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Group/ungroup/regroup: A dynamic assemblage of collectivity in drawing ideas

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Abstract
This paper aims to elaborate further on collectivity in architectural design education, especially in formulating design problems and ideas. Many studies have looked at important aspects such as communication, group management, and cooperative orientation or the quality of the collaboration that takes place. However, only a few studies have looked into the specific aspects of teamwork related to how group formation mechanisms relate to the design process. This study was conducted in the form of a design workshop as the main activities. A case study was also employed in the research strategy, mainly to provide context to the issues that participants responded to in the design workshop. The findings of this study are dynamism related to the collaboration that is based on the non-linearity of thinking between individuals, the composition of group members that changes throughout the activity process, and the impermanence of groups, from the problem formulation phase to the drawing ideas. This study shows that the group formation mechanism can take place dynamically without any conditions set strictly in the activity, but rather by giving designers the freedom to discuss and develop their working mechanism.

Keywords
Collaboration, Drawing ideas, Dynamic mechanism, Group formation.

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1. Introduction

In architectural and other design works, collective and collaborative processes are essential and relevant. It is not only because designers need to face the challenges in today's fast-paced global market (Feast, 2012) but also because wicked design problems are best solved using the understanding that the knowledge needed to solve them does not reside in one head or 'author' (Protzen & Harris, 2010). There is a fundamental difference between the view that design is the work of a single author and a non-single author, including in architectural design. The single-author view emphasises the perfection and separation of the designer/architect's position with full authority (Alberti, 1992; Carpo, 2008), while the non-singular author view is based on the critique of permanence and the unification of the work with the author's authority (Barthes, 1977), opportunities for collectivity in the presence of work (Rudofsky, 1964), and reality conditions that always involve users (Handa, 2015) or involve a social construction (Foucault, 1977).

Studies on design collaboration have been conducted with key themes such as teamwork, building information modeling framework, evidence-based design practice, and modality-supported collaboration design, as expressed in the study from Idi & Khaidzir (2018). In themes related to teamwork, studies have looked at important aspects such as communication, group management, and cooperative orientation (Feast, 2012) or the quality of the collaboration that takes place (Safin et al., 2021). However, only a few studies have looked into the specific aspects of teamwork related to how group formation mechanisms relate to the design process.

This paper aims to elaborate further on collectivity in architectural design, especially in formulating design problems and ideas. Furthermore, this research will focus on how possible patterns of collectivity formation occur in design activities and how collective processes will influence or affect the co-evolution process of formulating design problems and ideas. In collective design activities, collaboration is often interpreted only as a condition where two or more people working together (Leifer et al., 2018). However, collaboration is also about how an individual positions himself against other individuals and the forms of relationships that can be created. In that case, there is the potential to discover several things, such as how relationship mechanisms between individuals take place, how the mechanism of group formation occurs, and what underlies the formation of groups and their activity.

This study was conducted during the main activity in the research by design scheme, a design workshop involving eight final-year undergraduate students as participants or designers. The design workshop focused on design thinking, notably formulating design problems and solutions. The researcher observed their working process and engaged in progress discussion activities at specific times. As a case of mutual intention, the design workshop used the condition of Kampung Kupu in Depok, West Java, Indonesia, as a case study to be explored.

2. Literature review

There has been a shift and development in the discipline of architecture regarding the author as the actor who produces architecture. This shift takes place from thinking that emphasises the existence of a single-author to the potential of a multi-authors process. The existence of a single-author relates to the strict separation between the designer and the builder and maintaining the design's perfection (Alberti, 1992; Carpo, 2008, 2011). The separation between design and execution makes it impossible to disrupt the architect's position as the author with full authority (Handa, 2015).

The separation between individuals can relate to several positions on the concept of individualism. From a view that sees the existence of physical boundaries between individuals (closed individualism), which then defines that every human being is indeed separate, to an understanding that all humans are one and what defines the difference is only their respective perspectives in seeing and perceiving

things (open individualism) (Kolak, 2004). This condition can be the basis for why humans have the same view of something, even though they see it from different perspectives.

The shift in perspective from singular to multi-authors can be related to the tendency of humans to form certain groups. The primary things related to group formation are racial and gender similarities and due to similarities in activities and goals (Ritchie, 2018). Michel Foucault also put forward critical thinking about singular author perspective by posing fundamental questions and argues that authorship should be understood as a social construction (Foucault, 1977). According to Foucault, the mechanism of authorship with this understanding will be helpful to reveal the mechanism of society. The critique of the existence of a single author in architecture influenced the development of technology and user-orientated design methods (Anstey, 2007). Technology development then allows for 'self-generate design,' a new form of the allographic nature of drawing. User-centered design, on the other hand, allows various parties to participate in the design process.

The potential of the multi-authors condition opens the possibility of collaboration in architectural design. The words collective and collaboration are often related, although they emphasise different meanings. Collaboration relates to collective action involving individual strengths, while collective relates to collective action with a disregard for individuality (Kester, 2011). More important than understanding the definition of collectivity, however, is what underlies the presence of collectivity itself (Hess et al., 2018) as it will intersect with more fundamental aspects. The application of collaboration is not only in the context of the level of participation of parties outside the designer (Arnstein, 1969) but also in the context of how the multi-authors mechanism works in the design process. Collaboration in the design process can blur the boundaries of the position and knowledge of each participant and create collaborative negotiations (McDonnell, 2009). The other potential is because collaborative work is needed to capitalize on the strengths of different stakeholders to develop shared knowledge and to better deal with the complex combinations of interacting activities, behaviors, and relationships that affect design work (Feast, 2012).

Previous studies on collaboration and collectivity in architecture design have been carried out to see the potential for interaction techniques (Grossa & Stefanelli, 2009), quality of collaboration process and its interplay with design project evolution (Safin et al., 2021), process of negotiations (La Marche, 2014), or authorship and its relation with technology (Slavinsky, 2011; Weir et al., 2018). However, more must be done to explore the mechanisms related to forming groups in collaborative activities.

3. Research method

3.1. Research framework

This study was conducted with a qualitative approach, in the form of a design workshop using research and design interrelation (Frayling, 1993; Hill, 2022; Till, 2012; Verbeke, 2013) which opens up new possibilities and produces exploratory findings. Design studios often focus on individual projects by a single author (Thompson, 2015), so that this collaborative design workshop planned in this study aims to create collective learning, which capitalise on one another's resources and skills (Chiu, 2000).

The design workshop was organised using frameworks to elicit collaboration from the participants. These frameworks are related to the relatively short duration of the activity, which is six days, and the relatively limited number of participants, which is eight people. The duration and number of participants are conditioned as a constraint, which provides limits while potentially triggering the ability of the participants to collaborate. The duration of work is planned according to the research strategy, which seeks to see how they manage between working individually and in groups. The participants involved in the design workshop are final-year undergraduate students with sufficient skills and knowledge and the maturity to make

decisions or collaborate in activities that are rigorous in duration. The number of students involved allowed the researcher to make fairly intense observations within the short duration of the workshop. The research will look at the relationship between their design thinking process and their working mechanisms, both individually and in groups, and observe the dynamics in the relationship. In this study, the researcher was not one of the participants but rather set the stage for the activities, observed, and facilitated the reflection activities along with the actions carried out by the participants.

3.2. Research strategy and analysis

The strategy of the design workshop activities was implemented by dividing the activities into two main phases, namely field observation and design activities. The design activities can be broken down into problem formulation and idea establishment phases, with a presentation and discussion in between. Combining individual and group activities, also part of the workshop implementation strategy, created a particular working mechanism for the participants. The agenda set by the researcher in this workshop was that the participants had to start analyzing their observations individually. After presenting the analysis results, they had to continue forming groups. The number of groups and the composition of their members were deliberately not set so that participants had the freedom to determine their collaboration strategy. This condition also aimed to see how the participants realized the importance of leadership. Most collaboration requires leadership, although the form of leadership can be social within a decentralized and egalitarian group (Leifer et al., 2018).

A case study was also employed in the research strategy, mainly to provide context to the design workshop. Kampung Kupu and Nara Kupu Village (NKV) are case studies that workshop participants will respond to (Figure 1). Kampung Kupu is a residential village located in the Sawangan area, West Java and has the potential for agriculture and farming. Since 2019, NKV, an agro-lifestyle facilities was built there and stands on 3 hectares of land. NKV with its several facilities and platform for several activities involving the society, has the potential to become a generator for improving the quality of the society and the environment of Kampung Kupu. However, not many significant changes have occurred in the environmental or social quality of the society. The presence of NKV management as stakeholders is an important factor in the workshop, especially in data collection activities. Stakeholders can provide information about the background and conditions of Kampung Kupu from the begin-

Figure 1. *Kampung Kupu and Nara Kupu Village as case studies in the design workshop.*

ning of NKV's existence to the present. Stakeholders' perspectives based on daily experiences were also part of the discussion in the middle of the workshop process to condition the iteration and divergent thinking process.

The case studies are then positioned to be observed by participants in field observation phase using several data collection techniques such as sketching, photography, and making notes on the information obtained. Sketching is an appropriate technique to use in observation because it has a speed factor that is also its strength (Farrelly, 2008). In observational activities where the main activity is seeing and observing, the technique of applying sketches can also vary because doing so can involve the stimulation of visual memory and the kinaesthetic connection between thought and the act of drawing (Charitonidou, 2022). In addition to drawing, photography and video have the potential to push further the possibilities of representation (Riahi, 2017). These forms and techniques can also become part of fragmented, juxtaposed information and become a montage (Eisenstein et al., 1989, 2010). The use and combination of various forms, such as drawing, photography, and writing, opens up the possibility of not limiting the representation of architecture to a particular form (Manolopoulou, 2005).

Based on the case study, the research will focus on design thinking activities that will be conducted by the participants in formulating design problems and ideas. In the condition of working together, design thinking has an essential role because it can change the way people and their coworkers innovate, how they work in a team, and in which way it affects the quality of their output (Leifer et al., 2018). Data collection by the researcher in the workshop was done by taking notes on the main points/ideas of the participants' work either at the individual or group stage. This note-taking was also carried out throughout their discussions, presentations, their act of forming groups, and was complemented by recording archives of graphic presentations and sketches from participants. The recorded data was then analysed by clustering, interpreting, aggregating categories, pattern correspondence, and developing generalisations (Creswell, 2007; Stake, 1995). The analysis, which looked specifically at how participants formed groups and how this related to their design thinking process, was carried out by drawing up diagrams. The diagrammatic method of analysis aims to outline, and connect the parts (Zdebik, 2012). With its abstractive nature (Vidler, 2000), diagrams in this study are applied to read abstract patterns of connectedness that form a system of interactions and confrontations between aspects (Alexander, 1964; Garcia, 2010; Manolopoulou, 2005).

4. Result

This study found a dynamic process throughout the workshop, related to how participants conducted their design thinking process towards the case study. The results can be described through three sections that show how they formulated problems and solutions individually and collaboratively.

4.1. The problems formulation

In the individual activity, each participant analyses their observations

Figure 2. *Individual works presentation and discussion.*

and presents their analyses to each other. Each participant analyzed different scopes according to their point of view and used different techniques (Figure 2). Almost all of them used photography in their analyses, using different techniques such as photo-based mapping, photo-based diagrams, or photo collages. However, some participants used sketches and text-based diagrams. Table 1 compares the scope of analysis, problem focus, and techniques used by students number S1 to S8.

Participants were asked to continue the activities through collaboration after conducting individual analyses. They carried out a strategy by forming a large group of eight people to discuss and formulate the design problems that had been analyzed individually into certain problem groups (Figure 3). They did this because they believed the analyses had similarities and complementary differences. This collaboration blurred the lines of thinking between individuals and led to negotiation (McDonnell, 2009). The group developed a design problem formulation consisting of three keywords: hidden, separation, and alienation. They formulated these three keywords based on their view of what underlies the visible problems.

The three keywords became the basis for the participants to form new groups and divide the large group personnel into three smaller groups. These groups were Group A, which consisted of S1 and S5; Group B, which consisted of S2, S4, and S7; and Group C, which consisted of S3, S6, and S8. Group A elaborated on the keyword 'hidden,' Group B elaborated on the keyword 'separation,' and Group C elaborated on the keyword 'alienation.' The elaboration aimed to sharpen the formulation of design problems to be presented and discussed in a forum with stakeholders. Table 2 shows the composition of group members, the relationship between individual problem formulation and the keywords of problems elaborated in groups, and the negotiation of techniques used in group elaboration. At this stage, each group member communicates intensively by iterating key-

Table 1. *Individual analysis of design problem.*

Participants	Scope of analysis	Problem formulation	Techniques
Student 1 (S1)	macro, physical aspects, condition inside the NKV and environment	- the existence of NKVs is relatively hidden - Difficulties of accessibility	- Photo-based mapping
Student 2 (S2)	macro-micro, physical & non-physical aspects, condition inside the NKV and environment	- difficulties of accessibility - unclear entrance - residents' disregard for the environment	- diagram - photo collage
Student 3 (S3)	macro, non-physical aspects, interdependence of NKV and environment	- lack of participation - lack of harmony - lack of perceived usefulness	- photo-based diagram - photo collage
Student 4 (S4)	macro-micro, non-physical aspects, comparison between NKV's program and characteristics of environment	- empowerment gap - Private and public sphere gap - Inappropriate strategy & approach	- photo-based diagram - photo collage
Student 5 (S5)	macro, physical aspects, condition inside the NKV and environment	- difficulties of accessibility - lack of connectivity between NKV & environment - lack of program expansion	- photo-based mapping
Student 6 (S6)	macro, physical & non-physical aspects, infrastructures & characteristics of society	- poor infrastructure quality - human character that is reluctant to change - lack of systemic intervention	- diagram - Photo-based mapping
Student 7 (S7)	macro, physical & non-physical aspects, relation of inside & outside	- gap between NKV & environmental quality - relatively large separation	- sketches - diagram
Student 8 (S8)	macro-micro, physical & non-physical aspects, contextuality of NKV to environment	- lack of contextuality - lack of fit between program & environment - conditions of alienation are created	- sketches - diagram

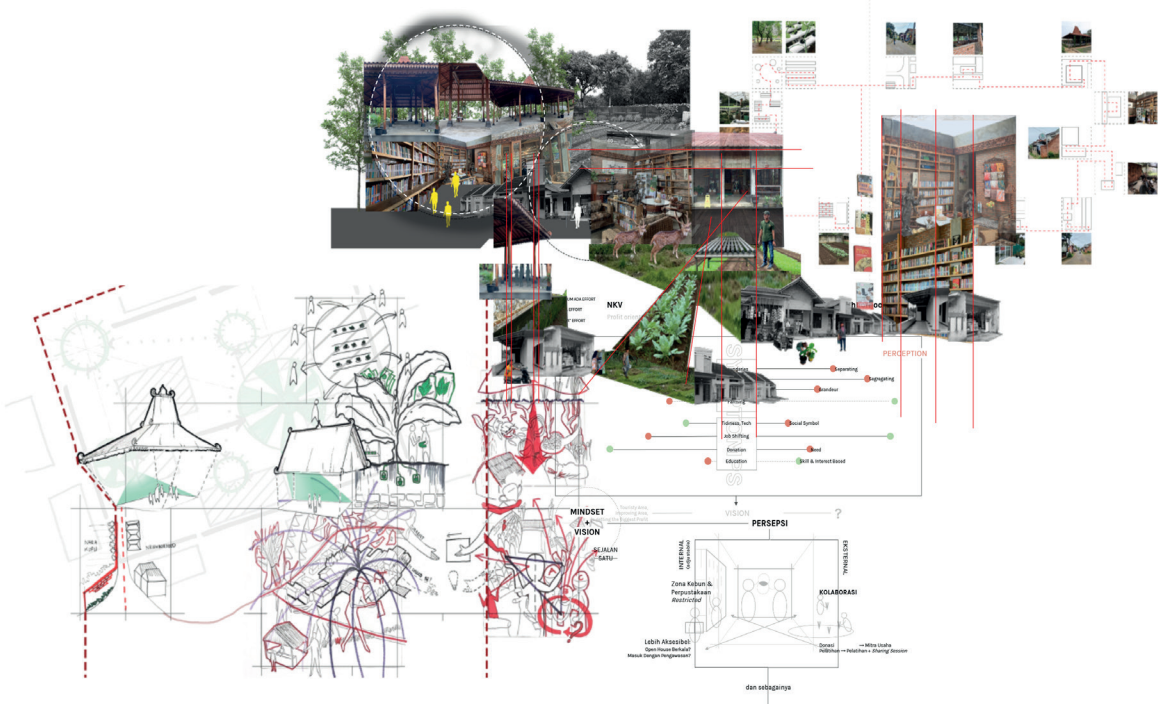

Figure 3. *Group works of problem formulation.*

words back to each individual's view and can use specific techniques. This iteration is essential because of the need to respond to the nature of design problems that always have the potential to trigger new design problem symptoms (Rittel & Webber, 1973).

4.2. The interchange

The interchange session is for participants to present and discuss with stakeholders about the analysis and formulation of the problems they have observed. This relational activity is also to share the knowledge that has been elaborated and get input through interactive mechanisms for follow-up (Rieger & Young, 2015). The presence of stakeholders in this stage is quite important because it will also present iteration again through communication between parties that takes place to build shared understanding (Gao et al., 2023). In addition, these conditions allow for a widening/divergent process again on design problems that have been formulated in a narrow/convergent manner (Cross, 2006).

At this stage, stakeholders responded to the analysis of the student team, especially regarding the three keywords of the problems raised. The responses and discussions revealed that NKV has a master plan that tries to place the zoning of facilities into two layers of areas/programmes, namely private (P1) and public (P2), but has not been implemented optimally. The discussion developed a reading of these layers into three, with the kampung's environment as the third programme layer (P3). With this reading, the perspective on NKV and Kampung Kupu is no longer separate and potentially more integrative when formulating ideas. The result of this stage is that participants will formulate ideas as solutions to problems based on the concept of NKV zoning and its position in the environment. Reading this concept leads to layers of programmes that can be further elaborated.

4.3. The idea establishment

The final stage of the workshop activity was to formulate ideas. At this stage, the participants formed large groups again with all of their members to elaborate on the discussion notes from the previous stage. The large group looked at the concept of layers. Then it criticised that the reading of area and programme layers is not only three but four layers, where between layer P1 (the most private area of the NKV) and P2 (the outermost area of the NKV) can be defined as an in-between layer

(P1.5) where the existence of gardens owned by NKV can be disaggregated in more detail.

The group then formulated two key ideas to respond to the problem: 'extending outwards' and 'activating society.' The first idea was intended to solve the hidden condition and change the perception of alienation associated with NKV. In contrast, the second idea solves the separation condition and builds a closer relationship between Kampung Kupu and NKV. These two key ideas then became the basis for the participants to form a new group again for the elaboration process (Figure 4). They divided the large group personnel into two small groups. The groups were group D, which consisted of S2, S3, S7, S8; and group E, which consisted of S1, S4, S5, S6. Both groups could use the required techniques without necessarily being the same as in the previous stages (Table 3).

In formulating this idea, Group D developed the keyword 'extending outwards' to spread the 'footprint' of NKV to the neighbourhood. In other words, the mindset of the idea is from P1 to P3, which aims to change hidden conditions, establish connections, and form familiarisation. This idea is easier

Table 2. *Comparation and relation between individual and group thoughts.*

Groups	Participants	Problem Formulation (Individual)	Problem formulation (Group)	Techniques (Individual)	Techniques (Group)
A	Student 1 (S1)	- the existence of NKVs is relatively hidden - Difficulties of accessibility	Hidden (visually & physically)	- photo-based mapping	- photo collage - Photo-based mapping
	Student 5 (S5)	- difficulties of accessibility - lack of connectivity between NKV & environment - lack of program expansion		- photo-based mapping	
B	Student 2 (S2)	- difficulties of accessibility - unclear entrance - residents' disregard for the environment	Separation (gap of mindset & perception)	- diagram - photo collage	- sketches - diagram
	Student 4 (S4)	- empowerment gap - Private and public sphere gap - Inappropriate strategy & approach		- photo-based diagram - photo collage	
	Student 7 (S7)	- gap between NKV & environmental quality - relatively large separation		- sketches - diagram	
C	Student 3 (S3)	- lack of participation - lack of harmony - lack of perceived usefulness	Alienation (form, program, atmosphere)	- photo-based diagram - photo collage	- photo collage - photo-based diagram
	Student 6 (S6)	- poor infrastructure quality - human character that is reluctant to change - lack of systemic intervention		- diagram - Photo-based mapping	
	Student 8 (S8)	- lack of contextuality - lack of fit between program & environment - conditions of alienation are created		- sketches - diagram	

Table 3. *Comparation and relation between group works of problem and solution formulation.*

Group	Participants	Problem formulation	Techniques	Group	Participants	Idea formulation	Techniques
A	Student 1 (S1) Student 5 (S5)	Hidden (visually & physically)	- photo collage - Photo-based mapping	D	Student 2 (S2) Student 3 (S3) Student 7 (S7) Student 8 (S8)	Extending outwards (minimum participation of society, concrete & instant solution)	- photo collage
B	Student 2 (S2) Student 4 (S4) Student 7 (S7)	Separation (gap of mindset & perception)	- sketches - diagram				
C	Student 3 (S3) Student 6 (S6) Student 8 (S8)	Alienation (form, program, atmosphere)	- photo collage - photo-based diagram	E	Student 1 (S1) Student 4 (S4) Student 5 (S5) Student 6 (S6)	Activating society (certain degree of participation of society, long-term solution)	- photo collage - diagram

to do and can be implemented immediately because it does not require much participation from society but is the responsibility of NKV. Group E developed the keyword 'activating society' with the opposite principle: spreading the 'footprint' from P3 to P1 and prioritizing community collaboration with a certain degree of participation. This idea is more challenging because it requires a longer process, needing to design community collaboration and participation schemes. However, it will have a positive impact in the long term.

The idea of 'extending outwards' is proposed to be the construction of public facilities such as musholla, community cooperatives, and neighbourhood guard posts, all of which have the characteristics of NKV. In addition, running a mobile library programme or road shows and school collaborations would also be possible under this idea. While the idea of 'activating society' is proposed to be in the form of workshops, bazaars, festivals, and various activities whose organisations respond to the needs and aspirations of society.

The workshop strategy, which did not stipulate the division of groups and instead gave participants the freedom to organise their mechanisms, led to a dynamic and complex process of collaboration and collectivity. This dynamism is related to the collaboration that is not only based on the linearity of thinking between individuals, the composition of group members that changes throughout the activity process, and the number and form of groups, from the problem formulation phase to the formulation of ideas. This condition occurs without any organisation by the leader among them but rather from the social leadership of their togetherness (Leifer et al., 2018).

5. Discussion

5.1. Non-linear collaboration within drawing ideas

Collaboration and collectivity in design cannot only be linear in that they begin with the condition of forming a group and working within that group throughout the design process, but can be cyclical and dynamic concerning the changes the group can make. This non-linear process creates complex combinations of interacting activities, behaviours, and relationships that affect their design work (Feast, 2012). The dynamism in the process also forms multi-layers in collectivity, both concerning the thought processes and actions implemented in the techniques they use.

The nonlinearity of thought is evident from the group's composition, which was not only composed of indi-

Figure 4. *Ideas representation of extending outwards and activating society.*

viduals with a similar scope of analysis or formulation but also between individuals with different formulations and techniques. This condition happens at the problem and idea formulation stages (Figure 5). At the individual works, five participants analysed at the macro level (S1, S3, S5, S6, S8), and three participants analysed at the macro-micro level (S2, S4, S7). Two participants focused on analysing physical aspects (S1 and S5), two participants focused on non-physical aspects (S3 and S4), and four participants focused on both physical and non-physical aspects (S2, S6, S7, S8). Some participants tried to look at the problem by analysing the condition and quality of the NKV and the village environment (S1, S2, S5, S6). However, some participants analysed the relationship between the two (S3, S4, S7, S8).

Participants did not divide members linearly according to their scope of analysis when forming groups A, B, and C to elaborate on the keywords hidden, separation, and alienation. However, they opened up the possibility of different individual analyses to discuss the chosen keywords. This non-linearity continued when they formed groups to formulate ideas, where the two keywords of ideas needed to add up to the keywords of the problem formulation. So, the ideas initially distributed in three groups had to be redistributed into two groups.

Non-linearity of collaboration also occurs in their techniques, from working individually to working in groups. Group A, whose members used similar techniques in the individual stage, tried different techniques when working together. Group B, which had two members (S2 and S4) using the photo collage technique at the individual stage, switched to the sketching technique used by the other members (S7). Group C, which had three members with different individual techniques, used photo collage as their group work method. This negotiation of techniques also took place when they changed their composition to groups D and E, wherein the final stage, they only used photo collage and diagram techniques.

5.2. Temporal position and relation within collaboration

In collaborative design, individuals will work together with others in the framework of working together. Interaction and communication between them will merge their position into a relational form. Communication is vital in collaborative design, especially as a medium for thinking together and building shared

understanding (Gao et al., 2023) and also as the basis for creating a dialogue between participants and is related to the relative position of individuals in a group (Harty & Sawdon, 2017). Harty & Sawdon state the position of individuals as 'me' and 'you' to show ourselves and the existence of others outside ourselves, as well as the existence of a form of 'us' when both individuals work together. Although they discuss about the dialogue in the 'you-me-us' relationship, it is also interesting to see the relativity of the notion of 'you-me-us.'

During the workshop activities, the form of collaboration was not in pairs between two individuals but also between three or more individuals. The only group with two individuals was group A during the problem formulation stage (S1 and S5). The condition where the number of group members is three or more people will indirectly create a relative position regarding 'me' and 'you' because the presence of 'you' can be one or more people. The movement of individuals within different groups throughout the process also resulted in repeated redefinitions of 'me' and 'you' positions. The movement of individuals from one group at a particular stage to a different group at another also resulted in a different composition of group members (Figure 6). The condition is that each individual must finally always make adjustments and renegotiations because they are dealing with different colleagues.

The difference in the composition of members in groups A, B, and C with groups D and E shows the dynamism of individuals in positioning themselves to cooperate with different individuals. The change in composition brings a greater possibility of the need for adjustments in thinking between individuals or in making decisions. An iterative cycle of creative collaboration, agreeing to disagree until some concepts (ideas) are worth further attention, is necessary for design thinking (Leifer et al., 2018).

The complexity of the notion and position of 'me' and 'you' in the workshop also evolved, as the group in the position of 'us' was not only present but in several numbers. The groups formed

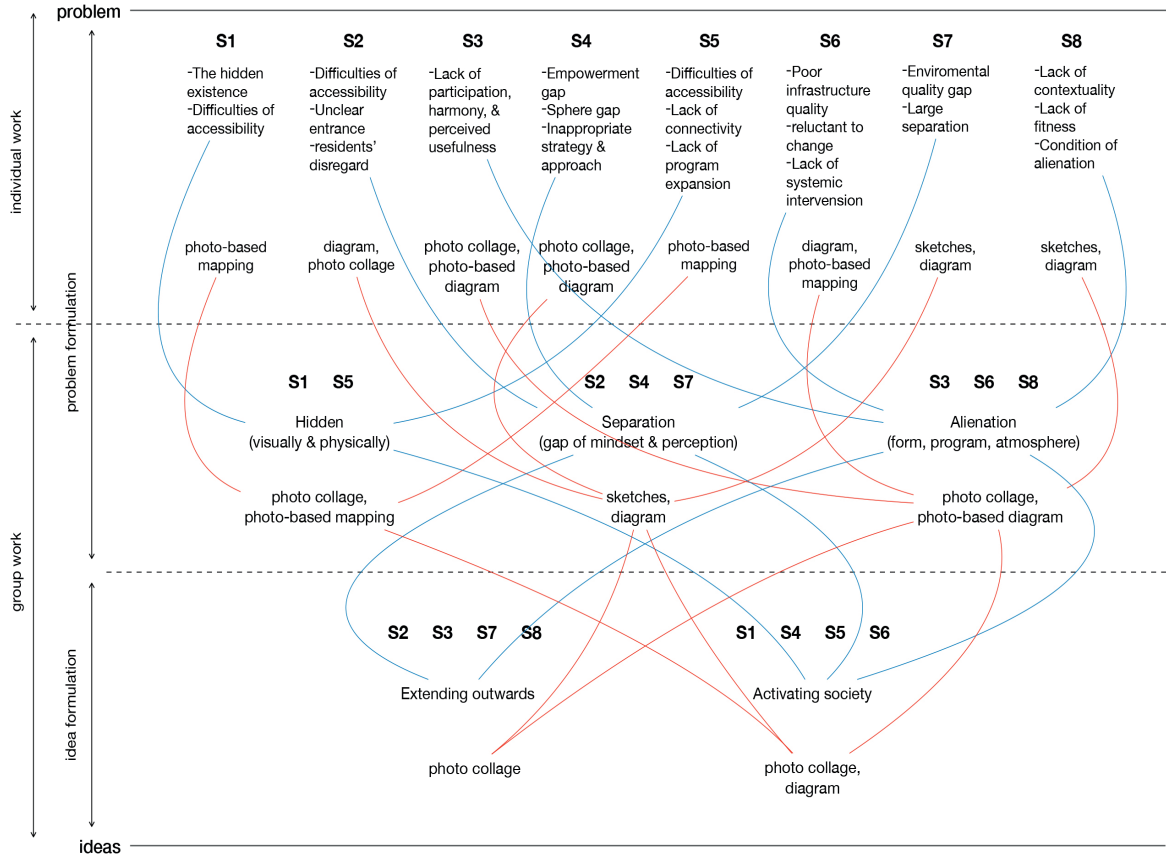

Figure 5. *The relation of thoughts and techniques.*

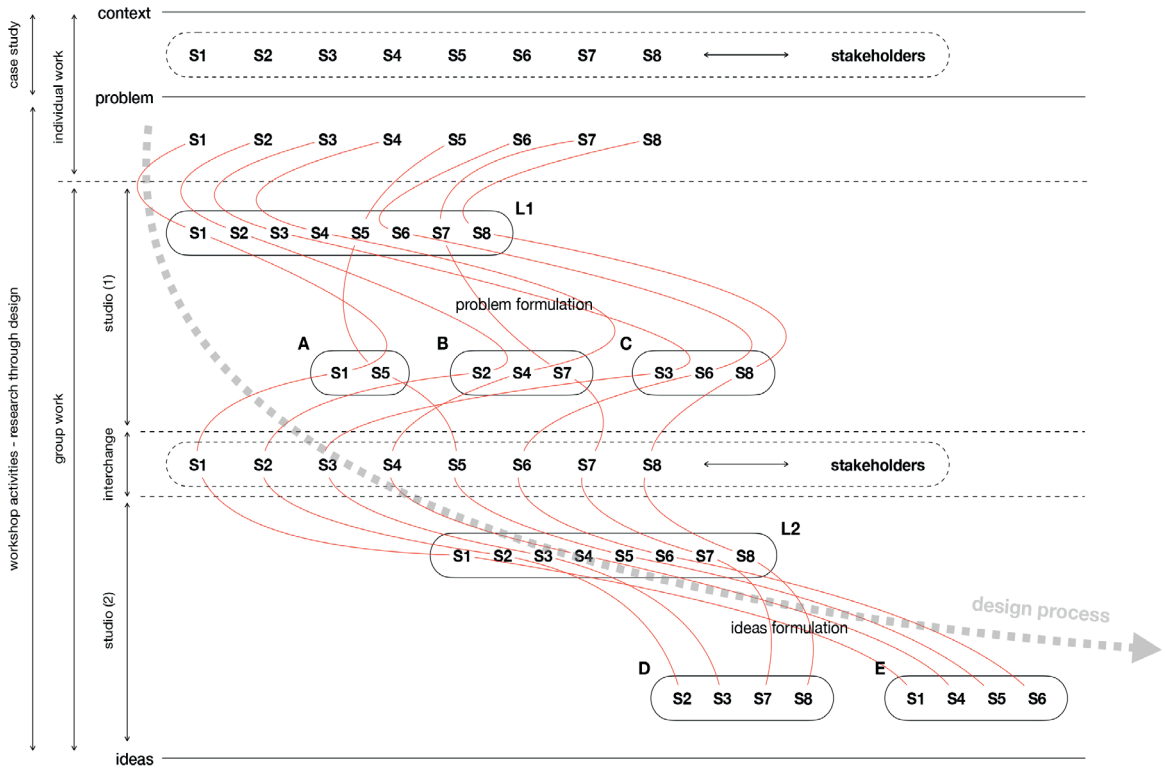

Figure 6. *The movement and composition of group members.*

and then involved in discussions when presenting each other's work indirectly created new definitions of 'me' and 'you,' where it was no longer in the sense of a single individual, but in the sense of one group with another group. The 'us' condition formed by the combination of individuals can become 'me' and 'you' again when positioned against another 'us' (group). This results in multiple positions and relationships in a collaborative activity related to its iterations.

5.3. Group impermanence within collectivity

The participants formed groups not only once from the beginning of the activity to the end but at least four times, and it took place dynamically and naturally without any specific instructions in the studio. This condition shows that in group form, the awareness of iteration and co-evolution of problem and solution is present collaboratively more intensely and naturally (Wiltschnig et al., 2013). The groups formed had different numbers in the two main phases (problems and ideas formulation). When formulating the design problem, they formed three groups, which made the number of group members different. One group had two members (Group A), and the other had three members each (Groups B and C). Meanwhile, when formulating ideas/solutions, they formed two groups (Groups D and E) with four members each.

The difference in the number of groups between the two phases is due to the need to adjust to the number of keyword formulations that they set in large groups. This condition shows that large groups in the problem formulation phase (L1 groups) and the idea formulation phase (L2 groups) are significant and not necessarily just a form of transition. The mechanism by which they formed the L1 and L2 groups also shows that each individual saw the importance of being positioned as 'one' entity, even though each of them had a point of view that could be different (Kolak, 2004). One of the arguments for the importance of large group formation is that it causes the composition of members in groups A, B, and C to differ from those in groups D and E. This composition shows the relativity of the position of each individual: as a person, their relationship with

other individuals, and their relationship within a group (Harty & Sawdon, 2017). L1 and L2 groups also indirectly divide the divergent and convergent grand schemes in the overall design process into having sub-divergent and sub-convergent in both phases.

The existence of L1 and L2 also presents a mechanism of group formation and the re-formation of groups that have been formed. The grouping and regrouping mechanisms are also due to ungrouping conditions that dismantle the group composition into individuals again, opening up the possibility of forming new groups (Figure 7). The ungrouping condition occurs when participants present and discuss with stakeholders before formulating ideas/solutions. Even though that stage is not a group activity, it is also a form of collaboration and collectivity because there is an interactive mechanism and knowledge exchange regarding decision-making (Rieger & Young, 2015) while also opening up a broader spectrum of 'ownership of the design' (McDonnell, 2009). The grouping-ungrouping-regrouping mechanism makes the presence of a group not positioned to be permanent but instead undergoes rearrangement and iteration. This mechanism takes place naturally along with and encourages the designer's response to present a co-evolutionary of problems and solutions in design.

6. Conclusion

In collaborative design, there needs to be an awareness that collaboration and collectivity are not only about how a group of people work together but also about the position and relationship between individuals and the mechanisms they use to form a group. This awareness will enrich the knowledge of collective and collaborative-based design, especially regarding the mechanism of design activities. The understanding that design thinking has an essential role because it can change how people work in a team can also work the other

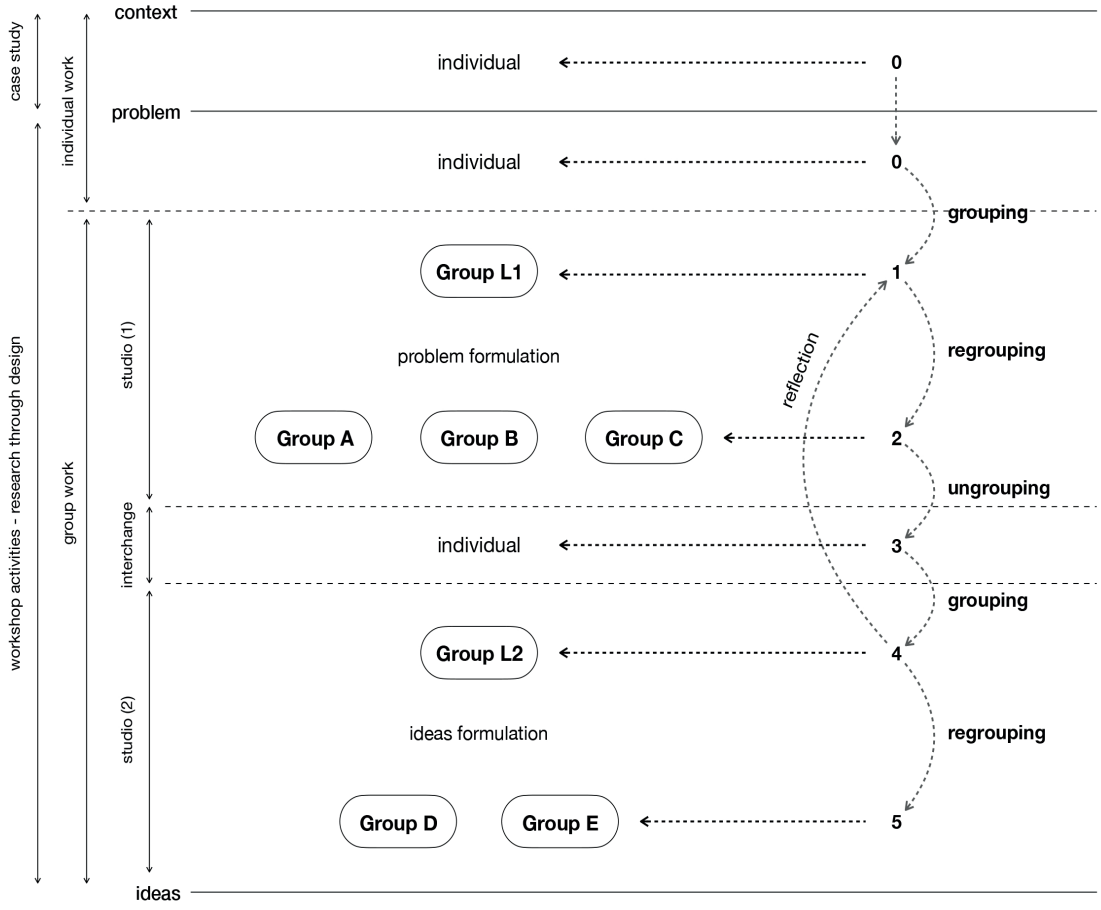

Figure 7. *The grouping-ungrouping-regrouping mechanism.*

way round, i.e., how people operate specific mechanisms in teamwork can influence their design thinking.

This study found a dynamic process throughout the workshop, related to how participants conducted their design thinking process towards the case study. The results can be described through three sections that show how they formulated problems and solutions individually and collaboratively. This study shows that in collaborative design activities, the group formation mechanism is related to the design process, both when formulating design problems and ideas. The connection is due to the need to carry out divergent and convergent processes in design, which opens up opportunities for the dynamics of working designers in groups. The group formation mechanism can take place dynamically without any conditions set strictly at the beginning of the activity, but rather by giving designers the freedom to discuss and develop their working mechanism. Furthermore, this study of collectivity that examines the dynamics of group formation can enrich essential aspects that affect the quality of collaboration, in addition to communication processes, management processes within the group, cooperative orientation, and task-related processes.

This study reflects on how collective action is essential in solving design problems and formulating ideas. In this study, the dynamic mechanism occurs in the form of grouping-ungrouping-regrouping actions related to how designers think collectively and use specific techniques in their processes. Collectivity allows for the enrichment of iterations in design thinking not only because there is a thinking process involving multi-authors but also because these multi-authors can form dynamic working mechanisms in their collaboration.

The findings of this study have implications for collaborative design methods, especially regarding how designers as individuals still have the freedom to work in groups based on dynamic workflows. Collaborative design can often obscure the uniqueness of individual thoughts and ideas due to binding rules or collaboration mechanisms. By applying a dynamic collaboration strategy, a static group existence is not the primary goal in the design process. Instead, the design flow that illustrates the dynamics of thinking relationships between individuals has its potential for problem-solving, even though the composition of the group may change. This strategy can be applied as part of design education pedagogy or design practice, significantly if it is associated with various collaboration platforms in the future, including those that utilize information technology as part of the way of working.

This study is limited to a specific design workshop strategy with a specific case study, which comes with all kinds of limitations. The potential sustainability of this study is in the various form of design workshop/studio, with different frameworks or strategies related to the number of participants and time duration. In addition, the development of studies that can be carried out is related to the pedagogy applied when planning individual and group work phases. It is also possible that certain design methods will have a relationship with the possible ways of working and the mechanisms of design collaboration that take place.

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