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Enhancing Understanding and Application of Fundamental Visual Elements and Visual Principles Through Collaborative Learning: Insights from the Experiences of Design Students

Gregorius Prasetyo Adhitama[1*], Yogie Candra Bhumi[2], Miranti Sari Rahma [3], Yuki Agriardi Koswara [4], Andriano Simarmata[5], Eljihadi Alfin[6], Arsaika Widasati [7], Dwi Hatmojo Danurdoro [8], Dona Saphiranti [9]

[1,2,3,4,5,6,7,8,9]Human and Spatial Interior Research Group, Faculty of Art and Design
Institut Teknologi Bandung, Jl. Ganesha 10, Bandung, 40132, Indonesia
[1]ORCID ID: https://orcid.org/0000-0001-8000-6354
[1]SCOPUS ID: 57220049949

gregoriusprasetyo@itb.ac.id

Recent scholarly discussions have robustly endorsed collaborative learning in educational settings but also highlight a significant gap in understanding its effects, particularly in the design disciplines of Indonesian higher education. This research aims to address this gap by investigating the impact of collaborative learning, specifically structured to incorporate fundamental visual elements and principles (FVEVP), on students' comprehension and application in three-dimensional design—an essential area of design education. The study integrates an immersive design workshop with questionnaire surveys to evaluate student perceptions of the pedagogical strategy's effectiveness, advantages, and challenges. The findings demonstrate significant benefits of collaborative learning, including advanced learning processes, enhanced innovative thinking, elevated student confidence, and improved project efficiency, all attained cost-effectively. These benefits contribute to greater student satisfaction and superior educational results. Nonetheless, the study also highlights challenges, such as the unequal distribution of workloads and extended decision-making times, which emphasize the need for structured management strategies to bolster the educational effectiveness of collaborative learning. By providing critical insights into the intricate effects of collaborative learning in design education, the study offers valuable contributions to refining educational practices and directing future research.

Keywords : *Collaborative learning, fundamental visual elements, fundamental visual principles, design education*

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INTRODUCTION

The fundamental visual elements (line, shape, volume, color, texture, form, and space) and visual principles (balance, contrast, emphasis, unity, movement, rhythm, harmony and proportion) are key components that designers and artists use to create impactful design/art works. Understanding and applying these elements and principles enable designers and artists to achieve visual appeal, balance, hierarchy, and effective communication in their designs. By utilizing these principles, designers can guide the viewer's eye, create visual interest, establish focal points, and convey messages effectively.

Understanding the fundamental visual elements and visual principles (FVEVP) is important in fields such as visual arts, graphic design, web design, industrial design, architecture, interior design, fashion design, and advertising/marketing (Bell, 2019). The importance of comprehending the FVEVP has been widely explored and extensively discussed in academic literature across diverse disciplines. White, Puhalla, Behnood and Kartika describe exploration of the FVEVP in visual art, offering practical examples and case studies to illustrate their application. Other researcher also provides comprehensive guide to understanding FVEVP, particularly focusing on form and space as a reference for creating effective, aesthetically pleasing designs. Even, FVEVP was recognized have been utilized centuries ago ; Behnood, 2020; Kartika et al., 2020).

University students develop their understanding of FVEVP through a studio-based learning (SBL) approach. This approach is deeply rooted in the studio setting, which transcends a mere physical space to become a zone of hands-on learning under the guidance of mentors. In this environment, students dive into the creative process, interacting directly with various materials, tools, and methods. This direct engagement enhances their intricate grasp of the design process (Obeidat 2012). SBL's unique approach pushes students to confront a range of complex, open-ended projects that mirror real-life situations (Kumar et al., 2021). These projects embody a sustainable approach, fostering ongoing improvement and refinement, which mirrors the challenging and introspective qualities inherent in professional practice.

In the wider context of higher education, SBL is valued for its realistic simulation of professional design practice, preparing students for real-world challenges, as noted by Hussein, Mustafa and Sharma (Hussein, 2023; Sharma, 2023). It focuses on developing critical thinking, adaptability, and a commitment to continuous learning, essential skills for designers. The studio setting in SBL acts as a miniature professional world, where learning is an active, collaborative, and iterative process, closely linked to practical design work. SBL fosters social interactions between students and mentors, promoting a collaborative learning environment that mirrors professional design settings. This approach enhances communication skills and the ability to effectively integrate feedback, as noted by Ezeanyanike (Ezeanyanike, 2013) and Lee et al. (Lee et al., 2019). SBL uniquely blends theory with practice, allowing students to apply theoretical knowledge in practical scenarios. This integration, highlighted by Jones et al. (Jones et al., 2021) and McAra (McAra, 2020), offers a comprehensive learning experience that prepares students for the complexities of professional practice.

Moreover, SBL's self-directed nature encourages students to be proactive, set personal objectives, and develop unique solutions to design challenges. The academic discourse also emphasizes the benefits of collaborative learning, which Arvanitis (Arvanitis, 2016) and Zygouris-Coe (Zygouris-Coe, 2021) argue, enhances outcomes and cultivates critical thinking. As Cruickshank, Coupe and Hennessy (Cruickshank, 2013) suggest, it's crucial to clearly communicate this learning mode to students to maximize their learning potential.

Feedback and critique sessions are central to SBL, providing a forum for students to showcase their work and receive communal feedback. This process, as outlined by Budge (Budge, 2013), aims to be constructive, offering diverse perspectives that aid student development. These sessions are crucial for reflection, enabling students to consider their learning journey, design choices, and the feedback they receive, assimilating these insights for future application. Mentorship is another key aspect of SBL, with instructors guiding students' creative journeys beyond traditional teaching methods. As Kamal El-Din & Ali (Kamal El-Din, 2015) highlight, this structured mentorship and assessment approach helps students clearly understand and achieve learning outcomes.

The effectiveness of using a collaborative, learner-centered approach as opposed to the more traditional teacher-centered approach is recognized in the realm of design studios (Emam et al., 2019). Meanwhile, Pawson highlight the learning benefits of peer interaction particularly within the context of group discourse and reflection common to collaborative

design education (Pawson, 2016). Integrating collaborative creativity into the design course can inspire students to generate more new ideas outside the box. Besides, students were more likely to clarify the motivation and dared to face challenges with confidence due to the assistance of teachers and team members. Finally, a model for collaborative creativity in design courses was proposed for the future development of design education at colleges and universities (Ni et al., 2022). Furthermore, there is relationship between support, co-creation of value and students' satisfaction and support students to achieve learning outcomes (Gillies, 2016; Hocaoğlu, 2019; Maxwell-Stuart et al., 2018) .

The process of learning, implemented through collaborative efforts within group settings, has been a significant area of academic inquiry for at least the past three decades. This approach, known as collaborative learning, provides a platform where individuals can closely observe and learn from the methodologies, strategies, and problem-solving techniques employed by their peers. Collaborative learning extends beyond mere observation; it actively engages individuals in a process where they can emulate, deepen their understanding, and gain motivation through ongoing interactions with their peers. This interaction is pivotal in forming effective learning outcomes, a theory supported by Bandura's research in 1977 and 1986 (Albert Bandura, 2023; Bandura, 2002; Boone et al., 1977; Rumjaun, 2020).

Moreover, collaborative learning plays a important role in the personal development of learners. It is instrumental in enhancing an individual's self-confidence and self-efficacy. These personal attributes are not developed in isolation but are nurtured through the shared experiences and collective knowledge gained in a collaborative learning environment. Lave and Wenger, in their works from 1991 and 1998, further expand on this concept by highlighting the importance of the social context in the learning process. They argue that learning is not an isolated activity that happens in seclusion. Instead, it is deeply embedded in social participation and active engagement. According to Lave and Wenger, learning is intrinsically linked to being a part of community practices and activities. It is through these social interactions and engagements that learning fundamentally occurs, emphasizing the social nature of the learning process. This perspective shifts the focus from individualistic, isolated learning to a more communal and interactive approach, highlighting the importance of social context and interaction in the educational process (Lave, 1991; Wenger, 1998).

In order to enhancing effectiveness of the learning process, it is crucial to involve students' perspectives. Evaluating students' goals and viewpoints is essential for developing effective teaching methods in higher education. This involves understanding the varied needs and perspectives of students. By focusing on these student-centered elements, educators and administrators can adapt their teaching styles and curriculum to meet the unique needs of their institutions. This approach improves the educational experience's relevance and effectiveness and creates a more inclusive and responsive learning environment (Komatsu et al., 2021; Morel, 2021). Therefore, these evaluations are crucial in ensuring that educational strategies are not only academically robust but also in tune with students' changing expectations and views.

In Indonesian design education, universities mostly employ teaching methods that focus on individual student achievements. Such studio-based educational practices are designed to endow students with the requisite competencies to produce design works through direct instruction and experiential learning, thereby ensuring the effective application of their acquired knowledge and skills in their respective creative practices, as discussed by Paryoko (Paryoko, 2019) as well as Astuti & Ismadi (Astuti, 2015). However, this method, while effective in nurturing individual skills, may not fully incorporate collaborative learning, increasingly important in the collaborative nature of the modern design industry. The current emphasis on individual work may reduce opportunities for students to engage in teamwork collaboration, which are vital in today's interconnected professional landscape. Thus, while this traditional approach is valuable for developing personal abilities, it could be enhanced by integrating more teamwork and collaborative learning to better reflect the demands of contemporary design practice.

Despite the extensive discussion of collaborative learning in various educational research studies in Indonesia, as exemplified by the works of Anggeraini & Nilawijaya (Anggeraini, 2021) as well as Pohan (Pohan, 2023), research concerning collaborative learning in the field of design, particularly concerning FVEVP in Indonesia, remains markedly limited. This scarcity of research results in an inadequate revelation of the realities and challenges inherent in collaborative learning.

These academic references offer insights into the benefits and effectiveness of collaborative learning in understanding design. They provide a foundation for further exploration and implementation of

collaborative learning strategies in design education. Nevertheless, these studies primarily focus on collaborative learning in a general context. In the context of Indonesian higher education, especially within universities specializing in design, the practice and evaluation of collaborative learning with a specific focus on FVEVP are notably scarce. This lack of practical application and critical assessment leads to a significant gap in the systematic implementation of best practices in collaborative learning methodologies. As a result, the potential challenges and intricacies associated with collaborative learning in the field of design education remain largely unaddressed and unanticipated.

The primary aim of this research is to delve into and explain the processes and advantages inherent in the collaborative learning approach, particularly in enhancing the comprehension and academic proficiency of university students concerning FVEVP. By doing so, this study endeavors to bridge the identified gap in this area of academic inquiry. It seeks to provide a deeper understanding of how collaborative learning can be effectively utilized and optimized in design education, thereby contributing valuable insights and strategies to overcome the challenges and maximize the benefits of this educational approach in the context of Indonesian design universities.

RESEARCH METHODOLOGY

The research aimed to explore the impact and efficacy of collaborative learning on enhancing the comprehension of Fundamental Visual Elements and Principles (FVEVP) among university students. This objective was addressed through two primary activities. Initially, a design workshop was conducted where students engaged in collaborative learning to grasp the concepts of FVEVP and its application in creating three-dimensional design compositions. The process and sequence of the workshop activities are depicted in Figure 1. Alongside, questionnaires were distributed to capture students' perceptions of the collaborative learning process. These questionnaires included both Likert scale and open-ended questions.

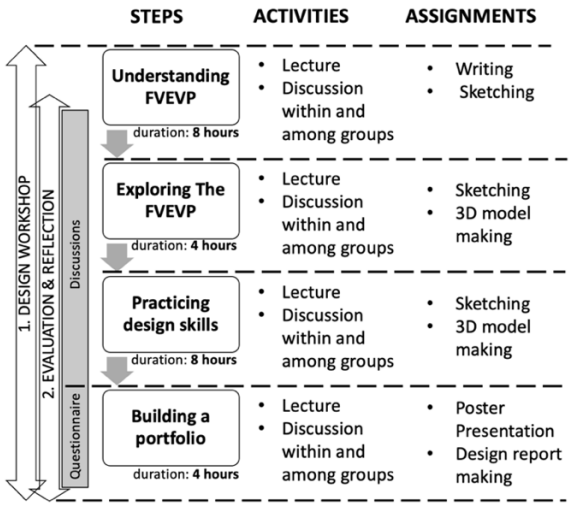

Figure 1. Collaborative learning process

The design workshop was structured to assess whether collaborative learning facilitated students' understanding and implementation of FVEVP in three-dimensional design compositions, while also promoting deeper internal reflection. The workshop began with lectures and group discussions to enhance understanding of FVEVP, followed by hands-on tasks such as critique writing and sketching. Fifty-two second-year university students participated, grouped into teams of four or five. They were overseen by four mentors throughout six sessions held in a design studio, each lasting four hours, totaling 24 hours.

During the workshop, students' designs resulting from the application of FVEVP were evaluated through presentations and discussions, as shown in Figure 2. In these sessions, students had the opportunity to present, defend, and critique the designs, fostering peer learning and critical engagement. Ultimately, the designs were assessed by the four mentors on two aspects: understanding of the fundamental visual elements (line, shape, color, texture, value, size, and space) and principles (balance, contrast, emphasis, unity, movement, rhythm, and proportion), and their application in three-dimensional compositions. Assessments were scored on a scale of 1 to 100, based on a consensus among the mentors. Subsequently, students were asked to complete a questionnaire to share their insights on the workshop and their understanding of FVEVP.

Figure 2. Presentation and discussions within and among groups

Likert scale questions were utilized to measure the attitudes and opinions of students regarding the collaborative learning method they implemented during the design workshop. To ensure the reliability of Likert Scale questions, the Cronbach's alpha test was conducted. Cronbach's alpha was found to be 0.93, which suggested strong internal consistency. The initial stage of research involved analyzing the data from the Likert scale to identify trends in student perspectives and to explore correlations between their responses concerning four specific aspects: (1) ease of understanding fundamental visual elements through collaborative learning, (2) ease of understanding fundamental visual principles through collaborative learning, (3) ease of applying fundamental visual elements through collaborative learning, and (4) ease of applying fundamental visual principles through collaborative learning. The analysis of the Likert scale responses entailed examining participant feedback and computing frequencies and percentages for each response option to identify dominant trends.

Furthermore, the use of open-ended questions aimed to gain a deeper understanding of the students' reasoning behind their attitudes and perspectives. These questions were designed to draw out more detailed insights into their viewpoints, capturing the uniqueness and depth of their evaluations and uncovering a range of opinions that might not be fully expressed through Likert scale questions. The process of analyzing the answers to open-ended questions from respondents was carried out manually through a series of steps: (1) creating a list of responses, (2) understanding the types of responses, (3) creating categories based on recurring keywords or central themes in the responses, (4) refining these categories to ensure each category is mutually exclusive and encompasses all relevant responses, (5) assigning codes to each response and associating them with the relevant categories, and (6) determining the frequency and percentage of each category to uncover any patterns or trends (Adhitama & Komatsu, 2013).

In this research, for analyzing responses to open-ended questions, a Sankey chart was utilized. In the context of open-ended question analysis, this chart effectively illustrated how different themes or categories emerge from the responses. It visually represents the volume of responses that fall into each category, showing the flow of responses from one category to another. This was particularly useful in understanding the nuances and diversity of the qualitative data. By using a Sankey chart, complex qualitative data from open-ended questions could be interpreted in a more structured and comprehensible manner.

The research findings were discussed in the context of established collaborative learning frameworks, particularly the principles of social learning theory, within the overarching field of education. The discussion then specifically addressed the application of these theories to design education, integrating the study into a wider academic narrative and highlighting its significance for pedagogical strategies in these specialized fields.

RESULT AND DISCUSSION

In this study, the analysis of data from design workshops and questionnaire responses from 52 participants elucidates several aspects, which are outlined below.

The Process of Collaborative Design Workshop.
In the initial stage of the workshop, students participated in lectures by mentors to gain a deeper insight into FVEVP, also receiving guidance on workshop execution. Initially, a significant challenge for the students was to effectively assume their roles within their groups. However, as the workshop progressed and they engaged in further discussions, their adaptability improved. The discussions proved to be a valuable learning exchange, offering a variety of information pertinent to the workshop's goals. The process of understanding and applying FVEVP in creating three-dimensional designs was enhanced through group discussions. These discussions were crucial for exploring FVEVP concepts and applications. During the exploration and design practice stages, one student per group led the discussion for each assignment and coordinated role distribution among members.

For instance, each member had to present a 3D design composition and provide feedback on others' work. All viewpoints were recorded and debated to formulate a unified design proposal. Although differences in opinion were common, groups eventually reached consensus, even if some members remained partially dissatisfied. In the final

portfolio-building stage, collaboration became smoother as each student had defined roles, such as creating posters, models, and narrative texts, or presenting orally during group sessions.

After completing the workshop, mentors collectively evaluated the 3D designs produced by each group. Each mentor first assessed the designs independently, then discussed their evaluations collectively, allowing for assessment revisions. The evaluation criteria included the use of various visual elements, clarity in applying visual principles, and the level of student participation in groups. The mentors' scores were compiled and averaged. The results showed that all groups effectively created diverse compositions and demonstrated a strong grasp of FVEVP principles, as reflected in the high average student score of 89.4, with scores ranging from 87 to 93.3 and a median of 89.

Students Perspectives on The Collaborative learning

Findings of the questionnaire survey conducted among students regarding collaborative learning and its impact on understanding and applying FVEVP in three-dimensional designs. The survey collected students' responses to questions about their preferences regarding 4 statements (Figure 3). According to the survey, 51% of the student respondents agreed that collaborative learning made it easier for them to understand FVEVP and effectively apply it in three-dimensional designs. Among this group, 27% agreed and 24% strongly agreed with this statement. On the other hand, 21% of the participants disagreed with the idea that collaborative learning facilitated the learning process of FVEVP. Furthermore, 29% of the respondents neither agreed nor disagreed with the statement, indicating a level of neutrality or indecision. Figure 3also mentions an overall Likert Score of 3.5, which suggests that, on average, most respondents reported benefiting from understanding FVEVP through the collaborative learning process.

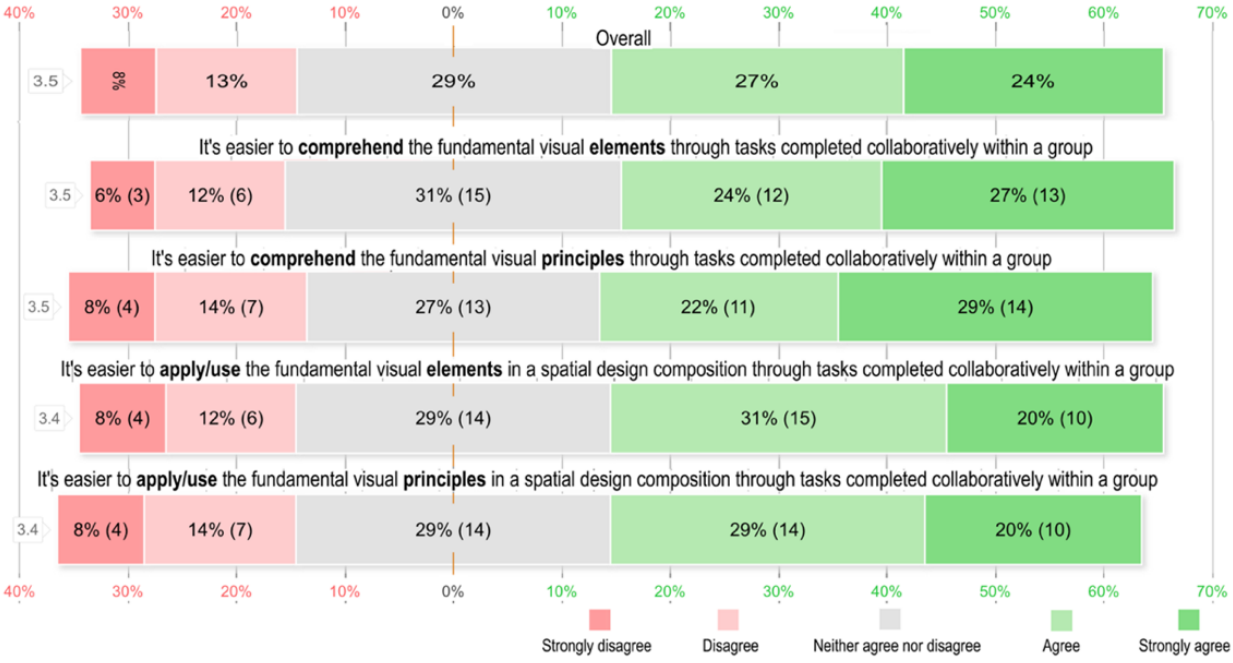

Figure 3. Opinions of students on collaborative learning regarding FVEVP

Going into more detail, Figure 3reveals that most of the respondents found it easier to understand both fundamental visual elements (51%) and visual principles (51%) through collaborative learning. Moreover, 51% of the participants also found it easier to learn the application of basic visual elements, while 49% found it easier to learn the application of basic visual principles. It suggests that, on average, the respondents expressed a positive perception of the benefits gained through the collaborative learning process. However, it's important to note that individual opinions and experiences may vary among the respondents, as reflected by the range of scores given.

Furthermore, Figure 4 illustrates a matrix of scatter plots representing the relationship between responses of the four statements. Each statement is rated on a Likert scale from 1 to 5, with 1 being the lowest and 5 being the highest, where 1 denotes

strong disagreement and 5 denotes strong agreement. The median values for the first three questions are at 4, indicating that more than half of the respondents agree (at least to some extent) that it is easier to understand and apply FVE through collaborative learning. Student's responses to the fourth question has a slightly lower median of 3, suggesting that respondents find it marginally less easy to apply FVP through collaborative learning compared to FVE. The mean values are all above the midpoint of the scale (3.5, 3.49, 3.43, and 3.39), which also indicates a general tendency towards agreement across all statements, although not as strong as the median suggests. This indicates a positive perception of collaborative learning's effectiveness, though with some variability. The positive correlation coefficients range from moderate (0.69) to very strong (0.88), showing that those who agree that collaborative learning helps with understanding a concept also tend to agree that it helps with applying it, and vice versa. The varying degrees of correlation (from 0.69 to 0.88) may suggest differences in how closely related the concepts of understanding and applying FVE and FVP are perceived to be. The strongest correlations (0.87 and 0.88) are for the application of both FVE and FVP, which could suggest that the practical application of these concepts through collaborative learning is viewed more consistently among participants.

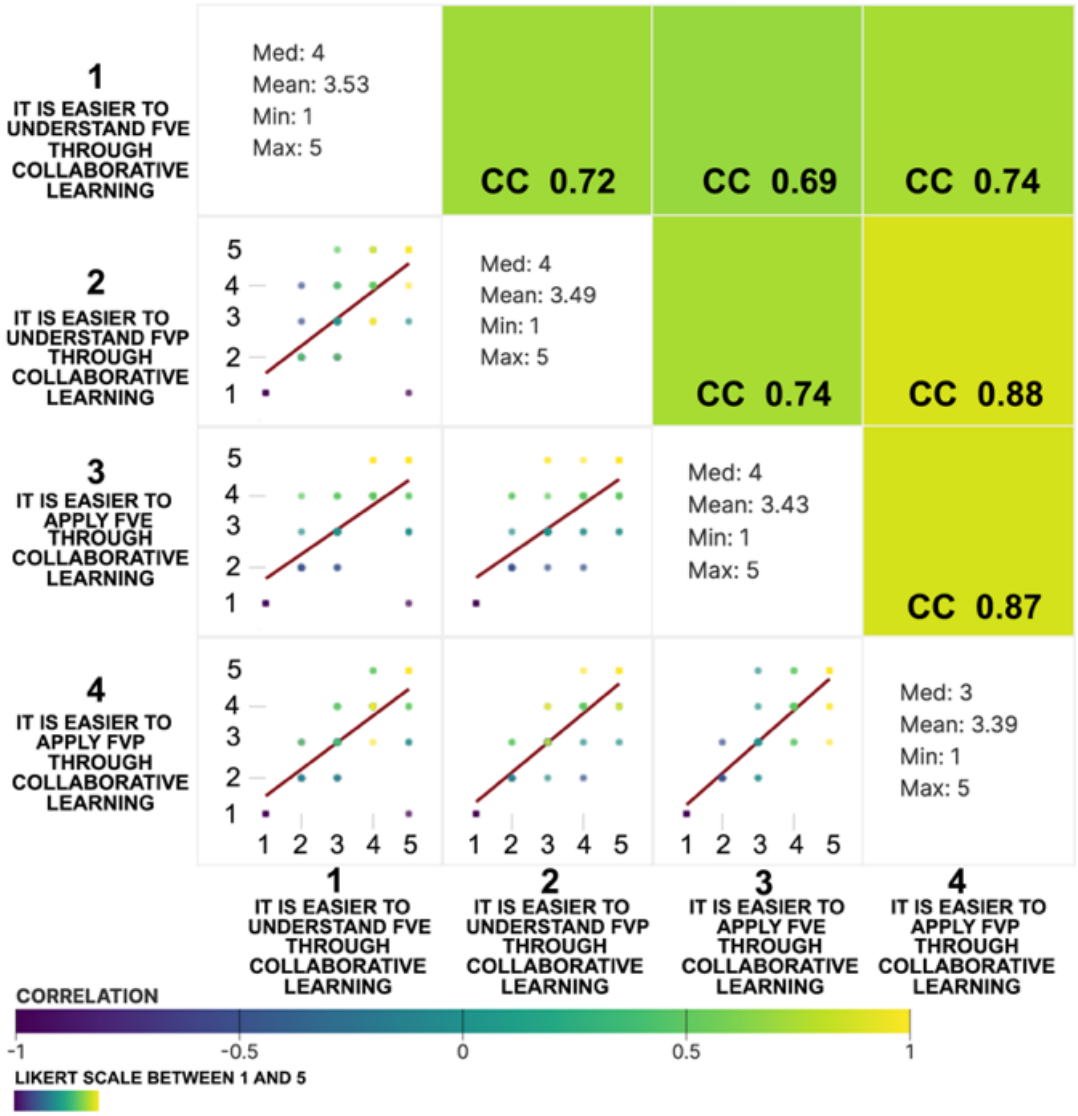

Figure 4. Visualization of pairwise relationships between the four statements

The overall implication is that the respondents generally perceive collaborative learning as a beneficial approach to understanding and applying concepts. The high correlations suggest that this perception is consistent across different aspects of learning—both the cognitive aspect (understanding) and the practical aspect (application). However, the fact that the data shows variability (with some respondents rating the statements as low as 1) highlights that collaborative learning may not be

universally effective for all individuals or in all contexts. It would be important for educators or trainers to recognize this variability and explore the reasons behind the range of responses, which could include personal learning styles, the nature of the content, or the implementation of the collaborative learning approach.

Next, to further explore the participants' opinions in the design workshop, an open-ended survey was conducted. Table 1. Perspectives of students' who agree on collaborative learning.represents the results of the study that explores the relationship between learning methods (specifically collaborative learning) and various factors such as the learning process, performance, and effects.

Table 1. Perspectives of students' who agree on collaborative learning.

Learning Method	Process	Performance	Effect	Count
Collaborative	share ideas			7
Collaborative	share ideas	fast	deeper learning	1
Collaborative	share ideas	fast	gain different perspectives	1
Collaborative	share ideas	easier	gain different perspectives	2
Collaborative	share ideas	easier		2
Collaborative	share ideas		gain different perspectives	12
Collaborative	share ideas		deeper learning	1
Collaborative	share ideas		gain insight	4
Collaborative	share ideas		effective output	2
Collaborative	support-motivate		gain different perspectives	1
Collaborative	support-motivate			1
Collaborative	learn from others			1
Collaborative	combine ideas		gain different perspectives	3
Collaborative	combine ideas		enhance output quality	1
Collaborative	combine ideas		gain insight	1
Collaborative	combine ideas			1
Collaborative		cheap/efficient		1
Collaborative			gain different perspectives	10
	Count: 41	Count: 7	Count: 39	Count: 52

N=52

The table also shows different combinations of learning processes and their associated outcomes. The first column indicates the learning method used, which in this case is collaborative learning. The second column describes the specific process involved, primarily focused on sharing ideas and combining ideas. The third column represents the performance, such as "Faster “and "Easier” insinuate a predominant inclination towards operational efficiency. The fourth column denotes the perceived effects of the learning process, including gaining different perspectives, gaining insight, enhancing output quality, or achieving effective output.

The table reveals several key insights into collaborative learning methods. The process of "sharing ideas" is the most frequently mentioned, appearing in a variety of contexts with different combinations of performance and effects. This highlights its central role in collaborative learning. In terms of effects, the most commonly noted is the ability to "gain different perspectives." It underscores the value placed on diverse viewpoints in collaborative settings.

Interestingly, the aspect of performance is not as frequently commented upon, with only 7 counts. This suggests that the respondents or observations were more focused on the processes and outcomes of collaborative learning rather than on how efficiently or quickly these processes were performed. Looking at the total counts at the bottom of the table, we see 41 counts for Process, 7 for Performance, and 39 for Effect. These numbers represent the total number of responses or observations in each category. Notably, the count for Effect is higher than the others, possibly indicating that multiple effects were often reported for a single process.

Overall, the table conveys that collaborative learning, especially through the sharing and combining of ideas, is perceived to have a range of positive effects. The most prominent of these is gaining different perspectives.

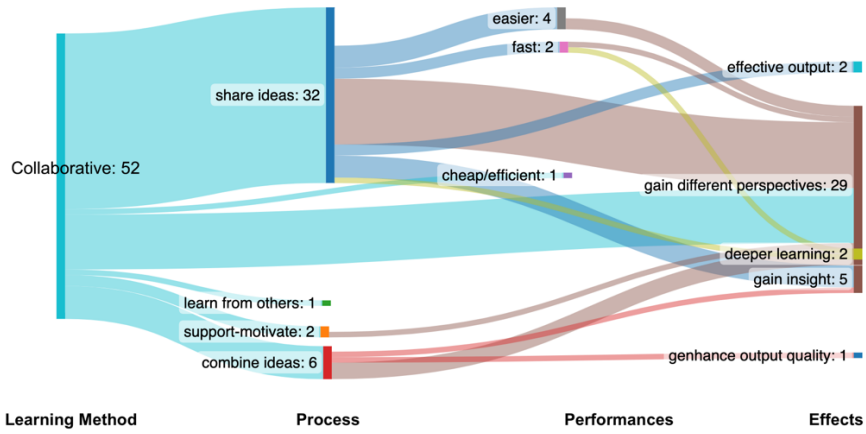

Figure 5. Ideas flows of students' who agree on collaborative learning.

Figure 5. Ideas flows of students' who agree on collaborative learning. **Figure 5** indicates that the collaborative learning method strongly emphasizes the process of sharing ideas (32), which is the most significant flow within collaboration. This is followed by combining ideas (6), suggesting that these two processes are central to the collaborative approach. However, learning from others and support-motivation are minimally represented (1 and 2, respectively), indicating they are less central to the concept of collaboration in this context. The outcomes of these collaborative processes are identified as performances that are easier and faster, though these are not the primary focus. The most substantial effect of collaboration is the gain of different perspectives (29), highlighting the value placed on diverse viewpoints as an outcome of the collaborative process.

Table 2. Perspectives of students' who disagree on collaborative learning.

Learning Method	Process	performance	Effect	Count
Collaborative	in equality of work distribution	difficult to manage time		1
Collaborative	difficult to articulate Individual ideas	Less independency		1
Collaborative	difficult to consolidate ideas			3
Collaborative	difficult to consolidate ideas	difficult to manage time		2
Collaborative	difficult to consolidate ideas, in equality of work distribution			1
Collaborative		difficult to manage time		2
Collaborative		longer time to make decision		1
Collaborative		Less independency		1
	Count: 5	Count: 6	Count: 0	Count: 12

N=12

Table 2 provides an overview of the negative perspectives of 12 students who disagree with collaborative learning, detailing specific aspects they find problematic across four categories: Learning Method, Process, Performance, and Effect. The primary concerns center on the processes and performances within collaborative settings, specifically the difficulty in consolidating ideas, mentioned 6 times, and managing time, cited 5 times. Students also highlight the inequality of work distribution and a perceived reduction in independency as significant drawbacks. Performance issues such as the difficulty in articulating individual ideas and the longer time required to make decisions also contribute to their disagreement.

The Sankey diagram (Figure 6) depicts students' objections to collaborative learning methods, highlighting that the difficulty in consolidating ideas is the most common issue, cited by 5 students. Time management is another significant challenge,

equally mentioned by 5 students, as a performance issue. Concerns about the equality of work distribution are raised by 1 student as a process issue and by another in conjunction with the difficulty of idea consolidation. Additional performance issues include difficulty articulating individual ideas and a longer decision-making process, each noted by one student. Meanwhile, a diminished sense of independency is an effect of collaborative learning that 2 students have identified. Lastly, none of the students who disagree with collaborative learning consider its effects.

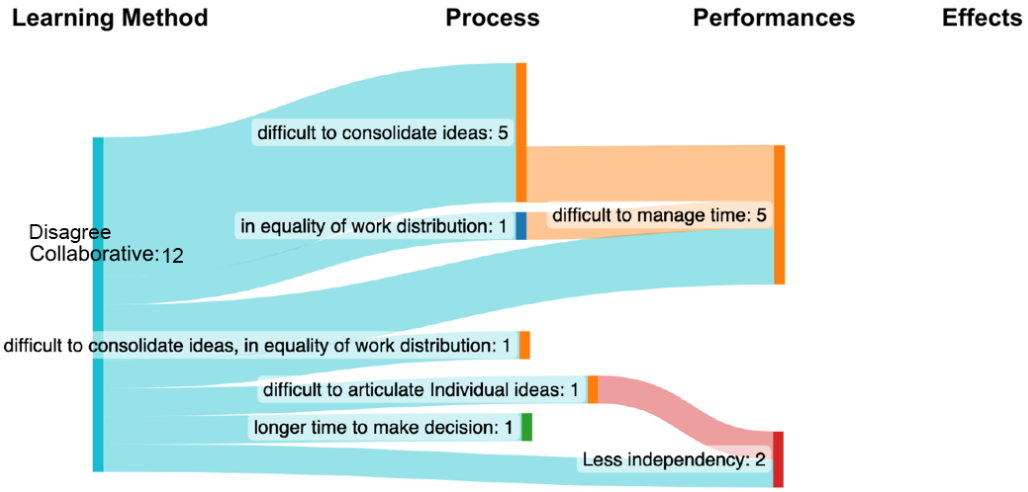

Figure 6. Ideas flows of students' who disagree on collaborative learning.

The diagram emphasizes that while collaborative learning is meant to be a joint effort, it can present significant challenges in balancing contribution, managing time, and preserving individuality for some students. This study emphasizes the significance of collaborative learning in design education, particularly in its ability to deepen the comprehension and practical application of Fundamental Visual Elements and Principles (FVEVP). At the same time, it reveals the inherent challenges and limitations of this method. The primary conclusion drawn is the necessity for an adaptable and well-rounded educational strategy. Such a strategy should cater to various learning preferences and tackle the obstacles associated with group work, thereby guaranteeing that every student has the opportunity to both contribute to and gain from the educational experience.

The research findings offer a nuanced examination of collaborative learning within the context of design education, with an emphasis on the assimilation and utilization of Fundamental Visual Elements and Visual Principles (FVEVP). The study suggests that the collaborative learning framework facilitates a shared space where students can collectively explore and apply FVEVP, echoing the core aspects of Bandura's Social Learning Theory. In such a learning environment, students engage with peers in an active exchange of ideas, leveraging the group's diverse experiences and knowledge, which enhances their individual and collective understanding of design concepts.

This active exchange is indicative of Bandura's emphasis on the power of learning through social interaction and observation. Students in the study reportedly experienced an enriched learning process, characterized by mutual support and motivation—elements that are central to the social learning experience and integral to the internalization of complex subjects. Furthermore, the collaborative approach reportedly led to more sophisticated outcomes in their design projects, showcasing the practical benefits of integrating social learning into educational strategies.

Regarding social engagement in collaborative learning, these findings also align with Bandura's exploration of human nature, positing that learning is not a passive absorption of information but an active and socially interactive process. In this research, students who reported positive outcomes from collaborative learning may exemplify this, as their engagement in the learning process through social interaction likely enhances their self-efficacy and cognitive development. Moreover, Bandura's emphasis on observational learning aligns with the collaborative context, where students learn not only from direct instruction but from observing and interacting with peers, a dynamic that seems to foster a deeper understanding and application of design elements and principles among learners. Delving into the situated learning theory proposed

by Jean Lave and Etienne Wenger, we see an emphasis on the importance of learning as a social practice, contextualized within a community that co-constructs knowledge. The survey findings that reflect students' positive reception of collaborative learning suggest that they are engaging in a community that supports and enhances their learning journey. This experience aligns with Lave and Wenger's concept of legitimate peripheral participation, where learners start on the outskirts of a community and gradually move toward becoming central participants as they assimilate and contribute knowledge. The concept of communities of practice, further developed by Wenger, underscores the value of shared practice and communal learning in the acquisition of knowledge. This also connects to the principles of experience-based learning, as highlighted by Jones et al., which stress the importance of direct engagement with material in real-world scenarios. The students' value for the practical application of design principles in a collaborative learning setting underscores the success of an experiential learning approach in education. Through active involvement with the material, students are able to connect theoretical knowledge with practical application, resulting in deeper and more lasting learning achievements. The study shows that students understand the significance of exchanging and combining ideas within their groups, a key aspect in forming a community of practice.

Nevertheless, the challenges highlighted by students, such as managing time and ensuring equitable work distribution, suggest that there may be obstacles to achieving a fully functional learning community. The research paints a picture of collaborative learning as a process deeply aligned with Bandura's theory, where the social aspects of learning are both its strength and its area of weakness. The study's findings illustrate that while collaborative methods can greatly enhance understanding and application of educational content, they also require thoughtful structuring and guidance to harness their full potential, a process that requires educators to be as much a part of the learning journey as the students themselves.

The results also clearly demonstrate that the principles of cooperative education, including interdependence, individual accountability, interpersonal skills, and group handling, are essential components of the collaborative learning experience. This is in line with Gillies' review on cooperative learning. The positive responses from students regarding their experiences indicate that collaborative learning can foster improved understanding and social connections. Nevertheless, the challenges faced by some students highlight the possible necessity for more structured cooperative learning approaches, designed to tackle and reduce the difficulties inherent in collaborative learning settings. In an elaborative reflection, it becomes clear that while collaborative learning is largely beneficial, its effectiveness can be highly variable. This variability is rooted in individual differences among learners and the diverse contexts in which collaborative learning takes place.

Moreover, although conducted within the context of design education in Indonesia, this research confirms the findings of Emam, Taha, and ElSayad, as well as those of Budge. Together, these studies underscore the crucial role of collaboration in the educational frameworks of design. The authors investigate the integration of collaborative strategies into the design education curriculum, thereby preparing students for professional practice. This convergence of global research findings affirms the universality of collaborative approaches in enhancing educational outcomes across diverse cultural landscapes. These also align with Bandura’s Social Learning Theory, which values knowledge acquisition through social interaction and observation, suggesting that learning is enhanced in a collaborative environment. This is especially relevant in a collaborative design studio setting, serving as an active learning model where students engage in dialogue, share insights, and create in unison, thus nurturing an atmosphere of scholarly cooperation.

Bandura’s theory and the discussed researches outcomes advocate a model of collaborative learning that goes beyond enhancing teaching methodologies. They suggest that such an approach is pivotal for achieving deeper and more meaningful educational results. In the context of design studios, it involves a thorough preparation of students to meet the collaborative demands of their future profession, equipping them with both theoretical knowledge and the interpersonal skills necessary for the complex dynamics of professional practice.

The findings suggest that educators must carefully consider these individual and contextual factors when designing and implementing collaborative learning experiences. They must create environments that support active, social interaction while also providing structure to ensure that all participants are engaged and accountable. This may include developing clear group goals, roles, and norms, as well as ensuring that there is sufficient time and resources for collaboration to occur

effectively. By doing so, educators can harness the full potential of collaborative learning, fostering not only the acquisition of knowledge but also the development of skills necessary for students to navigate and contribute effectively to their learning communities.

CONCLUSIONS

The research focused on students' perspectives on collaborative learning, particularly its impact on understanding and applying Fundamental Visual Elements and Visual Principles (FVEVP). Most respondents found collaborative learning beneficial in grasping FVEVP. The open-ended survey provided a deeper dive into the participants' experiences, revealing that collaborative learning consists of dynamic process. This process facilitated the sharing and merging of diverse ideas, offering mutual support and motivation. The benefits of this approach were manifold, including accelerated learning, cost-effectiveness, and enhanced efficiency. Moreover, participants believed that collaborative learning enriched their perspectives, leading to better quality in their design works. However, it's essential to acknowledge the challenges and limitations voiced by a subset of students. Concerns were raised about the complexities of merging diverse ideas, potential disparities in workload distribution, and the extended duration required for collective decision-making. These challenges sometimes led to perceived inefficiencies and potential conflicts. In essence, while collaborative learning offers numerous benefits, such as a deeper understanding of subjects and a broader perspective, it also presents challenges that educators and students must address to optimize the learning experience.

The research delved into the intricate nuances of students' perspectives on the efficacy and challenges of collaborative learning, especially concerning the understanding and application of Fundamental Visual Elements and Visual Principles (FVEVP) in three-dimensional designs. The research findings also suggest that students who found it easier to understand visual elements through collaboration also found it easier to apply these elements and principles in their designs. It painted a picture of collaborative learning as a vibrant, dynamic process. This process was characterized by the sharing of diverse ideas, mutual support, and a sense of motivation that permeated group interactions. The tangible benefits of this approach were various. Not only did it accelerate the learning process and prove to be cost-effective, but it also enhanced the overall efficiency of the learning experience. Furthermore, the enriched perspective that collaborative learning fostered had a tangible impact on the quality of students' work, particularly evident in their more sophisticated 3D design compositions.

In summary, the research highlights the multifaceted nature of collaborative learning. While it provides a wealth of advantages, promoting a more profound comprehension and a wider viewpoint on topics, it also brings forth obstacles that require careful handling. The responsibility for educators and institutions is to find an equilibrium, maximizing the benefits of the collaborative method while simultaneously tackling its intrinsic challenges.

This research endeavors to address a notable void in current academic discourse by offering a comprehensive exploration of the systematic implementation of best practices in collaborative learning methodologies within Indonesian design higher education. Through its detailed analysis and findings, it aims to contribute to the enhancement of collaborative learning strategies. In doing so, it enriches the field with refined, evidence-based approaches, tailored to the context of Indonesian learning culture. This research concentrates on learning techniques associated with the core subjects of design education in higher education institutions, particularly the basic elements and fundamental visual principles. For a more thorough insight into the design education curriculum, additional analysis is required for the advanced content as outlined in the curriculum of design study programs.

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