VILNIUS TECH
Vilnius Gediminas Technical University

Creativity studies
ISSN 2345-0479 / eISSN 2345-0487
2023 Volume 16 Issue 1: 297–314
https://doi.org/10.3846/cs.2023.17564

GROUP DYNAMICS AND CREATIVITY: A RESEARCH WITH YOUNG ADULTS IN REGGIO EMILIA, ITALY

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Received 8 September 2022; accepted 5 November 2022

Abstract. Modern society demands innovativeness and creativity. Few studies have examined group dynamics' influence on individuals' creativity. This study explores creativity in group settings and how the gender of participants influences group dynamics and the creative process by observing specific behaviors, including social interaction and play, creative action, and creative thinking. In groups of three, thirty participants (20–25 years) were asked to create mosaics representing a "learning community" using *Lego DOTS*. Relationships between group dynamics and creativity, creative thinking and creative action, gender of participants and their orientation to creativity and group dynamics were explored. Results showed negative relationships between group processes, creative thinking, and creative actions: the more intense the group dynamics were, the less the creativity. Surprisingly, female participants were more oriented to the creative task; male participants were more oriented to group dynamics. Further investigation of the relationship between creativity and cultural stereotypes on gender roles is needed.

Keywords: creative action, creative thinking, gender infusion, group dynamics, social interaction.

Introduction

Modern society requires people to be flexible and develop innovative solutions to unexpected situations. It is, therefore, necessary to develop creativity not only in children but also in adults. Creativity refers to the "Interaction among aptitude, process, and the environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context" (Plucker et al., 2004, p. 90). It is the complex human capacity to produce novel ideas, generate new solutions, and express oneself uniquely (Abraham, 2016):

> "A creative individual regularly solves problems, fashions products, or defines new questions in a domain in a way that is initially considered novel but that ultimately becomes accepted in a particular cultural setting" (Gardner, 1993, p. 35).

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The conceptual definitions of creativity revolve around originality and appropriateness in particular contexts. However, there have been numerous disagreements and discontent over the definition and the assessment of creativity: this is mainly due to the immeasurability of the two variables as they depend on the evaluative context and the perceiver (Adarves-Yorno et al., 2006).

Ordinarily, only groundbreaking scientific discoveries and outstanding works of art by novelists, visual artists, and poets are readily associated with the concept of creativity. Nevertheless, the potential to be creative exists within each person. Variability in both the amount and the type of creativity produced over a lifetime and the capacity to be creative is evident in nearly all aspects of daily human life, such as choice and decision making, planning and organization, and even language and communication. Our everyday creativity is not only beneficial, but also one of our most potent abilities, bringing us to life in each moment, influencing our health and well-being, providing variety and options in what we do, and assisting us in our creative and personal growth. Until recently, most studies on creativity have focused on the individual creator's minds, methods, and motivations (Abraham, 2016; Andreasen & Ramchandran, 2012; de Cássia Nakano et al., 2021; Richards, 2007). Creativity has been seen as a trait of some individuals, which is measurable by paper and pencil tests, with group creativity as anomalous; or simply at a sum of the capacities of the individual group members (Gardner, 2006).

It is essential to analyze creativity through social contexts for various reasons, including the definitional requirement that a creative idea must be perceived as valuable by others and that group effort often results in an increased output of new information and knowledge. Individuals derive their identities from their membership in certain social groups, and social identity and shared group membership are significant determinants of an individual's willingness to engage with others. The nature of a person's relationship to their group influences the perceptions and people's responses to creations and attempted innovations. As Gardner (1993) states, for instance, when a product is believed to be linked with an in-group or its creator is perceived to be an in-group member, it is more likely to be approached and evaluated favorably than when it is perceived to be associated with an out-group. In this book, Gardner argues that

> "indeed, the knowledge that one will be judged on some criterion of 'creativeness' or 'originality' tends to narrow the scope of what one can produce (leading to products that are then judged as relatively conventional); in contrast, the absence of an evaluation seems to liberate creativity" (1993, p. 33).

He reiterates that creative solutions occur more often when individuals are intrinsically motivated to engage in an activity rather than extrinsically driven.

"The most favorable situation for creativity seems to be an interpersonal exchange, with the negotiation of conflicts and comparison of ideas and actions being the decisive elements" (Edwards et al., 2011, p. 52). Nonetheless, due to the creative personalities and individual differences, group members' characteristics affect how people interact with each other cognitively and interpersonally. For instance, different problem-solving styles can make group creativity easier or more difficult. While groups can promote creativity through the combined experiences, expertise, and resources of multiple individuals pursuing a common goal,

certain conditions can lead to narrow thinking, leading to a reduced quality of creativity. Personal attributes interact with situational variables to influence creativity in groups (Slayton et al., 2019). As Kurtzberg and Amabile (2000–2001) argued, natural team interactions seem to hinder creativity: creativity is not a spontaneous process but is the intersection of an individual's creativity-relevant skills, domain-relevant skills, and motivation. Thus, it is important to examine how this creative process and ideas are influenced by the presence of other people in group settings. Group dynamics are the prominent interpersonal processes that take place within and between groups over time. Not only do these processes determine how group members relate to and interact with one another, but they also define the group's inherent nature and course: the actions the group undertakes, for example how it reacts to its surroundings and what it accomplishes (Forsyth, 2019).

All children undergo an extensive period of exploration of their environment. This period is an opportunity to discover the physical, social, and personal worlds, which becomes a background for further learnings and models for later exploratory behaviors, including probing phenomena that have never before been conceptualized. Those children who have sufficient capacity to explore fully accumulate an invaluable capital of creativity which they can draw in later in life. On the other hand, those children restrained from such discovering activities have a significantly reduced chance of developing their creative abilities in the future (Gardner, 1993). As individuals develop into adulthood, they strive to form a sense of identity and belonging, sometimes making them afraid to act or think until they know what their peers are thinking. There is the wish to create, make, build and try in various contexts, but sometimes feelings of inferiority may predominate. In group settings, this may work against the individual's creative drive. The young individual tends to seek group acceptance and validation through conformity. Additionally, the more acceptable a group member feels to other group members, the more capable they will be of risking getting deeper and intimate, gaining a more fulfilling involvement.

Groups are conceptualized as three or more people who are interdependent or related to one another and have an impact on one another through their interactions (Brown & Pehrson, 2020; Paulus, 2000). This article focuses on social groups, also known as secondary or task groups: they

> "are larger and more formally organized than primary groups, and memberships tend to be shorter in duration and less emotionally involving. Their boundaries are also more permeable, so members can leave old groups behind and join new ones, for they do not demand the level of commitment that primary groups do" (Forsyth, 2019, p. 6).

1. Problem statement

Woodman et al. (1993) argued that product, process, person, and situation are critical domains in group creativity. Group creativity is a function of individual creative behavioral inputs, interaction of the individuals involved, group characteristics, group processes such as approaches to problem solving, contextual influences such as the larger organization, and characteristics of group task. It is thus important to study interactive and communicative behaviors such as creative actions, creative thinking, distracting action, play, among members

as they are just as important to group creativity as individual attributes and processes (Slayton et al., 2019; Woodman et al., 1993).

While groups can combine the experiences, expertise, and manpower of different persons to accomplish a common goal, certain factors can cause groups to narrow their thinking and reduce the quality of their problem solving. Exploring interactions of individuals aspiring for team-level creativity can be useful in understanding both creativity and teamwork (Kurtzberg & Amabile, 2000–2001). As Paulus (2000) argued, group and team interactions can be a rich source of creative ideas and innovations. Thus research on group creativity can also have significant implications for organizational innovation and creativity, and to our everyday lives and personal development. We are part of a society and our approach to realizing things depends on others. Creativity is an inter-individual process among interested stakeholders, accepted domains, and creative actors. For this reason, it is essential to study creativity in the context of social group dynamics. With our everyday creativity, we adapt flexibly, improvise, and try different options in the context of social group interaction (Ford, 1996).

Empirical studies on the creative ability among children and adults are inconclusive and inconsistent regarding gender differences. Nearly half indicated no significant differences between males and females, and the other half indicated mixed findings, with an average of superior creative abilities in females (Abraham, 2016; de Cássia Nakano et al., 2021). Although aspects of creativity differ in men and women, it is not due to gender but the influence of cultural and environmental factors that determine the behaviors of each gender. The gender influence would also depend on the type of creativity being assessed, such as verbal, visual, or spatial tests. Most theories have analyzed gender differences in creativity related to socio-cultural, environmental, and neuro-scientific grounds (de Cássia Nakano et al., 2021). Limited scientific studies have examined group dynamics' influence on individuals' creativity. Furthermore, research on creativity has rested squarely on the individual's cognitive processing, individual differences, and the effects of the external environment on the individual. Relatively little consideration has been given to the creative ideas generated by the groups instead of one mind (Kurtzberg & Amabile, 2000–2001). Consequently, this study was generated to explore creativity in group settings and identify how the gender of group participants influences the group dynamics and the creative process.

Resnick (2007) concluded that the creative process is not limited by age and can be observed not only in childhood. He proposed the "kindergarten approach to learning", which is suited to the needs of the 21st century. It allows learners to develop the creative-thinking skills essential in today's society. Resnick believes that the "kindergarten approach to learning" is needed to help people of all ages develop the creative capacities needed to thrive in today's rapidly changing society". Following this idea, the idea to construct the same workshop used in a previous study with children for young adults and explore the relevance of the specific behaviors studied in the workshop with children was born. In the previous study, the research team observed children's creative process in groups of 3–4. The children were 6 to 12 years old and were all accompanied by their parents. They were asked to create mosaics representing their ideas of a "learning community" by using *Lego DOTS* (Komarova et al., 2022). While they created, they expressed different social and collaborative behaviors. Repetitive behaviors of children were identified and classified as shown in Table 1.

Table 1. Behaviors classification (source: created by authors)

Behavioral signal	Variables
A child stacks *Lego DOTS* on the base	Creative action
A child unstacks the *Lego DOTS*	
A child chooses the color of mosaic	Creative thinking
A child looks design of the other children	
A child searches for the dot on the floor	Distracting action
Peers help to put the mosaic on the base	Group work
A mother helps to put dots on the base	
A child talks with the mother	Group conversation
A child talks with peers	
A child talks with *Atelierista*	
A child plays with *Lego DOTS*	Play

2. Aim and objectives of the study

This study aimed at exploring the relevance of group dynamics to creative process, and how they compared across genders. The researchers agreed to use the same variables identified in children and focused on the behavioral signals observed during the group dynamics in the creative process with *Lego Mosaic*. Specifically, the focus was on social interaction, a dynamic, changing sequence of social actions between individuals or groups (Zhou et al., 2020). There are four types of social interactions: accidental, repeated, regular, and regulated (Argyle, 2017). In social interaction, the focus was on verbal communication: intrapersonal communication, interpersonal communication, small group communication, and non-verbal communication like body movement, postures, and gestures (Cafaro et al., 2016; Banasik-Jemielniak & Kałowski, 2022).

Each type of communication specification was also defined based on the appearance of the speech and body movements. Firstly, in verbal communication, our goal was to explore/observe the dynamics of the speech, the type of communication during the young adult interaction, and the order of the speech. For example, there was a focus on intrapersonal communications where the participants talked to themselves. In interpersonal communication, the focus was on the transmission of information that occurred between three people without using language. For example, behavior signals such as interpersonal communication were observed, where young adults talk with one another, and small group communication.

Secondly, in non-verbal communication, the positions of the young adults while relating to the other participants were observed, the distance between them, and how it changed during the activity. For example, body movement and postures such as turning around to ask for help in an ongoing activity.

Finally, the scale of appropriate behaviors of the categories detected during the same activity with *Lego* carried out with the children was defined. Such behaviors were operationalized into two sets of categories. The first included variables relating to group dynamics:

social interaction and play. The second included variables relating to the creative task: creative action and creative thinking. The research questions focused on: (1) the relationship between group dynamics and creativity; (2) the relationship between creative thinking and creative action; (3) the relationship between the gender of participants and their orientation to creativity and group dynamics.

3. Research questions

The following specific questions were explored:

1. What is the relationship between group dynamics and creativity?
   a. What is the relationship between group dynamics and creative thinking?
   b. What is the relationship between group dynamics and creative action?
2. What is the relationship between creative thinking and creative action?
3. What is the relationship between the gender of participants and their orientation to creativity or group dynamics?

3.1. Hypotheses of the study

The following hypotheses were set for the study:

H_1. The more intense the group dynamics, the higher the creativity level will be displayed. (The more the group engages in its dynamics – team building, having fun, socializing, leading – the better the group will perform in its creative task.)

H_2. Creative thinking and creative action are positively correlated (the more creative thinking, the more creative action).

H_3. Male participants will be more oriented to the task (creative), while female participants will be more oriented to group dynamics (men are more task-oriented than women, who are culturally process-oriented).

4. Description of experiment

An exploratory sequential mixed-methods design was used to investigate the group dynamics and creativity of the participants during the creative task (Berman, 2017). Within this framework, an initial preliminary study formed the basis for the follow-up design of the experiment. The qualitative study was built on a statistical analysis of observations of participants (Wolfe, 2000). More detailed discussions between the observers were conducted to gain in-depth insights into the behavior signals of participants in the *Lego* experiment (Parlitz et al., 1996). The experiment took place in the research laboratory *Scintillae* in Loris Malaguzzi International Center (LMIC), Italy, Reggio Children Foundation (RCF), Italy. Since experimenting in a research laboratory requires a meticulous design approach and a bureaucratic approval process, it was necessary to conduct a preliminary study. The pilot phase included two sessions, each consisting of three participants. The objectives of the pilot phase were: (1) to organize and test observation settings; (2) to develop the questionnaire; (3) to identify the observation report technique.

5. Participants and configuration of the experimental group

The study was conducted among 30 participants aged between 20 and 25 who attended university after completing a bachelor's degree. The sample size was based on guidance from Miles and Huberman (1984) and Hillman and Radel (2018). They were divided into groups of 3 depending on their gender. There were two pilot phase groups, as described previously, and eight experimental groups. The experimental groups were: two groups consisting of three girls; two groups consisting of two girls and one boy; two groups consisting of two boys and one girl; two groups consisting of three boys.

6. Ethical considerations

The Doctoral Program (DP) in Reggio Childhood Studies (RCS) provided ethical approval of the experiment. Since all sessions were video and audio recorded, the participants were asked to sign an informed consent before the beginning of the creative tasks. It explained the recorded material usage and assured them of privacy and confidentiality by the University of Modena and Reggio Emilia, Italy and the RCF, the two institutional partners in the DP. They were informed that no names were used during data collection, and that anonymity and confidentiality were protected for each participant by assigning a code number to each participant (Mineo et al., 2022). The data were stored in the principal investigator's *OneDrive* (linked with the institutional account of the university). The participants also signed an agreement that clearly explained the experiment to participate in the experiment voluntarily. They were told that they could leave the study at any time without giving a reason. Nobody backed out.

7. Materials and procedures

Eight sessions of the same experiment were performed. All sessions were carried out in 5 days. The three moderators observed one group at a time. The experiments lasted between 37–56 minutes, with the variation in time reflecting the creative task participants had to share. The average group session included a 5-minute introduction, 30 minutes of creative activity, and 5 minutes of a self-administration questionnaire. The creative task for the young adults was similar to that conducted with children. The tasks were: (a) collaborate in groups of three people using *Lego DOTS*; (b) reproduce what an educating community is for them with the *Lego DOTS*.

At the end of the activity, they were asked to fill in a questionnaire titled: "quality of collaboration with colleagues in the laboratory *Scintillae*". The experiments were conducted in Italian, and the translation was done by one of the observers at the analysis stage.

8. Data analysis and results

A qualitative analysis of each experiment session was performed, and then the results of all sessions were compared. The structure of the analysis was based on three main phases. In the

first phase, the behavior categories of young adults were defined using a scale related to the previous experiment on the children (Popescu, 2014). In the second phase, the qualitative data were transformed into quantitative data using the observational coding system. The percentages of represented behavior signals were calculated for each participant and group (Srnka & Koeszegi, 2007; Kuckartz & Rädiker, 2019, pp. 123–134). In the third phase, the behavioral variables of the participants and the groups were compared (Staffa & Zurakowski, 2020; Troendle et al., 2012).

8.1. Phase 1: definition of behavioral categories of young adults

After the two preliminary sessions, the observers discussed and agreed on the form of representation of behaviors. Each observer observed and transcribed the behavior signals of the 24 participants in 8 experimental groups, marked a classification of all observed behavior signals, and allocated them into variables for quantitative data analysis. The process of identifying the variables consisted of: (1) what does the behavior signal mean? (2) How can they group the variable? (3) Do behavior signals of young adults during the creative task represent the same variables defined previously?

The results of this analysis are represented in Table 2. Contrary to the findings with children, the table of young adults does not present group conversation. This may be because verbal communication in children is minimal compared to adults; thus, it could be distinguished into a separate group. Due to verbal communication, adults construct group processes (Vygotsky, 2006; Piaget, 1995). Contrary to young children's speech, adult speech is socialized. Adapted information, criticism and derision, questions and answers, and argumentations are typical forms of socialized speech and language (Gerosa et al., 2006).

Table 2. Behaviors classification (source: created by authors)

Behavioral signal	Variables
One or more group members perform an action related to using *Lego DOTS* to produce the mosaic group work.	Creative action
All communications revealing the creativity/innovation/ experimentation process.	Creative thinking
Distraction is a phenomenon of moving away from the task and the dynamics of group work. For example, when the participant changes their objective and is no longer referred to as a creative action	Distracting action
All actions and communications aimed at establishing and maintaining relations functional to the group.	Group work
Actions and behaviors aimed at playing with created work or efforts to play with the *Lego DOTS*.	Play

8.2. Phase 2: statistical representation of qualitative data

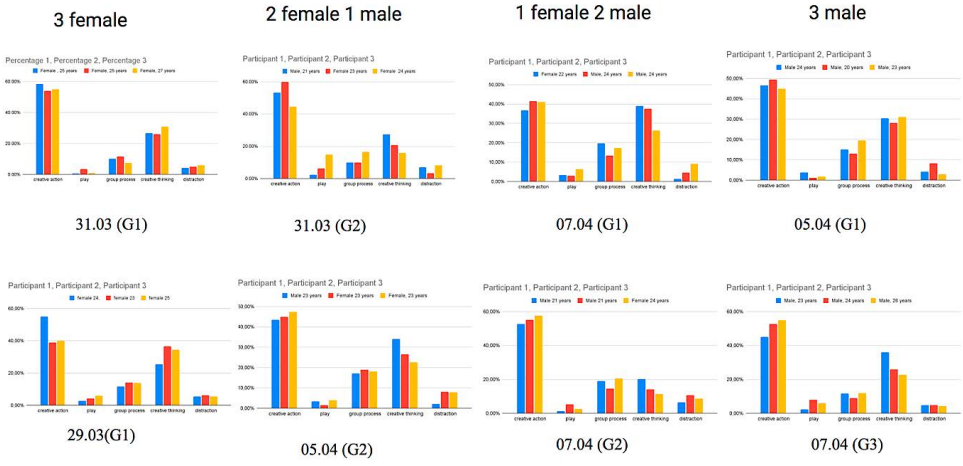
In the second phase, a statistical representation of the behavioral signals observed by the three observers was done. Five corresponding numbers were used to represent the five variables: creative action (1), play (2), group process (3), creative thinking (4), and distraction (5).

For each session, a three-page excel document was created, and the three observers inserted their observations for each participant in the eight sessions. To proceed with quantitative analysis and get the median, each observer assigned corresponding numbers to the behavior signals of each participant. Here, the total count of each observed behavior was represented and calculated. The observers unified the final repeated number of each behavior signal of each participant by finding the median. The medians of the five variables for each participant were then converted into percentages. The results are presented in Figure 1. The median of the three observations represents dynamics during the creative task of each participant in the group. Each collar bar represents in percent behavior signals performed by each participant, including creative action, play, game process, creative thinking, and destruction.

Figure 2 shows the comparison of behaviors of the male participants to the gender of the participants. Creative thinking behavior signals were performed more times by male participants in groups with two female participants in the group (30.41%). On creative action, male participants performed higher in the group composed of only males (50.63%). In the group process, male participants scored higher in groups with one female (16.74%). The play behavior signals were higher in groups with one female (4.18%). Also, groups with one female were more distracted (7.69%).

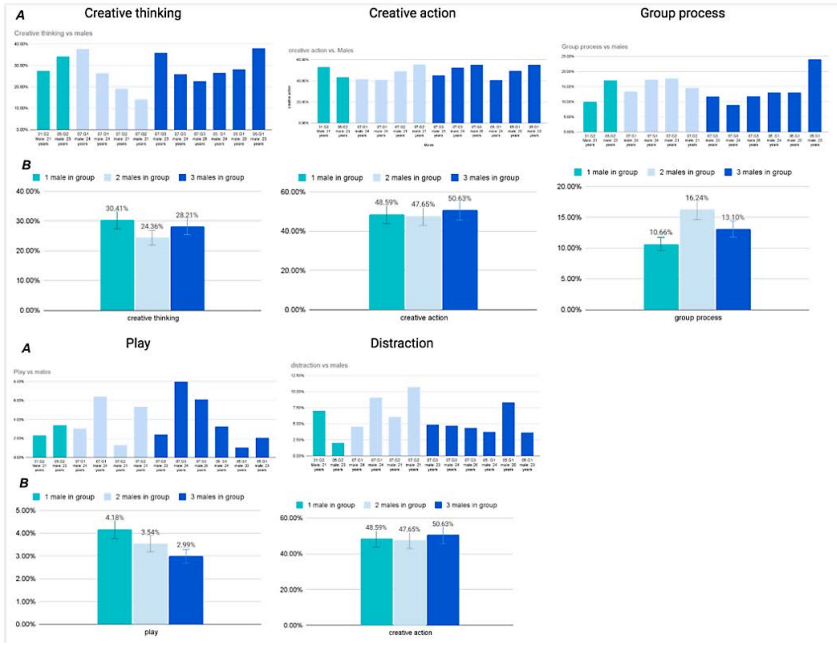
Figure 3 compares the behavior of the female participants with the gender of the participants. Creative thinking behavior signals were performed more times in groups that included only female participants (31.06%). The creative action of females was higher in only females groups (57.14%). Females scored higher in play in groups with two male participants (20%). The distraction action was higher when only female participants did the creative task together (5.45%).

This division approach helped in phase 3, where variables of the groups depending on their gender were compared.



Note: A. All participants; B. Median of the female participants with the gender of other participants.

Figure 1. Comparison of the groups based on the gender of participants (source: created by authors)



Note: A. All participants; B. Median of the male participants to the gender of other participants.

Figure 2. Comparison of the behavior of male participants to the gender of other participants (source: created by authors)

Note: A. All participants; B. Median of the female participants with the gender of other participants.

Figure 3. Comparison of the behavior of the female participants with the gender of other participants (source: created by authors)

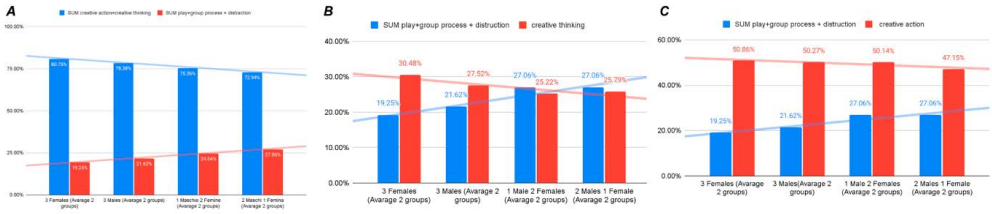
8.3. Phase 3: statistical analysis of the data

To analyze the results, the categories defined previously were grouped. Specifically: (1) group dynamics is made of group process, play, and distraction, and (2) creativity is made of creative thinking and creative action. To process the results of the two homology groups (*i.e.* only females, only males, two females and one male, one male and two females), we used the mean of the two median values.

Figure 4 (A) shows that the more intense the group dynamics, the lower the levels of creativity displayed. This means that the more the group attention was on the group dynamics, such as team building, having fun, socializing, and leading, the lower the group performed in its creative task. Figure 4 (B) shows that group dynamics negatively correlate with creative thinking. If group dynamics were growing, the creative thinking became lesser. Figure 4 (C) shows a negative correlation between group dynamics and creative action. If the group dynamics were growing, the creative action was performed less.

Figure 5 shows a positive relationship between creative action and creativity. The table below the figure elaborates on the difference. The higher the levels of creative thinking, the more creative action.

Figure 6 shows the relationship between the gender of participants and their orientation to creativity and group dynamics. The graph shows that the creative action of females was higher compared with male-only groups (57.14%). Group process was presented better by females in group with two males (20%). Therefore, female participants were more oriented to the creative task, while male participants were more oriented to group dynamics. Women were more task-oriented, and men were more process-oriented.



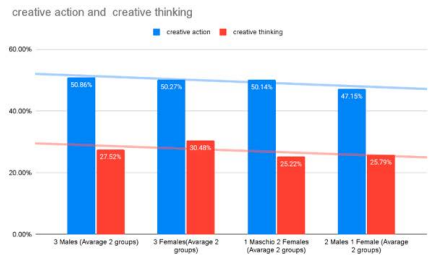
	3 female	3 male	1 male 2 female	2 male 1 female
Difference between 2 median	61.5 %	56.76%	50.72%	45.88%

	3 female	3 male	1 male 2 female	2 male 1 female
Difference group dynamics and Creative thinking	11.23%	5.9%	1.84%	1.27%

	3 female	3 male	1 male 2 female	2 male 1 female
Difference group dynamics and Creative action	31.61%	28.65%	23.08%	20.09%

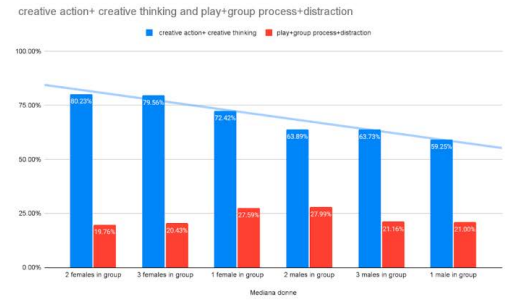
Note: A Relationship between the sum of creative process and creative action, and the sum of group of action and play, and distraction; B. Relation between the sum of group of action and play, and distraction and creative thinking; C. Relation between the sum of group actions, play and distraction, and creative action.

Figure 4. Relationship between group dynamics and creativity (source: created by authors)



	3 female	3 male	1 male 2 female	2 male 1 female
Difference between creative thinking & creative action	23.34%	19.79%	24.92%	21.36%

Figure 5. Relation between creative action and creativity (source: created by authors)



	2 female in group	3 female in group	1 female in group	2 male in group	3 male in group	1 male in group
Correlation between group dynamic and creativity	60.47%	59,13%	44.83 %	35.9%	42.57%	38.25%

Figure 6. Relation between the gender of participants and their orientation to creativity or group dynamic (source: created by authors)

Discussion

This paper aimed to explore how group dynamics influence creativity among young adults aged 20–25 through a mosaic-related experiment with the *Lego DOTS*. The study also focused on the role of gender on the creativity of groups. This section discusses the findings of this experiment compared to existing literature, grouping them by the original research questions (1–3).

Discussion part 1: relationship between group dynamics and creativity

An extensive literature has focused on factors influencing individual creativity with a narrow focus on how individuals tasked to work together generate creative output. However, there is evidence that personal attributes interact with situational variables to affect group creativity. Any comprehensive analysis of creativity should be predicated on the total interaction between people, tasks, and situations (Amabile, 1996; Slayton et al., 2019; Tromp & Sternberg, 2022; Zhou et al., 2020). This experiment indicated a negative correlation between group dynamics and creativity, rejecting hypothesis 1. This means that the more the group attention was on the group dynamics, such as team building, having fun, socializing, and leading, the lower the group performed in its creative task. This result could be interpreted as a loss of focus or diversion from the primary task, which reduces the time allocated to perform the creative task.

There is evidence that interpersonal relationships are essential in group creativity, and a collaborative environment increases the creative output. However, group members must be able to connect and coordinate with each other to effectively work as a team (Slayton et al., 2019). High levels of group dynamics, justified by the experimental situation of not knowing each other and having "to build a group"in the here and now, may increase the time taken to perform the given task within the allocated time, reducing the productivity of the creative task. Thus, there is a need to investigate this relationship further by comparing groups of people who are familiar with each other and groups who are not. Additionally, group dynamics

may influence creativity by constraining divergent thinking due to factors such as self-perception where group members self-censor and also choose not to share their creative ideas with the group (Meyer & Plucker, 2022). Furthermore, as argued, each component – person, task, and situation – plays an important role and can also serve as a compensatory function. A person who exhibits low creativity in a task, for example, may become more creative as a result of the right situational cues, such as group membership (Tromp & Sternberg, 2022).

Discussion part 2: relationship between creative thinking and creative action

The findings of this study were that there was a positive correlation between creative thinking and creative action, supporting hypothesis 2 of this study. The higher the levels of creative thinking, the higher the creative action. This result is evident from the outcome of groups of females only, who scored highly in both creative thinking and creative action.

High levels of creative thinking mean that the individuals spend more time figuring out the means of accomplishing the task, thus increasing the productivity of creative action. It also allows for the individuals to reflect more on the task at hand and the process of creation. Creative thinking is one of the major processes of the creative process. It is an important competency that must be possesed to help individuals make decisions (Fitrianawati et al., 2020; Glaveanu et al., 2020). These findings correspond to previous studies that have found a positive relationship between the two. For example, Meitiyani et al. (2020) argued that creative thinking allows students to investigate the problems at hand and leads them to identifying and considering the most appropriate actions to take. This enhances their problem solving skills and also their creativity.

Creativity has been viewed as a function of tasks, defined as the specific problem that a person is attempting to solve creatively (Tromp & Sternberg, 2022). Creative actions can have an impact on processes and outcomes that affect multiple levels of analysis, as well as solve dilemmas that arise during the creative process. One could even argue that creative actions are the distinguishing features that separate successful creative solutions from less noticeable efforts. In situations that encourage creative action, people are more likely to choose familiar behavioral options that are relatively more appealing based on their previous success, relative ease, and certainty. Ford (1996) argues that in such situations, new creative actions are unlikely to emerge unless they are expected to result in personal consequences that are preferable to familiar behaviors. This course of action would have impacted the results obtained on the relationship between creative thinking and creative action. Familiar behavioral options may arise from familiarity with the group members, or previous experiences with such tasks. This familiarity, would be similar to what Simonton (2018), argued to be non-creative ideas, such as routine, reproductive, or habitual ideas and incidental response bias; which were not assessed in this study.

Discussion part 3: relationship between the gender of participants and their orientation to creativity or group dynamics

The hypothesis that male participants would be more oriented to the creative task whereas female participants would be more oriented to group dynamics was rejected. The assumption was that men are more task-oriented than women, who are culturally process-oriented. Out

of necessity, women have established their attention to behaviors, attributes and feelings to compensate for their social subordination position (Berson & Berson, 1995; Halpern, 2014). On the contrary, the study's results indicated that females were more oriented to the creative task while males were more oriented to group dynamics.

Females displayed higher levels of creative thinking behaviors than male participants. As mentioned in the beginning, there have been inconsistencies in findings on gender differences in creativity across several studies. These differences in creativity could have been due to varying issues ranging from intrinsic to extrinsic factors such as the motivation of the individuals and environmental issues that cannot be disregarded (Abraham et al., 2021). As Meyer and Plucker (2022) emphasise, demographic diversities do not influence group creativity but the factors such a diversity of abilities and persectives have an influence. Another issue could be due to the sense of belongingness in the groups. As previous studies have argued, belongingness and identity with a certain group increases the likelihood of participating in such creative tasks in group settings (Adarves-Yorno et al., 2006). Our results highlight the need of further investigation recruiting males and females with equal levels of baseline, so individual creativity does not affect that of the group.

Conclusions

Despite its limitations, this study has attempted to bridge the gap between group dynamics and creativity, focusing on gender influences. The objective of the study was for the participants to complete the creative task and clearly, it motivated the participants. It would be important to anlyse what behavior signals that the group performed but that did not contribute to the achieving the objective. Furthermore, it would be important to compare the behavioral signals observed in this study with technological instruments to perform creativity.

The research team is currently analyzing the observation processto study the observers' influence on the group dynamics and therefore how the larger group (made of experimental subjects and the observers) affect the creativity process. In the future, there is a need to optimize the observation form and propose a technological solution such as an application that could simplify the observer's work. Ways to standardize the observation of group dynamics in connection to creative settings and tasks are under examination and will be the object of a future paper.

Limitations of the study

There are numerous essential aspects along which teams should be studied, such as their size, how work is distributed among their members, and the similarities and differences in the members' experiences and backgrounds (Klug & Bagrow, 2016). This study did not focus on these characteristics of the participants, yet these factors could have an influence on group behaviors. Specifically, as previously mentioned, the assessment of individual creativity prior to the group task, could allow a further study to draw a baseline and investigate the relationship between individual creative factors, the experience of group dynamics and the creative process of the group.

Another limitation of this study is that it did not analyze the result of the creative tasks. The focus was more on the behavioral cues and not the end product. Future studies should define more strategic ways of analyzing creative results in such experiments to achieve a better comparable analysis. Additionally, there was no control group to compare the behaviors observed. Having a control group allows to identify if the group setting has added value to the creative process (Paulus, 2000). The study also did not focus on the non-creative behaviors, which would be a great comparison across the groups. Another limitation is related to the Hawthorne effect (the observers' influence) on the relationship of group dynamics with creativity (Gillespie, 1993). The researchers did not put into consideration how the presence of observers would have influenced the behaviors of the participants.

Ethical approval

The DP in RCS provided ethical approval of the experiment in the 2 May, 2022 session of the Doctoral board on the basis that all the participants would sign an informed consent and that privacy and confidentiality of all data collected would be maintained as per the European laws on privacy and data management (Data Governance Act, COM/2020/767).

Acknowledgments

We wish to thank all the participants of this experiment, and the LMIC, specifically the laboratory *Scintillae* team for allowing us to use their facility, equipment, and *Lego* materials.

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