Redesigning Campus Cafeteria Shade, Circulation, And Furniture Settings For Improved User Experience And Efficiency

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Abstract
The cafeteria serves as a common area where individuals affiliated with the university, such as students, lecturers, guests, and staff, typically engage in activities such as dining, drinking, and resting either individually or in groups. In the case of the Department of Architecture at Diponegoro University, changes in campus regulations led to the relocation of the cafeteria, resulting in various challenges related to user circulation and impacting the overall efficiency of the space. To address these issues, a research initiative was undertaken to examine user behavior patterns with respect to the arrangement of furniture in the cafeteria. This study represents a post-occupancy evaluation aimed at generating new design recommendations. The research outcomes, derived through qualitative descriptive methods and behavior mapping, offer insights into user attributes. The investigation spanned five consecutive days, specifically during the peak hours from 11 am to 1 pm, chosen to coincide with the busiest time of the day. The ultimate goal of the proposed design changes is to enhance the overall user experience in the cafeteria by improving shade coverage, optimizing circulation pathways, and fostering increased engagement among campus residents.
Keywords: Cafeteria, User behavior, Furniture settings, Post-occupancy evaluation, Design recommendations.

I.   Introduction

Architecture is a scientific discipline focused on the creation of designs, with the expectation that these designs can adapt their functionality based on prevailing conditions and requirements. Among the architectural outputs, cafeterias stand out as facilities that cater to the provision of food and beverages. Specifically, the cafeteria, situated within the campus vicinity, serves as a multifunctional space for dining, refreshment, and fatigue relief, catering to individuals following work, classes, or study sessions. The hallmark of an effective cafeteria lies in its ability to provide comfort to its patrons.

The cafeteria, as a locus for user interaction—both individual and group-based—gives rise to diverse behaviors influenced by several factors inherent in the cafeteria environment. These factors encompass the cafeteria's geographical placement, arrangement of furniture, adherence to regulations, environmental conditions, and spatial dimensions. According to Lang (1987), human behavior within a physical setting is dynamic and context-dependent, evolving over time and situation. Recognizing the distinctiveness of user behavior patterns, it becomes imperative to tailor spatial configurations in adherence to established guidelines, facilitating the desired user conduct.

A cafeteria that aligns with its intended purpose and effectively addresses user needs is characterized by its ability to meet user comfort and other attributes. The cafeteria serves as a communal hub for various university stakeholders, fostering activities such as dining, drinking, and relaxation for students, lecturers, guests, and staff. However, changes in campus regulations at Diponegoro University's Department of Architecture prompted the relocation of the cafeteria, introducing challenges related to user circulation and efficiency. This shift underscores the need for a comprehensive examination of user behavior patterns in response to the new spatial arrangement, particularly focusing on the role of furniture placement within the cafeteria environment.

This study was undertaken to ascertain whether the spatial arrangements in the cafeteria align with anticipated behavior patterns, thereby fulfilling user attributes. This research embarks on a post-occupancy evaluation to investigate the intricacies of user behavior in the context of the relocated cafeteria. The primary goal is to uncover insights that inform new design recommendations aimed at optimizing user experience and overall cafeteria functionality. By assessing the impact of the relocation on user circulation and analyzing how furniture arrangement influences behavior, this study seeks to contribute valuable knowledge to architectural design and

facility management. The resulting recommendations are anticipated not only to address current challenges but also to serve as a guiding resource for future endeavors in enhancing communal spaces within university settings.

II.   Literature Review

2.1.   *Understanding Human Behavior in Diverse Spaces*

Behavior setting, as delineated by Barker (1968), is characterized by a stable amalgamation of activities, places, and specific criteria. These criteria encompass a repetitive activity pattern, environmental arrangements, a balanced relationship between the two, and the continuity of these elements over a defined period (Laurens, 2004). The diverse nature of activities is reflected in the distinct settings each activity actor occupies. Behavior setting boundaries, which may be physical, administrative, or symbolic, are contingent upon the required separation between different behavior settings. Concurrently, an activity system comprises intentional behaviors undertaken by an individual or a group of individuals. Sommer & Olsen (1980, as expounded by Haryadi (1995), involves Behavior Mapping—a process that entails sketching or diagramming an area where various human activities transpire. This method seeks to visually represent behavior on a map, elucidate the type and frequency of activities, and highlight the correlation between behavior and specific design elements. Behavior mapping can be conducted directly at the observed location and time, with subsequent analysis based on recorded notes.

Two distinct approaches are employed in behavior mapping. The first, known as place-centered mapping, focuses on understanding how individuals or groups utilize, engage, and adapt their behavior in specific locations during particular times. The procedural steps for this technique involve creating a sketch of the place or setting, encompassing all physical elements believed to influence user behavior. A list of behaviors is then generated, with corresponding symbols or sketch marks assigned to each behavior. Over a specified period, researchers document various behaviors occurring in the designated space using symbols on the prepared base map. Conversely, person-centered mapping emphasizes the movement of individuals over a defined timeframe and is not confined to a single location but spans multiple places. In this technique, the researcher focuses on observing specific individuals. The steps involve selecting the type of sample person (actors or individual space users), determining the observation time (morning, afternoon, evening), observing the activities of each individual, recording observed activities in a matrix, and creating a circulation flow to discern the person's movement within the observed area.

The utilization of space by individuals is intricately linked to size-related factors that indirectly govern user movement within a given space. Dimensions or distances that influence interpersonal activities can be classified into several categories, such as intimate distance, personal distance, social distancing, and public distance. Intimate distance, ranging from 0-15 cm for the near phase and 15-45 cm for the farthest phase, characterizes highly intimate conversations between two or more individuals. Personal distance, spanning 60-100 cm, defines the space between chairs in a private setting where restricted access is maintained.

Social distancing, crucial for public interactions in settings like meeting or conference rooms, typically spans 150-300 cm, and in semi-public buildings, it can extend to 2-3 meters. In situations where the number of participants is limited, maintaining a maximum distance of 4 meters is recommended to ensure clear audibility of conversations. Public distance, applicable in large halls such as concert or convention halls, extends up to 20-30 meters, necessitating the use of amplification systems for effective communication. Additionally, proxemics distance, as defined by Suptandar (1999), involves communication distances in public gatherings where individuals may be in close proximity without necessarily knowing each other, as seen in shared spaces like trains, buses, or planes, where maintaining a certain distance is still observed.

According to Haryadi (1995), space variables encompass several crucial aspects, beginning with size and shape. When crafting a space, adjustments in size and shape are made to align with the intended function. In the case of the observed cafeteria, a space that was excessively small led to the emergence of diverse behavioral patterns, a phenomenon to be further elucidated in the forthcoming data description. The dimensions of a space hold significant sway over the psychology and behavior of its users, with overly large or cramped rooms adversely affecting user experience. Furniture and its arrangement constitute another pivotal variable. Furniture, designed for functional purposes, not only serves utilitarian needs but also exerts influence on user behavior. The positioning and layout of furniture further contribute to shaping user activities within a given space. Additionally, space color holds significance in setting the ambiance and fostering specific behaviors, while sound levels, measured in decibels, can impact user experience negatively if excessively loud. Temperature considerations are essential for user comfort, as overheating due to direct sunlight exposure can induce discomfort. Lastly, lighting in a space not only fulfills the functional need for illumination but also plays a role in influencing the psychological state of individuals, serving both practical and aesthetic purposes.

2.2.   *Cafeteria as Public Spaces*

Public spaces refer to areas or land accessible to the public, facilitating functional public activities or additional pursuits that foster community cohesion, whether on a daily or periodic basis (Darmawan, 2003). Cafeterias fall within the category of public spaces due to their role in fulfilling functional needs and serving as

venues for diverse community activities. Carmona (2010) outlines key elements for the effective functioning of public spaces, including comfort, relaxation, passive engagement, active engagement, and discovery. Comfort is deemed a fundamental prerequisite for the success of a public space, with the duration individuals spend in the area serving as a gauge for its comfort level. Psychological comfort, closely associated with relaxation, is achieved in an atmosphere where both the body and mind are in a healthy and content state. Passive engagement involves activities influenced by environmental conditions, typically encompassing sitting or standing while observing ongoing activities or enjoying the surrounding view. Active engagement, on the other hand, denotes the successful facilitation of contact or interaction activities among community members, whether they be friends, family, or strangers. Lastly, the concept of discovery underscores the importance of managing public spaces to prevent monotony in activities, fostering a dynamic and engaging environment (Herlambang et al., 2023).

In the cafeteria context, as outlined by Hasanuddin et al. (2020), it serves as a locale where students typically engage in activities such as dining, drinking, and group relaxation. Meeting service and presentation standards within the cafeteria are crucial factors, particularly given the limited break time available for students (Zohrah, 2005). Adequate and prompt service is anticipated to ensure efficiency during these brief intervals. Furthermore, the provision of essential facilities like chairs, tables, and handwashing amenities is deemed essential for optimal cafeteria functionality. As the number of students utilizing the cafeteria increases, the resulting higher density in circulation contributes to suboptimal activities, including crowded seating and insufficient ventilation. Consequently, there is a recognized need to enhance both circulation and spatial dimensions within the cafeteria to transform it into a more comfortable environment for incoming students. Drawing insights from Panero & Zelnik's (1979) perspective, a lunch counter or eating place adheres to standard dimensions derived from anthropological data concerning human users of space and their movement patterns during related activities. Based on the literature review, the chosen approach involves applying the standard space dimensions observed at lunch counters to cafeterias due to the shared nature of activities, specifically those centered around eating.
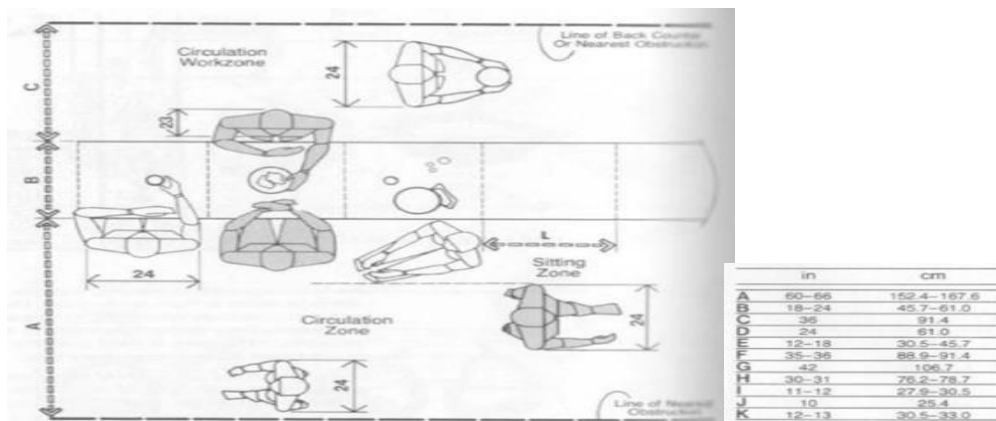
Source: Panero & Zelnik, 1979
Figure 1. Standard sizes at lunch counters as in cafeterias

III. Methodology

The research employs a qualitative descriptive methodology, aiming to articulate and synthesize diverse conditions, situations, or phenomena observed directly from the research object (Jogiyanto, 2008). Data collection in the field was executed through the random sampling method, followed by an analysis grounded in the behavior setting theory, spatial standards encompassing distance and size, and various spatial variables conducive to fulfilling user attributes within the context of utilizing the cafeteria..

The focus of this research is the Undip Architecture Cafeteria, which recently underwent relocation in compliance with campus policies. This cafeteria area, now situated in a pavilion-like structure, comprises a shop and a dining area. The latter, serving as an outdoor extension, is equipped with tables, benches, and refrigerated furniture for beverage and ice cream storage. Adjacent to the cafeteria's north side lies vacant land, presenting an opportunity for potential expansion or development of campus facilities. Regularly frequented by a diverse demographic, including students, lecturers, guests, and various campus personnel, the cafeteria serves as a communal space for dining, relaxation, discussions, and academic activities. The relocation of the cafeteria to this new site, previously unutilized, has brought to light several challenges that warrant investigation in this study.

**Table 1.** Physical Condition of Indoor Area

Space Components	Furniture	
• Wall	Photocopy	Glass display cabinets
• Folly	• Computer	• Stove
• Ceiling	• Chair	• Cooking table
• Rolling Door	• Photocopy machine	• Dining table
	• Printers	• Drinking table
	• Display glass cabinet	

The spatial configuration of the area under investigation comprises enclosed boundaries, delineated by walls, floors, and ceilings, as delineated in Table 1. Specifically, the cafeteria occupies a rectangular space measuring 13.5m x 7.5m in length and width. Positioned with one side facing a campus building, the room's orientation is further detailed (Table 2). The northern boundary of the cafeteria adjoins an empty plot of land and a footpath, while the southern boundary aligns with the parking area of the Undip Engineering campus. To the west, the boundary is marked by a footpath, and to the east, it is demarcated by the parking area of the Undip Faculty of Engineering Dean's building.

Table 2. Physical Conditions of Semi-outdoor Areas

Space components	Furniture
Column	Study table used for eating
Wall	Long chair
Floor	Magnum refrigerator
Ceiling	Ice cream refrigerator

Within the cafeteria area, users engage in a variety of activities, encompassing eating, relaxation, conversations, discussions, seating, and academic work. Figure 2 provides a detailed representation of the spatial layout, designating specific zones for distinct functions. The key elements outlined in the figure include A, identified as the warehouse, B for the cafeteria and kitchen, C denoting the photocopying area, D representing the drink ordering space, E allocated for the eating area, and F serving as the location for the fridge. This delineation offers a comprehensive overview of the designated zones within the cafeteria, facilitating an understanding of the spatial organization and functional distribution in relation to user activities and events.
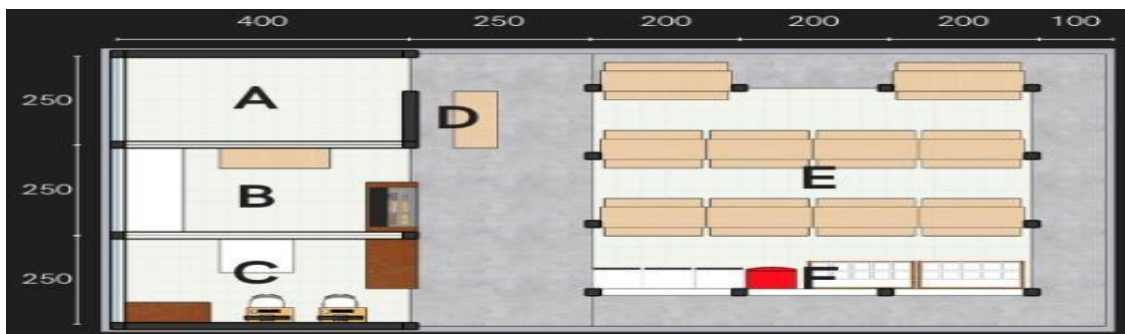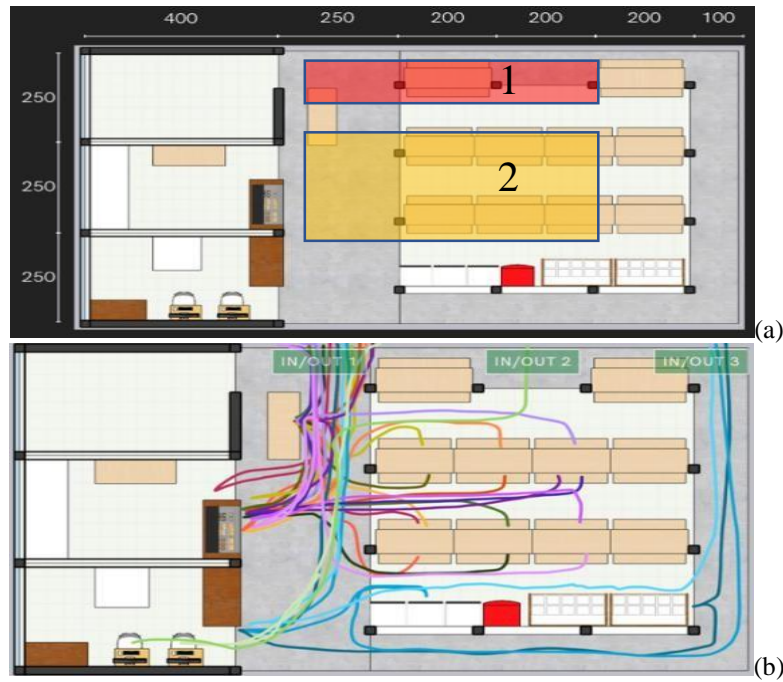

Source: Author data, 2022

Figure 2. Existing plan of cafeteria

In the non-physical dimension, data on visitor behavior was acquired through timing and observations conducted from October 24 to October 28, 2022, between 11 am and 1 pm (Table 3). Regarding place-centered mapping, the observed sections within the cafeteria are categorized based on the user selection and utilization of each area. Figure 3 provides a visual representation of potential outcomes from the observations. The details outlined in Figure 3(a) indicate that 1 corresponds to the dining area near the entrance, while 2 designates the middle dining area.

Table 3. Data on the number of users

Date	Number of users (people)
October 24	25
October 25	32
October 26	30
October 27	24
October 28	15
Average	25

(a)

(b)

Source: Author data, 2022
Figure 3. (a) Dinning Area and (b) Circulation Patterns

Table 4. Place-Centred Mapping Area Categorization

Code	Furniture	Existing photo
1	Study desk Long chair	
2	Study desk Long chair	

Regarding person-centered mapping, the observed movement patterns of individuals within the cafeteria, from entry to exit. Circulation patterns are visually represented in Figure 3(b). The illustration delineates three access points utilized by users for both commencement and conclusion of their engagement within the cafeteria area.

IV. Results

The observational outcomes reveal notable disparities in the frequency of usage among various areas, as depicted in Figure 4(a). Additionally, the circulation pattern analysis exposes instances of congestion or heightened user intensity concentrated at a specific location, particularly evident in front of the cafeteria area, as illustrated in Figure 4(b). The research findings are centered around the identification of areas within the cafeteria that are consistently and preferentially chosen by users. The frequency of use serves as a valuable indicator to discern the aspects and attributes that appeal to users. The recurrent selection of specific areas is closely tied to the attributes and settings provided within those spaces.

(a)

(b)

Figure 4. (a) Frequently Used Dining Table Zones; (b) User Crowding Level

Among the identified areas, Area 1 emerges as the most frequently utilized space, predominantly because it aligns with the majority of user attributes. Notably, this area (Area A) stands out due to its optimal accessibility, being the easiest and quickest to reach from the cafeteria. Moreover, Area A is a preferred choice owing to its abundant shade, providing protection from direct sunlight exposure and ensuring a comfortable environment for users engaging in various activities. In contrast, Area 2 follows as the second most commonly selected space, primarily meeting the user attribute of comfort. This area (Area B) excels in two aspects of comfort: firstly, it minimizes distractions to user circulation when entering or leaving the cafeteria, as observed in its circulation pattern. Secondly, Area B receives a moderate intensity of sunlight, surpassing Area A but falling below Area C, which receives the highest level of light exposure.

(a)

(b)   (c)
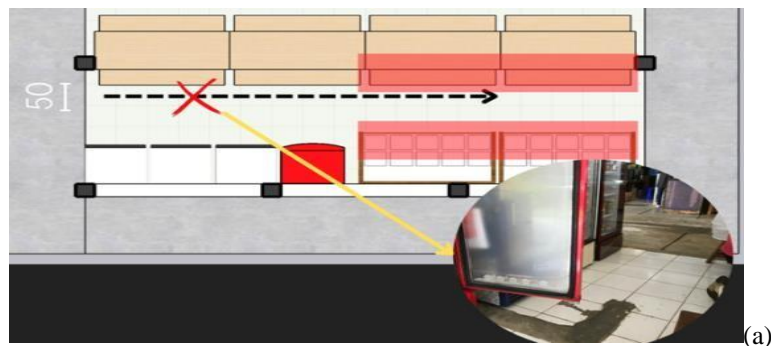
Source: Author data, 2022

Figure 5. (a) Student Food Ordering, (b) Refrigerator Layout Disruption to Circulation, (c) Student Seating Group Selection

Area 3 emerges as the third least frequently chosen zone among users, indicating its comparatively lower popularity. Several attributes within this area, such as comfort and accessibility, remain unmet, primarily due to its proximity to points frequently utilized by users for entering and exiting the cafeteria space. Positioned at the outermost edge of the dining area, Area 3 receives the highest light exposure, resulting in elevated temperatures compared to Areas A and B, and increased glare. The observed conditions unveil potential inefficiencies within the cafeteria area. Identified issues include: [1] Suboptimal circulation due to insufficient dimensions of the cafeteria and photocopy areas (2.5m x 4m each); [2] Impediments to user circulation caused by the placement of beverage refrigerators obstructing access to eating places and ice cream refrigerators (Figure 5(a)); [3] Inadequate accommodation for buffet-style food display, contributing to crowded circulation within the cafeteria room (see Figure 5(b)); [4] Limited diversity in dining table layouts leading customers to opt for seating areas outside the cafeteria zone (seating group) (Figure 5(c)).

(a)   (b)
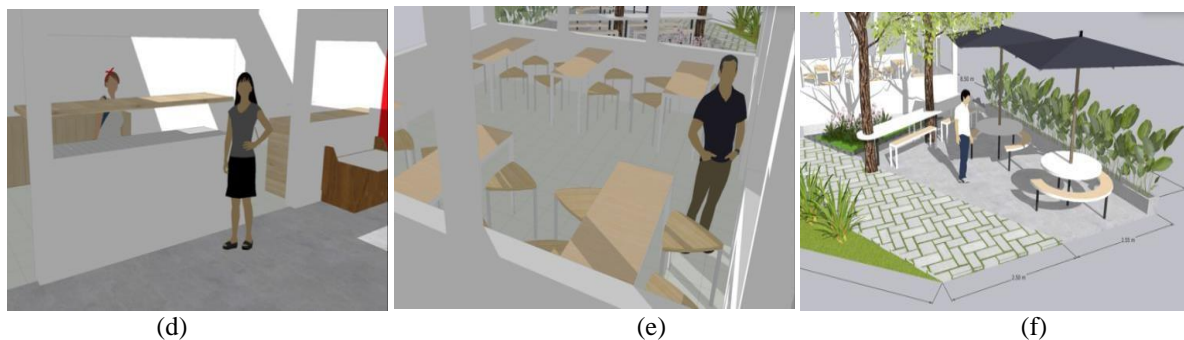

(c)

| (d) | (e) | (f) |
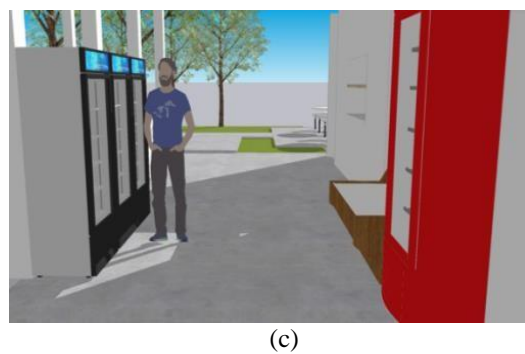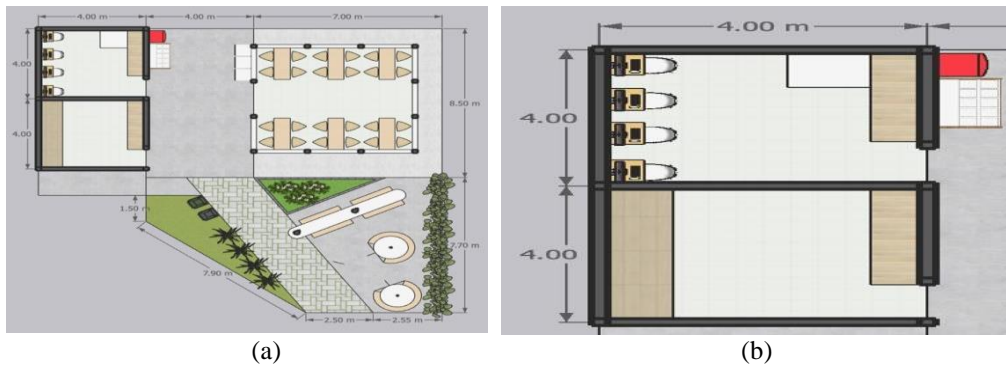
Figure 6: (a) Redesign Plan, (b) Cafeteria and Photocopying Area Redesign Plan, (c) Beverage and Refrigerators, (d) Food Display Design, (e) Dining Area Layout, (f) Dining Area in the Outdoor Space

For planners, designers, and campus management of the Undip Architecture Department, Figure 6 illustrates the suggested layout for the cafeteria. The design recommendations aim to address unmet user attributes through strategic redesign initiatives (Figure 6(a)). First, there is a proposal to enlarge the cafeteria and photocopying area to 4m x 4m each, accompanied by a comprehensive rearrangement of the room's layout and furniture (Figure 6(b)). This redesign focuses on enhancing comfort and accessibility attributes, intending to provide well-accommodated spaces for activities within the cafeteria and photocopying area.

Another crucial redesign recommendation involves repositioning beverage and ice cream refrigerators, strategically placing them near the photocopy area (Figure 6(c)). Moreover, the creation of a food display design that allows customers to access food directly from outside without entering the cafeteria is suggested (Figure 6(d)). This design modification caters to the accessibility attribute, aiming to streamline the food pickup process and make it more efficient. Additionally, the proposal includes rearranging the position of tables and opting for individual chairs instead of long benches, allowing users to customize their seating for personal comfort. This redesign focuses on fulfilling the comfort attribute, aiming to regularize circulation by concentrating entry and exit access at the center and enhancing user comfort attributes (Figure 6(e)).

Furthermore, an expansion of the dining area to an outdoor space on existing unused land is recommended. This expansion involves designing more varied dining areas with elongated circular and oval layouts, accompanied by the addition of shade to mitigate glare and heat (Figure 6(f)). The overarching goal is to meet comfort attributes, creating a more spacious cafeteria area capable of better supporting activities within the cafeteria.

V. Conclusion

The current arrangement of rooms and furniture in the Undip Architectural Engineering cafeteria lacks appropriateness, leading to an uneven distribution of seating areas for users to eat or dine. Additionally, the layout and dimensions of the rooms do not effectively support activities within the cafeteria, and users tend to favor alternative eating locations. Given these challenges, a comprehensive reassessment is deemed necessary. Key attributes such as accessibility, physical comfort, and visual comfort must be addressed to achieve an optimal design that resolves existing issues. Consequently, the researchers have undertaken the task of developing a redesigned layout and implementing a new system or regulation, aiming to rectify the identified problems and enhance the overall functionality of the cafeteria.

This study offers both theoretical and practical contributions to the fields of architecture, behavior, and human interaction within public spaces. The theoretical implications lie in the exploration and application of behavior setting theory, providing insights into the stable amalgamation of activities, places, and criteria that influence user behavior in the studied cafeteria. The findings contribute to a deeper understanding of the dynamics between users and their environment, shedding light on the factors influencing behavior within the context of public space design. From a practical standpoint, the study provides concrete design recommendations for improving the cafeteria, addressing issues related to user circulation, comfort, and accessibility. The proposed redesign points, including spatial expansions, furniture arrangements, and the strategic placement of facilities, offer actionable insights for architects and designers aiming to enhance user experience in similar settings.

Despite the valuable contributions, this study has certain limitations that should be acknowledged. Firstly, the research was conducted within a specific context—the Undip Architecture Cafeteria—which may limit the generalizability of findings to other public spaces. Additionally, the study's timeframe, spanning 5 days during specific hours, may not capture the full spectrum of user behaviors throughout different times and seasons. Furthermore, the qualitative descriptive method employed, while valuable for in-depth exploration, may lack the quantitative precision found in some research methodologies.

To build upon the current study, future research endeavors should focus on exploring alternative methodologies and adopting more suitable approaches to advance our understanding of architecture, human behavior, and the application of public space design. There is a pressing need for studies that delve into diverse research methods, considering the multifaceted nature of these fields. Investigating innovative approaches will contribute to a richer knowledge base, offering nuanced insights into the intricate dynamics between architectural design, human behavior, and the utilization of public spaces. This exploration will be pivotal in refining and expanding our understanding of how design elements influence user experiences and interactions within public spaces.

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