexivity on creative experiences and competence as well as training of required skills in innovation processes needs to activate both the pre-requisites and predictors of creativity.

Three factors of creativity constitute criteria for assessment of creative responses in three dimensions 1) fluency, that is, number of responses/suggestions/ideas during a specified time period), 2) flexibility, that is, the number of different responses/suggestions/ideas during a specified time period and 3) originality, for example [10–12], is assessed on criteria of a qualitative nature based on perceptions of deviations from the ordinary [13, 14].

In general, people are expected to be flexible when encountering new situations, new requirements, and new problems, adapting to new technologies and communicating in diverse cultural settings. Cognitive flexibility is important for living, working, and learning in our rapidly changing world [15]. Social flexibility can be practiced and trained by giving and receiving information that develops new insights into other people's opinions and perceptions, it is the ability to be critically susceptible in social interaction and exchange for alternative possibilities [16, 17]. Social flexibility is thus required for effective teamwork and a facilitator of interpersonal communication [18]. A social perspective on flexibility can be defined as the inclination to adjust one's view to suit changing interpersonal situations, an interactional trait conceptualized as "openness to others." When interactors display flexible behavior, it is perceived as social flexibility [19].

Creativity involves the interplay of several factors where the correlation between social interaction processes and the characteristics of interacting individuals needs to be addressed together [20, 21]. The generation of original initiatives is a result of divergent thinking processes whereas the blending of several deviant initiatives and the assessment of this combinational outcomes' appropriateness is regarded as a convergent thinking process [22, 23].

Chrysikou [24] maintains that generative processes that evoke originality are characterized by spontaneous, emergent bottom-up processes, whereas convergent processes are controlled, top-down processes focusing on a particular goal or result, rather than producing original content.

For research on social interaction creativity, it is particularly interesting that divergent thinking and broadened attention are mutually interconnected with prosocial behavior [25, 26]. In addition, this broader attention divergence is mutually related to underlying generic cognitive processes for social interaction and decision-making, c.f., executive functions [27, 28].

2.1 Social interaction and exchange: Group creativity

The need for skills for social interaction and exchange does not diminish in a distributed way of working such as digital meeting tools. The digital meeting tools do not function as designers expect as long as the interactants (users, participants) do not understand what social interaction quality consists of and how dialog and exchange of ideas can be developed. Furthermore, in an increasingly digitized and automated working life, the abilities associated with creativity will be increasingly in demand [29, 30].

We first need a distinction regarding ‘social group’, a term which in the innovation literature is used interchangeably as ‘organizational teams’, and then define social interaction in that context. Definition of group: important distinction between dyadic versus group interaction, a group consists of more than two interactants [6], that is, we are not dealing with dyadic interaction. Definition of interaction: more than “performing some actions in synch with each other”, that is, the quality that emerges during iterative exchange (such as in idea generation and creative problem solving) is related to the shared content and intersubjective understanding of that specific content. Definition of “interaction quality” [31, 32]:

There are different types of tasks and there are different levels of interaction quality as well. According to Sawyer [33] a work task complexity is defined in terms of how many operations that team members are required to work on together face-to-face, while a non-complex task can be performed more linearly without interacting face-to-face, such as via mail contact where each performs his part and sends to the next team member to add their part in the whole. An additive interaction characteristic is when every single group member’s contribution is collected and put together to find out similar and deviant opinions to reach consensus. That is something that all members can agree upon—which often tends to be the lowest common denominator. But, to develop content through the pool of interaction and results or solutions based on all members’ continuous contributions is not an additive process. And, from a group-creativity point of view the evolving content, the result, will probably be both new, unexpected, and useful as well as created from a genuine combination. Thus, it thereby meets all aspects of general definitions of creativity. In addition, Austin & Devin [34] used the ensemble concept to describe a specific quality of group interaction, often manifested in artistic ensemble interplay.

2.1.1 Group creativity

Group creativity can be described in terms of alterations between the individual’s creativity (divergence) and developed shared group ideas (convergence). Group creativity includes both the production of new ideas and the stability to be able to integrate them into a solution or an innovation. The integration process of group ideas can be described in terms of circularity and emergence, at the collective level, ideas, and structures emerge through interactions between individuals and these collective structures influence the interactions between individuals. This iterative

self-organizing group process is collective creative agency: an engagement of actors who, through the ongoing meaning-making of group members' initiatives and interplay of habit, imagination, and judgment, develops creative actions and decisions as an interactive response to the problem posed by change [4, 35].

This view on group interaction and idea exchange was developed in a study on working groups at five companies in mid-Sweden [36, 37]. To describe and present research results regarding group interaction and emerging group ideas, a diagrammatic visualization is well suited [38]. In these diagrams, the intensity of a group's exchange of ideas can be described and related to its capacity for self-organization and decision-making. In studies of group creativity, intensity can correspond to the concept of fluency at the individual level and the number of different group ideas during the same group session corresponds to the concept of flexibility at the individual level [36, 39].

2.2 Predictors of creativity or collaboration

2.2.1 Body movement

My research has involved artistic processes in both music and theater. The theater's methodology for establishing an ensemble of actors through physical movement and dance can be used as a tool to understand what creative processes in groups can be [40]. Artistic processes can also exemplify the potential of human interaction in terms of interactional qualities and abilities to listen and respond. One such example is how the collective ability to improvisation can support the self-organizing capabilities of groups [4, 41]. Another example of how rhythmic movements to music enhance school children's idea generation and problem-solving capabilities [42].

2.2.2 Originality takes abrasion

Creativity in work is the process of engaging practices that generate useful novelty. Organizations need to promote creative attitudes and provide open structures that can absorb resulting innovation. Core competencies in creative processes, such as critical thinking, problem-solving, and exchange, during teamwork are central to establishing distinctions between human-technology-artificial intelligence (e.g. [29, 30, 43]). Abilities that combine originality and usefulness in different ways characterize a creative agent. Original (different, deviant, unknown) actions need to be able to be used (meaningful, appropriate) functionally. Understanding and embracing this originality as appropriate and potentially valuable change is correspondingly an expression of creative agency capability. This creation and incorporation of new ways of doing things are not frictionless, the new is often perceived as questioning and criticizing, sometimes destructive. But the constructive contribution of creativity is to come up with alternatives to what it criticizes, this is the convergence of creative processes. Interactants, i.e., group members, need creativity for divergent differences to interact.

Creativity's laborious transcendence processes, balancing divergence and convergence, are often driven by enthusiasm and disruption—enthusiasm opens up to the new and discovering, while what threatens existing understandings and accustomed practices is perceived as disruptive. The new ideas criticizing the prevailing, that is, idea generation by definition means that all proposals and ideas cannot be combined. This critical function and even destruction as a result of the old needing to give way to the new is often overlooked aspect of creativity. Innovation seeks energy, drive, and an attractive work environment in creativity but is often surprised by criticism,

slowness (incubation), and destruction. This ambiguous effect of creativity at the workplace utilizes idea generation to develop the workplace climate [44].

2.2.3 Dialog and intersubjective ideas

How creativity emerges over time in different types of workplace-specific situations is a central question. A result of creativity in social interaction is the development of shared understanding in relation to innovation capabilities through dialog seminar methodology [41]. Findings from this study contributed to the understanding of attitudes and approaches that establish and maintain group dialog that develops intersubjective understanding. A consequence was that intersubjective understanding, emerging group ideas need to be made explicit and visualized, primarily for the group members'/participants' sensemaking and re-understanding of what is going on and thus act constructively and contribute to the continued development of the group ideas [45].

With this perspective and purpose as a starting point, a conceptual framework was developed that later came to be known as "GroPro" including a number of associated "tools" for training the creative abilities of groups [4]. This project was driven by the belief that creativity and group creativity can be learned and trained [39].

2.2.4 Interaction quality: Group flow

The psychological experience called flow can occur during the performance of challenging activities in which the difficulty of the task is matched to the skill level of the person [46]. Characteristics of the flow experience include high but subjectively effortless attention, a sense of control, loss of self-awareness, and altered experience of time and enjoyment [47]. Flow experiences have predominantly been investigated in individual performers, there is a growing research interest in the quality of shared flow experience in social contexts, that is, group flow [48]. Sawyer [33] defines group flow as "*an optimal collective experience that occurs when members develop a feeling of mutual trust and empathy, in which individual intentions harmonize with those of the group.*" When team members experience this synchronized state of flow, this can be considered a sign of increased performance and enhanced team-level effectiveness [49]. This type of self-reinforcing circularity between the group and its individuals is common in accounts of social interaction and group dynamics [2, 3, 50].

Van den Hout and colleagues [49] posit seven prerequisites and four predictors of team flow experiences. The prerequisites for team members' experiences of this collective quality of interaction are shared values and mutual recognition, (1) collective ambition and motivation. Alignment between members, (2) individual goals, and (3) the teams' goal. Team members' skill levels should be comparable, some of which are unique to each team member and (4) the team should be able to integrate those skills. Establishing communication and feedback (5) each team member develops broadened perspectives which thereby set the conditions for listening and exchanging, to agree on activities for achieving the common goal. Creating a safe environment requires the elimination of unnecessary and unacceptable risks while allowing for and acknowledging the possibility that any team member may fail, which in turn gives teams (6) the freedom they need to take necessary risks by making them feel it is safe to take action. Team members keep one another on task by using task-oriented behavior, accountability, and (7) mutual commitment to achieving the common goal [6, 16, 49, 51].

The four characteristics of team flow are (1) intense collaboration between team members as they strive towards the collective ambition and the achievement of their

goals. Interpersonal concentration on the shared activity and holistic focus, a shared sense of unity, that the team has merged to form (2) a cohesion of blending egos. Team members' awareness of (3) constantly and effortless synergistic accomplishments, the willingness to be vulnerable and interdependent on one another, and finally shared confidence and (4) mutual trust that the team can achieve its common task [33, 49].

As Pels et al. [48] point out group performance should be assessed considering the specific task framing the situation and constitute the basic criteria relevant to the specific interaction quality. However, the differing collective aspects should be seen as separate pieces of a single puzzle that come together to form the whole. With this approach, the definition of group flow becomes the integration of several interacting factors, as follows: Group flow is a shared experience of states represented by (a) positive interactions, (b) a high collective competence, and (c) a collective state of mind consisting of positive relationships between group members, often resulting in (d) optimal collective performance and creativity [48].

2.2.5 Interaction quality: Flow synchronization

Flow synchronization is a psychological mechanism stimulating the group members to interact with each other, and to work on shared goals collaboratively to reach a challenging interdependent task [52]. This specific quality of interaction can develop when the interactants have experience working together in an intensive exchange of initiatives, ideas, and opinions [32].

Predictors of group members' experience of flow synchronization are (a) that they know the purpose of the task and (b) share a common strategy to reach agreed goals. Group members help each other, (c) integrate their initiatives with consistency, (d) motivate themselves, and (e) learn from each other. In addition, when they (f) reflect on the experience of working together, they realize how much they have developed during the activity and how they influenced each other's performance [53, 54]. Thus, the coordination effect of interactional functioning has been highlighted in the studies of flow in a social context.

The flow synchronization has been operationalized with the 28-item Flow.

Synchronization Questionnaire [52], which collects the experienced components of the interaction during a shared flow situation. The questionnaire identifies five components: (1) effective cooperation and partnership evaluate the common activity from a personal, relational perspective. The component of (2) engagement and concentration on the task refer to the flow experience during the interdependent activity. The third and fourth factor focus on the motivational effect of the partners, related to the concept of emergent motivation [46] and the facilitating role of the partners (e.g. [55]). Coordination during the interdependent activity refers to the behavioral coordination of the cooperative partners, supporting the synchronization mechanism [54].

2.3 Prerequisites for interaction quality

2.3.1 Openness

The personality trait Openness is one of five factors in the well-established framework called the Big-Five, which is used to assess individuals' personality characteristics. Each factor, i.e., trait, is based on empirically derived personality traits which in turn are a cluster of several more specific aspects which in turn comprise a large number of even more specific characteristics [15, 56].

The experience of being engaged in an activity depends mainly on the existing degree of openness. For example, group members who have an open attitude tend to experience a greater effect from several days of training activities in improvisational approaches [57]. In social groups, engaging in creative problem-solving tasks [58] and openness to experience includes intellectual curiosity, reasoning and imagination, artistic and esthetic motivation, as well as emotional and fantasy richness [15].

Openness to others is associated with creativity and flexibility in thinking and acting [19]. Flexibility in thinking is related to divergent thinking, such as “jumping” between categories to avoid functional fixation, i.e., getting stuck in predefined categorizations or “downpipe”-thinking. Openness is thus a prerequisite attitude for divergent and flexible as well as for improvisational, self-organizational, activities in a group [58].

2.3.2 Mindfulness/mindlessness

Personal characteristics such as the personality trait openness to experiences correlate with mindfulness, engagement, and concentration in collaboration and self-efficacy. Actively engaging in reconstructing one’s impressions of the environment, for example, the behavior or suggestions of other group members and paying attention to what this may mean for one’s understanding of what the group as a whole strives to create, for example, a group idea, is a mindful approach which is one of the prerequisites for collaborative creativity. This approach enables own interpretations and conscious manipulation which in turn can constitute creative contributions to the group’s interdependent task ([59], p. 4). From a creativity perspective, Mindfulness is a composite of four components: (1) novelty seeking, (2) commitment, (3) producing novelty, and (4) flexibility.

Mindlessness on the other hand refers to when the individual mindlessly forms a cognitive commitment to the information and freezes its potential meaning. Alternative meanings or uses of the information become unavailable for active cognitive use [60].

Research on mindfulness in organizational contexts refers to this decidedly Western notion of mindfulness in terms of a socio-cognitive approach [61]. Weick and Sutcliffe are drawing extensively on Ellen Langer’s research and describe mindfulness as a rich awareness of discriminatory detail generated by organizational processes [62]. Valdesolo et al. stress the benefit of training group members’ perceptual sensitivity towards the other group members’ actions as this promotes performance in interdependent tasks [60].

In this socio-cognitive perspective, mindfulness becomes central to the mutual creation of meaning [63]. A mindful perceptual sensitivity towards others can thus be regarded as a prerequisite for interaction and exchange in social groups. Langer uses the concept of “sideway perception” relating to interaction theory regarding considering interactants (group members) actions, that these actions are not arbitrary but always express meaning, cf. intersubjectivity, [64].

In addition, from a sociocultural perspective on creativity, an attitude of mindfulness group members can interpret interactants’ actions as multifaceted with several different meanings [65, 66]. Prerequisites for collaborative creativity are then openness for others, flexibility for divergence exchange, mindfulness in interaction, intersubjective creation of meaningful creativity, and improvisational attitude.

2.3.3 Improvisational attitude

For making the group collaboration to eventuate into creativity all group members have to be present in whatever is going on, aiming their focus on whatever emerges out of the

social interaction. This corresponds to “improvisational attitude” defined as “being mindfully in the now” [59]. When the interactants are aware that their collaboration continuously produces some emerging content, they can relate the group interaction to what the group produces as an outcome related to the task. We denote the emergent content “group idea” [67]. This implies that constructive and creative group effort is built on group members’ awareness and ability to focus on whatever emerges through their interaction [68].

Sawyer outlines four rules or principles for constructive group improvisation [33]. Here follows our translation into four competence areas for collaborative creativity as a development of Sawyer’s principles of group improvisation:

The basic competence for collaborative creativity is that the interactants train themselves to execute a “Yes, and..” attitude. The “Yes...”-part is the foundation of collective creative performance. The “and...”-part is the contributing dimension that supports the so-called “Group Idea” to gradually develop, that is, the emergent content.

The second competence area concerns listening skills. “Listen to the group idea!” is about listening empathetically to whatever is expressed rather than pondering about which response would be the most intelligent. This conscious awareness of others is consistent with one of Alex Osborn’s guidelines for constructive brainstorming: “improve through combination” [69].

The third competence area is rather about developing a basic approach for all types of improvisation, that is, openness to others. A traditional concept in creativity research is functional fixation. The facilitative prompt for collaborative creativity aims to minimize this mindless fixation and reads “Do not write the script in your head!” When this call is heeded, interactants begin to be more mindful and “stay in the moment of interaction.” It involves a great deal of trust in handing over control to the group process, assured that creativity will emerge from the iterative interaction. After all, it is not possible for one person to create a group idea.

Finally, the fourth competence area is about avoiding interrupting the group members’ (interactants’) synchronized experience of flow. That is, do not slow down the dialogic exchange of ideas and suggestions with long justifications and explanations, but “describe by doing” instead. The intensity, that is, fluency, of collaborative creativity has a greater impact on both performance and results than laborious accounts of the excellence of a particular idea.

2.3.4 The ability to combine differences and reaching alternatives

The responsibility for achieving and maintaining the presented prerequisites can to some extent be attributed to the group’s leadership and distribution of work tasks, but the working group as a collective should also take responsibility for its way of interacting and making decisions, that is, the development of interaction maturity [31]. For the analysis of the interaction maturity of work groups, we have established a conceptual framework in the form of a maturity ladder inspired by Dreyfuss & Dreyfuss’ [70] five levels of competence, as follows:

First level—the Novice: Group members’ actions have no particular meaning for the other members’ understanding of the task or problem being solved. Second level- the Beginner: Group members’ action is collected to build consensus or to find the lowest shared denominator. Third level—the Experienced: The awareness of the group idea function as an interpretation background for members’ action. Different actions could be understood and given a shared meaning about the group idea. Fourth level—the Competent: A shift in interaction quality from the lower levels. The way of relating to (attitude) group members’ actions have an explicit connection to the

evolving group idea and this understanding is the background from which members' action is interpreted and given meaning. Fifth level—the Expert: The team is able to completely change the way of interaction. The team realizes and refers explicitly to the inter-subjective group idea and is able to shift between different group ideas [31].

3. Research approaches, conceptualization, and design

For new research initiatives to contribute to the development and expansion of the research field of collaborative creativity, it is important to relate to a common conceptual framework. Research on creativity within psychology-oriented scientific perspectives and methodologies such as psychodynamic, cognitive, and behavioral sciences. Research on creativity with cognition perspectives has developed methodology and conceptual frameworks for studying creativity (e.g. divergent thinking, functional fixation, incubation, traits), where, for example, divergent thinking is operationalized and analyzed in three conceptual dimensions of fluency, flexibility, and originality.

Research with social psychology-oriented perspectives has developed methodology and other types of conceptual frameworks for studying creativity (e.g. social interaction, interdependence, group dynamics). Research findings on socially oriented creativity should also be related to divergence and convergence as well as originality and functionality.

To establish a common framework to enable comparison of findings, we suggest the following conceptual analogies: *Fluency* in studies on creativity in group interaction should be assessed and analyzed in terms of “intensity” in the exchange of ideas and dialog. *Flexibility* in group interaction should be assessed and analyzed in terms of “the number of different types of group ideas” that the group is able to accommodate during group interaction. The creativity dimension *originality* should be assessed and analyzed in relation to the conventions in the relevant field. For example, an originality in group interaction can be assessed and analyzed in terms of deviations from expected behavior, such as the degree of collective improvisation which the group cohesively manages to act and treat.

3.1 Research conceptualization and design

To form a coherent and consistent development through the sections of this chapter from the theory-based conceptual framework, via research approaches and design, a model for research design on collaborative creativity is presented in this section. This has the overall purpose of enabling comparable studies in terms of methodology and findings to continue developing the knowledge area of collaborative creativity with joint efforts.

A scientific methodological approach that lends itself well to research on collaborative creativity is critical realism (4). Utilizing ontologically based stratification of structures (e.g. outcome, group ideas), events (e.g. idea generation, dialog), and underlying mechanisms (e.g. interaction quality, improvisational attitude), the combination of different types of methods for data collection and analysis is enabled, that is, retroduction [71]. In the research design according to **Figure 2**, stratification is visualized in four levels, where each level can consist of several events and each event can be caused by several mechanisms. It is the research question that determines which mechanisms a particular study should consider as appropriate explaining factors for the particular event which are thus analyzed through critical realism's so-called retroduction.

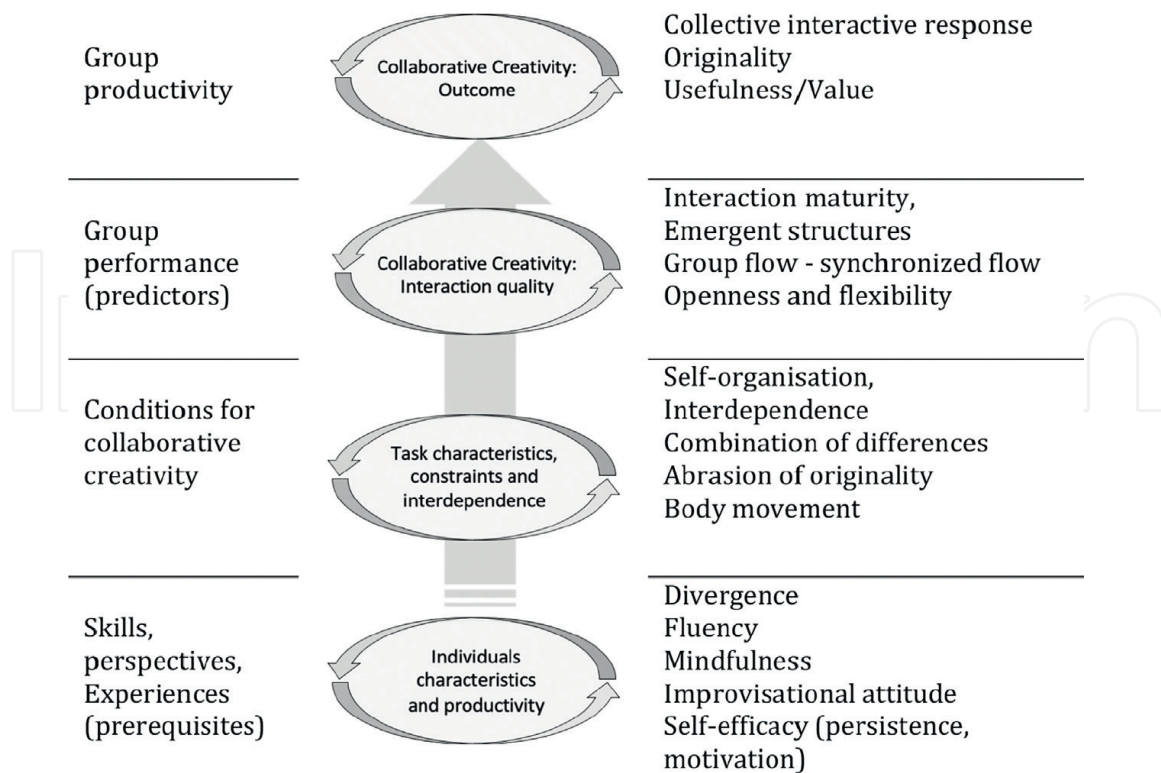


Figure 2.
 Suggested research design for collaborative creativity; stratification levels, theoretical concepts for qualitative and statistical analysis.

In relation to the methodology and research approach of critical realism, the proposed research design, the *mechanisms* are grouped into predictors and prerequisites. The *events* have also been grouped into two categories, that is, “conditions for collaborative creativity” and “group productivity.”

4. Discussion and conclusion

In the previous section, a methodological approach to investigating collaborative creativity was presented. The rationale for this is that creativity is composed of various factors that directly or indirectly influence each other, and these interdependencies are rarely simple and linear. Furthermore, the translation of traditional analysis concepts (i.e. fluency, flexibility, and originality) to social collaborative creativity, needs to be established to continue developing creativity research cumulative knowledge expansion by enabling comparison between the results of different studies.

It is, for example, important that findings in creativity research do not conflate creativity as outcome versus creativity as quality—or do not present a clear distinction between outcome versus performance. This can lead to problems in the assessment and analysis of collected empirical data and thus, by extension, the comparison of results between different studies, this especially applies to the originality dimension of creativity. Assessment of originality in creativity can be carried out by external experts grading the results of creative processes in the originality dimension continuum between everyday/traditional to unique/path-breaking, cf., consensual assessment technique, CAT [13]. However, assessment and analysis of the originality dimension in terms of creative quality in the process or more specifically in the group interaction is not as developed as the other dimensions, that is, fluency and flexibility.

In **Figure 2**, it was demonstrated that systematic research studies need to stratify these factors ontologically at different levels to understand, analyze and explain how factors at different levels interact in collaborative creativity and establish conditions that drive interaction quality and productivity.

Moreover, factors at different levels may need different methods of collecting and analyzing data to relate results between different levels, which is supported by a theory-based conceptual framework. Each with appropriate methods for data collection and analysis of mechanisms that at different levels contribute to the emergence of collaborative creativity. The construction of a conceptual framework for research should therefore consider and translate central concepts consistently between levels, enabling comparisons of results between different studies. The suggested conceptual framework for collaborative creativity thus has its function both within and between different research studies (**Figure 3**).

This chapter has presented a social perspective on collaborative creativity evolving through the combination of divergent differences. The premise for developing an understanding of the elements of collaborative creativity is the circular logic captured in two propositions, P1: Interaction drives creativity, and P2: Creativity enables interaction. These propositions express the relational logic that “the interactants need creativity for divergent differences to really inter-act.” Proposition P1 has been shown in research studies to have certain predictors, while proposition P2 has been shown to need the support of certain prerequisites.

Predictors of creativity:

Social interaction always establishes some kind of emergent property, in collaborative creativity, a specific interaction quality conceptualized as flow synchronization has been shown to be an emergent factor.

Idea generation develops Divergent thinking, which, in turn, initiates Executive functions. An example is the relationship between idea generation and creative productivity, which develops openness also in social interaction, such as empathic understanding of others’ perspectives and perceptions.

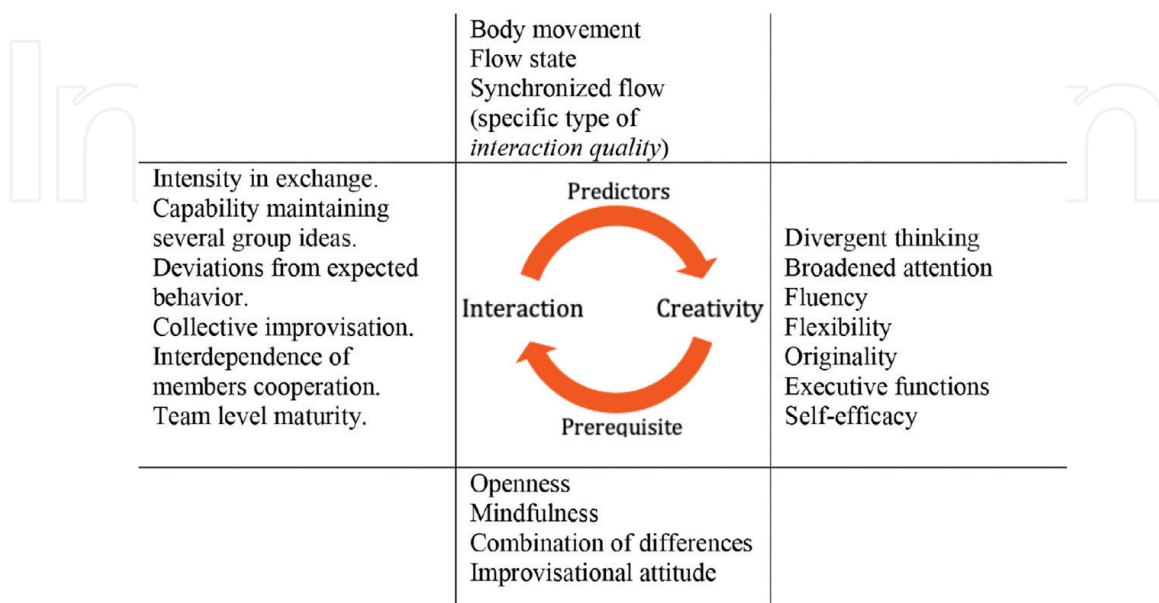


Figure 3. Collaborative creativity—predictors of creativity-related prerequisites for interaction.

It is crucial that the Originality dimension is assessed especially in studies on creative group interaction because it is necessary to get results relevant to creativity. But it is also methodologically important to avoid the problematic concept of “dynamics”, which seems to be the case when only the dimensions of Fluency and Flexibility are assessed and analyzed. It risks establishing yet another black box hiding what flexibility and fluency in social interaction can be also making comparison to other studies cumbersome, which in turn risks limiting the development of the research area that constitutes collaborative creativity.

Prerequisites for interaction:

An approach characterized by Mindfulness seems to work mutually reinforcing with Openness to others in a way that strengthens integrative action, that is, interaction between, for example, group members. These are two prerequisites for collaborative creativity. Two others are the desire to combine divergent differences and improvisational approach. These four have been shown to be prerequisites for collaborative creativity because they both support creative productivity and exchange in socially interdependent collaboration.

The presented premise should also constitute the pedagogical logic for didactic strategies that aim to activate predictors and prerequisites of collaborative creativity through the training of necessary skills and knowledge development. Acquiring these abilities and establishing relationships requires training and knowledge development. Education, training, and facilitation of collaborative creativity need to strive to structure learning and activate abilities based on the ontological prerequisites of creativity. The structuring of content should be connected in such a way that the students have the opportunity to be activated in creative productivity, analyzing the outcome of interaction and exchange, reflecting on flow experience and interaction quality in relation to the emergent content and evolving structures.

5. Conclusions

The presented reasoning and developed model of research design for investigation of collaborative creativity are derived from both qualitative and quantitative methodological approaches. The chapter advances the view that the impact of activities training group-based collaborative creativity should be elevated in importance beyond individuals' capabilities related to idea generation and production of original and functional ideas. Both training in and research on these abilities are important, but these activities should also be understood and developed based on their generative function in social contexts. Creativity is a genuinely generative ability, creative processes develop the ability to take initiative, make decisions, and interact constructively together and this should have implications for research approaches and methodological design as our conceptual framework for collaborative creativity suggests.

Practitioners, educators, and facilitators of creative processes should acquire a deeper understanding of the predictors and prerequisites of creativity. This recommendation is based on the presented research design, moreover, the conceptual framework are motivated by the fact that the social value of creativity is too often overlooked, that is, the combination and interaction between divergent differences, fostered understanding of different perspectives, diversity, and empathy. And, that this, therefore, needs to be taken more seriously into account in different types of education and training in creativity.

Educational initiatives for collaborative creativity should train skills that are needed as prerequisites for this type of interaction quality to be established. Such training

should include assessment of creativity at different levels, that is, individual, group, workplace, etc. In addition, the development of facilitation skills should include the development of action plans for different types of method used based on the stratification of levels in the suggested research design (**Figure 2**) [72]. These learning activities are important for facilitators of collaborative creativity where expectations of both deep theoretical knowledge and experience-based abilities are addressed [7].

6. Future development

Based on the previous discussion, further development of collaborative creativity is proposed in the following three points:

- The development of research on creativity with sociological research approaches is promising, presenting studies often based on conceptual frameworks from action theory [64, 65]. From a sociological research perspective, collaborative creativity can be defined as a temporal interactive engagement between actors in different structural environments where the interaction both reproduces and transforms emergent content and responses such as responses to interdependent problem-solving tasks [35].
- In addition to mapping the methodologies of similar research approaches and their presented results with each other, the suggested conceptual framework needs to be applied in several studies to establish significance and create credibility.
- Research on collaborative creativity should focus on the effects of creativity rather than on the immediate results of creative processes since social interaction is needed for creativity as well as creativity is needed for social interaction, integrating differences, and intersubjective meaning-making.

Conflicts of interest

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this chapter.

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Author details

Köping Olsson Bengt
Mälardalen University, Eskilstuna, Sweden

*Address all correspondence to: bengt.koping.olsson@mdu.se

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